HINDU COMMUNITY AND CULTURAL CENTER
SPECIFICATIONS FOR CIVIL WORK

The portions of the City of Livermore Standard Specifications, which are pertinent to the civil drawings, are as follows:

Division 1 – General Requirements for Developments

Section 011100 – Summary of Work
Section 013100 – Coordination
Section 013300 – Submittals
Section 014200 – Reference Standards
Section 014213 – Abbreviations
Section 014500 – Quality Control
Section 015100 – Temporary Utilities
Section 015500 – Site Access and Storage
Section 015526 – Temporary Traffic Control Systems
Section 015600 – Protection of Existing Facilities
Section 015700 – Site Preparation
Section 015713 – Temporary Erosion Control
Section 015719 – Temporary Environmental Controls
Section 016600 – Materials and Equipment
Section 017123 – Field Engineering
Section 017700 – Project Closeout

Division 2 – Existing Condition

Section 022100 – Monuments
Section 024100 – Demolition

Division 3 – Concrete

Section 033500 – Textured Concrete Paving
Section 034800 – Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets
Section 036000 – Grout

Division 5 – Metals

Section 055900 – Ductile Iron Pipe

Division 31 – Earthwork

Section 310000 – Earthwork
Section 311300 – Selective Tree and Vegetation Trimming and Removal
Section 311316 – Root Pruning
Section 312300 – Utility Earthwork
Section 312323 – Controlled Low Strength Materials (CLSM)

Division 32 – Exterior Improvements

Section 321000 – Asphalt Pavement, Base, and Surface Treatments
Section 321200 – Selective Tree and Vegetation Trimming and Removal
Section 321300 – Concrete Surface Improvements
Section 321723 – Traffic Stripes and Pavement Markings
Section 323113 – Chain Link Fences and Gates

Division 33 – Utilities

Section 330130 – Sanitary Sewer and Storm Drain System Leakage Testing
Section 330526 – Piping Identification Systems
Section 331100 – Piping General
Section 331102 – PVC Pressure Pipe
Section 331200 – Miscellaneous Piping, Valves, Fittings, and Appurtenances
Section 331213 – Backflow Prevention Assemblies and Pressure Reducing Valves
Section 331215 – Valves, General
Section 331216 – Gate Valves
Section 331217 – Butterfly Valves
Section 331218 – Check Valves
Section 331219 – Fire Hydrants
Section 331233 – Water Meters
Section 331300 – Pressure Pipeline Testing and Disinfection
Section 333102 – ABS and PVC Composite Pipe
Section 333104 – Small ABS and PVC Non-Pressure Pipe
Section 333106 – Vitrified Clay Pipe
Section 333900 – Precast Concrete Maintenance Holes
Section 334100 – Corrugated Polyethylene Nonpressure Pipe (HDPE)
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Division 34 – Transportation

Section 344105 – Signage

CITY OF LIVERMORE

TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS FOR DEVELOPMENTS

Section 011100 - Summary of Work
Section 013100 - Coordination
Section 013300 - Submittals
Section 014200 - Reference Standards
Section 014213 - Abbreviations
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Section 015719 - Temporary Environmental Controls
Section 016600 - Materials and Equipment
Section 017123 - Field Engineering
Section 017700 - Project Closeout

SECTION 011100

SUMMARY OF WORK

1.01 ORDER OF THE WORK

A. In order to expedite the work and to avoid irreparable damage to, or deterioration of the quality of any portion of the public works improvements, it shall be the responsibility of the DEVELOPER to schedule the major items of construction in the following order:

1. Street excavation and rough grading
2. Storm and sanitary sewers
3. Water facilities, and their services
4. Underground gas, electric, telephone, cable TV
5. Curb, gutter, sidewalk, driveways, and access ramps
6. Street sub-base (if required)
7. Base rock
8. Paving

1.02 NOTIFICATIONS

A. For all developments the DEVELOPER shall notify owners of adjacent property and affected utilities when prosecution of the work may affect them. Said notification shall consist of erection of a sign at the main construction site entrance and notices to the adjacent property owners. Guidelines on who to notify, and a sample of approved notification form are available from the Development Section. The sign and notices shall include the name, address, and (local) phone number of the DEVELOPER.

B. When work is required in any existing street, the CONTRACTOR shall notify all residents 72 hours in advance of all operations. When parked vehicles interfere with the CONTRACTOR'S operations, the CONTRACTOR shall post temporary "NO PARKING" signs maximum 100 feet apart on each side of the street 72 hours prior to the scheduled work day. "No parking" signs shall include the following information: Time(s), day(s), date(s), purpose and the following statement: "Violators will be towed at owner's expense. CVC 22651. For information on towed vehicles phone: 371-4900."

C. If the work has not commenced during this period, the work shall be rescheduled with five (5) working days advance notice. If the work is not completed by the end of the period covered in the initial notification of the CONTRACTOR shall re-notify all residents of the construction schedule extension. The CONTRACTOR will perform all re-posting of no parking signs and re-notification occasioned by his failure to meet the posted schedule.

1.03 PRE-CONSTRUCTION MEETING

A. Except for work covered by an Encroachment Permit, a pre-construction meeting is required prior to commencement of any work. The meeting will be held at a mutually agreed time and place which shall be attended by the CITY, the DEVELOPER/DEVELOPERS' ENGINEER or Representative, CONTRACTOR'S Construction Superintendent, Subcontractors (as appropriate), and other governmental or agency representatives as appropriate.

B. The CONTRACTOR shall bring to the preconstruction meeting 6 copies of each of the following:

1. Tentative construction schedule

2. Shop drawing/sample/substitute or "or equal" submittal schedule

C. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.

1.04 MAINTAINING TRAFFIC IN PUBLIC STREETS

A. The CONTRACTOR'S attention is directed to Sections 7-1.08, 7-1.09, and Section 12 of the CalTrans Standard Specifications. Nothing in these Contract Documents shall be construed as relieving the CONTRACTOR from his responsibility to comply with Sections 7-1.08, 7-1.09 and Section 12 of the Caltrans Standard Specifications.

B. The CONTRACTOR shall be responsible for providing all flagmen and traffic control in conformance with the current edition of the Caltrans Traffic Manual, and the "Uniform Sign Chart," issued by the Department of Public Works, Division of Highways, and shall furnish, erect, maintain, and remove all necessary signs and devices during the length of the construction. Modifications to the approved traffic control plan, dictated by the field traffic conditions, shall be made immediately by the CONTRACTOR as required by the ENGINEER.

C. Personal vehicles of the CONTRACTOR'S employees shall not be parked on the traveled way or shoulders within any section closed to the public traffic.

D. A minimum of one paved traffic lane, not less than 12 feet wide shall be open for use by public traffic in each direction of travel, except that single paved 12 foot wide traffic lane may be used with flagmen for short lengths and short periods of time when specifically allowed by the ENGINEER.

E. The full width of the traveled way shall be open for use by public traffic as follows unless otherwise approved by the Engineer:

1. On all designated major streets before 9:00 am and after 3:30 pm, Monday through Friday;

2. On all other streets before 7:00 am and after 5:00 pm, Monday through Friday;

3. On all streets regardless of designation all day on Saturday, Sunday, and designated legal holidays; and after 3:30 pm on the day preceding a City designated legal holiday.

END OF SECTION

SECTION 013100

COORDINATION

1.01 GENERAL

A. The CONTRACTOR shall be responsible for the coordination of all work and the coordination of the work of all subcontractors. The CONTRACTOR shall not delegate coordination to any subcontractor. Coordination, as referred to herein, shall include the establishment of on-site lines of authority and communication. The CONTRACTOR'S onsite supervisory person shall be present at all times when any work is in progress.

1.02 SCHEDULING

A. The CONTRACTOR shall prepare construction schedules as specified in Section 013300 "Submittals", and all schedule submittals shall conform to the requirements specified therein.

1.03 REQUESTS FOR SUBSTITUTIONS

A. The CONTRACTOR shall review subcontractor's requests for changes and for substitutions.

B. All requests or substitutions shall conform to the requirements of Section 013300 "Submittals".

1.04 SUBMITTALS

A. All submittals to the CITY shall be made by the DEVELOPER.

1.05 COORDINATION OF SUBCONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR shall be responsible for coordination of the work of each of its subcontractors and suppliers. Special attention is directed to the following obligations of the CONTRACTOR:

1. Verify that subcontractors have obtained permits for inspections.

2. Review all subcontractor shop drawings, product data, and sample submittals for compliance prior to submittal to CITY for review.

3. Maintain onsite documentation and keep current record drawing set at the construction site.

END OF SECTION

SECTION 013300

SUBMITTALS

1.01 GENERAL

A. General: Whenever submittals are required hereunder, all such submittals shall be submitted to the ENGINEER for review. A Submittal is defined as any drawing, calculation, specification, product data, samples, manuals, requests for substitutes, survey data, record drawings, or similar items.

B. Submittals Required at the Preconstruction Meeting: At the preconstruction meeting, the CONTRACTOR shall submit the following items:

1. A schedule of work, which shall be based on the following order of work:

    a. Rough Grading
    b. Sanitary Sewer
    c. Storm Drainage
    d. Water Mains
    e. Joint Trench
    f. Subgrade
    g. Aggregate Subbase
    h. Concrete Surface Improvements
    I. Aggregate Base
    j. Asphalt Concrete Pavement
    k. Striping, Markings
    l. Signs
    m. Monuments
    n. Fire Hydrants
    o. Street Lights
    p. Landscaping

2. A preliminary schedule of shop drawings, samples, and proposed substitutes or "or equal" submittals.

3. A list of all permits the DEVELOPER or DEVELOPER'S CONTRACTOR is required to obtain.

C. Submittals Required After the Preconstruction Meeting: The DEVELOPER'S CONTRACTOR shall submit to the ENGINEER all proposed substitutes or "or equal" products thirty (30) days prior to use on the work, for review. All such submittals shall be in conformance with the requirements of Paragraphs 1.03 and 1.04 herein.

1. The DEVELOPER shall submit copies of all required permits prior to starting any work covered by the various permits.

2. The CONTRACTOR hereby agrees that failure to submit alternative product requests within the stipulated time period shall act as a waiver of any future rights to offer such substitutes, and the CONTRACTOR hereby agrees to provide one of the specified products called for on the DRAWINGS.

3. The DEVELOPER shall also submit a copy of the valid trench shoring permit issued by CAL OSHA, if applicable, prior to starting any trenching.

D. All submittals shall be accompanied by a standard transmittal form or cover letter acceptable to the ENGINEER. Information shall include, but not be limited to, DEVELOPER'S name and address,

project identification, sender's name and phone number, and a summary of the purpose of the transmittal.

1.02 CERTIFICATES OF COMPLIANCE

A. **Certificates of Compliance**: The CONTRACTOR shall provide Certificates of Compliance for all products and materials proposed to be used. The Certificates of Compliance shall include identification of the material, material source, name of the supplier, project name, and the segment of the WORK where the material represented by the sample is to be used.

1.03 SHOP DRAWINGS

A. Whenever called for in the DRAWINGS, or where required by the ENGINEER, the CONTRACTOR shall furnish to the ENGINEER for review, a minimum of six (6) copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instruction, catalog sheets, data sheets, and similar items. Unless otherwise required, said Shop DRAWINGS shall be submitted to the ENGINEER at a time sufficiently early to allow review of same by the ENGINEER, and to accommodate the anticipated rate of construction progress.

B. All Shop Drawings shall be accompanied by a standard transmittal form or cover letter approved by the ENGINEER. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will not be considered. Incomplete submittals will be returned for resubmittal only if the sender is identified on the form or cover letter.

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

D. Except as may otherwise be provided herein, the ENGINEER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 21 calendar days following their receipt by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item. Anything after the initial submittal and first re-submittal for review is defined as EXCESSIVE REVIEW and all costs for EXCESSIVE REVIEW shall be charged to the DEVELOPER. Final acceptance will be withheld until all costs for EXCESSIVE REVIEW are reimbursed to the CITY.

E. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will NOT be required.

F. If a submittal is returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," a formal revision and resubmission of said submittal will NOT be required.

G. If a submittal is returned to the CONTRACTOR marked "AMEND - RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit a minimum of 6 copies of said revised submittal to the ENGINEER.

H. If a submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit a minimum of 6 copies of said revised submittal to ENGINEER.

I. Fabrication of an item may be commenced only after the ENGINEER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents.

J. All CONTRACTOR submittals shall be carefully reviewed by the DEVELOPER'S ENGINEER, prior to submittal to the ENGINEER. Each submittal shall be dated, signed, and certified by the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the ENGINEER of any CONTRACTOR submittals will be made for any items which have not been so certified by the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR. All non-certified submittals will be returned to the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

K. The ENGINEER's review of CONTRACTOR submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.04 PROPOSED SUBSTITUTES OR "OR EQUAL" ITEMS

A. For convenience in designation, any material, product, or equipment to be incorporated may be designated under a brand or trade name or the name of a manufacturer and its catalog information. The use of any substitute material, product, or equipment which is equal in quality and utility and possesses the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and utility of any such substitute material, product, or equipment shall be upon the CONTRACTOR.

2. The ENGINEER will be the sole judge as to the quality and utility of any such substitute material, product, or equipment and its decision shall be final.

B. Whenever the name or the name and address of a manufacturer or Supplier is given for a material, product, or equipment, or if any other source of a material, product, or equipment is indicated therefore, such information is given for the convenience of the CONTRACTOR only, and no limit, restriction, or direction is indicated or intended thereby, nor is the accuracy or reliability of such information guaranteed. It shall be the responsibility of the CONTRACTOR to determine the accurate identity and location of any such manufacturer, Supplier, or other source of any material, product, or equipment called for.

C. The CONTRACTOR may offer any material, product, or equipment which it considers equal to those specified. The CONTRACTOR, at its sole expense, shall furnish data concerning items it has offered as substitute or "or-equal" to those specified. The CONTRACTOR shall provide the data required by the ENGINEER to determine that the quality, strength, physical, chemical, or other characteristics, including durability, finish, efficiency, dimensions, service, and suitability are such that the substitute or "or-equal" item will fulfill its intended function.

D. Approval by the ENGINEER of a substitute item proposed by the CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substituted item. The CONTRACTOR shall also be responsible for resultant changes and all additional costs which the substitution requires in its work, the work of its subcontractors and of other contractors and shall effect such changes without cost to CITY.

1.05 SAMPLES

A. Unless otherwise specified, whenever samples are required, the CONTRACTOR shall submit not less than 3 units of each such sample item or material to the ENGINEER for approval at no cost to the CITY.

B. Samples, as required herein, shall be submitted for approval a minimum of 14 calendar days prior to ordering such material for delivery to the job-site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled for review by the ENGINEER.

C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and manufacturer's names for identification and submitted to the ENGINEER for review for compliance. Upon receiving approval of the ENGINEER, two sets of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set will be retained by the ENGINEER.

D. Unless otherwise specified, all colors and textures of specified items will be selected from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.06 ACCEPTANCE FOR MAINTENANCE

A. Improvements will not be accepted by the CITY for permanent maintenance until the CONTRACTOR-prepared sepialar Record DRAWINGS have been delivered to the ENGINEER.

1.07 USE OF PRIVATE PROPERTY

A. If the CONTRACTOR uses private property for access or construction the CONTRACTOR shall obtain all necessary permits/approvals from the Planning Department and submit to the ENGINEER a copy of each agreement executed with the private property owner(s) for access or use of the private property prior to using said private property.

1.08 PIPELINE CUT SHEETS

A. The CONTRACTOR shall submit to the ENGINEER cut sheets for any sanitary sewer line installation, storm drain line installation, and curb and gutter construction, 24 hours prior to start of construction work.

1.09 STREET LIGHT WIRING PLAN

A. The CONTRACTOR shall submit an acceptable street light wiring plan, indicating the wiring run, and the location of the power source, for review by the ENGINEER prior to starting installation of any street lights.

1.10 STREET TREE REMOVAL

A. The CONTRACTOR shall give the ENGINEER 10 calendar days notice prior to removal of any street tree designated for removal on the Approved Construction DRAWINGS. Whenever it is determined by the CITY that a street tree must be removed, the ENGINEER must post the tree under the provisions of Chapter 12.20 of the Livermore Municipal Code.

1.11 GRADING

A. The DEVELOPER shall notify the ENGINEER 2 working days prior to starting ANY grading on the site.

END OF SECTION

SECTION 014200

REFERENCE STANDARDS

1.01 GENERAL

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever in these specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date of CITY approval of the Construction Drawings or issuance of an Encroachment Permit, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the general provisions of other portions of the specifications, all work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. References herein to codes shall mean the following listed codes, the editions as adopted by the City of Livermore, including all addenda, modifications, amendments, or other lawful changes thereto:

1. Uniform Building Code, published by the International Conference of Building Officials (ICBO).
2. Uniform Plumbing Code, published by the International Association of Plumbing and Mechanical Officials (IAPMO).
3. Uniform Mechanical Code, published by the International Conference of Building Officials (ICBO).
4. National Electric Code, published by the National Fire Protection Association (NFPA).
5. Uniform Fire Code, published by the International Conference of Building Officials (ICBO).
6. California Code of Regulations; Title 8 Industrial Relations, Title 19 Public Safety, Title 24 Building Standards, and California Labor Code.
7. Livermore Municipal Code .
8. Livermore Zoning Ordinance.

C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor.

D. References herein or on the Drawings to "State Standard Specifications" or "Standard Specifications" shall mean the Standard Specifications current metric edition as adopted by the State of California, Department of Transportation ("Caltrans").

E. References herein or on the Drawings to "Livermore Standard Specifications" or "CITY Standard Specifications" shall mean the City of Livermore Standard Specifications, current edition or as specified on the Approved Construction Drawings.

F. References herein or on the Drawings to "State Standard Plans" or "Standard Plans" shall mean the Standard Plans, current metric edition as adopted by the State of California, Department of Transportation ("Caltrans").

G. References herein or on the Drawings to "Livermore Standard Details", "CITY Standard Details" or "Standard Details" shall mean the City of Livermore, Standard Details, current edition or as specified on the Approved Construction Drawings.

H. References herein or on the Drawings to "Cal-OSHA" shall mean State of California, Department of Industrial Relations, General Industry, Electrical and Construction Safety Orders, as amended to Date, and all changes and amendments thereto which are effective as of the date of construction.

I. References herein or on the Drawings to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

END OF SECTION

SECTION 014213

ABBREVIATIONS

1.01 GENERAL

A. Whenever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association., Inc.
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturer's Association
AHAM	Association of Home Appliance Manufacturer's
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CALOSHA	California Occupational Safety and Health Administration
CALTRANS	State of California Department of Transportation
CBM	Certified Ballast Manufacturer's
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLPCA	California Lathing & Plastering Contractors Assn
CLFMI	Chain Link Fence Manufacturer's Institute

CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission of Association
MTI	Marine Testing Institute
NAAM	National Assn of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NGLI	National Lubricating Grease Institute
NMA	National Microfilm Association
NWMA	National Woodwork Manufacturer's Association
OSHA	Occupational Safety and Health Administration (Federal)
PCA	Portland Cement Association
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Maker Association
SIS	Swedish Standards Association
SMA	Screen Manufacturer's Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPR	Simplified Practice Recommendation
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Assn of the Pulp and Paper Industry
TFI	The Fertilizer Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
USA	Underground Service Alert
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

END OF SECTION

SECTION 014500

QUALITY CONTROL

1.01 SITE INVESTIGATION AND CONTROL

A. The CONTRACTOR shall verify all dimensions in the field and shall check all field conditions continuously during construction. The CONTRACTOR shall be solely responsible for any inaccuracies built into the WORK.

B. The CONTRACTOR shall inspect related and appurtenant work and shall report in writing to the ENGINEER, any conditions which will prevent proper completion of the WORK. Any work required due to unsuitable conditions shall be done by the CONTRACTOR at its sole cost and expense.

1.02 INSPECTION OF THE WORK

A. General: The WORK shall be conducted under the general observation of the ENGINEER and shall be subject to inspection by the ENGINEER to assure strict compliance with the requirements of the Contract Documents.

B. The presence of the ENGINEER, or its representative, shall not relieve the CONTRACTOR of the responsibility for the proper execution of the WORK in accordance with all requirements of the Contract Documents. Compliance is distinctly a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of the ENGINEER.

C. All materials and articles furnished by the CONTRACTOR shall be subject to rigid inspection, and no material or articles shall be used until it has been inspected and reviewed for compliance by the ENGINEER.

D. Inspection at Place of Manufacture: Unless otherwise specified, all products, materials, and equipment shall be subject to inspection by the ENGINEER at the place of manufacture.

E. The presence of the ENGINEER at the place of manufacture however, shall not relieve the CONTRACTOR of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents.

F. At all times during construction, the CONTRACTOR shall prevent the formation of any airborne dust nuisance. If the CONTRACTOR fails to comply within 2 hours of notification, the CITY will issue a "STOP WORK ORDER".

1.03 SAMPLING AND TESTING

A. Sampling and testing for quality control is the sole responsibility of the CONTRACTOR. The CITY reserves the right to reject any products or materials found to be in non-compliance under quality assurance.

B. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM or other specified published standards, as applicable to the class and nature of the article or materials considered.

C. Any waiver by the CITY of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a "performance bond" to assure execution of any

necessary corrective or remedial WORK, shall not be construed as a waiver of any prescriptive or performance requirements of the Contract Documents. A "performance bond" as used herein is a separate bond in addition to the Performance Bond required in the Subdivision Agreement.

D. Notwithstanding the existence of such waiver, and in addition to any testing and inspection performed by any other inspector on behalf of the CITY or any other public agency having jurisdiction, the ENGINEER shall have the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the ENGINEER to require the removal or correction and reconstruction of any such work in accordance with the General Conditions for Development.

1.04 TIME OF INSPECTIONS AND TESTS

A. Required samples and test specimens shall be furnished by the CONTRACTOR and prepared for testing in ample time for the completion of the necessary tests and analyses before the subject materials or articles are to be used. The CONTRACTOR shall furnish all required test specimens at its own expense. Except as otherwise provided performance of the required initial test and first test will be by the CITY, and all costs therefor will be borne by the CITY; except, that the cost of any test after the first re-test, which shows unsatisfactory results shall be borne by the CONTRACTOR.

B. Whenever the CONTRACTOR is ready to backfill, bury, cast in concrete, or otherwise cover or make inaccessible any work, the CONTRACTOR shall notify the ENGINEER not less than 24 hours in advance of beginning any such work. Failure of the CONTRACTOR to notify the ENGINEER at least 24 hours in advance of any such inspections shall be reasonable cause for the CONTRACTOR's work to be delayed in order for inspections and any remedial or corrective work required, and all costs of such delays, including its impact or effect upon other portions of the WORK shall be borne by the CONTRACTOR.

END OF SECTION

SECTION 015100

TEMPORARY UTILITIES

1.01 CONSTRUCTION WATER

A. General: Construction water will be available and may be purchased from the City of Livermore, located at 1052 S. Livermore Ave., Livermore, CA 94550, or from the California Water Service Company, located at 195 South "N" Street, Livermore, CA 94550. The CONTRACTOR will also be required to apply for and furnish a deposit for use of the construction water meters. The CONTRACTOR shall provide all facilities necessary to convey the water from the designated source to the points of use in accordance with the requirements of the Contract Documents.

B. Reclaimed water may be used for dust abatement in accordance with Section 015719, "Temporary Environmental Controls". The CONTRACTOR shall contact the City of Livermore Water Resources Division for all permits required for use of reclaimed water.

C. The CONTRACTOR shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water therefrom.

D. Notices shall be posted conspicuously throughout the site warning the CONTRACTOR'S personnel that piped water may be contaminated.

E. Fire Hydrant Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant without first obtaining permission of the CITY or other authority having jurisdiction over the use of said fire hydrant and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant a valve and a construction meter, supplied by the CITY or said other authority and agency.

F. Pipeline Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any pipeline without first obtaining permission of the ENGINEER or California Water Service Company or other authority having jurisdiction over the use of said pipeline and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the pipeline a valve and a construction meter, supplied by the CITY or said other authority and agency.

G. Removal of Water Connections: Before final acceptance of the WORK on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of ENGINEER, the CITY, and/or other agency owning the affected utility.

END OF SECTION

SECTION 015500

SITE ACCESS AND STORAGE

1.01 MAINTAINING TRAFFIC

A. The CONTRACTOR shall be responsible for providing adequate traffic control in conformance with the requirements of the "Manual of Traffic Controls for Construction and Maintenance Work Zones," Current Edition, as Published by the State of California Department of Transportation.

B. Traffic Control: For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Traffic Controls for Construction and Maintenance Work Zones," Current Edition, published by the State of California, Department of Transportation and the Drawings, if applicable.

C. If closure of any street is necessary during construction, the CONTRACTOR shall submit a formal application and complete detour plan for a street closure to the CITY and/or other authority having jurisdiction at least 30 days prior to the needed street closure in order for the CITY and other agency having jurisdiction to review the application. The detour plan shall include all necessary signing and detour requirements, shall be signed and stamped by a registered professional engineer, and shall be a scaled design on 24" x 36" sheets.

1.02 HIGHWAY LIMITATIONS

A. All hauling by motor vehicles shall be confined to designated truck routes, except where otherwise authorized in writing by the ENGINEER.

1.03 CONTRACTOR'S WORK AND STORAGE AREA

A. The CONTRACTOR shall make its own arrangements for any necessary off-site storage areas necessary for the proper execution of the Work. Plans shall be submitted to the Planning Division for all proposed offsite storage areas in order to obtain any necessary permits. The CONTRACTOR shall obtain all necessary CITY permits for off-site storage and shall submit copies of the owner's written permission for such private property use.

B. The CONTRACTOR will not be allowed use of public street right-of-way or public land for work or storage areas without written approval of the ENGINEER.

1.04 TEMPORARY STREET USE

A. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alley, way, or parking area during the performance of the Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of the CITY, utility companies, or other agencies, or public access in such streets, alleys, ways, or parking areas. The CONTRACTOR shall be responsible for any damage to public facilities in the public right-of-way. Any damage done to these public facilities will be repaired and/or replaced by the CONTRACTOR.

B. No street shall be closed to the public without first obtaining the permission of the ENGINEER, the CITY, and other proper governmental authority, where applicable.

C. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times.

D. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and other drainage facilities.

E. Wherever necessary or required for the convenience of the public or individual residents or business places at street or highway crossings, private driveways, or elsewhere, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the ENGINEER prior to beginning the excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation.

F. Temporary bridges or steel plates for street and highway crossings shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

1.05 ACCESS SECURITY

A. Where construction site access is directly off of a public street the CONTRACTOR shall be responsible for providing and maintaining adequate fencing, barricades, and/or signs to prevent public access from the public street into the construction site 24-hours a day.

END OF SECTION

SECTION 015526

TEMPORARY TRAFFIC CONTROL SYSTEMS

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, place, and maintain all temporary traffic control systems, including construction and maintenance area traffic control devices and flaggers as required to perform the WORK in accordance with this Section, and all other appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Review of proposed WORK areas to determine temporary traffic control requirements.
2. Verification of temporary traffic controls with the ENGINEER or appropriate agency prior to implementation.
3. Maintenance of traffic control during the WORK.
4. Monitoring traffic control during the WORK to determine necessary changes required to maintain adequacy.
5. Maintenance of traffic control during non-work hours to maintain adequacy.
6. Removal of temporary traffic control systems after completion of the WORK.
7. Removal of traffic detector loops/detouring vehicles through signalized intersections.

C. The CONTRACTOR shall comply with Section 7058 of the Business and Professions Code as it applies to establishment of traffic control.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. State of California, Department of Transportation (Caltrans) Specifications and Standards:

1. Standard Specifications:

Section 7	Legal Relations and Responsibility
Section 12	Construction Area Traffic Control Devices

2. Standard Plans

3. Traffic Manual, current edition

B. Commercial Standards:

State of California, Division of Industrial Safety, Department of Industrial Relations:

Safety Orders of the Division of Industrial Safety, Department of Industrial Relations of the State of California, current edition.

C. State Codes: State of California Business and Professions Code.

1.03 CONTRACTOR SUBMITTALS

A. In addition to the submittal requirements of Section 011100 "Summary of Work," the CONTRACTOR shall provide the following at the pre-construction conference:

1. A "Letter of Responsibility," on company letterhead, indicating the names and telephone numbers of at least three different persons who shall be available to be contacted in case of emergency at any time during the life of the contract. Said persons must have decision-making authority within the company.

2. "Traffic Control/Construction Staging Plans" indicating proposed traffic control measures during all stages of the WORK. These plans shall be submitted for review and approval by the ENGINEER in order to determine the CONTRACTOR'S compliance with the requirements of this section.

B. The CONTRACTOR shall be responsible for submitting separate applications for encroachment permits to the appropriate agencies for WORK or traffic control within areas outside of the jurisdiction of the CITY. The CONTRACTOR shall be responsible for compliance with all traffic control requirements determined necessary by other permitting agencies or other public authorities acting within their jurisdictions.

1.04 PRODUCTS

A. All construction area stationary and portable sign panels, lights, barricades, and traffic control devices shall be the product of a commercial sign or safety device manufacturer conforming to the requirements of Section 12, "Construction Area Traffic Control Devices," of the Caltrans Standard Specifications, unless otherwise specified in this Section, shown on the Drawings, and/or as directed by the ENGINEER.

1.05 GENERAL

A. The CONTRACTOR shall provide all appropriate traffic control measures in accordance with this Section prior to start of construction in the public right-of-way or in any area adjacent to the street right of way where public safety is affected.

B. The CONTRACTOR shall take all necessary precautions for the protection of the WORK and the safety of its employees and the public. Traffic shall be maintained through the construction or maintenance zone in accordance with Sections 7-1.08, 7-1.09 and 12 of the Caltrans Standard Specifications and Sections 011100 "Summary of Work."

C. Proposed traffic control plans shall be approved by the ENGINEER and any other public agency with jurisdiction over the roadway prior to installation.

D. All construction area signs, lights, barricades, and traffic control devices shall be furnished, installed, maintained, and removed in conformance with the specifications of the Caltrans Traffic Manual, current edition, as published by the State of California Department of Transportation and Business and Professions Code Section 7058. Additional or alternate signs may only be used when specifically authorized by the ENGINEER.

E. The CONTRACTOR shall station guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by these Technical Specifications, the ENGINEER, or other public authorities acting within their jurisdictions. Section 12-2.02 of the Caltrans Standard Specifications is revised to provide that all flaggers and guards shall be furnished by the CONTRACTOR at its expense.

F. The CONTRACTOR shall monitor traffic and safety conditions and maintain adequate traffic control measures during both work and non-work hours in order to maintain compliance with the requirements of this Section.

G. The CONTRACTOR shall conform to all requirements of the current "Safety Orders of the Division of Industrial Safety, Department of Industrial Relations of the State of California."

H. If a hazardous condition is observed and the CITY notifies the CONTRACTOR either directly or by telephone, the CONTRACTOR shall correct the condition immediately. If the CONTRACTOR fails to correct the hazardous condition immediately, the CITY reserves the right to call in a local contractor to perform the necessary work needed to improve public safety. The cost incurred shall be billed to the DEVELOPER.

I. All construction area signs, lights, barricades, and temporary traffic control devices shall be completely removed from the roadway when not in use. Locations and methods of storing traffic control equipment adjacent to the roadway between interrupted use shall require prior approval of the ENGINEER.

J. The CONTRACTOR shall completely remove all temporary signs, striping and/or delineators and restore the pavement, as necessary, upon removal or relocation of any temporary traffic controls or detours constructed as part of the WORK.

K. When traffic is detoured to the bicycle/parking lane adjacent to the curb where street tree branches are interfering with vehicular traffic, the CONTRACTOR shall trim the trees in accordance with Section 311300 "Selective Tree and Vegetation Trimming and Removal."

L. When the construction activity will make any detector loop at a traffic signal inoperative for a period of 72 hours or more, the CONTRACTOR shall provide video detection, or any other similar device which is not installed in the pavement prior to the start of work at his own expense. The CONTRACTOR shall provide a temporary video detection device attached to the traffic signal pole luminaire arm which is wired to the traffic signal controller. The proposed detection device must conform to Section 344100, or as approved by the ENGINEER.

- END OF SECTION -

SECTION 015600

PROTECTION OF EXISTING FACILITIES

1.01 GENERAL

A. The CONTRACTOR shall protect all existing utilities, trees, shrubbery, landscaping, irrigation facilities, buildings, fences, roadside signs, poles, mailboxes, and all other improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.

B. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that my interfere with the WORK. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify the DEVELOPER'S ENGINEER and the ENGINEER.

C. Private hose bibs and hoses shall not be used for construction unless the CONTRACTOR secures the owner's permission to use same.

D. All reference markings made by the CONTRACTOR shall be done with spray chalk and shall be removed by the CONTRACTOR.

1.02 PROTECTION OF STREET OR ROADWAY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers unless specifically shown on the Drawings. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. All survey markers or points disturbed by the CONTRACTOR shall be accurately restored to the satisfaction of the Engineer by the CONTRACTOR at its own expense.

1.03 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The CONTRACTOR shall protect all Underground Utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR'S responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Utilities to be Moved: In case it shall be necessary to relocate or move the property of any public utility or franchise holder, the CONTRACTOR shall be responsible to contact the appropriate utility or franchise holder.

C. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or the facility at the direction of the affected utility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. Underground Utilities: The CONTRACTOR shall notify the appropriate utility or agency for any existing utility lines that are damaged or exposed during construction.

E. The CONTRACTOR shall keep existing streets free from dust and debris during all phases of construction.

1.04 TREES WITHIN STREET RIGHTS-OF-WAY

A. General: The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the CITY or other jurisdictional agency. Trees and shrubs which are not scheduled for removal shall be protected with temporary fencing placed around their driplines. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company and to the satisfaction of said CITY and/or other jurisdictional agency. Tree trimming and replacement shall be accomplished in accordance with the requirements of the CITY or other jurisdictional agency.

1.05 NOTIFICATION BY THE CONTRACTOR

A. The CONTRACTOR shall notify all utilities 48 hours prior to any excavation so that their lines can be marked. Those to be notified include, but are not limited to:

1. Underground Service Alert (USA), 800-227-2600.

B. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, irrigation, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the CONTRACTOR shall notify the Underground Service Alert agency and the respective authorities representing the owners or agencies responsible for such underground facilities 48 hours prior to the day of excavation so that a representative of said owners or agencies can be present during such work if they so desire.

END OF SECTION

SECTION 015700 - SITE PREPARATION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to protect or control traffic, surface drainage, pedestrians, noise, dust and any nuisance conditions created by construction and shall perform all work required to protect existing streets, curbs, gutters, sidewalks, access ramps, driveways, utilities, landscaping, fences and other existing improvements as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 310000	Earthwork.
B.	Section 312300	Utility Earthwork.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **State of California (Caltrans):**

1. Standard Specifications.
2. Standard Plans.
3. Manual of Traffic Controls for Construction and Maintenance Work Zones.
4. Traffic Manual.

B. **Commercial Standards:**

1. USA/Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall obtain and submit copies of all permits required by governing agencies prior to any construction.

B. The CONTRACTOR shall submit to the ENGINEER those drawings required in PART 2 - PRODUCTS of this Section outlining all methods and materials intended to protect existing features and control local conditions prior to construction.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All products shall conform to State, Federal and local standards as well as manufacturers' printed recommendations.

2.2 SAFETY AND NOISE BARRIERS

A. If the proximity of existing features will require construction of an appropriate barrier such as temporary fencing, berms, acoustic barriers, or similar facilities the CONTRACTOR shall prepare a

submittal for review to the ENGINEER of drawings that define the proposed safety or noise barriers, including any required signage, prior to beginning any construction.

2.3 TRAFFIC CONTROL

A. If the proximity of existing streets or access ways will require construction of appropriate safety barriers, flagging, trench plates, temporary lanes, warning signs, lane striping or similar facilities the CONTRACTOR shall prepare a submittal for review to the ENGINEER of drawings that define the proposed traffic control devices prior to beginning any construction. The submittal shall be submitted in accordance with the latest edition of the State of California (Caltrans) Traffic Manual, and Manual of Traffic Controls for Construction and Maintenance Work Zones.

2.4 SURFACE DRAINAGE

A. If the proximity of existing surface drainage will require construction of appropriate bypass, appropriate bypass, interceptors, or similar facilities the CONTRACTOR shall prepare a submittal for review to the ENGINEER of drawings that define the proposed drainage devices prior to beginning any construction.

PART 3 -- EXECUTION

3.1 SITE INSPECTION

A. Prior to moving onto the project site the CONTRACTOR shall visit and inspect the site conditions and review maps of the existing site and facilities delineating existing utilities, property and right-of-way lines.

3.2 SITE MOBILIZATION

A. All safety, noise, traffic, drainage control and other features required for construction shall be established at the site prior to any construction.

B. The CONTRACTOR shall notify and coordinate the utility location services of all agency utilities affected by the construction work. In addition, the Underground Services Alert (USA) organization shall be used to locate and mark underground utility locations prior to construction in each affected area.

3.3 SITE ACCESS

A. The CONTRACTOR shall install any necessary access to the site, including barrier facilities to be installed at the beginning of construction to prohibit entry of unauthorized persons.

3.4 SITE CLEARING, GRUBBING, AND STRIPPING

A. All clearing, grubbing and stripping shall be in accordance with Section 310000, "Earthwork," and Section 312300, "Utility Earthwork."

3.5 OVEREXCAVATION, REGRADING, AND BACKFILL

A. All overexcavation, regrading and backfill shall be in accordance with Section 310000, "Earthwork," and Section 312300, "Utility Earthwork."

- END OF SECTION -

SECTION 015713

TEMPORARY EROSION CONTROL

1.01 GENERAL

A. Temporary erosion control shall consist of, but not be limited to, constructing such facilities and taking such measures as are necessary to prevent, control, and abate water, mud, construction materials, hazardous materials and erosion damage to public and private property as a result of the CONTRACTOR'S operations.

B. Conformance with the requirements of this section shall in no way relieve the CONTRACTOR from the CONTRACTOR'S responsibilities, as provided in Section 7-1.01G, "Water Pollution," Section 7-1.11, "Preservation of Property," of the Caltrans Standard Specifications.

C. Construction vehicles and equipment entering existing paved areas shall be free of mud, silt and other debris during all phases of work. No mud, silt and other debris shall be tracked on paved surfaces. If such materials are tracked on the streets or other paved areas both public and private, the CONTRACTOR shall immediately remove these materials prior to these materials entering into the storm drain system.

D. Stockpiling of materials on the street will not be allowed unless otherwise approved by the ENGINEER. The CONTRACTOR shall cover with plastic any construction or excavated materials between October 15th and April 15th which may possibly erode and enter the storm drain system of paved streets or other paved areas both public and private. Stockpiling of dirt on paved areas will not be allowed.

E. The CONTRACTOR shall sweep the work area and clean up the work site daily before leaving the site.

F. If a Storm Water Prevention Plan (SWPP) is required for the project, the CONTRACTOR shall be responsible throughout the duration of the project for installing, constructing, inspecting and maintaining the control measures included in the SWPP and any amendments thereto and for removing and disposing of temporary control measures.

G. By October 15th of each year the temporary erosion control features as are necessary to prevent damage during forthcoming winter season shall be constructed and functioning. If the earthwork in any area has not progressed to a point where any part of the facilities on the temporary erosion control plans for that area can be constructed, the CONTRACTOR shall construct such supplementary temporary erosion control facilities as are necessary to protect adjacent private and public property.

Temporary erosion control measures shall include, but not be limited to, the following:

1. The CONTRACTOR shall conduct operations in such a manner that storm runoff will be contained within the site or channeled into the storm drain system which serves the runoff area. Storm runoff from one area shall not be allowed to divert to another runoff area.

2. Storm drain systems, toe of slope drains, and outlet structures shall be constructed and operating prior to commencing, or concurrently with placing an embankment. Temporary downdrains, drainage structures, and other devices shall be provided to channel storm runoff water into the respective permanent storm drain systems during construction. Mud and silt shall be settled out of the storm runoff before the runoff enters the storm drain system.

3. Embankment areas, while being brought up to grade and during periods of completion prior to final roadbed construction, shall be protected by various measures to eliminate erosion and the siltation of downstream facilities and adjacent areas. These measures may include, but shall not be limited to: temporary downdrains, either in the form of pipes or paved ditches with protected outfall areas; graded berms around areas to eliminate erosion of embankment slopes by surface runoff; confined ponding areas to desilt runoff; and temporary check dams in toe of slope ditches to desilt runoff.

4. Excavation areas, while being brought to grade, shall be protected from erosion and the resulting siltation of downstream facilities and adjacent areas by use of various temporary erosion control measures. These measures may include, but shall not be limited to : check dams; confined ponding areas to desilt the runoff; and protection, such as sandbags around inlets which have not been brought up to grade.

5. Contour graded areas shall be protected against erosion and the resulting siltation of downstream facilities and adjacent areas during grading operations. Various measures may include, but shall not be limited to: the use of graded contour berms to control sheet flow; supplemental grading of large areas around temporary or unfinished inlet structures to provide desilting basins; and temporary ditch paving.

6. From October 15th to April 15th:

   A. During embankment construction, an earth berm or appropriate grading to direct drainage away from the edge of the top of the embankment shall be constructed and maintained on those embankments where earthwork operations are not in progress.

   B. Special attention will be required to protect areas, which have been cleared, and grubbed prior to excavation or embankment operations, and which are subject to runoff during the period from October 15th to April 15th. Temporary measures may include, but shall not be limited to: temporary desilting basins; contour graded ditches; temporary paved and unpaved ditches; and filter fabric fences to contain silt and sediment from runoff.

   C. After each storm, desilting basins shall be checked against their design capacity and if necessary, silt and sediment shall be removed to restore capacity.

1.02 INSPECTION AND MAINTENANCE

A. To ensure the proper implementation and functioning of temporary erosion control measures, the CONTRACTOR shall regularly inspect and maintain the construction site for the control measures identified in the Storm Water Prevention Plan (SWPP). The CONTRACTOR shall identify corrective actions and time frames to address any damaged measures or reinitiate any measures that have been discontinued.

B. During the winter season defined as between October 15th to April 15th, inspections of the construction site shall be conducted by the CONTRACTOR to identify deficient measures, as follows:

   1. Prior to a predicted storm;

   2. After all precipitation which causes runoff capable of carrying sediment from the construction site;

   3. At 24 hours intervals during extended precipitation events; and

4. Routinely, on a minimum twice monthly basis.

If the CONTRACTOR identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected in a timely manner. If the ENGINEER identifies a deficiency in the deployment or functioning of an identified control measure, the CONTRACTOR will be notified in writing and the deficiencies shall be corrected by the CONTRACTOR in a timely manner.

END OF SECTION

SECTION 015719

TEMPORARY ENVIRONMENTAL CONTROLS

1.01 DUST ABATEMENT

A. The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective measures at all times during construction to prevent its operation from producing any airborne dust nuisance and dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity all in conformance with Section 10, "Dust Control", and Section 18, "Dust Palliative" of the Caltrans Standard Specifications. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER.

B. Reclaimed water, as specified in Section 015100, "Temporary Utilities" is available for CONTRACTOR's use for dust abatement.

C. Upon failure of the CONTRACTOR to remove the dust nuisance as specified in Paragraph A within 2 hours after notification by the ENGINEER, the CITY may order that such work be done by others, and all costs therefore shall be charged to the DEVELOPER.

1.02 RUBBISH CONTROL

A. During the progress of the Work, the CONTRACTOR shall not allow any rubbish or construction debris to blow or travel off the construction site. The CONTRACTOR shall keep all public streets and roads free from mud, dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable laws and regulations.

1.03 SANITATION

A. The CONTRACTOR shall insure that adequate existing sanitation facilities are available or the CONTRACTOR shall provide and maintain adequate sanitation facilities. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR'S operations shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto. Sanitation facilities will not be allowed in public street rights-of-way or in public lands. If more than four sanitation facilities are being used on a particular site, the CONTRACTOR shall locate these facilities no closer than 100' from existing residential units.

1.04 CHEMICALS

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

1.05 CULTURAL RESOURCES

A. The DEVELOPER'S attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470 and 36 CFR 800) which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. The DEVELOPER shall perform remediation in conformance with the requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations in the public street right-of-way or on public lands, the CONTRACTOR shall immediately cease all operations and shall immediately notify the ENGINEER.

1. The DEVELOPER shall be responsible for hiring a qualified archaeologist to assess the value of such potential cultural resources and make a recommendation to the State Water Resources Control Board Cultural Resources Officer.

2. The DEVELOPER shall obtain all necessary permits from the CITY Historic Preservation Committee.

D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Water Resources Control Board Cultural Resources Officer, the CONTRACTOR shall suspend work at the location of the find.

1.06 CONSTRUCTION NOISE

The CONTRACTOR shall be advised that the operation of any noise creating blower, power fan, or internal combustion engine which causes noise due to the explosion of operating gases or fluids is prohibited between the hours of 11:00 p.m. to 7:00 a.m. The operation between the hours of 8:00 p.m. and 7:00 a.m. of any pile driver, steam shovel, pneumatic hammer, derrick, steam, electric hoist, sandblaster or other equipment used in construction, demolition or other repair work, the use of which is attended by loud or unusual noise, is prohibited.

In addition, to the above noise requirements, the CONTRACTOR shall comply with all other requirements of Chapter 9.36 "Noise" of the Livermore Municipal Code.

END OF SECTION

SECTION 016600

MATERIALS AND EQUIPMENT

1.01 SALVAGE OF EXISTING FACILITIES

A. Any existing public or CITY facilities to be removed as directed by the ENGINEER shall be salvaged by the CONTRACTOR and delivered to the CITY facility as directed by the ENGINEER.

B. The CONTRACTOR shall carefully remove, in a manner to prevent damage, any and all materials and equipment specifically designated by the ENGINEER to be removed and salvaged.

C. Any items damaged during the removal, storage, or handling as a result of carelessnes, negligence, or improper procedures shall be replaced by the CONTRACTOR with corresponding items of equal or greater value.

D. The CONTRACTOR may at its option and on approval of the CITY furnish and install new items inlieu of those indicated to be salvaged or reused, in which case the original items shall become the property of the CONTRACTOR and shall be removed from the site after completion of the WORK. The cost of substituting new items in lieu of salvaged or revised items, at the CONTRACTOR'S option, shall be the responsibility of the CONTRACTOR.

E. Existing materials and equipment removed by the CONTRACTOR shall not be reused in the WORK, except where otherwise called for in the contract documents.

END OF SECTION

SECTION 017123

FIELD ENGINEERING

1.01 SUMMARY

A. The CONTRACTOR shall lay out and install all construction to lines and grades in accordance with the Drawings.

B. The CONTRACTOR shall be responsible for setting and maintaining all field engineering, establishing lines and grades, and for the accuracy of the stake information. All horizontal and vertical stake datum shall agree with the Drawings.

END OF SECTION

SECTION 017700

PROJECT CLOSEOUT

1.01 GENERAL

A. ALL construction shall meet the Public Works Occupancy Requirements prior to any building occupancy. Public works occupancy requirements include, but are not limited to, the following:

1. All underground facilities
2. Asphalt concrete pavement
3. Portland cement concrete improvements which may include, but not limited to: curb; gutter; sidewalk, driveways, and access ramps
4. Finish grading within the street right-of-way
5. Street name signs
6. Traffic regulatory signs, striping, and markings
7. Street lights installed and energized
8. Fire hydrants installed and accepted
9. All potential hazards removed within the street right-of-way
10. Street, and sidewalks and driveways cleaned
11. Water meters and boxes installed
12. Sanitary sewers cleaned out
13. Street trees installed *
14. All conditions of approval complied with

* The DEVELOPER may provide a tree bond in order to receive occupancy.

1.02 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove all rubbish, debris, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the CITY will be withheld until the CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

1.03 FINAL SUBMITTALS

A. The CONTRACTOR, prior to final acceptance, shall submit the following items to the ENGINEER:

1. Written guarantees or warranties
2. Record drawings as specified in Section 013300 "Submittals."

3. Completed Pavement Management Form

4. Maintenance stock items, including special parts; spare parts; special tools

5. Signed-off permits and/or certificates of inspection and acceptance by local governing agencies having jurisdiction

6. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

END OF SECTION

SECTION 022100 - MONUMENTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install cast-in-place Portland Cement Concrete survey monuments and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
C.	Section 321300	Concrete Surface Improvements
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM A 48	Specification for Gray Iron Castings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 FRAME AND COVER

A. Monument frame and covers shall be grey iron castings conforming to ASTM A 48, Class 30. Monument cover shall be marked "Monument." Each cover shall be ground or otherwise finished so that it will fit in its frame without rocking. Monument frame and cover shall be **Phoenix Iron Works P-2501, Monroe #9279, or equal.**

2.2 BRONZE SURVEY MARKER

A. Bronze survey markers shall be a 2-1/2 inch domed disk with stem and appropriate survey information as specified on the Drawings.

2.3 FORMING TUBE

A. Tubes for forming portland cement concrete collar and monument shall be a non-metallic type of the size and dimensions shown on the Drawings.

2.4 PORTLAND CEMENT CONCRETE

A. Portland Cement Concrete for collars and footings shall be Class C in conformance with Section 033050, "Utility Cast-in-Place Concrete."

2.5 ASPHALT CONCRETE PAVEMENT

A. Asphalt concrete for monuments shall be in conformance with "Fine Asphalt Concrete Paving" in PART 2 – "Products" of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

2.6 DRAIN ROCK

A. Drain rock material shall be in conformance with Permeable Material, Class 1 or 2, in PART 2 – "Products" of Section 312300, "Utility Earthwork."

PART 3 -- EXECUTION

3.1 GENERAL

A. Monuments shall not be installed until the asphalt concrete pavement has been completed. Monuments shall be installed at the locations shown on the Drawings.

B. Concrete, form tube, bronze survey marker, frame and cover, and asphalt concrete shall be installed as shown on the Drawings.

3.2 PORTLAND CEMENT CONCRETE

A. Hand mixing of the Portland Cement Concrete for use in constructing monuments will be allowed.

B. All portland cement concrete shall be placed and thoroughly consolidated.

3.3 ASPHALT CONCRETE PAVEMENT

A. Asphalt concrete for pavement shall be placed in conformance with PART 3 – "Execution" of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.4 DRAIN ROCK

A. Drain rock material shall be installed in conformance with Section 312300, "Utility Earthwork," and shall be compacted to 95 percent relative compaction.

- END OF SECTION -

SECTION 024100 - DEMOLITION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to perform and complete all demolition work shown on the Drawings and as specified herein. This includes, but is not necessarily limited to, such items as demolition, removal, recycling and disposal of asphalt concrete, miscellaneous concrete, vegetation and all other structures, or features as required.

B. Manufactured articles, materials, equipment, and accessories shall be demolished in accordance with the manufacturer's printed specifications and recommendations, and industry standards, unless otherwise shown or specified.

C. Hazardous materials shall be handled, removed and disposed of in accordance with all regulatory agency requirements.

D. Building utilities shall be disconnected, removed, capped and identified in accordance with the appropriate agency requirements.

E. The CONTRACTOR shall coordinate with the CITY for demolition permits required by the CITY and with all other regulatory agencies and utility companies.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The demolition and sealing of wells, septic tanks and underground tanks shall be in accordance with regulatory agency requirements. The CONTRACTOR shall obtain all required permits and file all required reports.

B. **Commercial Standards:**

1. USA Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. **Demolition Schedule:** The CONTRACTOR shall submit a complete coordination schedule for demolition work including shut-off and continuation of utility services prior to start of the work. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

B. The CONTRACTOR shall provide copies of written agreements from private land owner's, landfill operators, or other agencies accepting disposal of any demolished material prior to any work.

1.5 JOB CONDITIONS

A. **Condition of Facilities:** The CITY assumes no responsibility for actual condition of facilities to be demolished. The CONTRACTOR shall visit the site and inspect the existing facilities.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 OCCUPANCY AND POLLUTION CONTROL

A. Water sprinkling, temporary enclosures, chutes and other suitable methods shall be used to limit dust and dirt rising and scattering in the air. The CONTRACTOR shall comply with all government regulations pertaining to environmental protection.

B. Water shall not be used in a manner that creates hazardous or objectionable conditions such as ice, flooding, or pollution.

3.2 PROTECTION

A. Safe passage of persons around area of demolition shall be provided in accordance with all safety and regulatory requirements. Operations shall be conducted to prevent damage to adjacent buildings, structures, other facilities, people and property.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished and to adjacent facilities to remain.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary.

D. The CONTRACTOR shall protect and maintain conduits, drains, sewers, pipes and wires that are not to be demolished.

3.3 SMALL STRUCTURE DEMOLITION

A. Small structures may be removed intact when acceptable to the ENGINEER and approved by the City Building Official.

B. Demolition shall proceed in a systematic manner, typically from top of structure to ground.

C. Concrete and masonry shall be demolished in small sections.

3.4 BELOW-GRADE DEMOLITION

A. Footings, foundation walls, below-grade construction and concrete slabs on grade including utility lines shall be demolished and removed to a depth which will not interfere with new construction but shall not be less than 12 inches below existing ground surface or future ground surface, whichever is lower.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled.

C. All fill and compaction shall be in accordance with Section 312300, "Utility Earthwork."

D. All fill and compaction surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as shown on the Drawings.

E. Where installation of new utilities require partial removal or demolition of an existing utility, the existing utility shall be removed to sound material. Pipes to be demolished that require no future connection shall be removed to the extent required and sealed and capped. Sanitary sewer laterals shall be removed as required and a new two-way sewer clean out shall be installed in accordance with the Standard Specifications and Details. Pipes to be demolished that require a connection shall

be removed to the extent required to install the new connection. Pipe sections shall be removed either by sawcutting, removing a complete pipe section to an existing joint, or other adequate means which results in a clean joint.

F. The CONTRACTOR shall demolish and seal all wells, septic tanks and underground tanks in accordance with applicable regulatory agency requirements and permits.

G. Joint domestic/fire service laterals shall be abandoned as follows:

1. The Blow Off Assembly shall be removed and capped underground.
2. At the connection to the main the existing lateral valve shall be removed and a blind flange shall be installed on the tee at the main. The lateral pipe shall be abandoned in place by capping both ends of the lateral pipe.
3. The existing structural section of the roadway shall be replaced in kind in accordance with the City Standard specifications.

3.5 AT GRADE DEMOLITION

A. All asphalt concrete and all portland cement concrete curbs, gutters, sidewalks, access ramps and driveways shall be saw-cut at the nearest scoreline or deep joint and removed entirely to the saw-cut limits. Where adjacent pavement or concrete is broken or deteriorated sufficiently to prohibit a sound replacement the entire deteriorated section shall be removed to the limits determined by the ENGINEER.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the CITY. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish and other materials resulting from demolition operations shall become the property of the CONTRACTOR and shall be removed by the CONTRACTOR at the CONTRACTOR's expense to a suitable site. The proper and legal disposal of demolished materials shall be the responsibility of the CONTRACTOR.

3.7 PATCHING AND REPAIRING

A. The CONTRACTOR shall provide patching, replacing, repairing and refinishing of damaged areas or damaged adjacent facilities involved in the demolition. New concrete shall match the existing adjacent surfaces, in kind or of better quality, to the satisfaction of the ENGINEER, at no cost to the CITY or to the owners of the facilities.

3.8 CLEANUP

A. During and upon completion of work the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris and dust and shall leave areas affected by work in a clean, approved condition.

B. The CONTRACTOR shall clean adjacent structures and facilities of dust, dirt and debris caused by demolition, as directed by the ENGINEER or governing authorities, and return adjacent areas to condition existing prior to start of work.

C. The CONTRACTOR shall clean and sweep daily all street and roads affected by its operation.

- END OF SECTION -

SECTION 033500 - TEXTURED CONCRETE PAVING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place all textured concrete paving which may include but is not necessarily limited to, preparation of subgrade, aggregate base, reinforcement, concrete, colored hardener, colored curing compound, acrylic sealer, special imprinting tools and all other appurtenant work, complete in place as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 310000	Earthwork.
B.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
C.	Section 321300	Concrete Surface Improvements.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 19	Earthwork.
Section 26	Aggregate Bases.

B. **Commercial Standards:**

ASTM C 33	Specifications for Concrete Aggregates.
ASTM C 150	Specifications for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM D 1751	Specifications for Preformed Expansion Joint Filter for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.4 CONTRACTOR SUBMITALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. If requested, the CONTRACTOR shall provide a 2-foot by 2-foot square shop sample to be approved by the Engineer prior to start of construction.

1.5 QUALITY ASSURANCE

A. Textured concrete paving shall be installed by a licensed specialty CONTRACTOR.

B. All work shall comply with the current specifications and quality standards issued by the manufacturer.

PART 2 -- PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate base shall be class 2, 19 millimeter maximum size grading, aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications.

2.2 REINFORCEMENT AND DOWELS

A. Steel bar for textured concrete paving reinforcement and dowels shall be deformed billet-steel bars of the size or sizes as specified on the Drawings and shall be in conformance with PART 2 - PRODUCTS of Section 321300, "Concrete Surface Improvements."

2.3 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for textured concrete paving shall have a minimum 28 day compressive strength at 3000 psi.

B. Portland cement shall be Type II cement conforming to ASTM C 150.

C. Aggregate shall be minus 3/8-inch to 1 inch conforming to ASTM C 33.

D. When textured concrete paving is installed in the travelway, aggregate shall be minus 1-inch conforming to ASTM C33.

E. An air-entraining agent conforming with ASTM C 260 and/or a normal set or retarded set water reducing admixture conforming with ASTM C 494 may be used.

F. Calcium chloride shall not be permitted in the mix.

2.4 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be premolded expansion joint filler 1/2-inch thick in conformance with ASTM D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete improvements prior to being placed.

2.5 COLOR HARDENER

A. Color hardener shall be a ready to use, regular grade, dry-shake color hardener and shall be streak-free integregations of pigments, surface conditioning and dispersing agents, and portland cement blended with hard, graded aggregate.

2.6 COLORED CURING COMPOUND

A. Colored curing compound shall be in conformance with ASTM C 309 and shall conform with all applicable air pollution regulations.

2.7 ACRYLIC SEALER

A. A colored acrylic sealer may be used in lieu of a colored curing compound in accordance with the manufacturer's recommendations. A clear acrylic sealer may be used if textured concrete paving is multicolored.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall be in conformance with Section 310000 "Earthwork" and Section 321000 "Asphalt Pavement, Base and Surface Treatment."

B. Finish subgrade shall be within the tolerances established in Section 19-1, "General," of the Caltrans Standard Specifications.

3.2 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with PART 3-Execution of Section 321000 "Asphalt Pavement, Base and Surface Treatments." The aggregate base shall be placed to the depth as shown on the Drawings.

3.3 CONCRETE REINFORCEMENT

A. Concrete reinforcement and dowels shall be placed at the location as shown on the Drawings. Installation of concrete reinforcement and dowels shall be in conformance with Section 033050 "Utility Cast-in Place Concrete."

3.4 INSTALLATION OF TEXTURED CONCRETE PAVING

A. Textured concrete paving shall be installed to the dimensions as shown on the Drawings.

B. The concrete shall be placed and screeded to the finished grade and floated to a uniform surface in accordance with the manufacturer's recommendations.

C. The Contractor shall use manufacturer approved imprinting tools to make the desired impression to the surface of the concrete while the concrete is still in the plastic stage of set.

3.5 COLOR HARDENER

A. Color hardener shall be applied evenly to the concrete surface by the dry-shake method using a minimum of 60 pounds per 100 square feet in accordance with the manufacturer's recommendations.

B. Color hardener shall be applied in two or more shakes, floated after each and troweled only after the final floating.

3.6 EXPANSION JOINTS/DEEP JOINTS

A. Expansion joints shall be placed continuously between all textured concrete paving surfaces and concrete surfaces.

B. Deep joints shall be placed to a depth of 1/4 of the thickness of the textured concrete paving at a minimum spacing equal to 1.5 times the width of the textured concrete paving unless otherwise recommended by the manufacturer.

- END OF SECTION -

SECTION 034800 - PRECAST CONCRETE VAULTS, UTILITY BOXES, AND STORM WATER FIELD DROP INLETS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all precast items as required, including all appurtenances necessary to make a complete installation as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 033050	Utility Cast-In-Place Concrete.
B.	Section 033500	Grout.
C.	Section 055000	Miscellaneous Metalwork.
D.	Section 330526	Piping Identification Systems.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ACI 318	Building Code Requirements for Reinforced Concrete.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:**

1. The CONTRACTOR shall submit Shop Drawings for all specialty precast concrete items. Submitted drawings shall show design criteria, all dimensions, location and type of lifting inserts, and details of reinforcement and joints.

2. For all precast items which are manufactured, the CONTRACTOR shall also submit a list of the design criteria and product data sheets used by the manufacturer.

B. **Certification of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 DEFINITIONS

A. In these Specifications, where the terms "Precast Concrete," "Prefabricated Concrete" and "Precast Concrete Specialties" are used, they shall have equivalent meaning.

PART 2 -- PRODUCTS

2.1 MANUFACTURED ITEMS

A. **Miscellaneous Precast Vaults:**

1. Vault dimensions shall be as required by the specific installations and shall meet all required clearances.

2. Vaults shall be **Christy, Utility Vault Co. or equal.**

3. The vault frames shall be provided by the vault manufacturer. Vault covers shall be steel checker plate or vault access doors as specified and shall conform to Section 055000, "Miscellaneous Metalwork." When leveling bolts are used to set the vault top sections, the CONTRACTOR shall ensure that the load on the vault will be transferred through the mortar to the vault, and will not be carried by the leveling bolts.

4. Where vaults are in areas which may be subjected to vehicular traffic vault, frame and cover shall be designed for HS-20 traffic loading.

5. Vaults larger than 24 inches by 36 inches shall have vault access doors, with hinged meter reading lids when specified, and shall be located as specified or as shown on the Drawings.

B. **Utility Boxes:**

1. Utility boxes shall be sized as shown on the Drawings or shall meet the minimum clearance requirements as specified or as required for the intended use.

2. Utility boxes shall have covers that are designed by the manufacturer for HS-20 traffic loading in streets and driveways subject to vehicular traffic. The covers shall be embossed "Water," "Sanitary Sewer," or "Recycled" as appropriate. All water meter utility box covers shall have touch read recess holes in the lid.

3. Utility boxes larger than 22 inches by 36 inches shall have two piece steel checker plate lids and shall be located as specified or as shown on the Drawings.

4. Utility boxes shall be as manufactured by **Christy or equal.** The following table lists standard model numbers for Christy:

Service	Christy Box/lid*
a. Water Meters:	
Piston Meter Boxes	
5/8"	B-9/B-9P*
3/4"	B-12/B12P*
1"	B-16/B16P*
1-1/2"	B-36/B36P*
2"	B-36/B-36-61P*
Turbine Meter Boxes	
1-1/2"	B-36/B-36P*
2"	B-36/B-36P*
3"	Special design as approved by the City
b. Valve Boxes, Water Line Angle Marker Boxes	G-5/G5C
c. Sampling Station, Blow-Off and Angle Meter Stop Boxes	B-9/B-9*
d. Air Release Valves (1" and 2")*	B-24/B24-D (1" and 2" valves)
e. Sanitary Sewer:	
Clean Out Boxes	F8/F8*

* Utility boxes located in streets or driveways shall have cast-iron covers. Water meter boxes located in driveways shall have steel checker plate covers with a reading lid. All other utility boxes shall have reinforced concrete covers or polymer concrete covers.

5. Utility boxes in landscape areas, unimproved areas, and field installations shall have bolt or screw down lids or covers.

6. Utility boxes for blow-off valves on pipelines greater than 12" shall be Christy Box/lid B-30/B-30D* or equal and as shown on the DRAWINGS.

C. **Storm Water Field Drop Inlets:**

1. Frame and grate or cover plate shall be of the same manufacturer as the pre-cast inlet and shall be hot-dip galvanized after fabrication.

2. Precast storm water field drop inlets frame and grate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

3. **Storm water field drop side-opening inlet:** Precast storm water field drop side-opening inlets shall be **Santa Rosa, Type C, or equal.** Frame and grate or cover plate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

2.2 PREFORMED JOINT SEALANT

A. On vaults the joint sealing compound shall be a preformed, cold- applied, ready to use plastic joint sealing compound **Quick-Seal**, **Ram-Nek; or equal.**

2.3 NON-SHRINK GROUT

A. Non-shrink grout shall be as specified in the Section 033500, "Grout."

PART 3 -- EXECUTION

3.1 MANUFACTURED ITEMS

A. Precast Concrete Vaults, Utility Boxes and Field Storm Water Inlets shall be installed in accordance with the manufacturer's printed recommendations, and as shown on the Drawings.

B. Connections to precast vaults, utility boxes, and field storm water inlets shall be made by installing pipe sections into the structure wall using non-shrink grout as specified in Section 033500, "Grout." A water stop shall also be installed on all plastic pipes.

C. All utilities shall be identified as specified in Section 330526, "Piping Identification Systems."

D. Construction grade redwood shims and one-piece boards shall be installed as shown on the Drawings.

- END OF SECTION -

SECTION 036000 - GROUT

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place grout and shall form, mix, place, cure, repair, finish, and do all other work as necessary to produce finished grout as shown on the Drawings and as specified herein.

B. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: Non-Shrink grout is to be used unless another type is specifically referenced or as shown on the Drawings.

2. Epoxy Grout

3. Cement Grout

C. Cement grout for pressure grouting around steel casing pipes shall be in conformance with Section 330523, "Steel Casing Boring and Jacking."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 330523	Steel Casing Boring and Jacking.
B.	Section 033050	Utility Cast-in-Place Concrete.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 033050, "Utility Cast-in-Place Concrete," and as referred to herein.

B. **Commercial Standards:**

ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. or 50-mm Cube Specimens).
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 827	Test Method for Change in Height of Early Ages of Cylindrical Specimens from Cementitious Mixtures.
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics.
CRD-C 621	Corps of Engineers Specification for Non-shrink Grout.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance**: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-Shrink Grout:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (zero percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (zero percent) and a maximum of 0.2-percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.

4. Application:

   a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

   b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material.

B. **Epoxy Grout:**

1. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (zero percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other specified applications.

2.2 CEMENT GROUT

A. **Cement Grout:** Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement shall be as specified in Section 033050, "Utility Cast-in-Place Concrete."

2.3 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is specified, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

2.4 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using appropriate containers. Shovel measurement will not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 033050, "Utility Cast-in-Place Concrete." The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.

C. All mixing, surface preparation, handling, placing, consolidation and other means of execution for prepackaged grouts shall be done according to the printed instructions and recommendations of the manufacturer.

3.2 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

- END OF SECTION -

SECTION 310000 - EARTHWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and construct the roadway subgrade and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1 Site Clearing, Grubbing and Stripping.
2. Preparation for Fill Material.
3. Roadway Excavation.
4. Roadway Grading and Compaction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 024100	Demolition.
B.	Section 015700	Site Preparation.
C.	Section 312300	Utility Earthwork.
D.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 16	Clearing and Grubbing.
Section 19	Earthwork.
Section 68	Subsurface Drains.
Section 88	Engineering Fabrics.

B. **Uniform Building Code.**

C. **Commercial Standards:**

ASTM C 117	Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C 136	Method for Sieve Analysis of Fine and Course Aggregates.
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method.

ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 2844	Test Method for Resistance *R*-Value and Expansion Pressure of Compacted Soils.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place By Nuclear Methods (Shallow Depth).
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and martials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. All soils testing will be done by a testing laboratory of the CITY'S choice and at the CITY'S expense, except as otherwise specified in this Section.

B. Where soil material is required to be compacted to a percentage of relative compaction, the maximum density at optimum moisture content will be determined in conformance with ASTM D 1557. Field density in-place and moisture content tests will be performed in conformance with ASTM D 2922 and ASTM D 3017, respectively, or by such other means acceptable to the ENGINEER.

C. If the tested materials show non-compliance with the required relative compaction, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance.

D. The CITY will pay the cost of the first test and one re-test. Subsequent re-testing after the first re-test to show compliance shall be at the CONTRACTOR'S expense.

E. The CONTRACTOR shall notify the ENGINEER at least 48 hours prior to performing any site clearing, grubbing, or stripping.

F. Finish subgrade at any point shall not vary more than 0.1-foot above or below the subgrade shown on the Drawings.

1.6 PROJECT CONDITIONS

A. Material for embankments, where required, shall consist of suitable excavated material if available, or such imported fill material as may be required conforming to the requirements of this Section and the appurtenant soils report.

B. The CONTRACTOR shall be solely responsible for the maintenance of the graded surface at all times including implementing all erosion control measures as shown on the drawings during the winter months.

C. The CONTRACTOR shall be solely responsible for provision of adequate site drainage at all times as shown on the grading and erosion control plans during the course of the WORK.

PART 2 -- PRODUCTS

2.1 SUITABLE FILL MATERIAL

A. Import fill material shall consist of inert granular soil and rock fragments and shall conform to the requirements of the appurtenant soils report.

B. All fill material, import or native, shall be free of organic materials, trash and debris, moderately to highly expansive clays, or any other deleterious materials, and shall be subject to the approval of the ENGINEER.

C. In addition to the soils report requirements, the top 2 feet of import fill material below the subgrade for the roadway shall conform to the following requirements:

1. Fill material shall conform to the following as determined by ASTM C 117 and ASTM C 136:

a.	Maximum particle size	3 inches
b.	Percent passing 1-inch sieve	90-100 percent
c.	Percent passing No. 200 sieve	less than 20 percent

2. Plasticity Index for acceptable import fill materials shall be a maximum of 15 when determined by the procedure set forth in ASTM D 4318.

3. The liquid limit shall not exceed 40 percent as determined by the procedures set forth in ASTM D 4318.

4. Import fill material shall have an R-value of 25 or greater as determined by ASTM D 2844.

D. The CONTRACTOR shall submit to the ENGINEER at least 10 working days prior to use on the site its proposed source of import fill material along with a soils report and Certification from the designated source that the proposed source materials conform to this Section.

E. All suitable native fill material containing clods or hard lumps of earth over 6 inches in the greatest dimension shall be broken up before compaction. All suitable native fill material consisting of large rocky material or hard lumps, such as hardpan or cemented gravel which cannot be broken readily, shall be well distributed in the lower portions throughout the earthwork.

PART 3 -- EXECUTION

3.1 SITE CLEARING, GRUBBING AND STRIPPING

A. Clearing and grubbing shall conform to Section 16, "Clearing and Grubbing," of the Caltrans Standard Specifications and this Section.

B. Unless otherwise shown on the Drawings, clearing and grubbing shall be performed within the entire street right-of-way area. No burning of material will be allowed.

C. The site shall be stripped and cleared of all vegetation, debris and organic-laden top soil as required by the appurtenant soils report. The stripped material shall be removed from the site or stockpiled for landscaping purposes if allowed by the appurtenant soils report. This material shall not be used as import fill.

D. No clearing or grubbing of the site can take place until any environmental review associated with the project, if any, has been completed and approved by the appropriate agencies.

3.2 PREPARATION FOR FILL MATERIAL

A. Prior to placing import fill material, all areas to receive fill shall be scarified and compacted. Unless otherwise stated in the appurtenant soils report, the area shall be scarified to a minimum of 8 inches, material shall be moisture conditioned by wetting or drying to a range of 2 percent to 5 percent over optimum moisture content, and compacted to a density of not less than 90 percent relative compaction in conformance with ASTM D 1557.

3.3 ROADWAY GRADING AND COMPACTION

A. Roadway grading shall consist of grading the site to the lines and grades called for on the Drawings. Roadway grading, placing and compacting shall conform to Section 19-5, "Compaction" and Section 19-6, "Embankment Construction," of the Caltrans Standard Specifications and as modified by this Section.

B. Damage to underlying native soils caused by the CONTRACTOR'S operations shall be repaired and re-compacted under the supervision of and to the satisfaction of the ENGINEER at no additional cost to the CITY.

C. Material for roadway fill shall be placed in lifts or horizontal layers not exceeding 8 inches in un-compacted thickness. Unless otherwise specified in the appurtenant soils report, material shall be moisture conditioned by wetting or drying as specified in Section 3.2 above, and compacted to a density of not less than 90 percent relative compaction in conformance with ASTM D 1557. In addition, in fill areas the upper 2 feet below street subgrade for the width of the traveled way shall be compacted to a density of not less than 95 percent relative compaction in conformance with ASTM D 1557.

D. Final preparation of subgrade shall be in conformance with PART 3 - EXECUTION of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.4 ROADWAY EXCAVATION

A. Roadway excavation shall conform to Section 19-1, "General" and Section 19-2, "Roadway Excavation" of the Caltrans Standard Specifications, except the reference to Section 19-5, "Compaction," is deleted, and except that Section 19-2.02, "Unsuitable Material," is modified as follows:

1. When directed by the ENGINEER, the CONTRACTOR shall excavate the unstable or unsuitable underlying material to the depth determined by the appurtenant soils report.

2. Subgrade shall be prepared in conformance with PART 3 - EXECUTION, of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.5 UNDERGROUND STRUCTURES

A. Where abandoned underground structures and pipelines are encountered in the street areas, remove to sufficient depth to allow underground lines to cross, backfill and compact during rough grading. The ENGINEER may require further work to be done if visual inspection indicates during construction.

- END OF SECTION -

SECTION 311300

SELECTIVE TREE AND VEGETATION TRIMMING AND REMOVAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to perform the selective tree and vegetation trimming and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Verification of trees and vegetation to be trimmed with ENGINEER.
2. Trimming of trees and other vegetation in the street right of way.
3. Removal of trees and other vegetation as approved by the ENGINEER.
4. Removal of cuttings and clean-up of the jobsite.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321000	Asphalt Pavement, Base, and Surface Treatments.
B.	Section 321200	Flexible Pavement Coatings.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 12	Construction Area Traffic Control Devices.

B. **Commercial Standards:**

1. CAL-OSHA Standards.

2. ANSI Regulations.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit copies of the supervising arborist's certification from the Western Chapter of the International Society of Arboriculture to the ENGINEER prior to performing the WORK.

B. The CONTRACTOR shall submit copies of required resident notifications to the ENGINEER for review prior to distribution. The CONTRACTOR shall follow up each notification and parking restriction posting with submittal to the ENGINEER of a signed affidavit confirming time and date of each notification or posting.

1.5 QUALITY ASSURANCE

A. All trimming work shall be performed under the direct supervision of and in conformance with the recommendations of an arborist certified by the Western Chapter of the International Society of Arboriculture and the City of Livermore Municipal Code Section 12.20.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall be held responsible for any damage to trees, vegetation, or private property caused by its construction operations or trees that die after improper pruning or trimming. At the CITY'S option, the CONTRACTOR shall be assessed for the value of the damage to the trees, vegetation or private property based upon the the International Society of Arborculture's Standard method of valuation.

B. The CONTRACTOR shall furnish all tools and equipment and employ trained tree trimmer personnel under the direction of the arborist to operate all equipment and perform all handwork efficiently and skillfully.

C. The trimming work shall be performed in a safe and proper manner adhering to CAL-OSHA standards and ANSI regulations.

PART 2 -- PRODUCTS

2.1 TREE SEALER

A. Tree sealer shall be as manufactured by **Ready to Use "Tre-hold,"** or equal, tree sealer conforming to the following specifications:

1. A commercial grade, quick drying, tree sealer which shall have suitable qualities to coat and seal damaged bark and cuts, and inhibit secondary growth. Application shall be made in accordance with the manufacturer's printed recommendations.

PART 3 -- EXECUTION

3.1 ORDER OF WORK

A. Trimming and/or removal shall be performed only on trees or vegetation requiring work in order to conform to the parameters set forth in this Section, unless otherwise directed by the ENGINEER.

B. The CONTRACTOR shall identify all trees and vegetation determined to require trimming or removal with temporary chalk paint markings on the adjacent street travelway for review by the ENGINEER prior to beginning any cutting operations.

C. A list verifying the address and/or location of all trees or vegetation to be trimmed or removed shall be prepared by the CONTRACTOR and submitted to the ENGINEER for review by the City's designated landscape specialist.

D. The CONTRACTOR shall notify all property occupants when trees or vegetation is to be trimmed or removed in accordance with this Section. All written notifications to be distributed to affected property occupants shall be submitted to the ENGINEER for review prior to distribution. The CONTRACTOR shall distribute notifications and post temporary no parking restrictions per this Section a minimum of 72 hours in advance of any cutting operations.

3.2 PUBLIC NOTIFICATION

A. All residents, businesses, and public facilities affected by the WORK shall be provided with prior notification in accordance with Division 1, General Requirements. All notifications shall be in a form of written posting, setting the time and date that the cutting operations will take place. The CONTRACTOR shall follow up each notification with submittal to the Engineer of a signed affidavit confirming time and date of each notification or posting.

B. "No Parking" zones shall also be established where necessary to accomplish trimming operations in conformance with the Division 1, General Technical Requirements.

3.3 TREE AND VEGETATION TRIMMING

A. Tree limbs or other vegetation obstructions shall be trimmed to a minimum height of 11 feet above the roadway, as measured from the lip of gutter, and to 8 feet-9 inches above the sidewalk, as measured from the back of sidewalk. The crown of the tree shall be balanced as necessary. Balancing of the crown of the tree shall be accomplished by thinning, reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs, and sucker growth. Limbs shall be pruned back to an appropriate lateral branch.

B. Tree limbs shall not be torn or ripped. All final pruning cuts shall be clean cuts.

C. Trees and vegetation shall be trimmed in such a manner as not to injure adjacent trees, plants, and/or improvements which are to be preserved.

D. Cuts or damage to areas of tree bark caused by the CONTRACTOR'S trimming operations shall be treated with a sealer such as "Tre-hold," or equivalent, as approved by the ENGINEER. Application of the tree sealer shall be made according to the manufacturer's printed recommendations.

E. All trimmings and debris generated from these operations shall be removed completely from both the public right of way and adjacent private property and properly disposed of in a legal manner in conformance with the Division 1, General Requirements.

- END OF SECTION -

SECTION 311316

ROOT PRUNING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to perform all root pruning necessary to construct improvements, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
B.	Section 321300	Concrete Surface Improvements.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 12	Construction Area Traffic Control Devices.

B. **Commercial Standards:**

1. CAL-OSHA Standards.

2. ANSI Regulations.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit copies of the supervising arborist's certification from the Western Chapter of the International Society of Arboriculture to the ENGINEER prior to performing the WORK.

1.5 QUALITY ASSURANCE

A. All root pruning work shall be performed under the direct supervision of and in conformance with the recommendations of an arborist certified by the Western Chapter of the International Society of Arboriculture.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall be held responsible for any damage to trees, vegetation, or private property caused by its construction operations.

B. The CONTRACTOR shall furnish all tools and equipment and employ sufficient trained personnel to operate all equipment and perform all handwork efficiently and skillfully.

C. The root pruning work shall be performed in a safe and proper manner adhering to CAL-OSHA standards and ANSI regulations.

PART 2 -- PRODUCTS

2.1 ROOT SEALER

A. Root sealer shall be manufactured by **Ready to Use "Tre-hold,"** or equal conforming to the following specifications:

1. A commercial grade, quick drying, root sealer which shall have suitable qualities to coat and seal damaged bark and cuts, and inhibit secondary growth. Application shall be made in accordance with the manufacturer's printed recommendations.

PART 3 -- EXECUTION

3.1 TRAFFIC CONTROL

A. The CONTRACTOR shall use suitable measures, including signs, portable barricades, tape and flaggers, as required in conformance with the Division 1, General Requirements.

3.2 ROOT PRUNING

A. Where concrete repair work occurs adjacent to or over tree roots where damage has been caused by root intrusion, the roots shall be removed to a minimum depth of at least 8 inches below the bottom of the new concrete improvements. Roots shall be cut as far from the tree as possible alongside the edge of the new curb or sidewalk. Roots must be completely severed prior to their removal.

B. If removal of a root is determined by the Arborist to potentially endanger the stability or health of the tree, the CONTRACTOR shall provide the ENGINEER with the findings and avoid cutting the roots until approval from the ENGINEER has been received.

C. Root pruning shall not be performed until after removal of the existing concrete improvements but shall be completed prior to base and subgrade excavations. Root pruning shall be achieved by use of a **Vermeer** root cutter or equivalent method approved by the ENGINEER. Tree roots may occasionally be cut by sawing or chopping with a sharp saw or axe on an individual case basis, but only with the express approval of the Arborist and the ENGINEER.

D. Tree roots shall not be torn or ripped. All final root pruning cuts shall be clean cuts.

E. Cuts on tree roots 1-inch diameter or larger and areas of bark or skin damage caused by root pruning operations shall be treated with a root sealer and growth inhibitor.

F. At sites where excavation has exposed living roots to the air the CONTRACTOR shall cover the exposed roots within 2 hours of exposure with base rock, soil, moist burlap or other means acceptable to the Arborist and the ENGINEER. Inspection by the ENGINEER is required prior to permanent backfill.

G. Roots shall be pruned in such a manner as not to injure adjacent trees, plants and/or improvements which are to be preserved.

H. In addition to root pruning, trimming of the tree crown may be required as determined by the Arborist. Trimming of the tree crown shall be in conformance with PART 3 - Execution of Section 311300 "Selective Tree and Vegetation Trimming and Removal."

- END OF SECTION -

SECTION 312300 - UTILITY EARTHWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to perform and complete all utility earthwork as shown on the Drawings and as specified herein.

B. The work of this Section includes all earthwork required for construction of the project. Such earthwork shall include, but may not necessarily be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work, which shall include, but not necessarily be limited to, the furnishing, placing, and removing of sheeting, shoring and bracing necessary to safely support the sides of all excavations; all pumping, ditching, draining and other required measures for the removal or exclusion of water from the excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork.

C. Hazardous materials shall be handled in accordance with all regulatory agency requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 024100	Demolition.
B.	Section 015700	Site Preparation.
C.	Section 310000	Earthwork.
D.	Section 312323	Controlled Low Strength Materials (CLSM).
E.	Division 2 and 5	Pipe Sections as applicable.
F.	Section 328000	Irrigation Systems.
G.	Section 329113	Landscape Soil Preparation.
H.	Section 329300	Landscape Planting.
I.	Section 331100	Piping, General.
J.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State Codes:**

California Labor Code.

Construction Safety Orders of the State of California.

B. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 25	Aggregate Subbases.
Section 26	Aggregate Bases.
Section 68	Subsurface Drains.
Section 88	Engineering Fabrics

C. **Commercial Standards:**

ASTM D 422	Test Method for Particle-Size Analysis of Soils.
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
ASTM D 2419	Method for Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D 2487	Test Method for Classification of Soils for Engineering Purposes.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
ASTM D 3776	Test Methods for Mass Per Unit Area (Weight) of Woven Fabric.
ASTM D 3786	Method of Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D 4253	Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
ASTM D 4254	Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4491	Test Methods for Water Permeability of Geotextiles by Permittivity.

ASTM D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile.
OSHA	Occupational Safety and Health Administration.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR'S attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over, shall submit to the ENGINEER for review for compliance with Section 6705 the CONTRACTOR'S detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system standards established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared, stamped and signed by a civil or structural engineer licensed in the State of California at the CONTRACTOR'S expense.

B. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

C. For all materials that are not pre-approved by the CITY the CONTRACTOR shall designate the source and/or submit samples of all materials in advance of their use for required testing and ENGINEER's approval. All testing costs shall be at the CONTRACTOR'S expense.

1.5 QUALITY ASSURANCE

A. **General:** All soils testing will be done by a testing laboratory of the CITY'S choice at the CITY'S expense except as otherwise specified in Paragraph 1.5 C. below.

B. Where soil material is required to be compacted to a percentage of maximum density the maximum density at optimum moisture content will be determined in accordance with ASTM D 1557. Where cohesionless, free draining soil material is required to be densified to a percentage of relative density the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 2922, or by such other means acceptable to the ENGINEER.

C. In case the first test and one re-test of the fill or backfill show non-compliance with the requirements the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent re-testing after the first re-test to show compliance shall be at the CONTRACTOR'S expense.

D. The CONTRACTOR shall notify the ENGINEER at least 48 hours prior to performing any utility excavation.

PART 2 -- PRODUCTS

2.1 SUITABLE BACKFILL MATERIALS

A. Suitable Backfill shall be a selected or processed clean, fine earth, rock, or sand, free from objectionable material, vegetation, or other deleterious substances.

B. The following TYPES of backfill materials are designated and defined as follows:

TYPE 1. **Sand** shall be material with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.

TYPE 2. **Class 2 Aggregate Base** shall be crushed rock aggregate base material meeting the requirements of Section 26, "Aggregate Bases," for 19 millimeter maximum grading, of the Caltrans Standard Specifications.

TYPE 3. **Class 1, Type A or B, Permeable Material** shall be crushed stone, or gravel, durable and free from slaking or decomposition under action or alternate wetting or drying, uniformly graded, and shall meet the requirements of Section 68-1.025 for Class 1, "Permeable Material," of the Caltrans Standard Specifications.

TYPE 4. **Class 2 Permeable Material** shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying, uniformly graded, and shall meet the requirements of Section 68-1.025 for Class 2 "Permeable Material," of the Caltrans Standard Specifications.

TYPE 5. **Manufactured Backfill** shall be manufactured, angular, granular, crushed stone, rock, or slag with 100 percent passing a one-inch sieve and less than one percent passing a No. 4 sieve.

TYPE 6. **Controlled Low Strength Materials (CLSM)** shall conform to the requirements of Section 02320 "Controlled Low Strength Materials (CLSM)."

TYPE 7. **Native** material shall be material obtained from on-site excavations, provided the materials are not classified as unsuitable. Native material shall be free of stones, lumps, broken concrete or bituminous surfacing over 4 inches in diameter, objectionable material, vegetation, and deleterious substances.

TYPE 8. **Topsoil** material may be material which has been obtained at the site or may be imported, and shall meet the requirements of Section 02911, "Landscape Soil Preparation." Removal of the topsoil shall be done after the area has been stripped of vegetation and debris as specified.

TYPE 9. **Aggregate Subbase** shall conform to the grading and quality requirements of Section 25, "Class 2 Aggregate Subbase" of the Caltrans Standard Specifications.

2.2 UNSUITABLE BACKFILL MATERIAL

A. Unsuitable soils for backfill material shall include soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, or OL. Types CH and MH soils will be permitted in unimproved areas only where required compaction and stability can be demonstrated. In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classified as unsuitable material.

B. Any material determined to be hazardous is defined as unsuitable material.

C. Washed, smooth rock (pea gravel) is classified as unsuitable material.

D. Where moisture content of the material is not in conformance with Section 310000, "Earthwork," the material will be classified as unsuitable material.

2.3 USE OF SUITABLE BACKFILL MATERIAL TYPES

A. The CONTRACTOR shall use the types of materials as designated herein for all required backfill construction.

B. Backfill material types shall be used in conformance with the following provisions:

1. **Bedding** backfill, as defined under PART 3 - EXECUTION of this Section herein, shall be Sand; Class 2 Aggregate Base; Class 1, Type A Permeable Material; or Class 2 Permeable Material, meeting the requirements of Product Types 1, 2, 3A, or 4.

2. **Pipe Zone** backfill, exclusive of bedding, as defined under PART 3 - EXECUTION of this Section herein, shall be as follows:

   a. Plastic pipe shall be backfilled with Sand meeting the requirements of Product Type 1.
   b. Mortar coated pipe, concrete pipe, and ductile iron pipe shall be backfilled with Sand; Class 2 Aggregate Base backfill material; Crushed Rock or Gravel, meeting the requirements of Product Types 1, 2, 3A, or 4.
   c. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Sand; or natural, rounded, non-crushed material, meeting the gradation requirements of Product Types 1, 3 A, or 4.
   d. Vitrified clay pipe shall be backfilled with Sand, or Manufactured Backfill material, meeting the requirements of Product Type 1 or 5; or Class 2 Aggregate Base; Class 1, Type A Permeable Material; or Class 2 Permeable Material, meeting the requirements of Product Types 2, 3A, or 4, only if properly compacted with hand tampers or vibratory compactors as appropriate.
   e. Backfill for sub-drainage systems shall be designed on a case-by-case basis.

   The pipe zone backfill for all other pipelines excluding those listed above shall be Sand; Class 2 Aggregate Base; Class 1 Type A Permeable Material; Class 2 Permeable Material; Manufactured Backfill; meeting the requirements of Product Types 1, 2, 3A, 4, or 5. **Note:** Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a No. 4 sieve, trench plugs of impermeable clay type material or concrete shall be provided at minimum intervals of 200 feet.

3. Trench **Zone** backfill as defined under PART 3 - EXECUTION of this Section herein, shall be Sand; Class 2 Aggregate Base; Class 1, Type A, Permeable Material; Class 2 Permeable Material; Manufactured Backfill; Native; or Aggregate Subbase meeting the requirements of Product Types 1, 2, 3A, 4, 5, 6, 7, or 9.

4. **Final Zone** backfill as defined under PART 3 - EXECUTION of this Section herein, shall consist of the following materials for each condition listed below.

   a. Final Zone backfill under paved areas shall be Class 2 Aggregate Base, CLSM, or Class 2 Aggregate Subbase, meeting the requirements of Product Types 2, 6, or 9.

   b. Final Zone Backfill in unimproved areas shall be Native or Class 2 Aggregate Subbase meeting the requirements of Product Types 7 or 9.

   c. Final Zone backfill in landscape areas shall be Native meeting the requirements of Product Type 7. Topsoil and amendments shall be Product Type 8 as specified in Section 02911, "Landscape Soil Preparation," and as shown on the Drawings.

   d. Final Zone backfill under graveled roads shall be Class 2 Aggregate Base, CLSM, Native, or Class 2 Aggregate Subbase meeting the requirements of Product Types 2, 6, 7, or 9.

5. **Minor structures.** Backfill materials around minor structures shall be any Trench Zone Product Type except Sand, Native, or Topsoil, Product Types 1, 7, or 8.

6. **Over-excavation** backfill shall be Class 1, Type B Permeable Material meeting the requirements of Product Type 3B. For wet trench conditions place a filter fabric on top and below of the permeable material to prevent migration of fines.

2.4 FILTER FABRIC

A. Filter fabric shall be non-woven synthetic fabric meeting the requirements of Section 88-1.03, "Filter Fabric," of the Caltrans Standard Specifications. Filter fabric shall be non-woven synthetic fabric with a minimum Grab Strength of 90 pounds; a minimum Burst Strength of 180 pounds, a minimum Puncture Strength of 50 pounds, a Water Flow Rate of at least 40 gal/min/sf, and an Apparent Opening Size of between 60 and 110.

2.5 STEEL PLATE

A. When steel plate bridging is provided in-lieu of backfill and temporary asphalt, it shall conform to Section 602.1 of the Caltrans Encroachment Permit Manual, with the following minimum thicknesses:

Trench Width	Minimum Plate Thickness
(10") 0.25 m	(1/2") 13 mm
(1' - 11") 0.58 m	(3/4") 19 mm
(2' - 7") 0.80 m	(7/8") 22 mm
(3' - 5") 1.04 m	(1") 25 mm
(5' - 3") 1.60 m	(1 ¼") 32 mm

For spans greater than 5 feet-3 inches, a structural design shall be prepared by a California registered civil engineer.

PART 3 -- EXECUTION

3.1 GENERAL

A. Where abandoned underground structures are encountered in the street areas, remove to sufficient depth to allow underground lines to cross, backfill and compact during rough grading. The ENGINEER may require further work to be done if visual inspection indicates during construction.

3.2 MINOR STRUCTURE EXCAVATION

A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown on the Drawings or ordered by the ENGINEER. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures required for the removal or exclusion of water, including storm water, groundwater, and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The limits of structure excavation shall be a minimum of 12 inches beyond the outside edge of the structure, and at a minimum no larger than necessary to facilitate backfill, compaction and testing operations. For structures poured against undisturbed soil the width of the structure wall shall be no more than 2 inches greater than specified or shown on the Drawings.

B. **Excavation Beneath Minor Structures**: Except where otherwise specified for a particular structure or as directed by the ENGINEER, excavation shall be carried to the grade of the bottom of the structure. When directed by the ENGINEER, areas beneath minor structures shall be over-excavated. When such over-excavation is directed, both over-excavation and subsequent backfill to the required grade shall be performed. After over-excavation is performed and before backfill is placed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 90 percent of maximum density.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

A. **Trench Width:** Unless otherwise shown or directed, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and larger, and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches. For deep trenches, the maximum width requirement may be waived for constructability reasons with the written approval of the ENGINEER. For telecommunications conduits (electrical, telephone, cable TV/communication conduits), street light and traffic signal conduits, the width of the trench shall be as shown on the City standard details.

B. **Subgrade:** The surface of the subgrade after compaction shall be hard, uniform, smooth, self draining, and true to grade and cross section.

C. **Trench Bottom:** The pipe bedding shall be given a final trim establishing grade such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Rounding out the trench bottom or bedding to form a cradle for the pipe will not be allowed. The CONTRACTOR shall excavate for bell holes and fittings.

D. **Open Trench:** The maximum amount of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed and backfilled in a single day. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate may be waived in cases where the trench is located further than 100 feet from any travelled roadway or occupied structure. In such cases, however, barricades and warning lights meeting safety requirements shall be provided and maintained.

E. **Trench Over-Excavation:** Where indicated trenches shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the Pipe Zone.

F. **Over-Excavation:** When ordered by the ENGINEER, whether or not indicated on the Drawings, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the Pipe Zone.

G. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level a minimum of 2 feet above the top of the pipe, as directed by the ENGINEER, or as recommended by the pipe manufacturer, whichever is greater, before the trench is excavated.

3.4 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

A. Any over-excavation carried below the grade ordered, specified, or shown, shall be backfilled to the required grade and densified with the specified material and compaction. Such work shall be performed by the CONTRACTOR at its own expense.

3.5 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, stockpiled, watered and preserved for replacement. Excavated material may be placed on the lawn provided that a tarp or other suitable method is employed to protect the lawn from damage. The lawn shall not remain stockpiled for more than 48 hours. Immediately after completion of backfilling and testing of the pipeline, the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod, in kind, if removed sod has remained stockpiled for more than 48 hours.

B. All other landscaping shall be replaced in kind in conformance with Section 329113, "Landscape Soil Preparation," and Section 329300, "Landscape Planting," as shown on the Drawings or as directed by the ENGINEER. All damaged irrigation systems, including piping and electrical wiring, shall be repaired and operating properly the same day they are damaged, in conformance with Section 328000, "Irrigation Systems."

3.6 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the ENGINEER. Trees shall be supported during excavation by any means previously reviewed by the ENGINEER.

B. If existing roots over one inch in diameter are cut during the course of the work, the cut faces shall be thoroughly coated with emulsified asphalt made especially for use on cut or damaged plant tissues. Exposed roots shall be covered with wet burlap to prevent them from drying out.

3.7 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock.

B. **Explosives and Blasting:** Use of Explosives and Blasting will not be permitted.

3.8 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The CONTRACTOR shall remove and dispose of all excess excavated material to a suitable site. The proper and legal disposal shall be the responsibility of the CONTRACTOR.

3.9 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure for a minimum of 72 hours or until the concrete has attained sufficient design strength to withstand the loads imposed, whichever is greater.

B. Except for Product Type 3B material being placed in over-excavated areas or trenches and unless specifically excepted by the ENGINEER, backfill shall not be placed until after all water is removed from the excavation.

3.10 PIPE AND UTILITY TRENCH ZONES AND BACKFILL

A. **Pipe Zone and Backfill:**

1. The Pipe Zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 12 inches above the top surface of the pipe.

2. The Pipe Zone shall be backfilled with the specified backfill material. The CONTRACTOR shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.

B. **Bedding:** The bedding is defined as that portion of the Pipe Zone lying between a plane 6 inches below the bottom surface of the pipe, the trench subgrade, and a level line from the bottom of the pipe.

1. Bedding shall be provided for all pipelines.

2. After compacting the bedding the CONTRACTOR shall perform a final trim for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

C. **Trench Zone and Backfill:** After the Pipe Zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the Trench Zone may proceed.

The Trench Zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 24 inches below the roadway subgrade in paved areas, or 24 inches below the finished surface grade in landscaped or unimproved areas.

D. **Final Zone and Backfill:** The Final Zone is defined as the last 24 inches between the top of the Trench Zone and the roadway subgrade in paved areas, and the last 24 inches of the vertical trench cross-section lying between the top of the Trench Zone and the finish final grade in landscaped or unimproved areas.

E. **Utility Crossing:** For any new pipeline installation that crosses under an existing electric, gas, telephone, or cable tv utility pipe(s) or conduit(s) the CONTRACTOR shall replace the existing backfill material around the existing utility pipe(s) or conduit(s) with PG&E SAND. PG&E SAND shall be placed from a plane 6 inches below the bottom of the lowest utility pipe or conduit to a plane 12 inches above the top of the highest utility pipe or conduit, and for the full width of the new trench. PG&E SAND backfill shall be compacted to 95 percent maximum density in conformance with COMPACTION AND BACKFILL MATERIALS as specified below.

3.11 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in horizontal layers. The backfill layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.

B. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer and uniformity of moisture throughout backfill materials. Pipe Zone backfill materials shall be manually spread around the pipe so that when compacted the Pipe Zone backfill will provide uniform bearing and side support.

C. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried or replaced until the moisture content is satisfactory.

E. Backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type subject to review by the ENGINEER. Impact-type pavement breakers (stompers) will not be permitted. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or new improvements. The CONTRACTOR shall make its own determination in this regard.

F. Material for mechanically compacted backfill may be placed in loose lifts which, prior to compaction, shall not exceed the thickness specified below for various types of equipment:

1. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers - maximum lift thickness of 2 feet.

2. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels - maximum lift thickness of 1 foot.

3. Hand-directed mechanical tampers-maximum lift thickness of 4 inches.

G. Mechanically compacted landfill shall be placed in horizontal layers of thickness not exceeding those specified above, compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened or dried, if necessary, and then tamped or rolled until the specified relative compaction has been attained.

3.12 COMPACTION OF BACKFILL MATERIALS

A. Each layer of backfill material as defined herein, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content range.

B. Flooding, ponding, or jetting shall not be used.

C. Equipment weighing more than 10,000 pounds shall not be used closer to structure walls than a horizontal distance equal to the depth of the fill against the structure wall at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

D. **Compaction Requirements:** The following compaction test requirements shall be in accordance with ASTM D 1557 for cohesive type materials and in accordance with ASTM D 4253 and D 4254 for "non-plastic" cohesionless free draining granular type materials. Where other agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density	Percentage of Relative Density
Pipe Zone backfill including bedding and overexcavated zone.	90	65
Final Zone backfill beneath paved areas or structures.	95	70

Final Zone backfill beneath unpaved access areas, landscape, or unimproved areas.	90	55
Trench Zone backfill.	90	65
Backfill beneath minor structures.	95	70
Backfill around minor structures.	90	65

Maximum Density refers to maximum dry density according to ASTM D 1557 laboratory test procedures. Percentage of Relative Density refers to ASTM D 4253 and ASTM D 4254 laboratory test procedures. Relative density should only be used for "non-plastic" cohesionless free draining, granular-type materials.

E. **Trench Backfill Requirements:** The pipe class has been structurally designed based upon the trench configuration previously specified herein.

1. The CONTRACTOR shall maintain the previously specified trench width up to a horizontal plane lying 12 inches above the top of the pipe.

2. If, at any location under said horizontal plane, the CONTRACTOR slopes the trench walls or exceeds the maximum trench widths indicated the Pipe Zone backfill shall be "improved" or the pipe class improved at no additional cost to the CITY. "Improved" backfill shall mean Control Low Strength Materials or other equivalent materials acceptable to the ENGINEER.

3. If the allowable deflection specified for the pipe is exceeded, the CONTRACTOR shall expose and reround or replace the pipe, repair all damaged lining and coating, and reinstall the Pipe Zone material and Trench Zone backfill as specified.

4. All trenches shall have a minimum of 2 inches of temporary asphalt placed daily and maintained unless final paving can be completed in the same day. Temporary asphalt shall be placed flush with adjacent pavement grade.

Steel plates may be used to cover open trenches in-lieu of backfill and temporary asphalt pavement.

3.13 STEEL PLATE

A. **General:** When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a work day, steel plate bridging with a non-skid surface and shoring may be required to preserve unobstructed traffic flow.

B. When steel plate bridging is required, the following conditions shall apply:

1. Steel plates used for bridging must extend a minimum of 12 inches beyond the edges of the trench.

2. Steel plate bridging shall be installed to operate with minimum noise.

3. The trench shall be adequately shored to support the bridging and traffic loads.

4. Temporary paving with cold asphalt concrete shall be used to feather the edges of the plates, if plate installation by Method (2) is used.

5. Bridging shall be secured against displacement by using adjustable cleats, shims or other devices.

C. Steel plate bridging and shoring shall be installed using either Method (1) or (2):

1. Method 1 For speeds more than 45 mph:

   The pavement shall be cold planed to a depth equal of the thickness of the plate and to a width and length equal to the dimensions of the plate.

2. Method 2 For speeds 45 mph or less:

   Approaching plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates are butted to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope 8.5 percent with a minimum 12 inch taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry or an equivalent slurry.

D. Steel plate bridging should not exceed 4 consecutive working days in any given week.

- END OF SECTION -

SECTION 312323 - CONTROLLED LOW STRENGTH MATERIALS (CLSM)

PART 1 -- GENERAL

1.1 REQUIREMENTS

A. Controlled Low Strength Materials (CLSM) will be allowed only on a case-by-case basis with the written approval of the ENGINEER.

b. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place CLSM, complete in place, and shall mix, place, finish, and do all other work to produce a cementitious hand excavatable mixture of aggregate, cement, pozzolan, water, and admixtures to be used as backfill or pipe abandonment fill, as shown on the Drawings and as specified herein.

C. The CONTRACTOR is hereby advised that flotation or displacement of the pipe may occur during installation of the CLSM. The CONTRACTOR shall make necessary provisions to ensure that the pipe is installed according to the alignment and grade specified on the Drawings. Any pipe that is floated shall be removed and replaced at the CONTRACTOR'S expense.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ACI 229	Controlled Low Strength Materials.
ACI 232	Fly Ash/Other Pozzolans in Concrete.
ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 94	Specification for Ready-mixed Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Additive in Portland Cement Concrete.
ASTM D 1586	Method for Penetration Test and Split Barrel Sampling of Soils.

ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow-Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow-Depth).

1.4 CONTRACTOR SUBMITTALS

A. **Mix Design**: Prior to beginning any work the CONTRACTOR shall submit to the ENGINEER for review, the pre-approved CLSM mix designs which shall show the proportions and gradations of all materials proposed for each class and type of CLSM to be used.

B. **Certificate of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIALS (CLSM)

A. **General:**

1. CLSM shall be a flowable, hand-excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94.

2. **Composition:** The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.

   a. Mix proportions shall be as approved.

   b. Entrained air content shall be between 8 percent minimum and 20 percent maximum.

   c. Water reducing agent content shall be as approved.

3. **Properties:**

   a. Density shall be between 120 PCF minimum and 135 PCF maximum.

   b. Slump shall be as approved.

   c. Compressive strength at 28 days for flowable CLSM shall be between 50 psi minimum and 150 psi maximum.

B. **Cement:** Cement shall be Type II in accordance with the requirements of ASTM C 150.

C. **Pozzolan:** Pozzolan shall be added to improve the flowability and shall be Type F in accordance with the requirements of ASTM C 618.

D. **Aggregate:** Coarse aggregate shall consist of a well graded mixture of crushed rock, soil, or sand with a maximum size aggregate of ½ inch. 100 percent shall pass the 3/4 inch sieve. Not more than 30 percent shall be retained by the 3/8 inch sieve and not more than 12 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of the WORK.

E. **Admixtures:**

1. Air entraining shall be added to improve the workability and shall be in accordance with the requirements of ASTM C 260.

F. **Water:** Water shall be clean and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.

G. **Controlled Low Strength Materials (CLSM):**

1. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water batched by a ready mix concrete plant and delivered to the WORK by means of standard transit mixing trucks. The mixture shall produce a cementitious, flowable, hand excavatable material.

2. The actual mix proportion and slump shall be as determined by the approved mix design.

3. The entrained air content shall be a minimum of 8 percent and a maximum of 20 percent as required by the CONTRACTOR to meet the uses specified herein.

PART 3 -- EXECUTION

3.1 TESTING

A. All testing during the work will be done by a testing laboratory of the CITY'S choice at the CITY'S expense except as otherwise noted.

B. In case the tests of the CLSM show non-compliance with the specifications the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the CITY and shall be at the CONTRACTOR'S expense.

C. **Density:** The installed density of the material will be determined in accordance with ASTM D 2922.

D. **Compressive Strength:** The compressive strength will be determined in accordance with ASTM C 39.

3.2 PREPARING PLACEMENT FOR CLSM

A. The trench subgrade or compacted fill to receive CLSM shall be complete and acceptable in accordance with Section 312300, "Utility Earthwork."

3.3 DELIVERING CLSM

A. CLSM shall be delivered to the WORK in standard transit mix trucks.

3.4 PLACING CLSM

A. CLSM shall be delivered in place by means of tailgate discharge, conveyor belts, pumped in place, or other means acceptable to the ENGINEER.

B. CLSM shall be directed in place by means of a vibrator, shovel or rod to ensure that all voids, crevices, and pockets are filled with CLSM. Care shall be taken to avoid over-consolidation of the material separating the large and fine aggregate.

C. CLSM shall be continuously placed against undisturbed in-situ earth material unless otherwise approved by the ENGINEER. Where new CLSM must be placed against existing CLSM, the placement shall be clean of all loose and foreign material. The surface of existing CLSM shall be soaked a minimum of one hour before placement of fresh CLSM. No standing water will be allowed before starting placement of fresh CLSM.

D. When placing CLSM for trench plugs (trench dams), the CONTRACTOR shall ensure that no voids exist around the pipe barrel and that the CLSM completely fills the trench width, including keyways, for the full depth required, as shown on the Drawings.

3.5 PROTECTING CLSM

A. CLSM shall be protected from running water, rain, freezing or other conditions that could damage the material until the material has been accepted and final fill complete.

B. No equipment, traffic, or backfill shall be allowed on the CLSM until the surface of the CLSM is able to withstand a 20 psi load without displacement or damage. If necessary, the CONTRACTOR shall provide steel trench plates that span the trench, as specified in Section 312300, "Utility Earthwork," until the CLSM has reached the required strength.

3.6 CURING

A. CLSM shall be kept damp for a minimum of 7 days or until final fill is completed.

- END OF SECTION -

SECTION 321000

ASPHALT PAVEMENT, BASE AND SURFACE TREATMENTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and construct the roadway structural section, base repair, asphalt overlay, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1. Preparation of Subgrade.
2. Aggregate Subbase.
3. Aggregate Base.
4. Tack Coat.
5. Asphalt Concrete Base Repair.
6. Pavement Crack Sealant.
7. Remove and Replace Traffic Markings.
8. Pavement Grinding.
9. Pavement Pulverization and Reshaping & Compaction of Base Material.
10. Sawcutting.
11. Pavement Reinforcing Fabric.
12. Pavement Reinforcing Mesh
13. Asphalt Concrete Overlay, Utility Cut Pavement Replacement, and Pavement Structural Section.
14. Adjust Iron Castings to Grade.
15. Pavement Flood Testing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 311300	Selective Tree and Vegetation Trimming and Removal.
B.	Section 311316	Root Pruning.
C.	Section 310000	Earthwork.
D.	Section 312300	Utility Earthwork.
E.	Section 333900	Precast Concrete Maintenance Holes.
F.	Section 311723	Traffic Stripes and Pavement Markings.
G.	Section 321300	Concrete Surface Improvements
H.	Section 022100	Monuments.
I.	Section 055000	Miscellaneous Metal Work
J.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards**

1. Standard Specifications:

Section 15	Existing Highway Facilities.
Section 19	Earthwork.
Section 25	Aggregate Subbases.
Section 26	Aggregate Bases.
Section 37	Bituminous Seals.
Section 39	Asphalt Concrete.
Section 42	Groove and Grind Pavement.
Section 84	Traffic Stripes and Pavement Markings.
Section 85	Pavement Markers.
Section 88	Engineering Fabrics.
Section 92	Asphalts.
Section 93	Liquid Asphalts.
Section 94	Asphaltic Emulsions.

B. **Commercial Standards:**

ASTM D 36	Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus.)
ASTM D 276	Test Method for Melting Point of High Strength Open Fiber Glass Mesh.
ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 3407	Methods of Testing Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.
G.R.I. GGI-87	Methods of Testing High Strength Open Fiber Glass Mesh for Tensile Strength and Maximum Elongation at Break.
D 5261-92	Method for Determining Minimum Mass/Unit Area of Open Fiber Glass Mesh.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. **Delivery Tickets:** For City public works projects, the CONTRACTOR shall provide delivery tickets to the ENGINEER at the time of delivery of each load of product, including aggregate subbase, aggregate base, asphalt concrete, liquid asphalt, sealant, and paving reinforcement fabric. Each delivery ticket shall include or be accompanied by appropriate batch information produced by the batching plant or factory of origin and information stating the mix or model number, total yield in kilograms, liters, or square meters, and time, date, and location of delivery.

1.5 QUALITY ASSURANCE

A. The CITY will employ a testing laboratory to perform all quality assurance testing and inspection testing as may be required by this Section.

B. At the discretion of the ENGINEER the CONTRACTOR shall flood test all asphalt pavement for proper drainage by flooding with water in ample quantity to demonstrate the correct shaping of the pavement.

PART 2 -- PRODUCTS

2.1 AGGREGATE SUBBASE

A. Aggregate subbase material shall be the class specified on the Drawings and shall be in conformance with Section 25, "Aggregate Subbases," of the Caltrans Standard Specifications.

2.2 AGGREGATE BASE

A. Aggregate base material shall be Class 2 aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications. All aggregate base used on the work shall conform to the 19 millimeter maximum size gradations.

2.3 TACK COAT OR PAINT BINDER

A. A tack coat or paint binder shall be SS-1 asphalt emulsion in conformance with Section 39, "Asphalt Concrete," of Caltrans Standard Specifications.

B. A tack coat or paint binder to be used with pavement fabric or mesh shall be asphalt grade AR-8000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

2.4 ASPHALT CONCRETE BASE REPAIR

A. Asphalt concrete for base repair shall be Type A for all City streets.

B. The asphalt binder shall be paving asphalt Grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

C. The aggregate shall be 19 millimeter maximum size, medium grading, in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

2.5 PAVEMENT CRACK SEALANT

A. The pavement crack sealant shall be a modified asphalt composition conforming to the following requirements:

Test	Test Method	Requirements
Softening Point	ASTM D 36	180-degree F. minimum
Core Penetration at 77-degrees F.	ASTM D 3407	30-dmm minimum
Resilience at 77-degrees F.	ASTM D 3407	30 percent minimum
Flow	ASTM D 3407	3-mm maximum

B. If asphalt ground rubber is used, the gradation of the asphalt ground rubber shall be such that 100 percent will pass a No. 8 sieve.

C. The material shall be capable of being melted and applied to cracks and joints at temperatures below 400-degrees F. When heated, it shall readily penetrate cracks 1/4-inch wide or wider.

2.6 PAVEMENT REINFORCING FABRIC / CRACK-RETARDING MASTIC MEMBRANE AND PAVEMENT REINFORCING MESH

A. Pavement reinforcing fabric shall be a non-woven material designed as a pavement reinforcing fabric in conformance with Section 88, "Engineering Fabrics," of the Caltrans Standard Specifications.

B. Crack-retarding mastic membrane is intended as a stress relieving interlayer to control development of reflective cracking from occurring in the overlay of isolated areas of moderate to severe surface cracking. It may include an adhesive backing and release liner. Crack-retarding mastic membrane shall be as manufactured by **Pavetech International. - Paveprep, Paveprep SA , and AMOCO Fabrics and Fibers Company - Petrotac or equal.**

C. Pavement reinforcing mesh shall be a high strength glass fiber grid designed for reinforcing wider overlay areas with tensile resistance against pavement fatigue created by higher traffic loading and to prevent reflective cracking by relieving stresses as either an underlayment or an interlayer. It usually requires a self-tacking adhesive for installation or may be specified as a composite with a waterproofing membrane or nonwoven fabric layer.

The pavement reinforcing mesh shall be a knitted, glass fiber strand grid with the following minimum characteristics, or an equal material, as determined and approved by the ENGINEER.

Test	**Test Method**	**Requirements**
Tensile Strength	G.R.I. GG 1-87	560 lbs/in. (100 kN/m) Component strand strength
Elongation at Break	G.R.I. GG 1-87	5 Percent Maximum
Melting Point	ASTM D 276	425 deg.-F (218 deg.-Celsius)
Mass/Unit Area	D 5261-92	11 oz./sq. yd. (370 g/m2)

All values represent certifiable average minimum roll values in the weakest principal direction of the grid. The manufacturer shall supply test data to the ENGINEER for review prior to the start of mesh placement. Data shall be signed by the responsible quality assurance principal at the manufacturing facility and be representative of all of the product used on the project.

2.7 ASPHALT CONCRETE OVERLAY, UTILITY CUT PAVEMENT REPLACEMENT, AND PAVEMENT STRUCTURAL SECTION

A. Asphalt concrete shall be Type A on all City streets.

B. Asphalt concrete shall be placed at the thickness indicated on the Drawings.

C. The asphalt binder shall be paving asphalt grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

D. The aggregate shall be 12.5 millimeter maximum size, medium grading for overlays and top lift(s) of pavement structural sections in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications. The minimum overlay thickness for the top lift shall be 1.5 inches (38 mm). The aggregate shall be 19 millimeter maximum size, medium grading, for the bottom lift(s) of pavement structural sections in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications. For pavement structural sections less than 4 inches (102 mm), the aggregate shall be 12.5 millimeter maximum size, medium grading in accordance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

2.8 FINE ASPHALT CONCRETE PAVING

A. Fine asphalt concrete for patch paving shall be Type B, 9.5 millimeter maximum size. The asphalt binder shall be paving asphalt grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

2.9 PORTLAND CEMENT CONCRETE

A. Portland Cement Concrete used to adjust utility structure frames and monument frames to grade shall be Class B in conformance with Section 033050, "Utility Cast-in-Place Concrete."

2.10 IRON CASTINGS AND COVERS

A. The CONTRACTOR shall provide new iron castings in accordance with Section 055000 "Miscellaneous Metal Work" and the City Standard Details when required by the ENGINEER.

PART 3 -- EXECUTION

3.1 GENERAL

All work adjacent to existing pavement structural section shall butt up to the full existing structural section. Where the full pavement structural section is not encountered, continue removal of additional pavement structural section until a full pavement structural section is found.

3.2 ORDER OF WORK

A. Selective tree and vegetation trimming and/or root pruning operations necessary for work requiring equipment accessibility or installation of improvements shall be completed prior to commencement of that work.

B. All underground utilities shall be installed, inspected and approved, and all backfill and compaction operations shall be completed prior to commencement of pavement structural section construction.

C. Cutting or patching of finished pavement will not be allowed.

3.3 PREPARATION OF SUBGRADE

A. The subgrade shall be prepared in conformance with Section 19, "Earthwork," of the Caltrans Standard Specifications, unless modified by this Section.

B. Subgrade preparation shall extend a minimum of 2 feet beyond all concrete improvements and asphalt paved areas. Unless otherwise recommended in the soils report, the subgrade shall be scarified to a minimum depth of 6 inches below the grading plane, mixed thoroughly and wetted in conformance with ASTM D 1557, or dried as directed by the ENGINEER. The pavement section, the entire area under the curb and gutter, bus turnout area, and the area 2 feet beyond any edge of pavement without abutting concrete improvements shall be thoroughly compacted to not less than 95 percent relative compaction in conformance with ASTM D 1557. Compaction of subgrade under sidewalk, access ramps, driveways, median surfacing and the area 2 feet beyond any concrete improvements shall be thoroughly compacted to not less than 90 percent relative compaction in conformance with ASTM D 1557. The surface of the subgrade after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

C. All soft material which will not compact readily and all unstable material shall be removed in conformance with the Section entitled "Roadway Excavation," in PART 3 of Section 310000, "Earthwork." All materials for subgrade replacement shall be in conformance with the written recommendations of the Geotechnical Engineer.

D. Subgrade preparation and compaction and determination of subgrade stability shall performed under the observation of the ENGINEER. In no case shall lime or cement treatment be used to stabilize subgrade.

E. Finish subgrade shall be within the tolerances established in Section 19-1.03, "Grade Tolerances," of the Caltrans Standard Specifications.

3.4 AGGREGATE SUBBASE

A. Aggregate subbase shall be spread and compacted in conformance with Section 25, "Aggregate Subbases," of the Caltrans Standard Specifications unless modified by this Section. Finished aggregate subbase shall have a minimum thickness as shown on the Drawings and shall not vary more than 0.08 foot above or below the established grade. The aggregate subbase shall be compacted to 95 percent relative compaction in conformance with ASTM D 1557. The surface of the aggregate subbase after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

3.5 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications for Class 2 Aggregate Base. Finished aggregate base shall have the minimum thickness as shown on the Drawings and shall not vary more than 0.05 foot above or below the established grade. The aggregate base shall be compacted to 95 percent relative compaction in conformance with ASTM D 1557. The surface of the aggregate base after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

3.6 TACK COAT

A. The CONTRACTOR shall be responsible for the proper use of tack coats and shall be in conformance with applicable regulatory requirements.

B. Tack Coat or Paint Binder

Prior to placement of asphalt concrete a tack coat or paint binder shall be applied to existing paved and vertical surfaces where new asphalt concrete is to be placed on or against existing pavement at

an approximate total rate from 0.02 gallon to 0.10 gallon per square yard to all areas receiving asphalt concrete. The exact rate of application will be determined by the ENGINEER. Care shall be taken to prevent over application of tack coat material onto finish surfaces that will not be in contact with the new asphalt concrete pavement.

3.7 ASPHALT CONCRETE BASE REPAIR

A. Existing failed roadway sections shall be excavated to the limits as marked in the field and/or as shown on the Drawings. During base repair operations streets shall not be closed to traffic, but temporary traffic controls shall be implemented in conformance with the Division 1, General Requirements.

B. The CONTRACTOR shall not excavate more area than he is capable of paving within the same working day. At the end of each working day all open street excavations must be either backfilled and compacted to within one inch below existing finish grade, or covered with steel plating in conformance with Section 312300, "Utility Earthwork" in order to allow use by public traffic.

C. On residential streets, excluding truck routes and bus routes, requiring an asphalt concrete overlay, a minimum depth of 4 inches of pavement structural section shall be cut out, removed and replaced with asphalt concrete. On residential streets, excluding bus routes, not requiring an asphalt concrete overlay a minimum depth of 6 inches of structural pavement section shall be cut out, removed and replaced with asphalt concrete.

   On all other streets, including truck routes and bus routes, the depth of removal of the pavement structural section shall be as shown on the Drawings or as determined by the ENGINEER.

   Where soft or unsuitable materials are encountered, additional excavation and/or remediation will be required as determined by the ENGINEER.

D. For CITY owned traffic signals where traffic signal detector loops are present, the CONTRACTOR shall notify the ENGINEER a minimum of 48 hours prior to beginning asphalt concrete base repair work. For Caltrans traffic signals the CONTRACTOR shall notify Caltrans in conformance with Caltrans requirements.

E. **Cutting of Existing Pavement Structural Section:** All final cuts in asphalt concrete shall be straight, clean, and vertical for the full depth of the cut. Additional areas shall be cut out when determined by the ENGINEER that the edge of the asphalt concrete pavement to remain is loose, depressed, or potentially unstable. Cutting of the existing pavement structural section shall be done by one of the following options:

   1. Longitudinal cuts may be wheel-cut but shall be discontinued if the ENGINEER determines that excessive breakage or deflection of the adjacent pavement to remain is occurring.

   2. On streets that are to receive an asphalt concrete overlay as a part of the work a jack-hammer, sawcutter or grinder may be used.

   3. All other cuts shall be made by saw-cutting or grinding.

F. The asphalt concrete material removed shall become the property of the CONTRACTOR and shall be disposed of in a legal manner.

G. After removal of the asphalt concrete, the existing base or subgrade shall be shaped to conform to the cross slope or crown of the street, and a minimum of the top 6 inches re-compacted to 95 percent relative compaction in conformance with ASTM D 1557.

H. The vertical edges of the excavated paving repair area shall be treated with a tack coat. Care shall be taken to prevent over application of the tack coat material onto finish surfaces that will not be in contact with the new asphalt concrete pavement.

I. Asphalt concrete for pavement repair sections shall be placed in a minimum of 2 lifts and shall be spread and compacted in the number of layers and thicknesses in conformance with Section 39-6.01, "Spreading and Compacting," of the Caltrans Standard Specifications.

J. The finish grade of the new asphalt concrete pavement shall be flush with the adjacent existing pavement and shall conform to cross slope or crown of the street. Variances of more than zero to 1/8 inch above the existing pavement grade will not be allowed. Asphalt concrete base repairs that are out of tolerance with existing pavement shall be ground down or removed and repaved.

3.8 PAVEMENT CRACK SEALING

A. Prior to overlaying existing pavements, crack sealing operations shall be performed in accordance with the following:

1. Crack sealing shall be performed on all pavement cracks ¼-inch wide or wider. Cracks between a ¼-inch and a ½-inch wide shall be routed to a depth and width of ½-inch prior to sealing.

2. Crack sealing shall be performed after any required pavement repair or grinding operations and prior to placing flexible pavement coatings, pavement reinforcing fabric, or overlay.

3. All pavement cracks not routed shall first be treated with a liquid herbicide product.

4. Immediately prior to performing crack sealing, the cracks shall be cleaned by the use of high-pressure compressed air such that all vegetation, dirt, and other objectionable materials are removed. The compressed air shall be filtered of moisture and oils. Under damp conditions, a hot compressed air lance shall be utilized to dry the cracks as well.

5. Sealant material shall conform to the provisions of PART 2 "Products" of this Section and shall be applied at the temperature and rate recommended by the manufacturer.

6. Sealant shall be applied to a slightly overfilled condition, then struck off with a guide-shoe, plate, or squeegee to produce a band of material 2 inches to 4 inches in width, centered over the crack. On streets to be slurry or seal-coated, strike-off height shall be less than 1/8-inch above the pavement surface.

7. Extensively cracked pavement areas shall not be crack sealed unless specifically directed by the ENGINEER. This is necessary to avoid interference with proper adhesion of the flexible pavement coatings, pavement reinforcing fabric, or overlay, and to avoid subsequent asphalt bleeding on the new surface. Where the ENGINEER determines excessive coating or thickness of pavement crack sealant by the CONTRACTOR, the CONTRACTOR shall perform the necessary pavement base repairs to correct the problem prior to placement of any flexible pavement coating, pavement reinforcing fabric, or overlay.

8. Crack seal areas shall be protected from traffic until the material has sufficiently cured and does not track. Any damage or loss of material from freshly placed crack seal material shall be replaced by the CONTRACTOR .

3.9 REMOVE AND REPLACE TRAFFIC MARKINGS

A. Removal and replacement of existing traffic striping, legends, and pavement markers shall be in conformance with Section 02760, "Traffic Stripes and Pavement Markings."

B. Removal and replacement of traffic striping, legends, and raised pavement markers shall conform to the following scheduling requirements:

1. Existing traffic striping, legends, and pavement markers shall be completely removed prior to beginning of resurfacing operations. The CONTRACTOR shall then either begin said operations within 24 hours of the removal of the existing delineations or shall replace said delineations with painted markings.

2. Permanent traffic striping, legends, and pavement markers shall be installed no sooner that 2 calendar days nor later than 7 calendar days after the resurfacing has been placed. Raised pavement markers shall be installed no sooner than 7 calendar days no later than 14 calendar days after resurfacing has been placed. Traffic striping, legends, and pavement markers shall be installed in conformance with Section 84, " Traffic Stripes and Pavement Markings," and Section 85, "Pavement Markers," of the Caltrans Standard Specifications. The layout of permanent traffic striping, legends, and pavement markers shall be approved in writing by the ENGINEER prior to installation.

3.10 PAVEMENT GRINDING

A. Grinding necessary to perform edge and transverse pavement conforms shall be performed on all streets to be overlaid and shall be completed in conformance with Section 42-2, "Grinding," of the Caltrans Standard Specifications and this Section.

B. Grinding at curbs, gutters, valley gutters, and street intersections shall be in conformance with the Drawings and Standard Details. No grinding shall be performed through an intersection if the cross street is also to be overlaid.

C. Damage to detector loops at CITY owned traffic signals shall be reported to the ENGINEER and repaired by the CONTRACTOR at its own expense within 24 hours of disruption of service. If the CONTRACTOR fails to repair damaged loops within the specified time the CITY will repair the damage at the CONTRACTOR'S expense. Damage to detector loops at traffic signals owned by other Agencies shall be repaired in conformance with the appropriate Agency requirements.

D. All materials removed shall become the property of the CONTRACTOR and shall be disposed of in a legal manner. Residue from the grinding operations may be removed from the roadbed by a vacuum sweeper following within 50 feet of the grinding operations. The CONTRACTOR shall be responsible for maintaining the street in a clean condition during the course of the grinding operations. All loose materials shall be removed prior to the application of the tack coat.

E. Areas that cannot be reached with the grinding machine shall be jack-hammered or otherwise removed by hand.

F. When grinding operations proceed pavement overlay operations by more than 3 calendar days and/or the grinding exceeds 2 inches, the CONTRACTOR shall place temporary asphalt concrete ramps at all grinding limits which abut remaining asphalt pavement surfaces. Temporary asphalt concrete ramps shall be in place the same day as the grinding operation.

G. Temporary asphalt concrete ramps shall be a minimum of 5 feet in length, extending the entire width of the affected travelway, and shall be sufficiently compacted so as not to deform or ravel.

H. The CONTRACTOR shall maintain temporary asphalt concrete ramps to the satisfaction of the ENGINEER and shall completely remove them prior to the application of tack coat.

3.11 SAWCUTTING FOR ROADWAY WIDENING

A. When removing asphalt pavement in connection with roadway widening the existing asphalt pavement shall be sawcut with a power driven asphalt saw to provide a smooth joint for the new pavement. The CONTRACTOR shall sawcut the pavement before any pavement excavation to avoid damage to the pavement section to remain.

3.12 PAVEMENT PULVERIZATION AND RESHAPING & COMPACTION OF BASE MATERIAL

A. On public works projects when specifically required on the Drawings, the CONTRACTOR shall pulverize the existing pavement to the limits shown on the Drawings, or as otherwise directed by the ENGINEER, using specialized mechanized equipment capable of pulverizing asphalt concrete into a uniform gradation of not more than 1-1/2 inch maximum size. The equipment shall also be capable of capturing and containing airborne dust particles in an appropriate manner as to conform to the dust abatement requirements of the Specifications.

B. The CONTRACTOR shall pulverize the existing pavement until the maximum size of the asphalt concrete is not more than 1-1/4 to 1-1/2 inches and mix it with the underlying top two inches of base material.

C. The CONTRACTOR shall reshape and compact the combined mixture as a new base for the thickness of asphalt concrete shown on the Drawings. The street section shall be reshaped to a cross-slope of 2.0% minimum to 5.0% maximum as approved by the ENGINEER. The CONTRACTOR shall compact the base to a minimum relative compaction of 95% with a two-axle steel drum roller weighing not less than eight tons nor more than ten tons. Compaction will be determined from a moisture-density curve performed on the mixed material to determine the optimum moisture for compaction.

D. Should pulverization operations produce an excess of material which cannot be reshaped and compacted to meet the necessary cross-slope, the excess material shall become the property of the CONTRACTOR and shall be disposed of in a legal manner.

E. The CONTRACTOR shall be responsible for maintaining the street in a clean condition during the course of the pulverization operations. Surrounding traffic and pedestrian areas shall be swept and maintained free of loose material and debris at all times and residue from the pulverization operations shall be removed from the surrounding improvements by the end of the work day.

F. Areas that cannot be reached with the pulverization machine shall be jack-hammered or otherwise removed by hand.

G. Pulverization operations shall not precede pavement overlay operations by more than three calendar days, unless otherwise approved in writing by the ENGINEER.

H. The CONTRACTOR shall place temporary asphalt concrete ramps at all pulverization limits which are to conform to remaining asphalt pavement surfaces. Temporary asphalt concrete ramps shall be in place the same day as the pulverization operation.

I. Temporary asphalt concrete ramps shall be a minimum of 5 feet in length, extending the entire width of the affected travelway, and shall be sufficiently compacted so as not to deform or ravel.

J. The CONTRACTOR shall maintain temporary asphalt concrete ramps to the satisfaction of the ENGINEER and shall completely remove them prior to the application of tack coat.

3.13 PAVEMENT REINFORCING FABRIC / CRACK-RETARDING MASTIC MEMBRANE

A. Placement of pavement reinforcing fabric and mastic membrane, including application of tack coat shall be in conformance with Section 39-4, "Subgrade, Prime Coat, Paint Binder (Tack Coat), and Pavement Reinforcing Fabric," and Section 88, "Engineering Fabrics," of the Caltrans Standard Specifications and this Section.

B. Prior to placement of tack coat, fabric or mastic membrane, the CONTRACTOR shall insure that the existing pavement is clean and free of dirt, water, and vegetation. All cracks shall be cleaned and if necessary, sealed in conformance with this Section. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new asphalt concrete pavement.

C. Placement of pavement reinforcing mesh shall be in conformance with the manufacturer's recommendations as approved by the ENGINEER and this Section. The surface temperature before laying the mesh shall be between 40 degrees F (5 degrees C) and 140 degrees F (60 degrees C.)

D. Prior to placing pavement reinforcing mesh, the existing pavement shall be cleaned to provide an adequate surface for the adhesion of the mesh to the satisfaction of the ENGINEER and/or manufacturer's representative. The pavement shall be cleaned by sweeping or vacuuming and be free of oil, vegetation, sand, dirt, water, gravel, debris, paint, pavement markers, striping, or rubber, including loose aggregate and fines from level course or finish paving operations.

   All cracks shall be cleaned, and if necessary, sealed in conformance with this Section. For direct application of pavement reinforcing mesh on an existing pavement, cracks ¼-inch and larger shall be filled with crack sealer per this Section. Potholes shall be dug out and filled with hot mix to provide a level surface. Areas with uneven surfaces and/or extensive cracking shall require a leveling course as determined by the ENGINEER.

E. Tack Coat shall be applied by a suitably metered truck with all spray heads adequately adjusted to lay down an even coat. Tack coating for pavement reinforcing fabric or mastic membrane shall be applied per the manufacturer's recommendations. Mastic membrane with self-adhesive backing may be used without tack coat in accordance with the manufacturer's recommendations. Tack coating is not usually required for pavement reinforcing mesh and shall only be applied when recommended by the manufacturer for the specific work. In this application, emulsion type tack coating must be cured before placement of the reinforcing mesh.

F. Fabric placement equipment shall be mechanized and shall be capable of handling full rolls of material and of laying the fabric without forming excessive wrinkles and/or folds in conformance with the manufacturer's recommendations for installation. Manually laying the fabric shall only be allowed in small areas not practical for mechanical equipment.

G. Mesh laid by mechanical means or by hand must be under sufficient tension to eliminate ripples. Should ripples occur, these must be removed by pulling the grid tight or in extreme cases, by cutting to the manufacturer's recommendations and lying it flat. Transverse joints shall be lapped in the direction of the paver by a minimum of 4 inches. Longitudinal joints shall be 1-2 inches overlapped.

H. Fabric or mesh shall not be placed within the grinding limits unless placed on a level course first or as otherwise directed by the ENGINEER. Normally mesh placement shall end one foot before the grind at pavement conforms and one foot before vertical butt transitions.

I. Mastic membrane shall be rolled with a static drum roller or rubber tire pneumatic roller or as recommended by the manufacturer.

J. Pavement reinforcing mesh shall be rolled with a rubber coated roller or pneumatic tire roller, to activate the self-adhesive. Tires must be clean to avoid pick up of the mesh. A pneumatic tire roller or tractor installer with pneumatic tire roller assembly shall adhere the mesh to the surface. A vehicle with rubber tires may be used to adhere reinforcing mesh to existing surface if approved by the manufacturer. The CONTRACTOR shall not pave if adequate adhesion is not achieved first.

K. The CONTRACTOR shall neatly cut the reinforcing material around all utility structures and monuments prior to placing pavement overlay.

L. Construction and emergency vehicles may run across the reinforcing material after being rolled with the insurance that precautions are taken to avoid damage caused by turning and braking. The material must also be kept clean of mud, dust and debris. Damaged sections shall be removed and patched to the manufacturer's printed recommendations, taking care to completely cover the damaged area.

M. In areas of localized bleeding of tack coat through the fabric, the CONTRACTOR shall spread asphalt concrete over the area to prevent pick-up or lifting of the fabric.

N. The CONTRACTOR shall not place more fabric, mastic or mesh than can be covered with a minimum of 1-1/2 inches of hot asphalt concrete mix and compacted on the same working day.

O. All Pavement fabric, mastic, or mesh shall be stored, as per the manufacturer's recommendations, in a dry covered condition free from dust, dirt, and moisture.

3.14 ASPHALT CONCRETE OVERLAY OR PAVEMENT STRUCTURAL SECTION

A. Surface preparation for asphalt concrete overlay on existing asphalt concrete surfaces shall include removal of all traffic striping and legends, raised pavement markers, and all grinding, patching, and sweeping.

B. Application of a prime coat and/or tack coat shall not occur until all surface preparation has been performed.

C. Asphalt concrete shall be spread and compacted on the prepared base or existing asphalt concrete in conformance with the lines, grades and dimensions shown on the Drawings and in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

D. Spreading and compaction equipment and methods shall be in conformance with Sections 39-5,, "Spreading and Compacting Equipment," and 39-6, "Spreading and Compacting," of the Caltrans Standard Specifications and this Section. The ENGINEER may, at its option, call for continuous and/or random testing of asphalt concrete compaction. Asphalt concrete shall not be placed or stockpiled in windrows when the underlying layer or surface is frozen, or when, in the opinion of the ENGINEER, weather conditions will prevent the proper handling, finishing, or compaction of the asphalt concrete.

   Spreading by blading equipment consisting of motor graders will not be allowed unless approved in writing by the ENGINEER.

E. The finished grade shall be flush with the adjacent existing pavement, shall conform to the cross slope or crown of the street, and shall be within the tolerances of the "straightedge" test as defined in Section 39-6.03, "Compacting," of the Caltrans Standard Specifications. The CONTRACTOR shall be responsible for all damage to fresh surfacing until it is ready for use by public traffic. Damaged areas shall be repaired to the satisfaction of the ENGINEER.

F. Asphalt concrete for new pavement structural sections shall be placed in a minimum of 2 lifts and shall be spread and compacted in the number of layers and thicknesses in conformance with Section 39-6.01, "Spreading and Compacting," of the Caltrans Standard Specifications.

G. The depositing, distribution, and spreading of each lift of the asphalt concrete shall be accomplished in a single, continuous operation.

H. All utility structures and monuments shall be marked for reference in at least 2 directions by the CONTRACTOR prior to placing the asphalt concrete. Said reference marking shall be made using a temporary removable water based marking chalk. The CONTRACTOR shall be responsible for the complete removal of all such reference markings after the completion of raising utility structures and monuments to grade.

I. Fog sealing of new asphalt concrete structural sections will not be allowed.

3.15 ASPHALT CONCRETE UTILITY CUT PAVEMENT REPLACEMENT

A. **Preparation of Existing Asphalt Concrete Pavement:** The existing asphalt concrete pavement shall be sawcut 12 inches past the edge of the trench to provide a smooth joint for the new pavement. The CONTRACTOR may sawcut the pavement before excavating the trench to facilitate the removal of the pavement. In addition the CONTRACTOR shall sawcut and remove any irregular or damaged pavement along the open trench as directed by the ENGINEER before placing new asphalt concrete pavement.

B. Placement of asphalt concrete shall be in conformance with this Section, except that the number of layers and thicknesses shall be as shown on the Drawings.

3.16 ADJUST IRON CASTINGS TO GRADE

A. All Iron Castings shall be set to finish grade after placing the asphalt concrete. The adjustment of structures and monuments to grade shall be in conformance with Section 15-2, "Miscellaneous Highway Facilities," of the Caltrans Standard Specifications and this Section.

B. Adjustment rings will not be allowed.

C. When streets are overlayed unless deemed unsuitable by the ENGINEER, existing frames and covers shall be salvaged and re-used. All iron castings damaged during construction shall be replaced by the CONTRACTOR with new iron castings at the CONTRACTOR'S expense. Replacement iron castings for CITY utility structures shall be replaced in conformance with the appropriate technical section. Replacement iron castings for other Agency utility structures shall be replaced in conformance with the appropriate Agency requirements.

D. All water valve covers shall be exposed on the same day in which they are covered by resurfacing operations.

E. All maintenance hole covers shall be raised no later than 5 working days after resurfacing is placed, and shall be patch-paved with asphalt concrete within 5 working days after being raised.

F. Tops of frames shall be set within to zero to 1/8-inch above finish grade. Frames which do not meet this tolerance shall be re-adjusted by the CONTRACTOR at its own expense.

G. After adjusting frames CONTRACTOR shall insure all covers are removable and seat properly when replaced. For new iron castings the new covers shall not rock.

H. Hand mixing of concrete for use in raising iron castings to grade will be allowed. Concrete shall be placed and thoroughly consolidated in conformance with Section 321300, Concrete Surface Improvements..

I. Asphalt concrete patch paving shall be fine asphalt concrete placed over a tack coat. Patch paving may be placed by hand using a vibratory plate compactor or roller in conformance with this Section.

3.17 PAVEMENT FLOOD TESTING

A. Flood testing of asphalt pavement must be made prior to the placement of striping and legends. The ENGINEER must be present to witness the flood tests. The CONTRACTOR shall notify the ENGINEER a minimum of 3 working days prior to the flood test.
B. The CONTRACTOR shall repair any areas which are damaged or in which excessive ponding occurs. Excessive ponding is defined as areas in which water stands more than 3/16-inch in depth. Any areas requiring remedial overlay shall be prepared by grinding the pertinent area as defined by the ENGINEER and placing fine asphalt concrete patch mix over a tack coat. The corrective work shall be done prior to the placement of striping and legends.

- END OF SECTION -

SECTION 321200 FLEXIBLE PAVEMENT COATINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and construct the flexible pavement coatings and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Preparation and cleaning of pavement.
2. Pavement Crack Sealant.
3. Application of oil spot sealer to areas of fuel, oil and grease stains.
4. Application of emulsified asphalt slurry seal.
5. Pavement sweeping and clean-up of jobsite.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 311300	Selective Tree and Vegetation Trimming and Removal.
B.	Section 321000	Asphalt Pavement, Base, and Surface Treatments.
C.	Section 311723	Traffic Stripes and Pavement Markings.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 5	Control of Work.
Section 6	Control of Materials.
Section 37	Bituminous Seals.
Section 94	Asphaltic Emulsions.

B. **Commercial Standards:**

ISSA A105 (revised 1991)	International Slurry Surfacing Association. Recommended Performance Guidelines For Emulsified Asphalt Slurry Seal.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall provide the ENGINEER with Certificates of Compliance and sample materials for all products and materials proposed to be used under this Section.

B. The Certificates of Compliance shall identify the name of the material, material source, name of the supplier, project name and the segment of the WORK where the material represented by the sample is to be used.

C. At least 7 working days prior to beginning pavement coating operations, the CONTRACTOR shall provide the ENGINEER with signed original laboratory reports for the mix designs which covers the specific materials to be used, per the requirements of Section 37-2.03, "Mix Design," of the Caltrans Standard Specifications and this Section.

D. The CONTRACTOR shall provide the ENGINEER with weigh tags and gallonage for all materials delivered to the job site, including aggregate, asphaltic emulsion and any additives.

E. The CONTRACTOR shall include the proposed source of aggregate in the mix design laboratory report and a material sample for the ENGINEER'S review. In addition, the CONTRACTOR shall submit a list of three (3) slurry seal projects on which the proposed aggregate was used and has demonstrated a history of holding a dark coloration.

1.5 QUALITY ASSURANCE

A. The above mix design reports shall be performed by a certified testing laboratory capable of performing the applicable ISSA tests indicated in Section 37-2.03, "Mix Design," of the Caltrans Standard Specifications and this Section.

B. The above mix design reports shall also indicate the proposed source, type and coloration of the proposed aggregate and samples of the aggregate shall be submitted by the CONTRACTOR for the ENGINEER'S review prior to use.

C. The ENGINEER will employ a certified testing laboratory to perform additional quality assurance tests and inspections as may be required by this Section.

D. The percentage of asphaltic emulsion proposed in the mix designs shall be within the percentage range specified in Section 37-2.04, "Proportioning," of the Caltrans Standard Specifications and this Section.

E. A change in either aggregate or emulsion during the course of the WORK will require submittal and approval of a new mix design and aggregate samples. Substituted materials shall not be used until the mix design and materials are reviewed by the ENGINEER. Random samples of materials and mixes will be taken by the ENGINEER during operations for further analysis and testing.

F. Once the emulsified asphalt slurry seal materials and proportions to be used are reviewed by the ENGINEER, no substitution of other materials will be permitted unless the materials proposed for substitution are first tested and a laboratory report is submitted for the substituted design as specified above and the mix design of those materials is reviewed by the ENGINEER.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall comply with Section 6, "Control of Materials," of the State Standard Specifications and this Section.

B. Materials to be incorporated into the WORK shall be new and unused unless otherwise approved. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used.

C. Materials or equipment not conforming to the requirements of this Section shall be considered as defective and shall be removed from the site of the WORK unless otherwise permitted by the ENGINEER. No rejected materials or equipment, the defects of which have subsequently been corrected, shall be used until inspected and reviewed by the ENGINEER.

D. The CONTRACTOR shall permit the ENGINEER to take samples of the aggregate and asphalt emulsion used in the WORK at the ENGINEER'S discretion. Gradation and sand equivalent tests may

be run on the aggregate and residual asphalt tests on the emulsion. The ENGINEER will compare the test results with this Section and notify the CONTRACTOR immediately if any test fails to meet specifications.

E. If any two successive tests fail on the stockpile material, the WORK shall be stopped. Before WORK can continue, the CONTRACTOR shall, at his own expense, be responsible for proving to the satisfaction of the ENGINEER that the conditions have been corrected.

F. If any two successive tests fail on the mix from the same mixer-spreader machine, the use of the machine shall be suspended. It shall be the responsibility of the CONTRACTOR, at his own expense, to prove to the ENGINEER that the problems have been corrected and that the equipment is working properly before it will be allowed for use again on the WORK.

G. All WORK will be done by persons experienced in the specific work, under competent supervision, and in a manner to the ENGINEER'S complete satisfaction as specified in Section 5-1.06, "Superintendence," and Section 5-1.12, "Character of Workman," of the Caltrans Standard Specifications.

H. The CONTRACTOR shall furnish all tools and equipment and employ sufficient trained personnel to operate all equipment and perform all handwork efficiently and skillfully.

PART 2 -- PRODUCTS

2.1 EMULSIFIED ASPHALT SLURRY SEAL

A. Immediately prior to mixing, the slurry seal shall consist of a mixture of asphaltic emulsion, aggregate, water and additives (as required) in conformance with Section 37-2 of the Caltrans Standard Specifications and modified as follows:

1. Asphaltic emulsion shall be a quick setting, cationic type, in conformance with the requirements for CQS1h grade of Section 94, "Asphaltic Emulsions," of the State Standard Specifications, except that the test requirements for cement mixing and settlement shall not apply.

2. Aggregate for the slurry seal shall be in conformance with Section 37-2.02C, "Aggregate," of the Caltrans Standard Specifications for a Type II mix. The use of crushed granite or other light grey-colored aggregate will not be allowed. The aggregate shall consist of an aggregate or combination of aggregates dark in color and nature that shall be produced by crushing rock. All materials shall be free from vegetable matter and other deleterious substances, oversized particles and caked lumps.

3. Water shall be potable, and free from harmful, soluble salts.

4. Chemical retardant may be added up to one percent of dry weight of the aggregate to insure proper workability while not adversely affecting the seal.

2.2 OIL SPOT SEALER

A. Oil spot sealer shall consist of "OverKote" Oil Spot Seal manufactured by Reed & Graham, Inc., or equal, conforming to the following specifications:

1. A commercial grade, quick drying, latex emulsion sealer which shall have suitable additives to coat and promote adhesion of the flexible pavement coating to oil, grease and gasoline stained pavement.

2.3 PAVEMENT CRACK SEALANT

A. Pavement crack sealant shall be in accordance with PART 2 – "Products" of Section 321000 "Asphalt Pavement, Base and Surface Treatments."

2.4 BOND COAT

A. The bond coat shall consist of a tack coat mixture of emulsified asphalt binder and water mixed and applied uniformly to the entire surface where specified. The design mix shall conform to the Caltrans Standard Specifications and the following requirements:

1. Asphaltic Emulsion shall be in conformance with the requirements for SS1h grade of Section 94, "Asphaltic Emulsions," of the Caltrans Standard Specifications, except that the test requirements for cement mixing and settlement shall not apply.

2. Water shall be potable and free from harmful soluble salts.

2.5 ASPHALT PAVEMENT OVERCOAT

A. The asphalt pavement overcoat shall consist of a cold applied composition of petroleum sealer mixed with sand conforming to the following requirements and applied after the bond coat has dried:

1. Asphaltic Emulsion shall be of the same quality, or better, as "OverKote" asphalt pavement coating manufactured by Reed & Graham, Inc., or equal, such that it conforms to the specifications for SS1h grade per Section 94, "Asphaltic Emulsions," of the Caltrans Standard Specifications, not be of the clay type, and conform to the following minimum specifications:

SPECIFICATIONS	LIMITS	TEST METHODS
Residue at 300-400° F	55-65	See Note 1*
Dehydration, 96 hrs. at 100° F	0.6 min.	
Solubility of Residue in C_2HCl_3	15-20	AASHTO T-45-46
Loss of ignition of insoluble residue, %	16 max.	ASTM D-6
Cone penetration at 77° F, dmm	400-700	ASTM D-217

*Note 1 – Method for determination of residue:
A 25 gram sample is placed in a tin lid not less than 5" in diameter and heated on an electric hot plate at a temperature between 300-400° F for approximately 15-20 minutes until the vapor changes from white to a bluish color and bubbling ceases.

2. Sand – Sand for the overcoat mixture shall be No. 30 mesh blast sand composed of clean, hard, durable, uncoated particles, free from lumps of clay or organic matter. The use of crushed granite or other white or light gray-colored sand or aggregate shall not be allowed.

3. Water – Water shall be potable and free from harmful soluble salts.

PART 3 -- EXECUTION

3.1 ORDER OF WORK

A. All asphalt concrete pavement repairs and adjacent concrete curb and gutter repair operations shall be completed, inspected and reviewed by the ENGINEER prior to installation of the flexible pavement coating.

B. Tree and vegetation trimming and/or removal operations required for equipment accessibility shall be completed by the CONTRACTOR in accordance with Section 311300, "Selective Tree and Vegetation Trimming and Removal," prior to installation of the flexible pavement coating.

C. Prior to applying the pavement coating, all surface preparation, including pavement striping and marking removal, street cleaning and crack sealing operations shall be completed in accordance with this Section, including:

1. All weeds or other vegetation growing through the asphalt concrete shall be removed and all open cracks shall be blown clear of foreign material, including organics, sand, dirt and grease.

2. All pavement surfaces where heavy deposits of grease and oil are encountered shall be cleaned of dirt by scraping, washing with detergent, and rinsing with water. After the spots have dried, the CONTRACTOR shall seal the spots with an oil spot sealant, as specified herein, and allow to dry before application of surface coating.

3. All pavement surfaces where heavy deposits of dirt, sand, clay and other objectionable material are encountered shall be cleaned up by the CONTRACTOR through the use of high pressure blowers, vacuums or sweepers. The third paragraph of Section 37-2.06 of the State Standard Specifications is hereby amended such that the use of flushing as a means to clean the pavement prior to pavement coating placement shall not be allowed.

4. Immediately prior to pavement coating operations, all pavement surfaces shall be cleaned by vacuum sweeping to remove all loose particles of paving, dirt, vegetation and all other extraneous material and debris.

D. The ENGINEER shall review the surface preparation prior to placement of the pavement coating.

3.2 PUBLIC NOTIFICATION

A. All homeowners, businesses and public facilities affected by the WORK shall be provided with prior notification of the WORK and necessary parking restrictions, in conformance with Division 1, General Requirements. All notifications shall be in both the form of a distributed written notification, reviewed by the ENGINEER, setting the time and date that the operations will take place. The CONTRACTOR shall coordinate the notification process and follow up each notification with submittal to the ENGINEER of a signed affidavit confirming time and date of each notification.

3.3 TRAFFIC CONTROL

A. The CONTRACTOR shall use suitable measures, including signs, portable barricades, tape and flaggers, as required by this Section and the Division 1, General Requirements to protect the WORK area from damage from all types of vehicular and/or pedestrian traffic. Approval to open WORK areas to traffic does not constitute acceptance of the WORK.

B. In WORK areas which are subject to an increased rate of sharp turning vehicle or twisting tires, additional closure time may be required for a more complete cure of the seal coating to prevent damage to the pavement. Slight tire marks may be evident in these areas after opening but will diminish over time with rolling traffic. If areas should become noticeably rutted, they will be considered as abnormal characteristics of the pavement coating and will not be accepted.

3.4 PROTECTING UTILITY COVERS

A. Immediately prior to commencing pavement coating operations, all metal surface utility and monument covers shall be protected by completely covering the cover with oiled or plastic paper attached appropriately with adhesive, as approved by the ENGINEER. No adhesive or surface seal material will be permitted to cover, seal, or fill the area between the frame and cover of the structure or monument. All covers shall be exposed and cleaned of surface seal material by the end of the same working day.

3.5 OIL SPOT SEALER

A. The CONTRACTOR shall apply oil spot sealer to all street and surfaces where heavy deposits of grease and oil are encountered as part of the surface preparation. Pavement surfaces with heavy deposits of grease and oil shall be prepared by cleaning dirt and deposits off by scraping, washing with detergent and rinsing with water. After the spots have dried, the CONTRACTOR shall seal the spots with an oil spot sealant, as specified herein, and allow to dry before application of the pavement surface coating.

3.6 PAVEMENT CRACK SEALING

A. Crack sealing operations shall be in accordance with PART 3 – "Execution" of Section 321000 "Asphalt Pavement, Base and Surface Treatments."

3.7 EMULSIFIED ASPHALT SLURRY SEAL

A. Proportioning - The slurry seal mixture shall be proportioned in accordance with the requirements of Section 37-2.04 of the Caltrans Standard Specifications, except that the third paragraph of the section shall be amended as follows:

1. Asphaltic emulsion shall be added at the rate of from twelve to sixteen percent by weight of the dry aggregate. A job mix design shall be submitted by the CONTRACTOR for review by the ENGINEER that conforms to the specifications herein, and is suitable for the traffic, climate and curing conditions associated with the WORK.

2. No change in proportioning of the mix or substitution of materials shall occur without both testing and submittal of a laboratory report, as specified in the Caltrans Standard Specifications and this Section.

B. Mixing - The slurry seal shall be mixed in accordance with the requirements of Section 37-2.05 of the Caltrans Standard Specifications and this Section.

1. The ENGINEER may use the recorders, gauges and measuring facilities of each slurry seal mixer-spreader unit to determine application rates, asphalt emulsion content and additive content of individual loads.

2. The delivery rate of aggregate and emulsion per revolution of the aggregate feeder shall be calibrated at different gate settings for each mixer-spreader truck used on the project.

3. The CONTRACTOR shall check stockpile moisture content regularly and set the mixing equipment accordingly to account for aggregate bulking.

4. Samples of the slurry seal mixture may be taken directly from the mixer-spreader trucks as determined necessary by the ENGINEER. Consistency and residual asphalt content tests may be made by the ENGINEER on the samples and compared to the requirements of this Section. The ENGINEER will notify the CONTRACTOR immediately if any test fails to meet specifications.

C. Spreading Equipment - The slurry seal mixture shall be mixed in continuous pugmill mixers of adequate size and power and uniformly spread by means of a controlled spreader box and in accordance with the requirements of Section 37-2.05 of the Caltrans Standard Specifications and this Section.

1. A minimum of two 7 cubic yard or larger mixer-spreader trucks, in good operating condition, shall be on the job site at all times. Mixer-spreader equipment must be able to negotiate turns in cul-de-sacs on an initial, continuous pass next to the curb.

2. The mixer-spreader trucks shall be equipped with a pressurized water system and nozzle type spray bars to provide a fog spray immediately ahead of the spreader box. The rate of application shall be adjustable and shall cover the entire application surface without flowing or ponding.

3. If required by the ENGINEER, the mixer-spreader equipment shall be inspected and calibrated on a 300-foot test section. The CONTRACTOR shall use this calibration to establish the settings required to obtain the desired application rate for the slurry mix and to correct the proportioning of materials, in accordance with the requirements of this Section.

D. Placing - The slurry seal mixture shall be placed in accordance with the requirements of Section 37-2.06 of the Caltrans Standard Specifications, and this Section.

1. Slurry seal shall not be placed if either the pavement or the air temperature is below 50 degrees F, or when in the opinion of the ENGINEER, road conditions or imminence of inclement weather, are not conducive to successful results.

2. Slurry seal placement shall not begin before 7:00 a.m. and shall be terminated each day in sufficient time so that all streets will be open to traffic by 3:30 p.m.

3. The surface to be slurried shall be lightly pre-dampened with a fog spray of water from the applicator mounted on the mixer-spreader truck as described in "Spreading Equipment," above. The rate of application of the fog spray shall be adjusted to compensate for ambient temperature, and surface texture, and shall cover the entire surface without flowing or ponding.

4. The slurry seal mixture shall be of the desired consistency upon leaving the mixer. No lumping, balling, or unmixed aggregate shall be permitted. A sufficient amount of material shall be carried in all parts of the spreader at all times so that complete coverage is obtained. Overloading of the spreader shall be avoided.

5. The slurry seal mixture shall possess sufficient stability so that premature breaking of the material does not occur in the spreader box. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the courser aggregate. Spraying of additional water into the spreader box will not be permitted.

6. No streaks, such as those caused by oversize aggregate, shall be left in the finished surface. If excess oversize aggregate develops the job will be stopped until the CONTRACTOR proves to the ENGINEER that the situation has been corrected. Some situations may require screening

the aggregate just prior to loading it into mixer-spreader trucks going from the stockpile area to the lay down operation.

7. The slurry seal machine shall move forward at such a speed that the slurry seal mixture penetrates and substantially fills all surface voids in the existing pavement.

8. The forward speed of the slurry seal spreader shall be maintained so as not to cause corrugations and surface irregularities in the slurry seal.

9. The slurry box squeegees, rubber belting or similar material, shall be flexible enough to wipe the slurry uniformly over the surface of the existing pavement without gouging, scouring or abrading the surface.

10. Slurry seal shall be placed to the limits as shown on the drawings, as marked in the field, and as directed by the ENGINEER. Where recently resurfaced streets intersect with the project limits, slurry material shall be extended to provide a minimum overlap beyond the edge(s) of recent resurfacing, as marked in the field or as directed by the ENGINEER, irrespective of typical project limits.

11. The edges of the slurry seal application on both sides of the street shall be maintained in a neat and uniform line. Along concrete gutters, the slurry seal shall overlap the lip of gutter approximately one (1) inch maximum to seal the joint along the edge of the concrete. No runoff into the gutter will be permitted. Where there is no concrete gutter, the slurry seal shall extend to the limits of the existing asphalt pavement.

12. Areas which cannot be reached with the slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type of finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

13. The CONTRACTOR shall use 15-lb. roofing paper at slurry seal transverse limits and stop/start butt joint conforms to maintain a neat and uniform line and thickness of slurry seal at conforms. The CONTRACTOR shall position the paper to provide a minimum overlap at conforms, avoid double placement of material at stop/start joints, and hold excess slurry for easy removal without spillage.

14. Wherever possible, longitudinal lap joints shall coincide with lane lines or in the center of the lane. In no case will joints be allowed in the normal wheel track of vehicles. Care shall be taken to avoid leaving ridges at the lap joints between adjoining passes.

15. The CONTRACTOR shall not continue to the next street until all handwork has been completed and all excess slurry along gutters, walks and drives has been removed to the satisfaction of the ENGINEER.

16. All excess and unsuitable material within the street right-of-way shall be removed as it develops or no later than the end of each work day.

17. The CONTRACTOR shall not use diesel fuel or solvents of any kind for cleaning tools and equipment in such a manner as to permit spillage of the diesel fuel or solvent.

18. The CONTRACTOR shall be responsible for all damage to the slurry seal coat until it cures. All damaged areas shall be patched or the street re-slurried as directed by the ENGINEER at the CONTRACTOR'S expense.

E. Rolling - The CONTRACTOR shall roll the slurry seal once it has cured enough so as to not pick up on the tires of the roller. All surfaced areas shall be subjected to a minimum of two (2) full coverage passes by a self-propelled 10 ton pneumatic roller equipped with water spray. Tire pressure shall be set at 50 psi.

F. Sweeping - After the slurry seal has cured, the CONTRACTOR shall perform additional sweeping in to remove excess loose material per this Section.

1. The CONTRACTOR shall notify the ENGINEER of its proposed sweeping schedule.

2. The CONTRACTOR shall adjust the sweeping schedule at the discretion of the ENGINEER should unforeseen circumstances arise.

3. Within 4 to 7 calendar days after slurry seal has cured, the CONTRACTOR shall perform an initial sweeping operation on all slurry seal areas to remove excess loose material.

4. Within 10 to 14 calendar days after the slurry seal has cured, the CONTRACTOR shall perform a second sweeping operation in those areas of excess ravelling as directed by the ENGINEER.

5. The CONTRACTOR shall also perform additional sweeping operations after the second sweeping as determined necessary by the ENGINEER. The CONTRACTOR shall perform the required additional sweeping operations within 48 hours of the ENGINEER'S notification.

3.8 BOND COAT AND ASPHALT PAVEMENT OVERCOAT:

A. Proportioning:

1. The bond coat shall consist of a tack coat mixture of one (1) part emulsified asphalt binder (SS1h grade) and four (4) parts water.

2. The asphalt pavement overcoat shall be proportioned, mixed, and applied in a manner that takes into account the surface roughness of the pavement. The proportions of materials and the number of applications required shall be in accordance with those contained in the mix design submittal and the manufacturer's specifications as approved by the Engineer.

B. Mixing: The mixing or agitating equipment utilized by the contractor shall be a tank-type power mixer with a round bottom and shall be a power driven mixer of sufficient capacity to maintain the mineral content of the overcoat in suspension prior to application.

C. Placing:

1. No asphaltic emulsion products shall be placed when either the pavement or the air temperature is below 50°F, or when in the opinion of the Engineer, pavement conditions or imminence of inclement weather, are not conducive to successful results.

2. Placement shall not begin before 7:00 a.m. and shall be terminated each day in sufficient time so that all barricades may be removed prior to the end of the work day.

3. The Contractor shall remove all existing pavement markings, paint and thermoplastic, within the limits of the overcoat area as part of the pavement preparation process.

4. The Contractor shall protect all buildings, fences, utility boxes, storm drain grates, and adjacent concrete cubs, gutters, and sidewalks from overspray, spillage, and tracking during application of the bond coat and overcoats.

5. The Contractor shall apply the bond coat over the entire asphalt pavement to be overcoated at a rate of 0.05 to 0.10 gallon per square yard. The bond coat shall be allowed to dry prior to placement of the overcoat. Any pools of wet binder remaining in depressions shall be swept out and allowed to dry before applying the overcoat.

6. Prior to the first application of overcoat in hot weather, the Contractor shall dampen the pavement surface. Any excess water shall be removed to leave the surface only slightly damp prior to application.

7. In general, for the purposes of bidding the project, two (2) or more applications of overcoat mixture are required for the surface roughness with 3 pounds of 30 mesh sand and adequate water added per gallon of sealer (not to exceed 15% by volume) to the first application to obtain a semi-fluid consistency, and another application of sealer made without the application of sand as necessary to obtain a smooth and uniform surface. The quantity of undiluted sealer to be applied per 1,000 square feet of area shall also be determined in the mix design submittal, but is estimated at a minimum of 30 gallons per 1,000 square feet of area for the purposes of the bid. In the field, the controlling factor shall not be the quantity of sealer used, but that the finished surface shall be smooth and uniform, showing no evidence of course or uneven texture.

8. The asphalt pavement overcoat shall be applied by the combined use of rubber-faced squeegees and mechanized material spreading equipment or other suitable methods approved by the Engineer. The material should be applied to the area in continuous parallel lines and spread immediately by the use of rubber-faced squeegees and/or mechanized materials spreading equipment. Care shall be taken to avoid leaving ridges at the lap joints between adjoining passes.

9. Asphalt pavement overcoat material shall be placed to the limits as indicated on the plans and as directed by the Engineer. Where curbs and sidewalks exist, the overcoat shall seal the joint between the edge of pavement and the concrete, but shall not overlap onto the concrete. The Contractor shall use 15 lb. roofing paper to start and stop at sidewalks, in order to ensure a straight line conform and hold excess material for easy removal. The edge limits of the overcoat application shall extend to the existing edges of pavement.

10. All excess and unsuitable materials resulting from the Contractor's operations shall be removed as it develops by the end of each work day.

11. The Contractor shall not use diesel fuel or solvents of any kind for cleaning tools and equipment in such a manner as to permit spillage of the diesel fuel or solvent.

12. The Contractor shall be responsible for all damage to the overcoat until it cures. All damaged areas shall be re-coated as directed by the Engineer at the Contractor's expense.

13. After the pavement overcoat has cured, and during the duration of the contract, the Contractor shall perform additional sweeping in areas of excess raveling, as directed by the Engineer.

- END OF SECTION -

SECTION 321300 - CONCRETE SURFACE IMPROVEMENTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor to furnish and install all concrete surface improvements including concrete curbs, median curbs, gutters, valley gutters, sidewalks, access ramps, bus turnouts, driveways, median nose surfacing, pads, miscellaneous concrete footings, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1. Subgrade Preparation.
2. Root Pruning.
3. Aggregate Base.
4. Sidewalk Drains.
5. Forms for Concrete.
6. Concrete Reinforcement.
7. Portland Cement Concrete Placement.
8. Expansion Joints.
9. Deep Joints.
10. Score Lines.
11. Curing Compound.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 311316	Root Pruning.
B.	Section 310000	Earthwork.
C.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standards Specifications:

Section 19	Earthwork.
Section 26	Aggregate Bases.
Section 73	Concrete Curbs and Sidewalks.

2. Standard Plans

B. **Commercial Standards:**

ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A 185 Reinforcement	Specification for Steel Welded Wire Fabric, Plain, for Concrete
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 143	Test Method for Slump of Hydraulic Cement Concrete.
ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 1751	Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types.)
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D 2241	Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series.)

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. **Mix Designs:** A list of pre-approved ready-mix designs is on file in the ENGINEER'S office. If the CONTRACTOR does not use one of the pre-approved designs prior to beginning the concrete work, the CONTRACTOR shall submit to the ENGINEER, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein. Each mix design shall be accompanied by a Certificate of Compliance to these specifications.

C. **Delivery Tickets:** The CONTRACTOR shall provide delivery tickets at the time of delivery of each load of concrete. Batch tickets automatically produced by the batching equipment, indicating quantities of each ingredient, shall accompany each delivery ticket. Each delivery ticket shall, in additions, state the mix number, total yield in cubic yards, date, and the time of day, to the nearest minute, corresponding to when the batch was loaded, when it was dispatched, when it arrived at the job, and the time that unloading began.

PART 2 -- PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate base shall be Class 2, 19 millimeter maximum size grading, aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications.

2.2 CONCRETE REINFORCEMENT AND DOWELS

A. Steel bar for concrete reinforcement and dowels shall be deformed billet-steel bars of the size or sizes as specified on the Drawings and shall conform to the requirements of ASTM A 615 for Grade 40 or Grade 60 bars.

B. Steel welded wire fabric for sidewalk drains shall be cold drawn steel welded wire fabric, 6"x6"x 10/10, and shall conform to the requirements of ASTM A 82 for the tie wire and ASTM A 185 for the wire fabric.

C. Tie wire shall be a minimum of 18 gage, black annealed conforming to the requirements of ASTM A 82.

2.3 SIDEWALK DRAINS

A. Pipes for sidewalk drains shall be 3 inch PVC Schedule 40 or PVC SDR 32.5 in conformance with ASTM D 1785 and ASTM D 2241, respectively. Steel welded wire fabric shall be as specified in Section 2.2 above.

2.4 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for curbs, median curbs, gutters, valley gutters, sidewalks, access ramps, bus turnouts, driveways, pads, and miscellaneous concrete footings shall be in conformance with Standard Detail G-6.

B. Concrete shall be Ready-mix of a pre-approved mix design as listed in the ENGINEER'S office.

C. **Admixtures:** All admixtures shall be in conformance with Section 033050, "Utility Cast-in-Place Concrete."

D. **Water-Cement Ratio and Compressive Strength:** The water-cement ratio and compressive strength shall be in conformance with Section 033050, "Utility Cast-in-Place Concrete."

E. Except for miscellaneous concrete footings lampblack shall be added at the rate of 3/4 pound/pint per cubic yard of concrete.

F. Aggregate gradations proposed by the CONTRACTOR shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	*Sieve Sizes*		*Limits of Proposed Gradation*	
1-1/2" x 3/4"		1"		19-41
1" x No. 4	3/4"		52-85	
1" x No. 4	3/8"		15-38	
Fine Aggregate		No. 16		55-75
Fine Aggregate	No. 30		34-46	
Fine Aggregate	No. 50		16-29	

2.5 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be premolded expansion joint filler ¼ inch thick in conformance with ASTM D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete improvements prior to being placed.

2.6 CURING MATERIALS

A. All curing compound shall be of the non-pigmented type in conformance with ASTM C 309, Type 1-D, Class A.

2.7 ACCESS RAMPS

A. Access ramps shall conform to the "Curb Ramp Details" of the Caltrans Standard Plans.

B. Detectable Warning Surfaces shall be manufactured by Armor Tile Tactile Systems, dark gray in color, or approved equal.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall be in conformance with Section 310000, "Earthwork," and Section 321000, "Asphalt Pavement, Base and Surface Treatment."

B. Finish subgrade shall be within the tolerances established in Section 19-1, "General," of the Caltrans Standard Specifications.

3.2 SAWCUTTING EXISTING CONCRETE IMPROVEMENTS

A. Where a portion of existing concrete surface improvements is to be removed and replaced, the section to be removed shall be sawcut with an approved concrete saw to a minimum depth of 1-1/2 inches. For sidewalks, access ramps, and driveways the limit of the saw cut shall be at a minimum the first score line beyond the limits of the area to be replaced or as directed by the ENGINEER. For curb and gutter the limit of the sawcut shall be the nearest deep joint or as directed by the ENGINEER.

3.3 ROOT PRUNING

A. Where existing concrete improvement replacement is required due to tree root intrusion the tree roots shall be pruned in conformance with PART 3 - EXECUTION of Section 311316, "Root Pruning."

3.4 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with PART 3 - EXECUTION of Section 321000, "Asphalt Pavement, Base and Surface Treatments." The aggregate base shall be placed to the depth as shown on the Drawings.

3.5 FORMS FOR CONCRETE

A. No forms shall be placed prior to approval of the aggregate base and subbase by the ENGINEER.

B. All concrete surface improvements may be placed by slip form paver, and curb and gutter may be placed by extrusion machine.

3.6 CONCRETE REINFORCEMENT

A. Concrete reinforcement and dowels shall be placed at the location as shown on the Drawings. Installation of concrete reinforcement and dowels shall be in conformance with Section 033050, "Utility Cast-in-Place Concrete."

3.7 SIDEWALK DRAINS

A. Pipe for sidewalk drains shall be placed and installed as specified on the Drawings.

3.8 PORTLAND CEMENT CONCRETE

A. No concrete for concrete surface improvements shall be placed until the subgrade, aggregate base, forms and reinforcement, and sidewalk drains have been approved by the ENGINEER.

B. Concrete curbs, gutters, valley gutters, sidewalks, access ramps, bus turnouts, driveways, and miscellaneous concrete footings shall be constructed in conformance with Section 73, "Concrete Curbs and Sidewalks," of the Caltrans Standard Specifications, except that hand mixing of Portland cement concrete for use in concrete surface improvements will not be allowed, and except as modified in this Section.

C. Concrete surface improvements shall not exceed the tolerances established in Section 73, "Concrete Curbs and Sidewalks," of the Caltrans Standard Specifications.

D. When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1-1/2 hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F., or above, a time less than 1-1/2 hours may be required.

E. All existing square formed steel tube sign posts shall be protected prior to pouring concrete around the post such that no concrete will leak inside the post.

3.9 JOINTS

A. **Expansion Joints:** Expansion joints shall be placed at 200-foot spacings and at all changes in horizontal alignment.

B. **Deep joints:** Deep joints shall be placed at all driveway edges and at 10 foot spacing. Depth of deep joint shall be 3/4-inch.

C. **Score lines:** Score lines shall be placed transversely at 5-foot spacing between deep joints, longitudinally along back of curb, and longitudinally at mid-point on sidewalks over 8 feet in width.

D. When replacing concrete improvements score lines and deep joints shall match existing score line and deep joint spacing.

3.10 CONCRETE FINISH

A. All concrete surface improvements, except access ramps and miscellaneous concrete footings, shall have a soft broom finish. Access ramp surface finish shall conform to the "Curb Ramp Details" of the CalTrans Standard Plans.

B. Miscellaneous concrete footings shall be sloped to provide drainage away from the post/pipe.

3.11 CURING

A. All exposed surfaces of Portland cement concrete shall be cured in conformance with the manufacturer's printed recommendations.

- END OF SECTION -

SECTION 321723 - TRAFFIC STRIPES AND PAVEMENT MARKINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place all traffic stripes and pavement markings, which may include but is not necessarily limited to, removal of any existing striping, legends, and pavement markers; repair of damaged pavement; placement of pavement markers; placement of both thermoplastic and painted striping and marking; and all other appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321000 Asphalt Pavement, Base, and Surface Treatments.

B. Division 1 General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications and Standards:**

United States Department of Transportation, Manual of Uniform Traffic Control Devices

B. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 15	Existing Highway Facilities.
Section 84	Traffic Stripes and Pavement Markings.
Section 85	Pavement Markers.
Section 94	Asphalt Emulsions.

2. Standard Plans.

3. Traffic Manual.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. **General:** Unless otherwise noted on the Drawings, all permanent traffic stripes and pavement markings shall be thermoplastic and/or pavement markers.

B. **Thermoplastic:** Thermoplastic for traffic stripes and pavement markings shall conform to Section 84-2, "Thermoplastic Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.

When thermoplastic marking is applied within a crosswalk or a bike lane, the following composition shall be used with a maximum thickness of 0.12 inches (3.0 mm):

Binder 20% (18% min)
Glass Beads 20% (15% min)
TiO_2 Pigment 10% (7% min)
Filler 35% (37% max)
Cullet 1 5 % (10% min)

The crushed glass cullet in such mixture shall be produced from cullet of clear glass, with a maximum size of 850 micrometers (100% passing by weight) and a minimum size of 425 micrometers (0-5%% passing by weight). The skid resistance shall be a minimum of 55 BPN.

C. **Paint:** Paint for traffic stripes and pavement markings shall conform to Section 84-3, "Painted Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.

D. **Pavement markers:** Pavement markers shall conform to Section 85, "Pavement Markers," of the Caltrans Standard Specifications and as specified herein. Fire Hydrant markers shall be two-way, reflective blue markers.

E. **Pavement arrows:** Type II and III pavement arrows shall be installed on streets with speed limits of 45 mph or greater. Type I(10), IV, VII, and VIII pavement arrows shall be installed on all other streets.

2.2 ADHESIVE

A. Adhesive shall be the hot melt bituminous type conforming to Section 85, "Pavement Markers," of the Caltrans Standard Specifications.

PART 3 -- EXECUTION

3.1 GENERAL

A. Centerline and lane lines shall be re-established the same day as they are removed by the use of temporary reflective markers placed at 24-foot maximum spacing.

B. Stop bars, crosswalks, advanced school crossing legends and arrows, shall be re-established the same day as they are removed using paint or traffic tape and shall match the width, size, and color as the removed markings unless otherwise shown on the Drawings.

C. Temporary traffic stripes and pavement markings placed on the finish lift of asphalt concrete shall be made with temporary traffic tape. Temporary traffic stripes and pavement markings placed on sub-lifts of asphalt concrete may be made with paint or traffic tape. Traffic tape will not be placed on slurry seal surfaces.

3.2 REMOVE EXISTING TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. All removed traffic stripes and pavement markings and excess material shall become the property of the CONTRACTOR and shall be disposed of in a legal and proper manner. Removal and disposal of existing traffic markings and excess material shall conform to Section 15, "Existing Highway Facilities," of the Caltrans Standard Specifications and as specified herein.

B. The CONTRACTOR shall conduct his work so as not to damage existing pavement and public improvements to remain. Any resultant damage determined to be excessive by the ENGINEER shall be repaired in kind by the CONTRACTOR at its sole expense.

C. Damage to the pavement resulting from removal of pavement markers shall be considered as any depression more than 1/4-inch deep and shall be repaired by the CONTRACTOR by filling the depression with hot melt bituminous adhesive to the satisfaction of the ENGINEER.

D. Where blast cleaning is used for the removal of traffic stripes and pavement markings or objectionable material, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation.

E. Where removal of traffic stripes and pavement markings is done by grinding or sandblasting methods, the effected pavement surface shall be completely covered by applying asphaltic emulsion conforming to Section 94 of Caltrans Standard Specifications.

F. All reference markings made by the CONTRACTOR shall be done with spray chalk.

G. All temporary traffic stripes and pavement markings shall be removed by the CONTRACTOR on the same day as placement of the permanent striping and markings.

3.3 TRAFFIC STRIPES AND PAVEMENT MARKINGS INSTALLATION

A. Placement of all traffic stripes and pavement markings shall be in conformance with Section 84, "Traffic Stripes and Pavement Markings," and Section 85, "Pavement Markers" of the Caltrans Standard Specifications, referenced Plans of the Caltrans Standard Plans, as shown on the Drawings and as specified herein.

B. All layouts must be inspected and approved by the ENGINEER prior to permanent placement of the traffic stripes and pavement markings. The CONTRACTOR shall notify the ENGINEER no later than 48 hours prior to the start of the scheduled placement.

C. Any overlap, dripping, or tracking of fresh thermoplastic or paint onto unmarked surfacing shall be removed to the satisfaction of the ENGINEER.

D. Thermoplastic and paint shall be placed as close as possible to existing utility structure and monument frames and covers without covering them.

E. The CONTRACTOR shall protect all fresh thermoplastic and paint and shall repair or replace all damage to traffic stripes and pavement markings caused by his failure to do so at its own expense.

F. All traffic stripes and pavement markings, new or existing, within or adjacent to the WORK limits which become defaced or damaged during the CONTRACTOR'S operations shall be replaced by the CONTRACTOR at its expense concurrently with other traffic marking operations in the immediate area. The ENGINEER shall be the sole judge as to which stripes or legends are defaced or damaged.

G. Fire hydrant markers shall be installed at all fire hydrant locations as shown on the Drawings.

- END OF SECTION -

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install chain link fencing and gates, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Where the WORK requires temporary removal and replacement of existing fences, the fences shall match the adjacent fence.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321300	Concrete Surface Improvements
B.	Section 033050	Utility Cast-in-Place Concrete.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (CALTRANS) Standards:**

1. Standard Specifications:

Section 80	Fences.

B. **Commercial Standards:**

ASTM F668	Standard Specification for Poly (Vinyl Chloride)(PVC) - Coated Steel Chain Link Fence

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. Product data sheets for gates, typical fence construction, and fence corner construction shall be submitted to the ENGINEER for review prior to fabrication and construction.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Fencing shall be 3 feet or 6 feet high, unless otherwise specified on the Drawings. All fencing materials shall be hot-dip galvanized after fabrication. All materials and components shall be new, first quality items specifically manufactured for the intended application. All fencing shall be vinyl coated steel chain link fabric.

B. All galvanized fence material shall be galvanized in accordance with Section 80-4, "Chain Link Fence," of the Caltrans Standard Specifications. All steel parts shall be hot-dipped galvanized prior to vinyl coating.

2.2 MATERIALS

A. Fence fabric without slats shall be No. 11 gage galvanized steel wire, 2 inch mesh. Fence fabric with slats shall be a No. 9 gage galvanized steel wire, 2-inch mesh. The fabric shall have a knuckled finish on the top and bottom edge.

B. Fabric ties shall be galvanized steel wire of the same gage as fence fabric, spaced 14 inches apart on posts. Aluminum ties will not be permitted. A continuous No. 7 gage galvanized steel tension wire shall be interlaced with the fabric or attached to the fabric with clips along the extreme top and bottom of the fence.

C. Posts shall be one-piece without circumferential welds, and shall be:

   1. Line Posts:

      a. Fence With Slats - Posts shall be 2 inch Schedule 40 pipe, 3.65 lb./ft.

      b. Fence Without Slats - Posts shall be 1-1/2 inch Schedule 40 pipe, 2.72 lb./ft.

   2. End and Corner Posts:

      a. Fence With Slats - Posts shall be 2-1/2 inch Schedule 40 pipe, 5.79 lb./ft.

      b. Fence Without Slats - Posts shall be 2-inch Schedule 40 pipe, 3.65 lb./ft.

   3. Gate posts shall be 3-1/2 inch Schedule 40 pipe, 9.1 lb./ft.

D. Braces shall be 1-1/4 inch Schedule 40 pipe, 2.27 lb./ft.

E. Truss Rod and turn buckle shall be in conformance with Section 80-4, "Chain Link Fence," of the Caltrans Standard Specifications.

F. Fence stretcher bars shall be 1/4-inch by 3/4-inch galvanized steel bars, and steel bands for fastening stretcher bars to the posts shall be 1/8-inch by 3/4-inch.

G. Nuts, bolts and screws shall be of steel, hot-dipped galvanized after fabrication, minimum size 3/8-inch diameter.

H. Fence swing gate frames shall be constructed of 1-1/2 inch Schedule 40 pipe, minimum, and shall be fabricated by welding with all welds ground smooth prior to hot-dip galvanizing. Each gate leaf shall be provided with at least one diagonal brace. Frames shall be galvanized after fabrication. Galvanized malleable iron fittings for latching the gate shall be provided. Swing gates shall be hung by at least 2 steel or malleable iron hinges not less than 3 inches in width. Fabric shall match the fabric used in the fence. Each pair of gates shall be provided with a heavy drop rod latch assembly with a locking device for a padlock.

I. Fence sliding gates shall be track guided cantilever type. They shall be engineered and designed special for opening size and opening directions. Their construction shall be similar to that specified for swing gates. The gate components shall be engineered for proper piping and bracing size, and shall be provided complete with all necessary operating hardware including, but not necessarily limited to the following: tracks, supports, brackets, guides, heavy duty rollers with roller or ball bearings, and finish hardware. They shall be engineered for not less than a wind load of 25 lb./sq. ft. and maximum deflection of 1/160 of the full span with a 200-pound live load at the free end. The completed, welded, gate frame units and any ungalvanized hardware shall be hot-dip galvanized after fabrication. The cantilever gates shall have a free clear space under them of not less than 4 inches.

J. Concrete shall be a Class C in conformance with City Standard Detail G-6..

K. Slats shall be high density polyethylene blend, UV stabilized wide slat resistant to chemicals, salt & petroleum products, 3/8-inch by 2-1/2 inch. Unless otherwise specified, the color shall be Redwood.

L. Vinyl coated steel chain link fabric shall be No. 11 gauge steel wire, 2-inch mesh in accordance with ASTM F668, Class 2B. The color shall be as specified on the drawings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All earth, brush, or other obstructions which interfere with the proper alignment of construction of fences and gates shall be removed and disposed of at the expense of the CONTRACTOR.

B. Fence line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts and measured generally parallel to the ground slope. Line posts shall be set plumb and shall be centered in 12 inch diameter concrete footings extending 39 inches into the ground.

C. Fence end posts and corner posts shall be set plumb, and shall be centered in 12 inch diameter concrete footings extending 39 inches into the ground.

D. Gate posts shall be provided with a concrete footing in accordance with the manufacturer's printed recommendation.

E. Where a horizontal fence alignment angle is 15 degrees or more corner posts shall be installed in lieu of line posts.

F. Bracing shall be provided at all end, gate, and corner posts, the latter in both directions. Horizontal brace rails shall be set 6 inches below top of fence fabric running from the corner, end, or gate post to first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

G. Fence corner posts shall be installed in lieu of line posts at intervals not exceeding 500 feet and shall be braced horizontally in both directions.

H. The fabric shall be fastened on the side of the posts as shown or as designated by the ENGINEER. The fabric shall be stretched and securely fastened to the posts, and between the posts the fabric shall be fastened to the top and bottom tension wires and the truss rod. The truss rod shall be stretched tight with turnbuckles at the end and corner posts.

I. The fabric shall be fastened to the end, corner, and gate posts with stretcher bars and stretcher bar bands spaced at approximately 14 inches on line posts and at approximately 18 inches on tension wires.

J. Concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating in an approved manner. Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing the concrete, the earth around

the hole shall be thoroughly moistened. The concrete shall completely fill the hole and top surfaces of the concrete shall be crowned and sloped away from the post to shed water and shall have a neat appearance. Not less than 7 days shall elapse after placing the concrete footings before the fence fabric is fastened to the posts.

K. Any galvanized coating damaged during construction of the fencing and gates shall be repaired by application of molten **Galvo-Weld; Galvinox; or equal.**

- END OF SECTION -

SECTION 330130 - SANITARY SEWER AND STORM DRAIN SYSTEM LEAKAGE TESTING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor to perform and complete pipeline flushing and testing, complete, for sanitary sewer and storm drain system piping, as specified herein.

B. The CONTRACTOR shall be responsible for conveying test water from the source to the point of usage and also for proper disposal, as required, of water used in the testing operations. All costs associated with supply and disposal of test water shall be at the CONTRACTOR'S expense.

C. Structural (Deflection) testing requirements for sanitary sewers and storm drains are as specified in the various appropriate piping sections.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM C 828	Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

1.3 CONTRACTOR SUBMITTALS

A. A testing schedule, including proposed plans for conveyance, control and disposal of test water shall be submitted in writing to the ENGINEER for review a minimum of 72 hours before testing is to start.

B. The CONTRACTOR shall submit laboratory calibration certificates for all gages to the ENGINEER for review along with the testing schedule.

PART 2 -- PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. All testing equipment and materials shall be provided by the CONTRACTOR. No materials shall be used which would be injurious to pipeline system or structure and future function. All test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the CONTRACTOR'S expense prior to the leakage test.

PART 3 -- EXECUTION

3.1 GENERAL

A. All lines shall be cleaned and flushed prior to testing using a "Wayne Ball," high pressure sewer "jets," or other methods acceptable to the ENGINEER.

B. CONTRACTOR will be solely responsible for the proper disposal of all water used in the flushing and testing process. Disposal of all water shall be in accordance with appropriate regulatory agency requirements.

C. All flushing and testing operations shall be performed in the presence of the ENGINEER.

3.2 TESTING OF MAINTENANCE HOLES

A. All sanitary sewer maintenance holes shall be vacuum tested for leakage after installation in the presence of the ENGINEER. Prior to vacuum testing all maintenance holes shall be visually inspected for leaks. All leaks, cracks and lift holes shall be repaired by the CONTRACTOR, prior to vacuum testing, to the satisfaction of the ENGINEER. All repairs shall be made with non-shrink grout. The CONTRACTOR shall test the maintenance hole up to and including the cone, and shall make all repairs as necessary to achieve a final passing test. Any alternative repair methods shall be approved by the ENGINEER. All pipe inlets and outlets in the maintenance hole shall be securely plugged to sufficiently hold against vacuum pressure during testing, and removed following successful completion of the testing. A rubberized test plate shall be placed on the maintenance hole dome after potential leaks on the top of the dome have been sealed.

B. A suitable vacuum pump shall be used to reduce the pressure inside the maintenance hole to a vacuum of ten (10) inches of mercury, stabilizing the vacuum at ten (10) inches of mercury for one (1) minute. The vacuum pump shall be shut off, and with the valves closed, the increase (loss of vacuum) shall be measured inside the maintenance hole during the test hold period. The maximum allowable pressure increase (loss of vacuum) shall be one (1) inch of mercury over a sixty (60) second test hold period. If vacuum drops below nine (9) inches of mercury within the test period, the leakage shall be considered excessive. The CONTRACTOR shall make all repairs necessary to achieve a passing test and the maintenance hole shall be retested. Maintenance holes repairs and retesting shall proceed until a passing test is completed.

3.3 TESTING OF PIPING SYSTEMS

A. **General:** All sanitary sewer and storm drain systems and service laterals shall be tested as specified. All sanitary sewer gravity lines shall be tested for leakage using a low pressure air test. All sanitary sewer maintenance holes shall be tested for leakage, as specified. Maintenance holes shall be tested prior to backfill placement, whereas all pipe shall be backfilled prior to testing. All leakage tests shall be completed and approved prior to placing of permanent surfacing. When leakage exceeds the amount allowed, the CONTRACTOR at its expense, shall locate the leaks and make the necessary repairs or replacements in accordance with the Specifications to reduce the leakage to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.

B. During flushing of the sewer lines, the maintenance hole at the low end of the new line shall be plugged and incoming water pumped to a drain point approved by the CITY. Before the plug can be removed, all sand, silt, gravel and other foreign material shall be completely removed from the maintenance hole.

C. **Deflection:** All PVC non-pressure pipe shall be tested for deflection obstructions and protruding laterals by passing a "mandrel" from the nearest downstream structure to the nearest upstream structure. The "deflection test" procedure shall be acceptable to the ENGINEER. The 'mandrel' diameter shall be 95 percent of the pipe inside diameter.

D. **Air Pressure Test:** The CONTRACTOR shall furnish all materials, equipment and labor for making an air test. Air test equipment shall be approved by the ENGINEER.

The CONTRACTOR may conduct an initial air test of the sewer main line after densification of the backfill but prior to installation of the laterals. Such tests will be considered to be for the CONTRACTOR'S convenience and need not to be performed in the presence of the ENGINEER.

Each section of the sewer shall be tested between successive maintenance holes by plugging and bracing all openings in the main sewer line and the end of all laterals. Prior to any air pressure

testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated and the test procedure started over again.

The final leakage test of the sewer main line and laterals shall be conducted in the presence of the ENGINEER. The time and procedure for air testing vitrified clay pipe (VCP) shall be calculated in accordance with ASTM C 828.

For other pipe types, the test procedure shall be conducted by first increasing the pressure within the line to approximately 4 psi using a compressed air supply. After the air supply is turned off or disconnected, there shall be a two minute waiting period to allow stabilization of air within the sewer line before the actual test begins. In no case shall the test pressure within the line be less than 3.5 psi when the test begins. The allowable air pressure loss shall not exceed 1 psi. After completion of the test, the air pressure shall be released slowly and the test plugs shall not be removed until the air pressure is no longer measurable. The test periods for all sewer pipes other than VCP shall be determined using the Ramseier's equation, as follows:

$$T = 0.085 * \frac{DK}{Q}$$

Where:
- T = Shortest time, in seconds, allowed for the air pressure to drop to 1.0 psig.
- K = 0.000419 DL, but not less than 1.0.
- Q = 0.0015 cubic feet/minute/square feet of internal surface.
- D = Nominal pipe diameter in inches.
- L = Length of pipe being tested in feet.

At the CONTRACTOR'S option, joints may be air tested individually, joint by joint, with the use of specialized equipment. The CONTRACTOR shall submit its joint testing procedure for the ENGINEER'S review prior to testing. Prior to each test, the pipe at the joint shall be wetted with water. The maximum test pressure shall be 3.0 psi. The minimum allowable pressure drop shall be 1.0 psi over a 30-second test period.

E. **T.V. Inspection:** All sanitary sewer systems shall be TV inspected. In addition, all storm drain systems are subject to TV inspection. In all paved areas the TV inspection must be coordinated by the CONTRACTOR to allow sufficient time for the TV inspection to be performed prior to the final lift of asphalt paving being placed. The CITY or approved TV testing company will perform the TV inspections. The CONTRACTOR shall repair all problems revealed by the TV inspection. The CONTRACTOR shall coordinate with the ENGINEER to arrange for a compatible time to conduct the inspection.

F. **The Contractor shall contact the Water Resources Division for a list of approved TV testing companies.**

G. **The Contractor shall submit the sanitary sewer video tape (VHS) to the City for review. Tape shall become the property of the City.**

3.4 FLOW TESTING OF EXISTING COMMERCIAL/INDUSTRIAL SEWER LATERALS

A. Prior to connecting to all existing sewer laterals other than single family residential units, the CONTRACTOR shall flush test the existing sewer lateral with water in the presence of the ENGINEER to determine if the lateral is damaged

- END OF SECTION -

SECTION 330526 - PIPING IDENTIFICATION SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, mark, and install identification devices for piping, valves, and appurtenances using warning tape, buried wire, color codes, lettering, and related permanent identification devices as required and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 331219	Fire Hydrants.
B.	Section 055900	Ductile Iron Pipe
C.	Section 099000	Protective Coating
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI A13.1	Scheme for the Identification of Piping Systems.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 IDENTIFICATION OF BURIED PIPING

A. Identification of all buried pressure pipe shall be accomplished by color-coded warning tape consisting of a minimum 2 inch wide plastic tape with lettering giving a warning and a description of the pipe function (for example: "WARNING, WATER LINE BURIED BELOW"). For pipe diameters larger than 12 inches the warning tape shall be a minimum 6 inch wide. Identification color codes shall be as listed in the IDENTIFICATION SCHEDULE in PART 3 – "Execution" of this Section.

B. Warning Tape manufacturer shall be **THOR ENTERPRISES, CALPICO, or equal.**

C. In addition, for all non-metallic buried pressure pipe systems a No. 10 A.W.G. UF Insulated solid copper wire shall be attached to the pipeline.

D. Tape to hold the wire in place shall be pipe wrap tape, 2 inches wide, 10 mil.

2.2 RECYCLED WATER SIGNING

A. All identification signs and stickers for irrigation controllers for recycled water systems are to be purchased by the CONTRACTOR from the Water Resources Division located at 101 West Jack London Boulevard, Livermore, CA.

2.3 PAINT MANUFACTURERS AND COLORS

A. Paint manufacturers and colors shall be as specified in Section 099000 "Protective Coating."

PART 3 -- EXECUTION

3.1 WARNING TAPE

A. Warning tape shall be installed with all buried pressure piping. The tape shall be placed directly at the top of the Pipe Zone.

3.2 COPPER WIRE

A. Buried non-metallic pressure pipelines for potable/recycled water systems, sewer force main systems and irrigation mains shall be provided with an USE-2 Insulated copper wire laid along the top of the pipe. On main line installations the wire shall be held in place with ties or tape spaced not more than 10 feet apart. On service laterals the wire shall be wrapped around the pipe. At all buried valves install copper tracer wire on the outside of the polyvinyl chlorite valve sleeve to a notch cut out at the top of the valve sleeve.

3.3 IDENTIFICATION SCHEDULE

A. Application of identifying water systems and devices shall conform to the following color codes.

B Blue (Potable)
G Green
P Purple (Recycled)
R Red
W White
Y Yellow

	FH	Valve Lid	Dist. /Type in Face of Curb	"W" on top of Curb over Service	Vent Pipe	Guard Post	Marker Post
Sanitary Sewer/Storm Drain System	-	-	-	-	-	-	G
Water Sampling Station	-	-	-	-	-	W	-
Potable Fire Hydrants	Y or R	W	R	-	-	W	-
Dedicated FS, street valves	-	-	R	W	-	-	-
All other main line potable valves	-	B	W	-	-	-	W with B top
Recycled	P	P	P	P	-	W	W with P top
Comm/Ind Dom/Fire	-	W	W	W	-	-	W with B top
Manifold	-	W	W	W	-	-	-
Air Release Valve	-	-	W	-	*W with B or P	-	-

* Vent pipe on Air Release valves: white post with top 6 inches of pipe B or P, with 3" "AR" in B or P 12" below top of pipe facing curb, color to match top 6" of pipe.

3.4 RECYCLED WATER SIGNING

A. All recycled hydrant signs will be installed on a square formed steel tube, telescoping metal breakaway type post in accordance with PART 2 "Products" and PART 3 "Execution" of Section 02891 "Signage." Signs shall be located behind the hydrant between 36" and 48" from the center of hydrant. The top of the sign shall be level with the top of the hydrant.

B. The locations of all signage for landscape irrigation systems shall be as approved by the Water Resources Division.

Irrigation controllers will also contain the purple recycled water sticker. The following message on the irrigation controller sticker will be printed in English and Spanish:

CONTROLLER OPERATES IRRIGATION SYSTEM USING RECYCLED WATER

1. Controller Operation hours: 10:00 p.m. p.m. to 6:00 a.m.
2. Operate controller to minimize overspray and runoff.
3. Maintain controller schedule and system map located inside.
4. Failure to comply may result in loss of service.

UNAUTHORIZED OPERATION PROHIBITED

C. All recycled water piping and purple warning tape will be clearly marked stating "**Caution: Recycled Water - Do Not Drink.**" All purple polyethylene encasement for recycled water piping shall be clearly marked stating **"Caution: Recycled Water – Do Not Drink."**

D. All recycled water meters, valves, covers, backflow preventers and other appurtenances shall be painted purple.

E. All recycled water stickers shall be purple, with white lettering.

F. All internal signs (building interiors) shall be purple, with white lettering stating "**Caution: Recycled Water - Do Not Drink.**"

G. Dual plumbed buildings shall have all internal and external water spigots clearly marked with the appropriate small blue metal sign for potable water or the small purple metal warning sign for recycled water.

- END OF SECTION -

SECTION 331100 - PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all piping systems as shown on the Drawings and as specified herein. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. It is the CONTRACTOR'S responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and appurtenances, for a complete and functional system.

C. All pipe grades and elevations shown the Drawings are the pipe flow-line.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330523	Steel Casing, Boring and Jacking.
C.	Section 331300	Pressure Pipeline Testing and Disinfection.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 033055	Cast-in-Place Concrete Pipe
F.	Section 055000	Miscellaneous Metalwork.
G.	Section 099000	Protective Coating.
H.	Section 330526	Piping Identification Systems.
I.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
J.	Division 1	General Requirements.
K.	Division 2 and 5	Pipe Sections as applicable.
L.	Division 15	As applicable.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch).
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.

ANSI B31.1	ASME Code for Pressure Piping.
ANSI/AWS D1.1	Structural Welding Code.
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile for Strength.
ASTM A 325	Specification for Structural Bolts, Heat Treated 120/105 ksi Minimum Tensile Strength.
ASTM C 564	Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
ASTM D 792	Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
ASTM D 2000	Classification System for Rubber Products in Automotive Applications.
AWWA C207	Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
AWWA C606	Standard for Grooved and Shouldered Joints.
AWWA Manual M-11	Restrained Joint Harness.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. The CONTRACTOR shall submit complete shop drawings and certificates, and test reports, for all products and materials proposed to be used for all piping systems. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

C. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

D. The CONTRACTOR shall submit copies of welder's certificates to the ENGINEER.

1.4 QUALITY ASSURANCE

A. **General:** All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. **Tests:** Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. The CONTRACTOR shall assure tests are performed at no additional cost to the CITY.

C. **Welding Requirements:** Certificates of Compliance shall be supplied by the pipe fabricator for all welding procedures used to fabricate pipe and welding procedures shall be prequalified under the provisions of ANSI/AWS D1.1.

D. **Welder Qualifications:** All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent, local, approved testing agency not more than 6 months prior to commencing work on the pipeline. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.5 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is required, in order to obtain compliance for pipe fabrication and installation, the CONTRACTOR shall furnish such assistance at no additional cost to the CITY.

1.6 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.7 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and all other debris, shall be removed from the site. The entire piping system shall be left in a clean and functional condition.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 through 15 and as specified herein.

B. **Miscellaneous Pipes:** Miscellaneous pipes and fittings shall be in accordance with the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances" and as specified herein.

C. **Lining:** All requirements pertaining to thickness, application, and curing of pipe lining, shall be in conformance with the requirements of the applicable piping specifications and Section 099000, "Protective Coating," unless otherwise specified.

D. **Coating:** All requirements pertaining to thickness, application, and curing of pipe coating, shall be in conformance with the requirements of the applicable piping specifications, and Section 099000, "Protective Coating."

E. **Pressure Rating:** All piping systems shall be designed for the maximum expected pressure and test pressure as defined in Section 331300, "Pressure Pipeline Testing and Disinfection," or as shown on the piping schedule.

2.2 THREADED INSULATING CONNECTIONS

A. **General:** Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. **Materials:** Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.3 COUPLINGS

A. **Cast Couplings/Transition Couplings:** Flexible couplings for 4 inch through 12 inch pipe shall be ductile iron or steel, with ductile iron followers and Buna N gaskets, **APAC Style 341, Ford FC1 or FC3, or equal.** Cast transition couplings shall be **APAC Style 335, Ford FL2A, or equal.** The couplings shall have the manufacturer's factory fusion bonded epoxy coating and lining, and Type 304 stainless steel bolts and nuts.

B. **Rigid PVC Coupling:** Rigid couplings for 4 inch through 12 inch pipe shall be PVC High Deflection Stop Couplings and Closure couplings, **Certain Teed C900 HD Stop and Closure Coupling, or equal.**

C. **Sleeve-Type Couplings**

1. **Construction:** Sleeve-type couplings shall be provided for pipe 14 inch and larger, steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. The middle ring shall be not less than 1/4 inch in thickness and shall be either 5 or 7 inches long for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to the requirements of Section 055000, "Miscellaneous Metalwork." Buried sleeve-type couplings shall be epoxy-coated at the factory in accordance with Section 099000, "Protective Coating."

2. **Pipe Preparation:** The ends of the pipe, where specified or shown, shall be prepared for flexible couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, except for AC pipe, with outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe. For connections to existing AC pipe the tolerances will be established by the ENGINEER. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

3. **Gaskets:** Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall meet the following specifications:

   a. Color - Jet Black.

   b. Surface - Non-blooming.

   c. Durometer Hardness - 74 +/- 5.

   d. Tensile Strength - 1000 psi Minimum.

e. Elongation - 175 percent Minimum.

The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Product in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and use.

4. **Insulating Sleeve Couplings:** Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

D. **Flexible Joints:** Where harnesses are required for flexible sleeve-type couplings, they shall be in conformance with the Drawings. Hardware shall be stainless steel in conformance with Section 055000, "Miscellaneous Metals."

E. **Repair Clamps:** Repair clamps shall be full circle repair clamps, **APAC Series 431, 432, and 433; Ford F1, F2, or F3; or equal,** with ductile iron lugs and Type 304 stainless steel bands, rubber gasket, and T-Head stainless steel bolts and nuts. The repair clamp shall have the manufacturer's standard coatings and linings for the appropriate service use.

F. **Mechanical Compression Joints:** Mechanical compression joints shall have a synthetic SBR rubber body conforming to ASTM C 564 and shall have Type 302 stainless steel bands and clamps. They shall be manufactured by **Calder Couplings, Fernco, or equal.**

2.4 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

2.5 PRESSURE GAUGES

A. Pressure gauges shall be provided on each side of pressure reducing valves, and where shown on the Drawings.

B. Gauges shall be industrial quality type with stainless steel movement and stainless steel or alloy case, unless otherwise shown or specified, gauges shall have a 4-inch dial, 1/4 threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve.

C. **Manufacturers or Equal:**

1. **Ashcroft Industrial Instruments (Dresser)**

2. **Foxboro/Jordan, Inc.**

3. **Duro Instrument, Corp., Series 100**

2.6 PIPE INSULATION

A. Domestic backflow preventers and appurtenances without an approved protective enclosure shall be insulated.

B. By-pass piping and appurtenances on Class 3, 4, 5, and 6 Fire Service Installations shall be insulated.

C. Insulation shall be a prefabricated foam insulation material with an all-purpose jacket. The minimum insulation thickness shall be 2-inches. The insulation shall be **Polycell Insulating Foam, or equal.**

D. The insulation shall be wrapped with a 2-inch wide minimum, 10 mil black pipe tape.

2.7 RUBBER LINK SEALS

A. Rubber link seals shall be modular rubber sealing elements, with non-metallic pressure plates and galvanized folds, **Thunderline "Link Seals," O-Z Electrical "Thruwall" and "Floor Seals," or equal.**

2.8 FLANGED COUPLING ADAPTORS

A. Flanged coupling adapters for pressure reducing stations shall be factory fusion bonded epoxy **Ford FFCA or FFCA-1, APAC 201 or 221, or equal**. Nuts and bolts shall be for ductile iron pipe.

PART 3 -- EXECUTION

3.1 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in conformance with the requirements of the applicable Sections of Divisions 2 and 15 and with the manufacturer's printed recommendations. All coatings shall be in conformance with Section 099000, "Protective Coatings."

B. Where the grade or alignment of the pipe is obstructed by existing utilities and structures such as conduits, ducts, pipes, maintenance holes, or other utility facilities, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in conformance with the requirements and approval of the owners of such utilities and structures.

C. All pipe shall be stockpiled and stored in conformance with the manufacturer's printed recommendations.

D. **Fill Material or Trench Support:** Overexcavation fill material, bedding, and trench subgrade shall be compacted as specified in Section 312300, "Utility Earthwork," and graded to provide a uniform and continuous support beneath the pipe at all points.

- END OF SECTION -

SECTION 331102 - PVC PRESSURE PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install 4 inch to 36 inch polyvinyl chloride (PVC) pressure pipe, and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 331300	Pressure Pipeline Testing and Disinfection.
C.	Section 330130	Sanitary Sewer and Storm Drain System.
D.	Section 055900	Ductile Iron Pipe.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
H.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

AASHTO	Standard for Highway Bridges.
ANSI/AWWA C104	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
ANSI/AWWA C110	Standard for Ductile-Iron and Gray-Iron Fittings, 3-In. through 48-In., for Water and Other Liquids.
ANSI/AWWA C111	Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
ANSI/AWWA C153	Standard for Ductile-Iron Compact Fittings, 3-In. through 6-In., for Water and other Liquids.
AWWA C600	Installation of Ductile-Iron Water Mains and their Appurtenances.
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4-In. through 12-In., for Water Distribution.
AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-In. through 36-In.

AWWA Manual M23 PVC Pipe - Design and Installation.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section, as specified in the referenced standards, and the following supplemental requirements:

1. Hydrostatic proof test reports.
2. Sustained pressure test reports.
3. Burst strength test reports.

B. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

1.5 QUALITY ASSURANCE

A. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section, and as specified in the referenced standards, as applicable.

B. The CONTRACTOR shall have said material tests performanced at no additional costs to the CITY. The ENGINEER shall have the right to witness all testing provided, that the CONTRACTOR'S schedule is not delayed for the convenience of the ENGINEER.

C. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the CITY. The additional samples shall be furnished at no additional cost to the CITY.

PART 2 -- PRODUCTS

2.1 GENERAL

A. PVC pressure pipe, 4 inch through 12 inch and 14 inch through 36 inch shall conform to the applicable requirements of AWWA C900 and AWWA C905, respectively, and shall be subject to additional requirements specified herein.

B. All pipe material used for reclaimed water shall be purple such as **PW Purple Plus pipe as manufactured by PW Pipe**, **Purple Save Pipe as manufactured by J-M Manufacturing Company, Inc., Purple Centurion Pipe as manufactured by IPEX , or equal.**

C. All PVC pipe shall be continuously marked in conformance with the appropriate ASTM. All purple PVC pipe shall be continuously marked in accordance with the requirements of Section 330526, "Piping Identification Systems."

2.2 PIPE DESIGN

A. **General:** PVC pressure pipe shall be designed in accordance with the requirements of AWWA C900, or AWWA C905, as applicable, except that safety factors and surge pressure requirements of C900 shall be applied to all pipe, 4 inch through 36 inch. Pressure class shall be as shown on the Drawings, but in no case shall the dimension ratio be greater than 18 for C900 or 26 for C905 pipe. The pressure class for reclaimed water pressure pipe shall have a dimension ratio of 14 for C900 pipe or a dimension ratio of 18 for C905 pipe.

2.3 PIPE

A. The pipe shall be of the diameter and pressure class as specified or shown, furnished complete with rubber gaskets, and all specials and fittings shall be provided as required. The dimensions and pressure classes for Dimension Ratios for PVC pressure pipe with Cast-Iron Pipe Equivalent O.D.'s shall conform to the requirements of AWWA C 900, or AWWA C 905, as applicable.

B. **Joints:** All joints for the buried PVC pipe shall be an integral bell manufactured on the pipe employing a rubber ring joint. The bell shall be the same or greater thickness as of the pipe barrel.

C. **Joint Deflection:** Deflection at the joint shall not exceed 1.0 degrees for AWWA C905 or 1.5 degrees for C900 or the maximum deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints which are over-belled or not belled to the stop mark.

D. Bending of pipe shall not exceed recommendations of AWWA or manufacturers printed recommendations.

2.4 FITTINGS

A. Fittings shall be ductile iron and shall conform to the requirements of AWWA C 110 or AWWA C153 minimum Class 250. Fittings shall be mechanical joint.

B. Restrained joints shall be as approved in writing by the ENGINEER.

C. All fittings shall be lined and coated in accordance with the requirements of Section 05060 "Ductile Iron Pipe."

D. Each fitting shall be clearly labeled to identify its size and pressure class.

E. **Service Saddles and Tapping Sleeves:** All service saddles, and tapping sleeves shall be in accordance with the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

PART 3 -- EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective materials from the site of the work.

B. Installation shall conform to the requirements of AWWA Manual M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 PIPE HANDLING

A. **Handling:** Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean and sanitary condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

3.3 STORAGE

A. Pipe shall be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution is to be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe shall be stored in such a way as to prevent sagging or bending and protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons. Pipe, fittings, or accessories improperly stored are subject to rejection by the ENGINEER.

3.4 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirements of Section 312300, "Utility Earthwork," and as specified herein.

3.5 INSTALLATION

A. Bell and spigot pipe shall be laid with the bell end pointing in the direction of laying. Pipe shall be set to grade in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable as determined by ENGINEER. At the end of each day's work, open ends of pipe shall be closed temporarily with water-tight, expandable type plugs.

B. Pressurized lines laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. Water lines shall be laid uphill on grades exceeding 10 percent.

C. Pipe shall be supported at its proper elevation and grade, care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells and joints. Anchors and supports shall be provided where necessary and where indicated on the Drawings for fastening work into place. Fittings shall be independently supported.

D. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's printed recommendations.

E. Pipe shall be cut by means of saws, power driven abrasive wheels or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disc.

F. All necessary precautions shall be taken to prevent uplift or floating of the pipe prior to the completion of the backfilling operation. The CONTRACTOR shall assume full responsibility for any damage due to this cause and shall, at its own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

G. Each pipe elastomeric gasket joint shall be installed in conformance with the manufacturer's printed recommendations.

3.6 COPPER WIRE AND WARNING TAPE

A. Installation of copper wire, warning tape, and pipe identification shall conform to Section 330526, "Piping Identification Systems."

3.7 SERVICE CONNECTIONS

A. **Service Connections:** Service saddles or fittings for PVC pipe shall be used for all service connections on new pipeline installations. On existing PVC pipelines all service connections shall be tapping sleeves. Service saddles shall have a bearing area of sufficient width along the axis of the pipe, so that the pipe will not be distorted when the saddle is made tight. An internal shell cutter shall be used to drill through the corporation stop to minimize PVC shavings, retain the coupon, and reduce stress. **Single fluted shell cutters or twist drills will not be allowed.** Lubricate the cutting and tapping edges of the tool with cutting lubricant. Make the cuts slowly and use the follower very lightly. Do not force cutter through pipe wall. Shell cutter shall have sufficient throat depth to handle the heavy wall PVC pipe. Maximum outlet size permitted with service saddle is 2 inches.

B. Tapping sleeves and valves shall be used for all outlets greater than 2 inches in diameter. Tapping sleeves shall be assembled and installed in accordance with the manufacturer's printed recommendations and Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.8 TESTING AND DISINFECTION

A. Field testing and disinfection of all pressure pipe shall conform to the requirements of Section 331300, "Pressure Pipeline Testing and Disinfection."

- END OF SECTION -

SECTION 331200 - MISCELLANEOUS PIPING, VALVES, FITTINGS, AND APPURTENANCES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all exposed and buried piping, complete, including but not necessarily limited to small steel pipe, small valves, red brass pipe, copper tubing, solvent-welded PVC pipe, fittings, gaskets, bolts, insulating connections, and all such other specialties as required for a complete and operable piping system, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Division 2 and 5	Piping Sections.
B.	Section 331219	Fire Hydrants.
C.	Section 055000	Miscellaneous Metalwork.
D.	Section 099000	Protective Coating.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
ANSI/ASME B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300.
ANSI/ASME B16.15	Cast Bronze Threaded Fittings, Classes 125 and 250.
ANSI/ASME B31.1	Power Piping, DoD Adopted.
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A 106	Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
ASTM A 325	Specification for Structural Bolts, Steel, Heat-Treated, 120/105 ksi minimum tensile strength.
ASTM B 43	Specification for Seamless Red Brass Pipe, Standard Sizes.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.

ASTM B 88	Specification for Seamless Copper Water Tube.
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D 2239	Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR). Based on Controlled Inside Diameter.
ASTM D 2737	Specification for Polyethylene (PE) Plastic Tubing.
AWWA C207	Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 inch through 144 inch.
AWWA C507	Standard for Ball Valves 6 In. Through 48 In. (150mm through 1200mm).
AWWA C 800	Standard for Underground Service Line Valves and Fittings.
AWWA Manual M 11	Steel Pipe - A Guide for Design and Installation.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1. Manufacturers product specifications and performance details shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 SMALL STEEL PIPE

A. Galvanized steel pipe shall conform to the requirements of ASTM A 53, and shall be Schedule 40 or 80. NPT fittings for galvanized steel pipe shall be of galvanized malleable iron.

2.2 POLYETHYLENE PLASTIC PIPE AND TUBING (FOR WATER SERVICES)

A. Polyethylene plastic pipe, for 1 inch Residential Joint Domestic/Fire Services only, shall be PE 3408 with SIDR 7, iron pipe size conforming to the requirements of ASTM D 2239, and a rating of 200 psi. Polyethylene plastic tubing, for 1 inch, 1-1/2 inch, and 2 inch services, shall be PE 3408 with SIDR 9, copper tubing size conforming to the requirements of ASTM D 2239, and a rating of 160 psi.

B. All joints connecting Polyethylene Plastic Pipe or Tubing shall utilize "Pack Joint Type" compression fittings.

2.3 BRASS PIPE

A. Brass pipe shall conform to the requirements of ASTM B 43. Fittings shall be of bronze conforming to the requirements of ASTM B 62 with threaded ends, conforming to ANSI/ASME B16.15.

B. Two inch brass street elbows, for Dead End and In-Line Blowoffs shall be **Jones 2619, Ford F84.77-G, or equal.**

2.4 COPPER TUBING

A. Copper tubing shall conform to the requirements of ASTM B 88 and shall be Type K, soft temper, joint free, for buried tubing; and hard-drawn joint free, for above-ground applications. All fittings connecting copper tubing shall be compression fittings.

2.5 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, SOLVENT-WELDED

A. PVC pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be Schedule 40 or 80, as specified, conforming to ASTM D 1785. Joints and fittings shall be of the same material as the pipe and shall be solvent-welded construction.

2.6 CORPORATION STOP VALVES

A. **Tapered Plug Type**

1. Tapered plug style valves shall be brass conforming to AWWA C800.

2. The connection joint to the service saddle shall be in conformance with AWWA C800 iron pipe thread.

3. The connection joint to the service lateral shall be a "Pack Joint Type" compression joint.

4. Tapered plug style valves on steel or ductile iron pipe shall utilize a threaded insulating bushing between the tapping outlet or service saddle on the water main and the stop valve.

B. **Manufacturers, or Equal**

1. Iron Pipe Sizes, 1" Residential Joint Domestic/Fire Service only:

	Mueller	**Jones**	**Ford**
Size			
1"	**n/a**	J-3404	F-1101-4

2. Copper Tubing sizes, 1", 1-1/2", and 2" service:

	Mueller	**Jones**	**Ford**
Size			
1"	**n/a**	J-3403	F-1100-4
1-1/2"	**n/a**	**n/a**	**n/a**
2"	**n/a**	**n/a**	**n/a**

C. **Ball Valve Type**

1. Ball valve style valves shall be brass conforming to AWWA C800.

2. The connection joint to the service saddle shall be in conformance with AWWA C800 iron pipe thread.

3. The connection joint to the service lateral shall be a "Pack Joint Type" compression joint.

4. Ball valve style valves on steel or ductile iron pipe shall utilize a threaded insulating bushing between the tapping outlet or service saddle on the water main and the stop valve.

D. **Manufacturers, or equal.**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	E-25029	J-1936	FB-1101-4

2. Copper tubing sizes, 1", 1-1/2", 2" services:

Size	Mueller	Jones	Ford
1"	P25028	J-1935	FB-1100-4
1 ½"	P-25028	J-1935	FB-1100-6
2"	P-25028	J-1935	FB- 1100-7

2.7 ANGLE METER STOP VALVES

A. Angle meter stop valves shall be a brass ball valve or brass angle meter valve with a 90-degree lock wing. The connection joint to the water service line shall be a "Pack Joint Type" compression joint.

B. **Manufacturers, or Equal**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	**n/a**	J-1962W	BA63-444W

2. Copper tubing sizes, 1", 1-1/2", and 2" services:

Size	Mueller	Jones	Ford
1"	P-24258	J-1963W	BA43-444W
1-1/2"	P-24276	J-1975W	BA43-666W
2"	P-24276	J-1975W	FV43-777W

2.8 METER ADAPTERS

A. Slotted meter adapters shall be used for piston meter sizes 1" and smaller when service lateral size is 1-1/2" or 2".

B. Manufacturers shall be **Ford A47 slotted adapter, Jones or equal.**

2.9 LOCKABLE BALL VALVES

A. Lockable ball valves for commercial services shall be a brass ball valve with iron pipe threads on both ends with padlock wings.

B. **Manufacturers, or equal.**

1. Female iron pipe threads both ends for turbine meter installation:

Size	Mueller	Jones	Ford
1"	B-20200	J-1900W	B11-444
1-1/2"	B-20200	J-1900W	B11-666
2"	B-20200	J-1900W	B11-777

2. Female iron pipe threads by meter swivel for piston meter:

Size	Mueller	Jones	Ford
1"	B-24351	n/a	BF13-444W
1-1/2"	B-24337	J-1912W	BF13-666W
2"	B-24337	J-1912W	B13-777W

2.10 POLYETHYLENE PIPE TUBING LINERS

A. Stainless steel liners shall be used with all compression fittings on polyethylene pipe and tubing.

B. **Manufacturers, or equal.**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	505142	J-2806	72

2. Copper tubing sizes, 1", 1-1/2", 2" services:

Size	Mueller	Jones	Ford
1"	504385	J-2805	52
1-1/2"	506139	J-2105	54
2"	506141	J-2805	55

2.11 TAPPING SLEEVES

A. Tapping sleeves shall be cast iron, mechanical-joint sleeves with a rated working pressure of at least 150 psi, stainless steel with stainless steel nuts and bolts, or steel, mortar lined and coated, with stainless steel nuts and bolts. Bolts and nuts on epoxy lined sleeves shall be Type 304 or 316 stainless steel.

B. Manufacturers, or equal

Pipe Type	APAC	Clow	Ford	Mueller	Tyler
Plastic	512 (14-30")	F-5205 (4-16")	FTSC* (14-30")	H-615 (4-12")	5-149
	512 (6-12")*	F 5207** (4-12")	FTSC (4-12")*	H-304 (14-24")	
Ductile Iron	512 (4-30")	F-5205 (4-16')	FTSC (4-30")	H-615 (4-24")	5-149
				H-304 (4-24")	
Asbestos Cement	512 (6-30) *	F-5207 (4-12") **	FTSC (14-30")* FTSS (SS)(4-12")	H-619 (4-12") H-304 (14-16")	5-349
Steel	504 (4-36")	--	FWS (4-16")		

* allowed only if the pipe is out of round and it is approved by Water Resources.
** for Class 100 pipe, 10" and 12", use the F-5205.

2.12 TAPPING OUTLETS

A. Tapping outlets for steel mortar-lined and coated pipe shall be designed and fabricated to comply with design procedures in AWWA Manual M-11. The tapping outlets shall be designed for the pressure rating of the pipeline to which they are attached, with a minimum rated working pressure of 150 psi.

B. Tapping outlets for mortar-lined and coated steel pipe shall be factory fusion bonded epoxy lined and coated steel in conformance with Section 099000, "Protective Coatings," with stainless steel nuts and bolts.

C. **Manufacturers for steel pipe, or equal:**

APAC	**Ford**
534	FWS

2.13 SERVICE SADDLES

A. Service saddles shall be bronze or stainless steel for use on plastic; bronze for use on asbestos cement ; and steel or iron for use on ductile iron pipe.

B. Service saddles will not be allowed on mortar lined and coated steel pipe. Tapping outlets shall be used on mortar-lined and coated steel pipe.

C. Service saddles shall be double strap type except for service saddles on plastic pipe.

D. The service tap on the service saddle shall have an AWWA C800 iron pipe thread.

E. **Manufacturers, or equal**

Pipe Type	APAC	Mueller	Jones	Ford
Asbestos Cement	113	BR 2B 0684 IP to BR 2B 1732 IP	J-979	202 B
Ductile Iron	102 to 103	DR 2A 0659 IP to DR 2A 1740 IP	**n/a**	202
Plastic PVC C900	**n/a**	H-13491 to H-13494	J-996	S-91
Plastic PVC C905	**n/a**	**n/a**	**n/a**	202 BS

2.14 WELD-O-LETS

A. For 1", 1-1/2", and 2" service connections to steel mortar lined and coated pipe use 3000#, forged steel, **Bonney Forge Co., "Weldolet," Allied Piping Products Co., "Branchlet; or equal.**

2.15 SANITARY SEWER LATERAL CONNECTIONS TO EXISTING MAINS

A. Lateral connections to existing vitrified clay pipe, PVC, and ductile iron pipe sanitary sewer mains shall be made using the "Tap-Tite" Method or the Saddle-Type Method with a sewer pipe saddle manufactured by **Sealtite, Romac, or equal.**

B. Lateral connections to existing ABS and PVC composite pipe shall be made with solvent welded saddle fittings in accordance with the manufacturer's printed recommendations.

2.16 SANITARY SEWER LATERAL CLEAN OUTS

A. Two-way Sanitary Sewer Clean outs on 4 inch sanitary sewer laterals shall be cast iron **ANACO,Two-Way Combination Clean-out; American Brass and Iron, Two-Way Clean-out fitting (Kelly); or equal.** Sanitary sewer cleanouts on 6 inch and larger pipe shall be a combination Wye and 1/8th bend, **ANACO; American Brass and Iron; or equal.**

2.17 AIR RELEASE VALVES

A. Air release valves shall be **Crispin P-Series, APCO 200 Series, or equal.**

2.18 THREADED INSULATING BUSHING

A. Male threaded by compression or slip insulating bushings of PVC shall be provided at CITY water meters.

2.19 WATER SAMPLING STATION

A. Water Sampling Station housing, base flange, internal valve and support and bolts will be supplied and installed by the CITY and paid for by the developer. The CONTRACTOR shall furnish all other products and materials required to install Water Sampling Stations and as shown on the Drawings.

2.20 PIPE SUPPORTS

A. All piping systems and pipe connections to equipment shall be properly supported to prevent undue deflection, vibration and stresses on piping, equipment and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1, except as supplemented or modified by this Section.

2.21 STOCK PARTS

A. Where not specifically shown or detailed use stock or production parts wherever possible. Such parts shall be new, of best commercial quality, designed and rated for the intended purpose.

2.22 PIPE FLANGES

A. **Flanges:** Where the design pressure is up to a maximum of 275 psi, flanges shall conform to either AWWA C207 Class E or ANSI B16.5 for 150-pound flanges. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207. Flanges for miscellaneous pipes shall be in accordance with the appropriate Specification Sections for these pipes.

B. **Blind Flanges:** Blind flanges shall be in accordance with AWWA C207, or with the appropriate Specification Sections for the various pipe types.

C. **Flange Coating:** All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. **Flange Bolts:** All bolts and nuts shall conform to Section 055000, "Miscellaneous Metalwork." Studs and bolts shall extend through the nuts a minimum of 1/4 inch. All-thread studs shall be used on all valve flange connections where space restrictions preclude the use of regular bolts. Flange bolts for fire hydrant installations shall be in accordance with Section 331219, "Fire Hydrants."

E. **Insulating Flange Sets:** Insulating flange sets shall be provided where shown. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulated flanges shall have bolt hole diameter 1/4 inch greater than the bolt diameter. Insulating sleeves shall be 1/32 inch thick NEMA LI-1 (1989) Grade G-10 fiberglass epoxy. Washers shall be 5/32 inch thick NEMA LI-1 (1989) Grade G-10 fiberglass epoxy. Steel washers, bolts and nuts shall be in accordance with ASTM A 325. Insulating gaskets shall be 1/8 inch thick full-face Neoprene-faced phenolic.

F. **Insulating Flange Manufacturers, or Equal:**

1. **JM Red Devil, Type E**

2. **Maloney Pipeline Products Co.**

3. **PSI Products, Inc.**

G. **Flange Gaskets:** Gaskets for flanged joints shall be full-faced, 1/16 inch thick compressed sheets of aramid fiber base, with nitrile binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to 11, and pressures to 1000 psig. Blind flanges shall have drop-in gaskets. Drop-in gaskets shall be 1/4 inch smaller than the inside edge of the bolt holes. Ring gaskets will not be allowed.

2.23 SEWER LATERAL BACKFLOW PREVENTOR

A. Sanitary sewer lateral backflow preventors shall be as manufactured by National Diversified Sales, Lindsay, CA, Flow Control Inc., Burbank, CA, or equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **Small Steel Pipe:** Galvanized steel pipe shall be coated as specified in Section 099000, "Protective Coating."

B. **Plastic Pipe:** PVC pipe joints shall be solvent-welded in accordance with the manufacturer's printed instructions.

C. **Couplings:** Pipe couplings shall be installed in strict accordance with the manufacturer's printed recommendations, using the correct style coupling and gasket as appropriate.

D. **Gaskets for Flanged Joints:** Gaskets shall be in accordance with the requirements of Section 331100, "Piping, General."

E. **Insulating Connections:** All insulating connections shall be installed in accordance with manufacturer's printed instructions and Section 331100 "Piping, General." Care shall be exercised to prevent damage to insulating fittings while making up the joints.

F. Unless otherwise shown on the Drawings, service saddles, tapping sleeves, tapping outlets and Weld-O-Lets shall be field coated equal to the existing pipe coating.

G. Tapping of any existing main shall be coordinated with the ENGINEER. A minimum of 48 hours notice shall be given to the ENGINEER before installation. The ENGINEER will be present during the tapping process. After completion of the tap the Coupon ("Cookie") shall be given to the ENGINEER.

H. Plastic water service pipe or tubing shall be installed joint free between the corporation stop valve and angle meter stop valve.

I. Water Sampling Stations shall be installed at the locations shown and in conformance with the Drawings.

J. Installation of warning tape and copper wire shall be in conformance with Section 330526, "Piping Identification Systems."

- END OF SECTION -

SECTION 331213

BACKFLOW PREVENTION ASSEMBLIES AND PRESSURE REDUCING VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install Backflow Prevention Assemblies and small and large Pressure Reducing Valves, complete and operable including accessories and, where designated operators, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A.	Section 331100	Piping, General.
B.	Section 331200	Miscellaneous Piping, Valve Fittings, and Appurtenances.
C.	Section 331215	Valves, General.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A.	CITY OF LIVERMORE	Backflow Preventer Ordinance.
B.	**Commercial Standards:**	
	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings.
	ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
	AWWA C 510	Double Check Backflow-Prevention Assembly.
	AWWA C 511	Reduced-Pressure Principle Backflow-Prevention Assembly.
	USC	University of Southern California, Manual of Cross-Connection Control.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall contact the Water Resources Division for a list of the approved Backflow Prevention Assemblies, and testing services.

B. All exposed, manually operated butterfly valves shall have operators with position indicators.

2.2 BACKFLOW PREVENTION ASSEMBLIES

A. Backflow Prevention Assemblies shall be as follows:

1. For low hazard Industrial/Commercial Fire Services: Double-Check Detector-Check Backflow Prevention Assembly.

2. For high hazard Industrial/Commercial Fire Services: Reduced-Pressure Detector-Check Backflow Prevention Assembly.

3. For low hazard domestic or non-CITY owned irrigation: Double Check Backflow Prevention Assembly.

4. For high hazard domestic or non-CITY owned irrigation: Reduced-Pressure Backflow Prevention Assembly.

5. For CITY owned irrigation: Reduced-Pressure Backflow Prevention Assembly.

2.3 INSULATED ENCLOSURES

A. Insulated enclosures are required for Backflow Prevention Devices 2 inches and smaller. Insulated enclosures shall be an above ground fiberglass rock enclosure by **Hot Box- Hot Rok, , Dekorra Products LLC, or equal**, and as shown on the Drawings.

2.4 PRESSURE REDUCING VALVES

A. Small pressure reducing valves (2 inch and smaller)

1. **General:** Small Pressure Reducing Valves, 2 inches and smaller, shall be of the spring-loaded diaphragm type with a pressure rating not less than 250 psi, with bronze body, nickel alloy or stainless steel seat, and threaded ends. Each valve shall be furnished with built-in or separate strainer and union ends.

2. **Manufacturers, or Equal:**

a. **Mueller Company**

b. **Watts Regulator Company**

c. **Wilkins Regulator**

B. Large pressure reducing valves (4 inch and larger)

1. The CONTRACTOR shall purchase all large pressure reducing valves 4 inches and larger from the Water Resources Division. The CONTRACTOR shall provide all required connections and fittings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All Backflow Prevention Assemblies and Pressure Reducing Valves shall be installed in accordance with the manufacturer's printed recommendations, as required by the CITY'S Backflow Prevention Ordinance, and applicable codes and regulations.

B. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly.

C. Backflow Prevention Assemblies shall be installed in potable and recycled water lines where required by City of Livermore Backflow Prevention Ordinance, Title 17 California Code of Regulations, applicable codes or regulations, or wherever there is any danger of contamination, and where shown on the Drawings.

D. Backflow Prevention Assemblies shall be installed in the location shown on the Drawings and in conformance with the CITY'S Backflow Prevention Ordinance, Title 17 California Code of Regulations, and City Standard Detail.

E. Backflow Prevention Assemblies shall be tested by an approved testing service prior to putting the assemblies into service. The CONTRACTOR shall contact the City's Water Resource Division for a list of approved testing services. All costs of testing shall be at the CONTRACTOR'S expense.

F. Insulated enclosures for backflow prevention assemblies 2 inches and smaller shall be installed as required and in conformance with the manufacturer's printed recommendations and as shown on the Drawings.

G. The CONTRACTOR shall install all CITY supplied large Pressure Reducing Valves in accordance with manufacturer's printed recommendations.

- END OF SECTION -

SECTION 331215 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, install, and test all valves and all appurtenant work, complete and operable as shown on the Drawings and as specified herein. Where buried valves are shown, the CONTRACTOR shall furnish and install valve boxes to grade, with covers, sleeves, and valve extensions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets.
B.	Section 055000	Miscellaneous Metalwork.
C.	Section 099000	Protective Coating.
D.	Section 331100	Piping, General.
E.	Division 1	General Requirements.
F.	Divisions 2 and 15	As applicable.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested in conformance with the appropriate AWWA Standard for the specific type of valve being used.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62.

PART 2 -- PRODUCTS

2.1 VALVES

A. **General:** The CONTRACTOR shall furnish all valves, valve-operating units, stem extensions and other accessories as shown or specified. All valves shall be new and of current manufacture. Where buried, all valves shall be provided with valve boxes and covers and valve extensions as required.

B. **Valve Flanges:** The flanges of valves shall be in accordance with Section 331100, "Piping, General."

C. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

D. **Protective Coating:** Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves, as well as the exterior surfaces of all valves, shall be coated as specified in Section 099000, "Protective Coating."

E. All unburied manual operators shall have handwheels.

F. All buried valves shall have operating nuts, valve boxes and other features as shown on the Drawings. Stem extensions shall be provided when valve is more than 8 feet deep.

G. **Bolts and Nuts:** All nuts and bolts on valve flanges and supports shall be in accordance with Section 055000, "Miscellaneous Metalwork."

H. **Valve Traffic Boxes and Covers:** Traffic boxes and covers shall be as specified in Section 034800, "Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets."

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General:** All valves, operating units, stem extensions, valve boxes and accessories shall be installed in accordance with the manufacturer's printed instructions and as shown and specified. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access:** All exposed valves shall be installed to provide easy access for operation, removal and maintenance and to avoid conflicts between valve operators, structural members, or piping.

C. All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. All valves shall be installed so that the valve stem is plumb and valve is in the location shown on the Drawings.

D. Prior to installation of any valve the CONTRACTOR shall operate each valve and, as necessary, adjust stem packing to ensure proper operation.

- END OF SECTION -

SECTION 331216 - GATE VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install gate valves, 4 inch to 12 inch, complete and operable, including but not necessarily limited to operators, epoxy lining and coating, and appurtenant work, as shown on the Drawings and as specified herein. Unless otherwise shown or specified, all shut-off valves 12 inches and smaller shall be Gate Valves.

B. All manual shutoff valves over 12 inches shall be Butterfly Valves in accordance with Section 331217, "Butterfly Valves."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Section 331217	Butterfly Valves.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA C509	Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems.
AWWA C550	Standard for Protective Epoxy Interior Coating for Valves and Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 GATE VALVES

A. **General:** All gate valves shall be resilient-seated, of the inside screw type. Valves shall be capable of being repacked under line pressure. All ferrous surfaces of the valves shall be factory fusion bonded epoxy lined and coated, as specified, in conformance with AWWA C550 and Section 099000, "Protective Coating" for exterior coating.

B. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

C. Resilient-seated gate valves conforming to AWWA C509 shall be provided. Resilient-seated gate valves shall have cast iron bodies with flanged or mechanical joint ends, elastomer-coated cast iron

wedge/disc, flanged bonnet, bronze stem, O-ring seals, and operators with handwheel or square nut, unless otherwise shown.

D. **Manufacturers, or Equal:**

1. **American Flow**

2. **M and H No. 4067, Kennedy 1500, Clow**

3. **Mueller A-2370**

PART 3 -- EXECUTION

2.3 INSTALLATION

A. All gate valves shall be installed in accordance with AWWA Standards and the manufacturer's printed recommendations, and in accordance with the applicable provisions of Section 331215, "Valves, General."

- END OF SECTION -

SECTION 331217 - BUTTERFLY VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install manually-operated full body butterfly valves, complete and operable, including epoxy lining and coating, appurtenances, operators, and accessories as shown on the Drawings and as specified herein. Unless otherwise shown or specified, all shutoff valves 14 inches and larger shall be Butterfly Valves. Wafer style Butterfly Valves will not be allowed.

B. All manual shut-off valves 12 inches and smaller shall be Gate Valves in conformance with Section 331216, "Gate Valves."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Section 331216	Gate Valves.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/AWWA C504	Standard for Rubber-Seated Butterfly Valves.
AWWA C550	Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificate of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 BUTTERFLY VALVES

A. **General:** Butterfly valves shall conform to ANSI/AWWA C504 subject to the following requirements. Valves shall be of the size shown. Flanged valves shall be a 150-pound class B type valve drilled with a 125-pound bolt pattern and unless otherwise shown, may be either short-bodied or long-bodied. When flanged valves are installed on the Recycled Water System or on the Potable Water System where the working pressure exceeds 150 psi, the valves shall be a 250-pound class type valve drilled with a 125-pound bolt pattern and unless otherwise shown , may be either short-bodied or long-bodied. Mechanical Joint Ends are allowed except when using PVC C900 DR14 and C905 DR18 pipe. Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal. The interior passage of butterfly valves shall not have any obstructions or stops. The rubber seat shall be positively clamped or bonded into the disc or body of the valve. Cartridge-type seats will not be allowed. All interior ferrous surfaces of valves shall be factory applied epoxy lined in conformance with AWWA C550. Exterior ferrous surfaces of valves exclusive of the

flange faces, shall be factory applied epoxy in conformance with Section 099000, "Protective Coating" for exterior coating.

B. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

C. **Manual Operators:** Operators shall conform to ANSI/AWWA C504, subject to the following requirements. Unless otherwise shown, all unburied manually-operated butterfly valves shall be equipped with a handwheel and position indicator. Buried valves shall be equipped with a 2 inch square operating nut. All operators shall be side mounted.

D. **Manufacturers, or Equal:**

1. **Kennedy Valve/M&H/Clow**

2. **Mueller/Pratt**

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The installation of all butterfly valves shall be in accordance with Section 331215 "Valves, General."

B. All buried butterfly valves shall be oriented so that the operating nuts are on the side of the water main closest to the curb.

C. Where butterfly valves are connected to a "Tee" or "Cross" fitting, a 12-inch spool shall be installed between the fitting and the valve. An adaptor (FLGxMJ) is required between the valve and the pipe when PVC C-900 DR14 and PVC C905 DR18 pipe are used.

D. Where butterfly valves are installed with PVC C-900 DR14 and PVC C905 DR18 pipe, an adaptor (FLGxMJ) is required on both sides of the valve.

E. All exposed butterfly valves shall be installed with a coupling that can be used in removing the complete valve assembly without dismantling the valve or operator.

- END OF SECTION -

SECTION 331218 - CHECK VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and install all check valves in the types and sizes shown and specified, complete and operable, including epoxy lining and coating as appropriate, appurtenances and accessories, as shown on the Drawings and as specified herein.

B. All valves on Fire Service Installations shall be Factory Mutual approved or Underwriters Laboratories listed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/ASME B1.20.1	Standard for Pipe Threads, General Purpose.
ANSI B16.1	Standard for Cast Iron Pipe Flanges and Flanged Fittings
ASTM A126	Specifications for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM B 61	Specifications for Stream or Valve Bronze Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 148	Specifications for Aluminum-Bronze Sand Castings.
AWWA C508	Standard for Swing-Check Valves for Waterworks Service, 2-In Through 24-In, NPS.
AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants.
FM	Factory Mutual Engineering of Research Corp.
UL	Underwriters Laboratories Inc. Standards.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 SWING CHECK VALVES (3 INCH AND LARGER)

A. **General:** Swing check valves 3 inch or larger for general service shall be of the outside lever and spring or weight type, in accordance with AWWA C508, unless otherwise specified below, full-opening; designed for a water-working pressure of 250 psi unless otherwise shown, and shall have a flanged cover piece to provide access to the disc. All ferrous surfaces of valves shall be factory fusion bonded epoxy lined and coated in conformance with AWWA C550 and Section 099000, "Protective Coating."

B. **Body:** The valve body and cover shall be of cast iron conforming to ASTM A 126, with flanged ends conforming to ANSI B 16.1, or mechanical joint ends, as shown.

C. **Disc:** The valve disc shall be of cast iron, ductile iron, or bronze conforming to ASTM B 62.

D. **Seat and Rings:** The valve seat and rings shall be of bronze to conforming ASTM B 62 or B 148, or Buna-N.

E. **Hinge Pin:** The hinge pin shall be of bronze or stainless steel.

F. **Manufacturers, or Equal:**

1. **Mueller Company**

2. **Kennedy Valve**

3. **Hersey**

2.2 SWING CHECK VALVES (2-1/2 INCH AND SMALLER)

A. **General:** Swing check valves in sizes 2-1/2 inch and smaller shall be suitable for a water pressure of 300 psi. They shall have screwed ends, unless otherwise shown, and screwed caps.

B. **Body:** The valve body and cap shall be of bronze conforming to ASTM B 61 and with threaded ends conforming to ANSI/ASME B1.20.1.

C. **Disc:** Valves shall have bronze discs.

D. **Hinge Pin:** The hinge pins shall be of bronze or stainless steel.

E. **Manufacturers, or Equal:**

1. **Ford**

2. **Mueller**

3. **Stockham**

2.3 DOUBLE-LEAF CHECK VALVES

A. **General:** Double-leaf check valves shall be of the wafer-type designed to fit between ANSI B16.1 flanges for 125-pound rating. The check valve leaves shall be spring-loaded. Flow from one direction shall cause the valve to open, and upon valve shutoff, the spring shall shut the valve leaves before reverse flow starts and at a point of zero velocity, for non-slam closure. The spring-tension of each valve shall be designed for the individual operating condition.

B. **Body:** The valve body shall be of cast iron with integrally-cast seat, rated for minimum 150-psi working pressure. All ferrous surfaces of valves shall be factory fusion bonded epoxy lined and coated in conformance with AWWA C550 and Section 099000, "Protective Coating."

C. **Leaves:** The leaves shall be of bronze, aluminum bronze, or ductile iron, revolving on stainless steel or monel hinge pins with retainers.

D. **Seat:** The valves shall have resilient seats for bubble-tight shut-off. The seat rings shall be firmly attached to the body or disc by compression-molding or similar acceptable method.

E. **Springs:** The springs shall be of Type 316 stainless steel, or Inconel.

F. **Manufacturers, or Equal:**

1. **APCO 900 Series**

2. **TRW Mission**

3. **VAL-MATIC**

2.4 DETECTOR CHECK VALVES

A. Detector check valves shall conform to the requirements of PART 2 – "Products" of this Section herein, except that valves shall be provided with a full-faced rubber clapper seal and an elevated bypass meter. The elevated bypass shall be comprised of a shutoff valve, check valve, and either a magnetic turbine or positive displacement meter. The bypass pipe shall be either copper or brass pipe. When the pressure loss through the bypass exceeds a preset amount, the valve automatically opens, allowing unrestricted flow.

B. **Manufacturers, or Equal:**

1. **Mueller A-2132-6 (4"-10")**

2. **Hersey**

PART 3 -- EXECUTION

3.1 GENERAL

A. All valves shall be installed in accordance with provisions of Section 331215, "Valves, General."

- END OF SECTION -

SECTION 331219 - FIRE HYDRANTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install fire hydrants, complete and operable including all appurtenances and accessories, as shown on the Drawings and as specified herein.

B. All valves on fire hydrant Installations shall be in conformance with 331216, "Gate Valves."

C. All valves on Fire Service laterals shall be Gate Valves for laterals 8 inch and less and Butterfly Valves for laterals larger than 8 inches.

D. In the California Water Service Area the CONTRACTOR shall contact California Water Service Company for their requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 331300	Pressure Pipeline Testing and Disinfection.
B.	Section 099000	Protective Coating.
C.	Section 330526	Piping Identification System.
D.	Section 331215	Valves, General.
E.	Section 331216	Gate Valves.
F.	Section 331217	Butterfly Valves.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA C503	Standard for Wet-Barrel Fire Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 WET-BARREL FIRE HYDRANTS

A. **Construction:** Fire hydrants shall be of the wet-barrel type, in accordance with AWWA C 503. Fire hydrants shall have a factory supplied buried section of mortar lined ductile iron and a solid spool between 6 inches and 12 inches long connected to the hydrant head. When located in residential areas, the hydrant shall have one 4-1/2 inch steamer connection and one 2-1/2 inch hose connection. For commercial and industrial areas, hydrants shall have one 4-1/2 inch steamer connection and two 2-1/2 inch hose connections. The hydrant inlet shall be 6 inches in diameter. The hose and steamer

connections shall be provided with cast iron caps and metal chains. Hose connection threads shall be American National Fire Hose Threads. The hydrants shall be tested to 300 psig and they shall be suitable for a working pressure of 150 psig. All interior and exterior surfaces of fire hydrant, spool, and bury shall be coated in accordance with Section 099000, "Protective Coating."

B. Fire hydrants shall have a minimum weight of 190 pounds.

C. **Manufacturers:**

a. Hydrants for residential areas shall be:

1. **Clow Corporation East Bay Series, Model 5; or Ranger 900 Series, Model 950.**

2. **Long Beach Iron Works, Inc. East Bay Type, Model 611; or Anacapa 600 Series, Model 614.**

b. Hydrants for commercial/industrial areas shall be:

1. **Clow Corporation Ranger 900 Series, Model 960.**

2. **Long Beach Iron Works, Inc. Anacapa 600 Series, Model 615.**

2.2 BOLTS AND NUTS

A. See notes on City Standard Detail W-1C.

2.3 IDENTIFICATION

A. All valve lids on potable and reclaimed water systems shall be identified in conformance with Section 330526, "Piping Identification Systems." Valve lids in reclaimed water systems shall be factory purple.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All fire hydrants shall be installed in strict accordance with the manufacturer's printed recommendations, AWWA Standards, and all applicable codes, and the applicable provisions of Section 331215, "Valves, General." Any deviation from installation requirements or specified location is subject to prior approval of the Fire Department.

B. All fire hydrant lateral gate valves shall be flanged by mechanical joint valves. All fire hydrant buries shall be installed with a concrete thrust block. Fire hydrant flange bolts shall be installed with the bolt end facing up. Slotted on offset spools shall be used only when approved by the ENGINEER.

C. The 4-1/2 inch steamer connection shall be installed perpendicular to the street. The fire hydrant lateral must be installed perpendicular to the water main.

D. Hydrants, fire hydrant valve lids and guard posts shall be painted in accordance with Section 099000 "Protective Coatings."

3.2 TESTING

A. Testing for fire flows shall be in accordance with Section 331300, "Pressure Pipeline Testing and Disinfection."

- END OF SECTION -

SECTION 331233 - WATER METERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install water meters, radio read meter transceiver units and other appurtenances in the CITY'S water service area, complete and operable as shown on the Drawings and specified herein.

B. In the CITY'S Water Service Area the CONTRACTOR shall purchase all meters, radio read meter transceiver units and other appurtenances from the CITY. The CONTRACTOR shall provide all water meter parts and accessories not purchased with the CITY'S water meter packages.

C. All meters, radio read meter transceiver units and appurtenances purchased from the CITY shall be inventoried and controlled by the CONTRACTOR. Any meters found to be defective must be returned to the CITY for exchange. Damaged meters will not be eligible for exchange.

D. In the California Water Service Area the CONTRACTOR shall contact California Water Service Company for their requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets.
B.	Division 1	General Requirements.
C.	Divisions 2 and 15	As applicable.

1.3 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 WATER METER STRAINERS

A. Separate strainers shall be purchased from the CITY for all turbine meter installations 3 inches and larger.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's printed instructions, and as shown on the Drawings.

B. Care shall be taken to protect the meters from damage, dirt or foreign material.

C. For all turbine meters 3 inches and larger the CONTRACTOR shall install a separate strainer purchased from the CITY.

- END OF SECTION -

SECTION 331300 - PRESSURE PIPELINE TESTING AND DISINFECTION

PART 1 -- GENERAL

1.1 REQUIREMENT

A. The CONTRACTOR shall furnish all materials, equipment, and labor to perform and complete flushing and testing of all pipelines and appurtenant piping, and disinfection of all pipelines and appurtenant piping for potable and recycled water, complete, including conveyance of test water from CITY-designated source to point of use and all disposal thereof, and as specified herein.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA B300	Standard for Hypochlorites.
AWWA C651	Standard for Disinfecting Water Mains.

1.3 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided or all products and materials proposed to be used under this Section.

B. A testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection shall be submitted in writing to the ENGINEER for review a minimum of 72 hours before testing is to start.

1.4 TESTING AND DISINFECTION

A. The CONTRACTOR will test the pipe for pressure and disinfection. All testing will be conducted in the presence of the ENGINEER.

PART 2 -- PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. All test equipment, chemicals for chlorination, temporary valves or assemblies, bulkheads, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER'S review. No materials shall be used which would be injurious to the piping system or its proposed function.

B. Chlorine for disinfection shall be in the form of sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

C. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of AWWA B300.

PART 3 -- EXECUTION

3.1 GENERAL

A. The CITY will furnish the water for the first hydrostatic test, and for the first disinfection test up through the first flushing sequence. All water for any re-testing shall be paid for by the

CONTRACTOR. The CONTRACTOR shall make all necessary provisions for conveying the water from the CITY-designated source to the points of use.

B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the ENGINEER.

C. Bacteriological testing will be performed by the ENGINEER. Results of the bacteriological testing must meet the requirements of the State Department of Health Services.

3.2 HYDROSTATIC TESTING OF PIPELINES

A. Connections for testing of pipe shall be in conformance with the Drawings. Backflow assemblies used to comply with City Standard Detail W-7 shall be tested and approved by a certified backflow assembly tester. A passing test report on the backflow assembly shall be provided by the CONTRACTOR to the CITY before the assembly is used.

B. The CONTRACTOR shall test all pipelines as a single unit, or in sections if approved by the ENGINEER. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 72 hours. The test may be made by closing new valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. Unless approved by the ENGINEER testing shall not be performed against existing system closed valves. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The CONTRACTOR shall provide sufficient temporary air release assemblies to allow for evacuation of all entrapped air in each pipe unit or section to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air release assemblies are open during filling.

C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air release assemblies at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline unit or section thereof has been filled, it shall be allowed to stand under pressure for at least 24 hours to allow the pipe concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.

D. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for pipelines shall be 100 percent of the pipe pressure class. The test pressure for piping shall be as shown or specified, measured at the lowest point of the pipeline unit or section being tested. All visible leaks shall be repaired in a manner acceptable to the ENGINEER.

E. **Maximum Leakage**

1. The maximum allowable leakage for pressure pipelines shall be in accordance with the following formula:

   Design Basis

$$L = \frac{ND\sqrt{P}}{7400}$$

   Where: L = allowable leakage (gal/hr)
   N = number of joints in the tested line
   D = nominal diameter of pipe (in.)
   P = average test pressure (psi)

   Pipe with welded joints, flanged joints, and service lateral pipe shall have no leakage.

2. In the case pipelines fail to pass the prescribed leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

3.3 DISINFECTING PIPELINES

A. **General:** All potable and recycled water pipelines shall be disinfected. Pipeline disinfection operations shall be performed at the Primary Jumper location in conformance with the Drawings.

B. **Chlorination:** Hypochlorite shall be used to chlorinate the piping system in accordance with the requirements of AWWA C651 and as modified by this Section. Care shall be taken to prevent chlorine solution in the pipeline being disinfected from flowing back into the pipeline supplying the water. Any one of the following 2 methods as listed in the AWWA standard (brief summary of two methods as modified below) can be used for the initial disinfection; however, if the pipeline fails a bacteriological test, it must be disinfected again by the slug method:

   1. The continuous feed method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. The potable water shall be chlorinated so that after a minimum 24 hour holding period in the main there will be a free chlorine residual of not less than 25 mg/l.

   2. The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l.

C. **Retention Period:** Chlorinated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours but disinfecting solution higher than 50 mg/l shall not remain in the pipeline for more than 96 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/l.

D. **Valve Disinfection:** During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.

E. **Final Flushing:** After the retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the existing system. The CONTRACTOR shall apply a reducing agent to the water to thoroughly neutralize the chlorine residual remaining in the water prior to disposal of the water. The CONTRACTOR will be solely responsible for the proper disposal of all water used for the disinfection process in accordance with regulatory agency requirements. With prior approval by the ENGINEER, the CONTRACTOR may discharge the heavily chlorinated water into the sanitary sewer system in lieu of the above neutralization requirements.

F. **Bacteriological Testing:** Pipe shall be left for a period of 24 hours after final flushing before any sample is collected. A sample, or samples will be collected by the ENGINEER and will be tested for bacteriological quality in accordance with the requirements of the State Department of Health Services. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated until acceptable results are obtained. All lab costs for subsequent bacteriological testing after the initial test shall be borne by the CONTRACTOR. All lab costs for initial bacteriological testing will be paid by the CITY. All costs for water used for flushing, and re-filling of the pipeline after failure of a bacteriological test shall be borne by the CONTRACTOR.

3.4 CONNECTIONS TO EXISTING SYSTEM

A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a sodium hypochlorite solution in conformance with the requirement of AWWA C651, except that the solution shall be 5 percent, before they are installed.

3.5 TESTING

A. Fire flow testing of fire service lines and fire hydrant laterals will be tested by the CITY and approved by the ENGINEER prior to acceptance of the pressure pipeline installation.

- END OF SECTION -

SECTION 333102 - ABS AND PVC COMPOSITE PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite pipe gravity sanitary sewers, and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

B. The pipe shall consist of two concentric extruded thermoplastic tubes integrally braced across the annulus. The resultant annular space shall be filled with inert material such as light-weight portland cement concrete to provide continuous support between the inner and outer tubes.

C. All sanitary sewer lines in industrial areas shall be vitrified clay pipe in conformance with Section 333106 "Vitrified Clay Pipe."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333104	Small ABS and PVC Nonpressure Pipe.
D.	Section 333106	Vitrified Clay Pipe.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
H.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM D 2564	Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
ASTM D 2680	Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Composite Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, ASTM Specification Number, type of plastic, and extrusion code, including date and location of manufacture.

2.2 PIPE DESIGN

A. Composite Pipe shall be manufactured and provided to meet the pipe strength classifications as shown on the Drawings and in accordance with ASTM D 2680, but in no case shall have a pipe stiffness less than 200 lb/in/in.

2.3 PIPE AND FITTINGS

A. Composite Pipe and fittings shall conform to the requirements of ASTM Designation D 2680, and shall have either solvent cement joints or elastomeric gasket joints.

B. "WYE" fittings are required on all new mains. Connections to existing mains shall be made by Tap-tite method or solvent welded, banded, saddle "wye" fittings.

C. Sanitary sewer clean outs shall be in conformance with in Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

D. Sewer lateral connections shall accommodate solid wall pipe, PVC or ABS as specified in Section 333104, "Small ABS and PVC Nonpressure Pipe."

2.4 SOLVENT CEMENT JOINTS

A. Cement for ABS joints shall be MEK containing a minimum of 20 percent by weight of dissolved ABS and shall comply with ASTM D 2564.

B. Cement for PVC joints shall comply with ASTM D 2564 except that the minimum resin content shall be 16 percent and minimum viscosity shall be 3500 cP.

2.5 ELASTOMERIC GASKET JOINTS

A. Composite Pipe with gasketed joints shall comply with ASTM D 2680 and shall be manufactured with a socket configuration which will prevent improper installation of the gasket and will ensure that the gasket remains in place during the joining operation. The gasket shall be manufactured from a synthetic elastomer containing not less than 50 percent by volume of first-grade synthetic rubber.

PART 3 -- EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective material from the site.

3.2 BEDDING

A. Pipe bedding shall conform to the requirements of Section 312300, "Utility Earthwork."

3.3 PIPE LAYING

A. Composite Pipe shall be installed in conformance with the requirements of the pipe manufacturer's recommendations and the provisions of this Section.

B. Bell and spigot pipe shall be laid with the bell end at the lowest point with the spigot end pointing in the direction of the flow.

C. Handling of the pipe shall be done with care to insure that the pipe is not damaged in any manner during storage, loading, transit, unloading, and installation.

D. The pipe shall be laid to the lines and grades shown on the Drawings and the sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for jointing, the bedding for the pipe shall be checked for firmness and uniformity of surface.

E. Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the CONTRACTOR for safe and efficient installation. All pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

F. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or will produce ragged, uneven edges.

G. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar plugs will not be permitted.

H. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered shall be furnished by the CONTRACTOR at its own expense.

I. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.4 FIELD JOINTING

A. **General:** The pipe shall not be deflected either vertically or horizontally in excess of the manufacturer printed recommendations.

B. When pipe laying is not in progress, the open ends of the pipe shall be closed by approved means to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of the ENGINEER, the trench conditions or weather are unsuitable for such work.

C. **Solvent-Weld Joints:** Each solvent-weld pipe joint shall be sealed with solvent cement in conformance with the requirements of ASTM D 2680 and the manufacturer's printed recommendations. The spigot and socket shall be wiped clean before the solvent cement is applied. After insertion of the spigot end into the solvent weld bell end the inside surfaces shall be wiped clean of excess cement.

D. **Gasketed Joints:** Each gasketed pipe joint shall be joined with a lock-in elastomeric gasket. The gasket and the gasket seal inside the bell shall be wiped clean before the gasket is inserted. At this time a liberal amount of lubricant shall be applied to the gasket and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall

then be forced into the bell to complete the joint. On field cut spigot ends, the outer pipe wall shall be chamfered with a file to remove all burrs and rough spots.

E. All Composite Pipe ends which are not factory sealed shall be sealed with an approved epoxy sealing material prior to installation.

3.5 SANITARY SEWER CLEAN OUTS

A. Sanitary Sewer cleanouts shall be installed in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.6 TESTING

A. Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333104 - SMALL ABS AND PVC NONPRESSURE PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all 4 inch to 15 inch polyvinyl chloride (PVC) solid wall nonpressure pipe; 4 inch and 6 inch acrylonitrile-butadiene-styrene (ABS) solid wall nonpressure pipe; and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein. All 4 inch and 6 inch ABS nonpressure pipe will only be allowed for sanitary sewer laterals.

B. All sanitary sewer lines in industrial areas shall be vitrified clay pipe in conformance with Section 333106, "Vitrified Clay Pipe."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333102	ABS and PVC Composite Pipe.
D.	Section 333106	Vitrified Clay Pipe.
E.	Section 033050	Utility Cast-in-Place Concrete.
F.	Section 331100	Piping, General.
G.	Section 330526	Piping Identification Systems.
H.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
I.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM C 425	Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
ASTM D 1784	Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
ASTM D 1869	Specification for Rubber Rings for Asbestos-Cement Pipe.
ASTM D 2241	Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR-Series).
ASTM D 2321	Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
ASTM D 2751	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe.

ASTM D 3034	Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Tests:** All materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

B. All costs of such inspection and tests shall be borne by the CONTRACTOR.

C. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All solid wall pipe shall be continuously and permanently marked in conformance with the appropriate ASTM.

B. The CONTRACTOR shall also require the manufacturer to mark the date of extrusion on the pipe.

C. Pipe shall be of the pipe pressure class as shown on the Drawings.

2.2 PIPE

A. All PVC pipe shall be joined by compression joints unless otherwise specified or as shown on the Drawings, and shall conform to the following requirements:

1. Polyvinyl chloride pipe (PVC) shall conform to the requirements of ASTM D 3034, and shall have a maximum SDR of 35 and a minimum pipe stiffness of 46 psi. Material for PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein.

2. Flexible rubber rings for elastomeric gasket joints for PVC pipe and fittings shall conform to the requirements of ASTM D 1869.

B. ABS solid wall pipe shall conform to the requirements of ASTM D 2751, and shall have a maximum SDR of 35, or a minimum SDR of 23.5 with solvent welded joints.

2.3 FITTINGS

A. All fittings including wyes and sanitary sewer lateral cleanouts for PVC pipe shall conform to the requirements of ASTM D 2241. The ring groove and gasket ring shall be compatible with PVC pipe ends.

B. ABS solid wall fittings shall be of the same SDR rating as the pipe and provided with solvent welded joints.

C. The strength class of the fittings shall be not less than the strength class of any adjoining pipe.

2.4 BEDDING MATERIAL

A. Unless otherwise specified or shown, all material used for pipe bedding shall conform to the requirements for bedding in Section 312300, "Utility Earthwork."

2.5 FLEXIBLE COUPLINGS

A. Flexible couplings used for repairs shall be rubber, full-circle, clamp-on type conforming with ASTM C 425 and provided with 2 stainless steel band screw-clamps to secure the coupling tightly to entering and exiting pipes. All screw-clamp hardware shall be Type 304 or Type 316 stainless steel. Rubber material shall be suitable for use on sewage systems.

2.6 LATERAL CONNECTIONS TO SANITARY SEWER

A. Service lateral connections to new sewers shall be made with wye fittings, installed as the sewer pipe is laid.

B. Service lateral connections to existing sewers shall be made by "Tap-Tite" method, or with approved "Sealtite" type saddle fittings which utilize neoprene gasket seals and stainless steel bands.

C. Sanitary sewer cleanouts, shall be in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

PART 3 -- EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective materials from the site of the WORK.

B. Installation shall conform to the requirements of ASTM D 2321 and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the requirements of ASTM D 2321 are in conflict, the more stringent provision shall apply.

C. The CONTRACTOR shall perform the deflection 'mandrel' test as specified in Section 330130 "Sanitary Storm Drain Sewer System Leakage Testing." If the amount of allowable pipe deflection is exceeded, the CONTRACTOR shall uncover the pipe and shall improve the quality of the Pipe Zone backfill material and/or compaction to the extent that the allowable pipe deflection is not exceeded.

3.2 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirements of Section 312300, "Utility Earthwork," and as specified herein.

3.3 PIPE LAYING

A. The pipe shall be installed in conformance with the requirements of ASTM D 2321, as specified herein and as shown on the Drawings. The pipe sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for connecting joints, the bedding for the pipe shall be checked for firmness and uniformity of surface.

B. Proper implements, tools, and facilities as recommended by the pipe manufacturer's printed instructions shall be provided and used by the CONTRACTOR for safe and efficient execution of the work. All pipe, fittings, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

C. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or will produce ragged, uneven edges.

D. Installation of pipes in prepared trenches shall start at the lowest point, with the spigot ends pointing in the direction of flow.

E. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

F. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR at its own expense.

G. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.4 PIPE HANDLING

A. Handling of all pipe shall be done with care to insure that the pipe is not damaged in any manner during storage, transit, loading, unloading, and installation.

B. Pipe shall be inspected both prior to and after installation in the trench and all defective lengths shall be rejected and immediately removed from the working area.

3.5 PVC FIELD JOINTING

A. Each pipe elastomeric-gasket joint shall be installed in conformance with the manufacturer's printed recommendations.

B. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. At this time a thin film of lubricant shall be applied to the exposed surface of the ring and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the ring to complete the joint.

C. The pipe shall not be deflected either vertically or horizontally in excess of the printed recommendations of the manufacturer.

D. When pipe laying is not in progress, the open ends of the pipe shall be closed to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of the ENGINEER, the trench conditions or weather are unsuitable for such work.

3.6 ABS FIELD JOINTING

A. ABS pipe shall be solvent welded in strict accordance with the manufacturer's printed recommendations.

3.7 FITTINGS

A. All fittings shall be installed utilizing standard installation procedures. Fittings shall be lowered into trench by acceptable means without damage to the fittings. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to insure a sound and proper joint.

3.8 SANITARY SEWER CLEANOUTS

A. Sanitary sewer cleanouts shall be installed in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.9 TESTING

A. Field testing of pipe shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333106 - VITRIFIED CLAY PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all vitrified clay pipe and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 331100	Piping, General.
E.	Section 330526	Piping Identification Systems.
F.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

- -	National Clay Pipe Institute - "Clay Pipe Engineering Manual."
AASHTO	Standard Specifications for Highway Bridges.
ASTM C 12	Practice for Installing Vitrified Clay Pipe Lines.
ASTM C 301	Test Methods for Vitrified Clay Pipe.
ASTM C 425	Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
ASTM C 700	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
ASTM C 828	Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Testing at Manufacturer's Plant:** All pipe shall be subject to a hydrostatic pressure test and a 3-edge bearing test at the manufacturer's plant. The ENGINEER may select at random and test as specified one length of pipe for each 1000 feet or fraction thereof to be installed for the test as specified in ASTM C 301. The cost of pipe and the test shall be borne by the CONTRACTOR. Pipe

will be acceptable under the test requirements specified herein when all test specimens conform to the test requirements. Should any of the test specimens fail to meet the test requirements, the manufacturer will be allowed to retest 2 additional specimens for each specimen that failed, and the pipe shall be acceptable only when all the retest specimens meet the strength requirements.

B. **Inspection of Materials:** All pipe and fittings shall be true, circular, and concentric with the barrel of the pipe, cut off on a plane at right angles to the longitudinal axis of the pipe. At no point shall the thickness of the shell of the extreme outer end of the spigot be less in thickness than the shell of the main body of the pipe. Socket ends shall be square with the longitudinal axis and shall be true, circular, and concentric with the barrel of the pipe. All pipe shall be subject to inspection at the place of manufacture. The CONTRACTOR shall notify the ENGINEER, in writing, of the manufacturing starting date not less than 14 days prior to the start of any phase of the pipe manufacture.

C. All pipe and fittings shall have smooth interiors and shall be free from injurious cracks, checks, blisters, broken extremities, or other imperfections.

D. The following imperfections in the barrel or socket of a pipe or fitting will be considered injurious and cause for rejection:

1. A single crack in the barrel of the pipe or fitting extending through the entire thickness, regardless of the length of such crack; a single crack which extends through 1/5 of the barrel thickness and is over 3 inches long; any surface fire crack which is more than 1/32-inch wide at its widest point.

2. Lumps, blisters, pits, or flakes on the interior surface of a pipe or fitting.

3. When spigot or bell of the pipe varies from a true circle more than 3 percent of its nominal diameter.

4. Any piece broken from the spigot end which extends through the barrel.

5. Tramp clays, grog, or other foreign matter which is fused permanently to the exterior or interior surface of the pipe or fittings.

PART 2 -- PRODUCTS

2.1 PIPE AND FITTINGS

A. All pipe and fittings shall conform to the following requirements:

Clay pipe and fittings shall be extra strength, unless otherwise shown and shall conform to the requirements of ASTM C 700.

B. Service Laterals:

1. Service laterals in new sewers shall be installed using wye-type fittings.

2. Service laterals into existing sewers shall be in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

C. Sanitary sewer cleanouts shall conform to the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

2.2 VITRIFIED CLAY PIPE

Vitrified clay pipe shall be extra strength pipe and shall be in accordance with ASTM C 12 and C 700.

2.3 JOINTS

Joints in vitrified clay pipe shall be made up using a factory-made bell and spigot compression joint for all pipe diameters. For connections to existing VCP up to 12 inches in diameter, a synthetic rubber collar with stainless steel shear ring and stainless steel take-up clamps, bolts and nuts, meeting the requirements of ASTM C 425, may be used.

PART 3 -- EXECUTION

3.1 GENERAL

A. The VCP pipe shall be constructed to the alignment and grade shown. The grade line shown on the profile is the invert of the pipe. The excavation shall be made a sufficient distance below the grade lline to allow for the placing of the sewer pipe and embedment. Should the trench be excavated to a depth greater than required, the CONTRACTOR shall refill such excess over-excavation according to the requirements of Section 312300, "Utility Earthwork."

B. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.2 INSTALLATION OF PIPE

A. Installation of pipe shall be in accordance with ASTM C 12. Pipe laying shall proceed upgrade starting at lowest point with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench and immediately before joining the pipe, the ends of the pipe to be joined shall be cleaned and the gasket lubricated, all in accordance with the pipe manufacturer's written instructions. Assembly of the pipe length shall be in accordance with the recommendations of the manufacturer of the type of joint used. All special tools and appliances required for joining the pipe shall be provided by the CONTRACTOR. When cutting or machining of the pipe is necessary, only tools and methods recommended in writing by the pipe manufacturer and reviewed by the ENGINEER shall be employed.

B. The CONTRACTOR shall take all necessary precautions to prevent excavated or other foreign material from getting into the pipe during the laying operations. At all times, when laying operations are not in progress and at the close of the day's work, the ends of the pipe in the trench shall be closed with appropriate bladders, to prevent entry to animals and foreign materials. Plywood will not be allowed.

C. All necessary precautions shall be taken to prevent uplift or floating of the pipe prior to the completion of the backfilling operation. The CONTRACTOR shall assume full responsibility for any damage due to this cause and shall, at its own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

3.3 TESTING

Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333900 - PRECAST CONCRETE MAINTENANCE HOLES

1.1 THE REQUIREMENT

The CONTRACTOR shall provide all materials, equipment, and labor to furnish and install all prefabricated maintenance holes complete with frame, cover, pipe connections, and cast-in-place or prefabricated base, and all other appurtenances complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 333100	Reinforced Concrete Pipe (PVC-Lined).
C.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 036000	Grout.
F.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Field Drop Water Inlets.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Commercial Standards:**

ASTM A 48	Specification for Gray Iron Castings.
ASTM C 150	Specification for Portland Cement.
ASTM C 478	Specification for Precast Reinforced Concrete Manhole Sections.

1.4 CONTRACTOR SUBMITTALS

Certificates of Compliance: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. **Maintenance Holes:** Maintenance holes shall be constructed of concentric precast reinforced concrete sections in accordance with ASTM C 478. Precast concrete sections shall be manufactured by a process that will produce a dense, homogeneous concrete section of first quality. Steps or rungs will not be allowed in maintenance holes. The sections shall have a minimum wall thickness of 4 inches for 48-inch diameter sections and a minimum wall thickness of 6 inches for 60 inch diameter sections. Cement used in manufacturing the sections for sanitary sewer maintenance holes shall be Type V portland cement as specified in ASTM C 150. Maintenance hole sections shall be sealed using preformed joint material as specified in Section 034800, "Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets" and grout as specified in Section 036000, "Grout." All maintenance holes shall have reinforced cast-in-place or reinforced precast concrete bases and formed channels

with inverts to match the adjoining pipes. Maintenance hole sections shall be designed for a minimum of HS-20 traffic loading plus earth loads. Calculate earthload with a unit weight of 130 pcf.

B. Maintenance holes in sewers constructed of PVC lined reinforced concrete pipe shall be provided with compatible PVC lining from the top of the base up to and including 1/2-inch minimum of the cast iron frame. PVC-lining shall conform to the requirements of Section 333100, "Reinforced Concrete Pipe (PVC-lined)."

C. **Castings:** Castings for maintenance holes frames and covers shall be non-rocking and shall conform to the requirements of ASTM A 48, Class 30B. Cast iron covers and frames shall be heavy duty traffic type, 24 inches in diameter, with a curved blind pickhole, and embossed lettering for "Storm Sewer" or "Sanitary Sewer," as applicable. Frame and cover shall be designed for HS-20 traffic loading. For installations in unimproved areas, cover and frames shall be bolted. All castings shall be thoroughly cleaned and subject to a hammer inspection after which they shall be twice dipped with an asphalt or coal tar coating applied at a temperature of not less than 290 degrees F. nor more than 310 degrees F.

D. **Castings Suppliers, or Equal:**

1. **Phoenix P-1002** for field installations.
   Phoenix P-1090 for street and paved installations.

2. **D & L Supply Company A-1024.**

E. **Water Stops:** Plastic pipe connections to precast concrete maintenance holes and cast-in-place bases shall also be sealed using a premolded elastomeric waterstop material.

F. All connections to precast concrete maintenance holes shall be made with non-shrink grout.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All precast concrete maintenance holes shall be installed in strict conformance with the manufacturer's printed instructions on a well compacted foundation as specified in Section 312300, "Utility Earthwork."

B. Maintenance hole frames and covers shall not be set to final grade until the pavement has been completed. Frame and cover shall be set and adjusted to grade after final paving. The street cut in asphalt concrete pavement shall be circular and paving around the maintenance hole shall be in accordance with the Drawings. Openings in maintenance holes shall be protected from construction loads, debris, and unauthorized entry.

C. Maintenance hole sections shall be set so as to be vertical with sections in true alignment. The joint of the previously set section shall be clean and covered with preformed joint sealant before the next section is placed. The joint material shall be installed in accordance with manufacturer's printed recommendations.

D. No pipe ends shall protrude into the maintenance hole. No bell section of the pipe shall be placed into the maintenance hole wall.

E. Structure backfill and compaction shall be as specified in Section 312300, "Utility Earthwork."

3.2 TESTING

A. Testing of precast concrete maintenance holes shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 334100 - CORRUGATED POLYETHYLENE NONPRESSURE PIPE (HDPE)

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install 12 inch to 36 inch corrugated polyethylene nonpressure pipe with all necessary fittings and coupling systems and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets.
F.	Section 331100	Piping, General.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

Section 61	Culvert and Drainage Pipe Joints.
Section 64	Plastic Pipe.

B. **Commercial Standards:**

AASHTO M 294	Specification for Corrugated Polyethylene Pipe, 36 in. Diameter.
ASTM D 2412	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel - Plate Loading.
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins (R 1985).
ASTM D 3350	Specification for Polyethylene Plastics Pipe and Fittings Materials.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Testing:** All materials testing shall be based upon applicable ASTM Test Methods referenced herein for the materials specified. All costs of such manufacturing inspections and tests shall be borne by the CONTRACTOR.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Corrugated polyethylene pipe shall be smooth interior wall Type S and shall be as specified in AASHTO M 294, except as otherwise specified herein. Corrugated polyethylene pipe shall be manufactured from high density polyethylene (HDPE) virgin compounds.

1. HDPE compounds used in the manufacture of corrugated polyethylene pipes shall conform to the following cell classifications as provided in ASTM D 3350:

Property	Cell Classification
Density	3
Melt index	2[(a)], 3 or 4
Flexural modulus	4, 5 or 6
Tensile strength	4, 5 or 6
Environmental stress crack resistance	1, 2, or 3
Hydrostatic design basis	0, 1, 2, 3, or 4
Ultraviolet stabilizer	C[(b)]

(a) The melt index for cell class factory 2 material used to manufacture pipe shall not be greater than 0.6. Rotationally-molded couplings and end fittings may be produced from material compounds having a melt index cell classification of one.

(b) HDPE resin shall contain not less than 2 +/- 1/2 percent carbon black ultraviolet stabilizer.

B. The residue from ignition of the HDPE compounds shall not exceed 30 percent as determined by ASTM D 2584, except that the muffle furnace temperature shall be 450 +/- 25 degrees C. (840 +/- 45 degrees F.)

2.2 PIPE THICKNESS, STIFFNESS AND UNIT WEIGHT

A. Wall thickness of Type S corrugated polyethylene pipe shall be the thickness of the inner liner measured between corrugation valleys.

B. The pipe stiffness shall be determined in accordance with ASTM D 2412. Pipe stiffness shall be determined for 3 test specimens for each manufactured run. Minimum pipe stiffnesses and wall thickness shall be as follows:

Pipe Diameter (in.)	Minimum Wall Thickness (in.)	Minimum Pipe Stiffness (psi)
12"	0.035	50
15"	0.035	42
18"	0.050	40
24"	0.050	34
30"	0.050	28
36"	0.050	22

The minimum pipe unit weight shall meet the requirements of Table 2 of Section 64-1.03 "Pipe Thickness, Stiffness and Unit Weight" of the Caltrans Standard Specifications.

C. The pipe unit weight shall be computed as the average weight per foot of length determined from 3 test specimens, taken from each manufactured run. Each test specimen for pipes 24 inches in diameter and less shall be a minimum length of 2 diameters. The length of each test specimen for pipes larger than 24 inches in diameter shall be one diameter or a maximum of 36 inches, whichever is less. The weight of pipe specimens shall be determined with any suitable weighing device accurate to 0.10 pound.

2.3 JOINTS

A. The joint shall be bell and spigot design and shall include a rubber gasket meeting the requirements of ASTM F-47.

Fittings used in the system shall not reduce or impair the overall integrity or function of the pipe line. Fittings may be either molded or fabricated Common Corrugated fittings including in-line joint such as tees, wyes, and end caps. Unless otherwise specified, fittings shall be installed using a joint configuration meeting the requirements of cell Class 335420C as defined and described in ASTM D3350. Only fittings supplied or recommended by the manufacturer shall be used.

B. Water tightness shall be attained by the use of approved durable, high quality, resilient joint materials designed to perform the intended function. These materials shall be neoprene expanded rubber or sheet rubber gaskets, "O" ring rubber gaskets, butyl rubber base joint sealant, or other approved resilient materials. Watertight joints shall be tested in accordance with Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

PART 3 -- EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage, shall be performed in the presence of the ENGINEER. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective material from the site of the WORK.

3.2 PIPE HANDLING

A. Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

3.3 INSTALLATION

A. Pipe shall be laid and jointed in accordance with the manufacturer's printed recommendations and the following provisions in order to be suitable for the purpose intended.

B. Necessary facilities shall be provided for lowering and properly placing the sections of pipe in the trench.

C. The pipe shall be laid to line and grade with the sections closely jointed.

D. Every precaution shall be taken to prevent flooding the pipe trench before backfilling operations.

E. New pipe shall be connected to existing or new drainage facilities as shown on the Drawings.

3.4 CONNECTIONS

A. Connections of HDPE to existing structures and pipes shall be as follows:

1. Connections to cast-in-place structures shall include a water-stop at mid-wall of the structure.

2. Connections to pre-cast structures shall include a water-stop at mid-wall of the structure, and opening shall be filled with cement grout in conformance with Section 036000 "Grout."

3. Connections to existing HDPE pipe shall be made with a premium split-coupling saddle tee.

4. Connections to existing PVC shall be made with a PVC saddle with a HDPE/SDR 35 PVC adaptor.

5. Connections to existing DIP shall be made with a DIP tap and heat shrink material around the joint. Heat shrink material shall be supplied by the HDPE pipe manufacturer.

6. Connections to existing RCP shall be as shown on the Drawings, except that the PCC concrete encasement around the RCP shall be extended to cover the HDPE a point 6 inches to 12 inches beyond the RCP sleeve.

3.5 TESTING

A. Testing of corrugated polyethylene non-pressure pipe shall conform to the requirements of Section 330130 "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 334102 - REINFORCED CONCRETE PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all reinforced concrete pipe and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets.
F.	Section 331100	Piping, General.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ASTM C 76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 150	Specification for Portland Cement.
ASTM C 443	Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.
ASTM C 596	Test Method for Drying Shrinkage of Mortar Containing Portland Cement.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used in this Section.

PART 2 -- PRODUCTS

2.1 PIPE MATERIALS

A. **Reinforced Concrete Pipe:** Reinforced concrete pipe shall conform to the requirements of ASTM Designation C 76. Cement shall conform to ASTM C150, Type II. Pipe shall be bell and spigot having O-ring rubber gaskets conforming to ASTM C 443 retained in a groove on the spigot end. All reinforcement shall be circular. **Elliptical reinforcing will not be allowed.**

B. **Cement Mortar:** Cement mortar for structures or pipe connections shall consist of a mixture of portland cement, sand, and water. Mortar shall be composed of one part of cement and 2 parts of clean, well-graded sand of such size that will pass a No. 8 sieve. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

C. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar will not be allowed.

D. Concrete material shall conform to the requirements of Section 033050, "Utility Cast-in-Place Concrete."

E. **Admixtures:** No admixture shall be used in mortar unless otherwise specified or accepted in writing by the ENGINEER.

2.2 PIPE DESIGN

A. Reinforced concrete pipe shall be manufactured and provided to meet the pipe strength classifications as shown on the Drawings and in accordance with ASTM C 76, but in no case shall be less than Class III for Wall "B" or Wall "C." Class I and II pipe will not be allowed.

B. Wall "A" pipe will not be allowed

PART 3 – EXECUTION

3.1 PIPE LAYING

A. Installation of pipes in prepared trenches shall start at the lowest point, with the spigot ends pointing in the direction of flow.

B. Pipe shall have a minimum laying length of approximately 8 feet, except for closure and other special pieces as approved by the Engineer. The length of the incoming and outgoing concrete pipe at each structure shall not exceed 4 feet.

C. Care shall be used to make sure that the bottom of the pipe is in contact with the bottom of the trench for the full length of each section.

D. **Excavation:** Bell holes shall be excavated at each joint to provide full length barrel support of the pipe and to prevent point loading at the bells.

E. **Pipe Laying:** Unless otherwise required, all pipe shall be laid straight between the changes in alignment and at uniform grade between changes in grade.

F. **Rubber Gasket Joints:** The rubber gasket joint shall be made by properly lubricating the rubber gasket with a suitable vegetable compound soap before it is placed in the groove at the spigot end. The gasket shall be stretched over the spigot end of the pipe and carefully seated in the groove, with care taken to equalize the stress in the gasket around the circumference of the joint. The gasket shall not be twisted, rolled, cut, crimped, or otherwise injured or forced out of position during the closure of the joint. A feeler gauge shall be used to check the position of the rubber gasket after the joint has been assembled. Where a joint placement is found to be improper, the tested pipe section shall be removed, the gasket checked for damage, a new gasket installed, if necessary, the pipe re-laid and the gasket placement rechecked.

G. Pointing and bonding mortar at pipe connections to structures shall be plastic and of such consistency that it will readily adhere to the pipe and structure.

3.2 TESTING

A. Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 344105 - SIGNAGE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all roadside signs, street name signs, and City/private property off-street signs, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 033050	Utility Cast-In-Place Concrete.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications and Standards:**

United States Department of Transportation, Manual of Uniform Traffic Control Devices

595-A Federal Standard

B. **City of Livermore:**

1. Sign Ordinance
2. Zoning Ordinance

C. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 56 Signs.

2. Standard Plans
3. Traffic Manual

D. **Commercial Standards:**

ASTM C 653	Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed,) by the Hot-Dip Process.
USA	Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 UTILITY LOCATIONS

A. The CONTRACTOR'S attention is called to the fact that utilities are present in the work areas. It is the CONTRACTOR'S responsibility to notify the utility companies having facilities in the project work areas at least 48 hours prior to beginning WORK to accurately locate said utilities before beginning of underground work. Utilities may be notified by contacting USA, Underground Service Alert, at (800) 642-2444.

B. For utilities not marked by USA, such as irrigation mains and laterals or on site services, the CONTRACTOR shall contact the property owner for assistance in locating said facilities.

C. The CONTRACTOR shall be responsible for repairing, at his own cost, any damage to utilities or irrigation facilities encountered during construction.

1.6 PRIVATE PROPERTY SIGNS

A. All private property signs are subject to approval by the City of Livermore Planning Division and shall be in conformance with the Zoning Ordinance, the Sign Ordinance, and all other City of Livermore regulations.

PART 2 -- PRODUCTS

2.1 SIGNS

A. **Roadside Signs:** Roadside signs shall be of the type as shown on the Drawings in accordance with the Caltrans Traffic Manual unless as otherwise noted on the drawings. Signs shall conform to Section 56, "Signs" of the Caltrans Standard Specifications and the Caltrans "Approved Sign Specification Sheets" as modified by this Section.

B. **Sign Plates:** Sign Plates shall be 0.080 gage aluminum alloy. Sign message shall be made using engineering grade sheeting **3M or equal**. Type N markers shall be made using high intensity reflective sheeting **3M or equal**.

C. **Street Name Signs:** Street names and size of signs shall be as shown on the Drawings. Sign background shall be reflective green with white lettering.

D. **City/Private Property Off-Street Signs:** City/private property off-street signs shall have message and size of sign as shown on the Drawings.

E. All signs in street right-of-way shall have "COL" and installation date etched or stamped on back of sign with 1/4" letters at lower right corner.

2.2 POSTS

A. **Roadside Signs, Street Name Signs, and City Off-Street Signs:**

1. All posts for signs installed on City property or within the public right of way shall be square formed steel tube, telescoping metal breakaway type, **Unistrut Telespar Sign Support System or equal**, of the size and dimensions as shown on the Drawings and as specified herein.

2. All posts shall be painted green and electrically powder coated except the sleeve and anchor which shall be galvanized. The color shall be green in conformance with Federal Standard 595-A, color number 14109 (Dark Limit V).

3. Tubing shall be 12 gage strip steel, structural quality, conforming to ASTM A-570 Grade 33.

4. Galvanized tubing shall be 12 gage strip steel, structural quality, conforming to ASTM A 446 Grade A; hot-dipped galvanized with a 1.25-ounce zinc coat, interior and exterior, conforming to ASTM C 653 coating designation G90; and the corner welds shall be zinc coated after scarifying operations.

2.3 HARDWARE

A. **Roadside, Street Name, and City Off-Street Signs:** Hardware for signs installed on City property or within the public right of way, shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal**. Drive rivets to be **Unistrut TL 3806 or equal**.

B. **Street Name Sign Installation on Street Lights:**

1. The cantilever bracket supports for street name signs installed on round street light standards shall conform to the requirements of **SIGNFIX Cantilever Sign System or equal**.

2. For sign blanks up to 20 inches in length with a maximum area of 2 square feet use **SIGNFIX Stainless Steel Mini Cantilever Brackets** with 5/8-inch 0.030 gauge stainless steel band and buckle **BAND-IT or equal**.

3. For sign blanks up to 42 inches in length with a maximum area of 6 square feet, use **SIGNFIX V-Back Aluminum Cantilever Brackets** with 3/4-inch 0.030 gauge stainless steel band and buckle **BAND-IT or equal**.

PART 3 -- EXECUTION

3.1 GENERAL

A. All sign locations on City property must be inspected and approved by the ENGINEER prior to installation. The CONTRACTOR shall notify the ENGINEER no later than 48 hours prior to the start of the scheduled sign installation.

B. The locations of all Off-Street signs must be approved by the Planning Division prior to start of installation of the signs.

C. All reference markings made by the CONTRACTOR shall be done with spray chalk and shall be removed by the CONTRACTOR after installation of the signs.

D. Roadside signs shall be installed 6" behind 5' monolithic sidewalk, and 18" behind face of curb where there is a separated sidewalk, 10' sidewalk or no sidewalk unless otherwise noted on plans.

E. All utilities damaged by the CONTRACTOR shall be repaired and replaced by the CONTRACTOR at its expense to the satisfaction of the ENGINEER and the owner of the utility.

3.2 INSTALLATION OF POST

A. **Roadside, Street Name, and City Off-Street Signs:** Installation of roadside, street name, and City off-street signs installed on City property shall be at the locations shown on the Drawings or as specified herein.

1. Installation shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal**.

2. The square end of the anchor shall not be modified or pointed, but shall be capable of being driven into the ground by the use of an approved driving cap. The driving cap shall be

reusable and shall allow the square anchors to be manually driven into the ground with the aid of a sledge hammer or a jack hammer without deforming the anchor or the driving cap.

3.3 INSTALLATION IN EXISTING SIDEWALK

A. For signs installed in existing sidewalks a 6-inch core shall be drilled, the anchor installed, the the core filled with Class B portland cement concrete in conforming to Section 033050, "Utility Cast-In-Place Concrete." Existing surfacing other than portland cement concrete shall be replaced in kind, with the replacement matching the existing product, depth, and pattern, to the satisfaction of the ENGINEER. The sleeve shall be protected such that concrete will not enter the inside of the square post.

3.4 INSTALLATION OF SIGN

A. **Roadside, Street Name, and City Off-Street Signs:** Mounting of the sign to the pole for roadside, street name, and City off-street signs on City property shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal**.

B. Mounting of Street Name Signs on street light standards using Cantilever support brackets shall be installed in accordance with the manufacturer's recommendations. Cantilever bracket system shall be installed on both the top and bottom of each sign.

C. An R26E, "Tow-Away Zone" shall be installed below each R26F sign in designated fire lanes.

- END OF SECTION -