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CONSTRUCTION SPECIFICATIONS

SECTION 1 - GENERAL

CS1-01. INSPECTION REQUIREMENTS: Any improvement constructed to the Standard Construction Specifications for which it is intended that the City will assume maintenance responsibility, shall be inspected during construction by the City Engineer or his designated representative. Each phase of construction shall be inspected and approved prior to proceeding to subsequent phases.

Any improvements constructed without inspection as provided above or constructed contrary to the order or instructions of the City Engineer will be deemed as not complying with Standard Construction Specifications and will not be accepted by the City of Dixon for maintenance purposes. It is the responsibility of the contractor to arrange the needed inspections, and to give 48 hours minimum notice for the inspections.

CS1-02. IMPROVEMENT ACCEPTANCE BY THE CITY: When all work called for on the improvement plans is complete, the Contractor may request a final inspection. If the City Engineer agrees that the project is substantially complete (95%), an inspection shall be performed and a punch list prepared. The punch list will identify the deficiencies in the work that must be corrected prior to acceptance. Every effort will be made to have the punch list address all deficiencies, however, if additional deficiencies are found after the punch list is made, the Contractor shall also correct these additional items. After all deficiencies have been corrected and the City Engineer approves the work, the Contractor, Design Engineer, and Developer will be notified by the City Engineer in writing within five (5) working days as to the date of the final approval and acceptance.

CS1-03. DUST CONTROL: Dust control shall conform to Sections 10, "Dust Control", 17, "Watering", and 18, "Dust Palliative", of the State Specifications. Additional dust control measures may be required, either by the Special Provisions, the plans, or by direction of the City Engineer. It is intended that the dust control measures specified in the State Specifications will be a minimum requirement for dust control in the City of Dixon. Additional dust control measures required shall not constitute an additional cost item.

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CONSTRUCTION SPECIFICATIONS

SECTION 2 - CLEARING AND GRUBBING

CS2-01. ITEM: This work shall consist of removing all natural and artificial objectionable material from the right-of-way, construction areas, road approaches and material sites within the work area. Clearing and grubbing shall be performed in advance of grading operations and in accordance with the requirements herein specified, subject to erosion control requirements. Demolition of buildings and structures, other than foundations or slabs, shall be as specified in the Special Provisions or on the plans.

CS2-02. CLEARING AND GRUBBING OPERATIONS: Unless otherwise specified, the entire area of the project to the widths specified below shall be cleared and grubbed.

The area above the natural ground surface shall be cleared of all vegetative growth, such as trees, logs, upturned stumps, roots of downed trees, brush, grass, weeds, and all other objectionable material, within the following limits:

A. For streets, road and highway construction areas, including structures, frontage roads, or streets, ramps, approaches, ditches and channels and all other accessory roads and connections to be constructed, such grubbing shall extend to a width of 5 feet outside structures, excavation and embankment slope lines, except that where slopes are to be rounded, the areas shall extend to the outside limits of slope rounding.

B. Within the limits of clearing, the areas below the natural ground surface, except in embankment areas where the grading plane is 2 feet or more above the natural ground, shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Such objectionable material shall not be left in or under embankments or dikes. All trees, existing stumps and roots within embankment areas where the grading plane is 2 feet or more above the natural ground shall be cut off not more than one foot above the natural ground at any point, or completely removed where other items of work are to be placed and the unsuitable material is to be removed.

   Trees and plants that are not to be removed shall be fully protected from injury by the contractor at his expense. Trees shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to be preserved.

   Destruction of abandoned wells shall be accomplished in conformance with "Bulletin 74 Water Well Standards: State of California".

CS2-03. REMOVAL AND DISPOSAL OF MATERIALS: All removed materials shall be disposed of by Contractor at Contractor’s expense. The roadway and adjacent areas shall

be left with a neat and finished appearance.
The Removal of existing improvements shall conform to the following requirements:

A. Bituminous Pavement--shall be removed to clean straight lines. Saw cutting shall be made to the depth required to prevent damage to existing pavement, but in no case shall be less than 1-1/2 inches deep. A neat line cut is acceptable if the existing pavement is being overlayed.

B. Concrete Pavement--shall be removed to neatly sawed edges. Saw cutting shall be made to the depth required to prevent damage to existing concrete, but in no case shall be less than 1-1/2 inches deep.

CS2-04. TRAFFIC SIGNS: The protection and maintenance of existing signs and the removal, protection, storage, and resetting of City traffic signs that are effected by the work shall be the responsibility of the Contractor, as directed by the City Engineer, or as specified in the Special Provisions. The Contractor shall inventory all existing City signs prior to the start of work and provide a copy of the inventory to the City Engineer. The City Engineer shall confirm the inventory in writing prior to the start of work. Traffic signs and traffic control facilities existing within the limits of the project shall not be moved except as necessary to prevent them from being damaged by construction operations. When a sign needs to be removed because it interferes with the Contractor's work, it shall be done in one of the following described manners:

A. Stop signs shall be maintained in their existing positions as noted in the inventory. Any stop sign which must be moved from its existing position and reinstalled in a new position, must be approved by the City Engineer before said stop sign is moved.

B. Traffic signs and traffic control facilities, other than stop signs, necessary for the control of traffic during the project shall be maintained in place in an upright position and located so as to properly control traffic. Whenever it is necessary to remove them from their permanent location due to construction work, they shall be reinstalled in their permanent location at the earliest possible time. Control of traffic during the time which the signs are temporarily removed shall be the contractor's responsibility.

C. Traffic signs and traffic control facilities not necessary for the control of traffic during the project shall be removed and salvaged by the Contractor. When signs are removed and salvaged as provided herein, they shall be stockpiled in an upright position and reinstalled by the Contractor at the conclusion of the project.

The project sign inventory shall indicate which of the above categories applies to each sign, subject to approval of the City Engineer.

CS2-05. MAILBOXES: Mailboxes and newspaper tubes, which are effected by the construction shall be removed and reset. All mailboxes shall be maintained in an upright position

adjacent to the construction area between the time the mailbox is removed and reset in its final location. Mailboxes shall be reset on 4" X 4" Douglas fir or redwood posts surfaced on four sides, unless otherwise noted on plans. They shall be set in a minimum of two feet of concrete. Mailboxes which can be salvaged intact, including ornamental or iron supports, shall be salvaged and reset. The bottom of mailboxes shall be set at a height of 3'6" above the back of curb or edge of shoulder. The face of the box shall be set one foot behind the back of sidewalk. Individual property owners and occupants will be notified of the action.

CS2-06. SURVEY MONUMENTS: The preservation of survey monuments and markers shown on the plans or encountered along the line of the work shall be the responsibility of the Contractor. The Contractor shall notify the City Engineer of monuments encountered, and shall not remove or damage said monument until the monument can be cross referenced and tied out by the survey party. When notified by the City Engineer that the ties have been completed, the monument or marker can then be removed. The Contractor is not responsible for the replacement of any monument or marker, the removal of which is necessitated by the work to be performed and which has been referenced and tied as set forth herein. If, through negligence or carelessness on the part of the Contractor, notification is not made as provided above or markers are removed which are not in direct conflict with the construction, the Contractor shall be responsible for the cost of referencing, resurvey, and replacement of the monument or marker. Such sums for the replacement shall be deducted from the final contract payment.

CS2-07. DRAINAGE FACILITIES: The Contractor shall be responsible for maintaining all existing drainage and irrigation facilities and to re-establish the drainage and irrigation ditches and facilities to their original location and condition as soon as possible after completion of the work in the area, to the complete satisfaction of the City Engineer, except when such realignment or modification of the existing facilities are set forth on the plans and in other items of work.

CS2-08. SPRINKLERS AND LIGHTS: Sprinkler system pipes, heads, hose bibs, and yard lighting systems which interfere with the clearing and grubbing or excavation for roadway or drainage projects within roadway rights-of-way or drainage easements for channels shall be cut and capped at the right-of-way line or easement line unless otherwise set forth on the plans and in the Special Provisions. These facilities shall be replaced and reconstructed to their original location and condition, unless otherwise set forth in the Special Provisions. Individual property owners and occupants will be notified of the action.

CS2-09. FENCING: The Contractor shall be responsible for the placing, maintenance, and removal of any temporary fencing that may be necessary along the line of work to confine or protect livestock that may be pastured in areas through which the work is to proceed. All existing fences that intersect a fenced channel easement line or a right-of-way line at an angle shall be cut and a new end post equal to or better than the existing shall be set at the right-of-way line and the existing fence attached thereto. Any fences removed for the Contractor's convenience during construction shall be replaced in accordance with the General Provisions or the Special Provisions.

CS2-10. SILT CONTROL: During Construction, provisions shall be made to prevent

siltation of the downstream drainage system, both from winter runoff or from any dry season flow passing through the construction site. Such provision may include silt basins, silt fences, or other physical means. If the Contractor's methods fail to prevent siltation, or fails to provide a protection against siltation, the Contractor shall clean the downstream drainage system to the satisfaction of the City Engineer, and he shall be responsible for any damage which might result.

CS2-11. DISPOSAL AND SALVAGE: All materials removed as provided herein shall become the property of the Contractor and shall be disposed of off the rights-of-way or easement unless otherwise set forth on the plans or in the Special Provisions. Existing public or private improvements which are designated on the plans or in the Special Provisions to be salvaged shall be carefully removed and stockpiled in the right-of-way or easement for later removal as specified in the Special Provisions.

CS2-12. RECLAMATION OF MATERIALS: The City of Dixon participates in various State reclamation and recycling programs which require minimum yearly quantities of recyclable materials be reused. Reclamation District 2068, (707) 678-5412 and B & J Landfill, (707) 451-3276 typically accept broken concrete, providing the materials are received without wire, bar or other embedded contaminates. As a part of this project, the Contractor will be required to recycle the maximum quantity of concrete material possible. Estimated quantities reclaimed shall be reported to the City in the form of certificates of acceptance or property owner permission slips, with original signatures.

CS2-13. PAYMENT: Under this item of the Proposal, the Contractor shall bid a lump sum price for clearing and grubbing. If no item for clearing and grubbing is included in the Proposal, it shall be understood that such work will be done as herein specified, and that the cost for such work will be included in the prices bid for other items of work, and that no additional compensation for clearing and grubbing shall be made.

Full payment for protecting existing facilities shall be considered as included in the lump sum price or the price paid for the various contract items of work and no additional compensation will be allowed therefore.

CONSTRUCTION SPECIFICATIONS

SECTION 3 - ROADWAY EXCAVATION

CS3-01. ITEM: The work for this section shall be as set forth in Section 19 of the State Specifications. This work shall consist of performing all operations necessary to excavate all materials, regardless of character and subsurface conditions, from the roadway prism or adjacent thereto; to excavate drainage ditches; to excavate selected material from the roadway and borrow material for use as specified; to construct embankments, including the placing of selected material in connection therewith as specified; to backfill trenches and depressions resulting from the removal of obstructions; to backfill holes, pits and other depressions within the roadway area; to apply water; to remove and replace unsuitable material; to excavate and grade road approaches, driveways, and connections; to construct protection dikes; to remove unstable material outside the roadway prism; to prepare basement material for the placing of other material thereon; all as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer; and furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work that may be required to construct and maintain the roadway facilities.

CS3-02. SUBGRADE PREPARATION: When the roadbed has been constructed to the required grade and cross section and is in a smooth and even condition, it will be ready for preparation of subgrade.

The roadbed shall then be scarified to a depth of at least 8 inches. The loosened material shall then be worked to a finely divided condition. The moisture content shall be brought to optimum as specified by the soils engineer. The material shall then be compacted by approved equipment to the specified relative compaction.

CS3-03. COMPACTION: Upon completion of the subgrade compaction tests shall be taken. The top 8 inches of subgrade material shall be compacted to a relative density of 95% as determined by Test Method California #216 or ASTM 1557-D (Nuclear Method). In addition to compaction test the City Engineer shall require a roller test to insure that no pumping occurs in the completed subgrade. The roller test shall be accomplished by the three-wheeled roller weighing at least 12 tons or a 3 axle 10-wheeled water truck carrying a minimum of 3,000 gallons of water. No appreciable indentation shall be made by the roller tires and no "pumping" shall occur in the completed subgrade. Any spots in the subgrade which show appreciable settlement or "pumping" under the roller wheels shall be removed, dried out, re-compacted and retested until satisfactory. If the existing material cannot be made to pass the above described inspection, it shall be removed and suitable material replaced, compacted and tested.

CS3-04. GRADE TOLERANCES: The finished subgrade shall not vary more than 0.05 foot above or below grade. Subgrade that does not conform to the above requirements shall be reshaped to conform to the specified tolerances and watered and re-compacted, all at the Contractor's expense.

The City Engineer will inspect all compacted subgrade and must approve it prior to placing aggregate subbase or aggregate base. Aggregate subbase or aggregate base placed upon sections of subgrade not approved shall be removed and the subgrade compacted and approved.

CS3-05. SOIL TREATMENT: Soil treatment to increase the "R" value of subgrade soils may be used with the approval of the City Engineer. A soils report by a Registered Geotechnical Engineer will be required. Permissible soil treatment shall be as follows:

A. Lime Treatment: Lime treatment shall conform to Section 24 of the State Specifications.

B. Cement Treatment: Cement Treatment shall conform to Section 27 of the State Specifications.

CS3-06. UNSUITABLE ROADWAY EXCAVATION AND BACKFILL: Any unsuitable material encountered within two feet below the subgrade or two feet below original ground, whichever is lower shall be brought to the attention of and removed at the direction of the City Engineer. The additional excavation greater than that required for preparation of original ground or subgrade shall be computed and paid for at the contract unit price per cubic yard of roadway excavations. Unsuitable material excavated more than two feet below subgrade shall be paid for as extra work if no item for "unsuitable material excavation" appears in the proposal.

The Contractor shall use extra care in excavating unsuitable material so as not to aggravate the condition. If, in the opinion of the City Engineer and the Geotechnical Engineer, the Contractor's methods for excavating are increasing the amount of unsuitable material required to be excavated, the City Engineer will require the Contractor to take the necessary steps to correct the condition.

Geotextile fabric, as approved by the City Engineer, shall be required between the subgrade and the base rock to prevent "pumping" when the subgrade is considered "unstable" by the City Engineer and/or the Geotechnical/Design Engineer.

CS3-07. UNSUITABLE MATERIAL IN EMBANKMENTS: Unsuitable material excavated as roadway excavation, which, in the opinion of the City Engineer, cannot be worked into the roadway embankment, shall be removed from the job site or wasted within the right of way as directed by the City Engineer. No additional compensation will be allowed for removing unsuitable material from the job site. Unsuitable material excavated as roadway excavation, which in the opinion of the City Engineer can be used for roadway embankment, shall be placed in embankment below a plane 30 inches below the finished grade and compacted to a minimum relative compaction of 90 percent. No additional compensation will be allowed for placing unsuitable material in the roadway embankment.

CS3-08. SURPLUS MATERIAL DISPOSAL: The Contractor's attention is directed to Section 8 "Surplus Material Disposal" of these construction specifications for disposal of excess excavation materials outside of easements or right of way.

CS3-9. PAYMENT: Under this item of the proposal, the Contractor shall bid the contract unit price per cubic yard for roadway excavation which shall include full compensation for compacting natural and original ground, for subgrade preparation, for all haul and overhaul, for excavation, for placing earth embankment and any proposed soil treatment as shown on the plans and as directed by the City Engineer, and for furnishing all water necessary for the compaction of the material and subgrade preparation. The bid price shall also include shaping and trimming slopes to solid material and to the lines and elevations shown on the plans.

Ditches and channels in the median area, between roadway and frontage roads and side ditches contiguous to the roadway and other locations as shown on the plans will be paid for as roadway excavation as specified herein, unless specifically indicated as ditch and channel excavation in the Special Provisions and the Proposal.

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CONSTRUCTION SPECIFICATIONS

SECTION 4 - IMPORTED BORROW

CS4-01. ITEM: Imported borrow shall consist of material required for the construction of embankments; as determined by the City Engineer; or as specified in the Special Provisions and shall be obtained from sources listed in the Special Provisions, or if no sources are listed, from sources the Contractor may elect. The Contractor's optional sources shall be approved in advance by the City Engineer. Imported borrow shall be free of roots, vegetative matter, and other unsatisfactory material, and be of such character that it will readily bind to form a firm and stable embankment when compacted.

CS4-02. AGREEMENTS: The Contractor shall enter into an agreement with the owner of any privately owned material site to hold said owner harmless from any claims for injury to persons or damage to property resulting from the Contractor's operations on said property. The agreement shall contain provisions to relieve the City of any obligation to the owner or claims for injury or damage of persons or property. Before commencing operations at the material site, the Contractor shall deliver satisfactory written evidence of said agreement to the City Engineer. The Contractor's attention is directed to Section 6.2 of the State Specifications in regard to local materials and their sources.

CS4-03. PLACEMENT: The imported borrow material shall have a sand equivalent of not less than the average sand equivalent of the native material that is adjacent to the existing roadbed, or as otherwise set forth in the Special Provisions, and shall be placed and compacted as herein specified for roadway embankment.

CS4-04. COMPACTION: Upon completion of the subgrade, compaction tests shall be taken. The top 6 inches of subgrade material shall be compacted to a relative density of 95% as determined by Test Method California #216. In addition to compaction test the City Engineer shall require a roller test to insure that no pumping occurs in the completed subgrade. The roller test shall be accomplished by the three-wheeled roller weighing at least 12 tons or a 3 axle 10-wheeled water truck carrying a minimum of 3,000 gallons of water. No appreciable indentation shall be made by the roller tires and no "pumping" shall occur in the completed subgrade. Any spots in the subgrade which show appreciable settlement or "pumping" under the roller wheels shall be removed, dried out, recompacted and retested until satisfactory. If the existing material cannot be made to pass the above described inspection, it shall be removed and suitable material replaced, compacted and tested.

CS4-05. PAYMENT: Under this item of the Proposal, the Contractor shall bid a unit price per cubic yard for imported borrow compacted in place.

If no item for imported borrow appears in the Proposal, and the City Engineer deems it necessary to place imported borrow, the material shall be furnished and placed as extra work in accordance with Section GP4-06 of these specifications.

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CONSTRUCTION SPECIFICATIONS

SECTION 5 - STRUCTURE EXCAVATION AND BACKFILL

CS5-01. ITEM: Structure excavation shall conform to Section 19-3 of the State Specifications, except as herein modified. Structure backfill shall consist of furnishing, placing and compacting backfill material around structures to the lines designated on the plans or specified or directed by the Design Engineer.

CS5-02. JETTING: Jetting of structure backfill will not be allowed except when specifically set forth in the Special Provisions.

CS5-03. EXISTING STRUCTURES: When removing an existing structure which is to be replaced with a new structure, no payment will be made under this item for the area occupied by the existing structure.

CS5-04. PIPES AND MISCELLANEOUS STRUCTURES: Payment for and method of excavation and backfill for all pipes, manholes, inlets and miscellaneous facilities shall be as set forth elsewhere in these specifications.

CS5-05. UNSUITABLE MATERIALS: Unsuitable materials encountered at the grade elevation of the structural excavation which are directed by the City Engineer to be removed and backfilled shall conform to Section 3 of these specifications.

CS5-06. FINAL QUANTITY: The quantity of structural excavation shown on the plans and in the proposal shall be the final quantity for which payment will be made as provided in Section 9-1.015 of the State Specifications.

CS5-07. PAYMENT: Under this item of the Proposal, the Contractor shall bid a price per cubic yard for structure excavation.

The contract unit price per cubic yard for structure excavation shall include full compensation for all necessary excavation, structure backfill, and previous backfill within the limits set forth on the plans, Construction Details, and in the Special Provisions. Structure and previous backfill shall conform to Section 19-3.06 of the State Specifications.

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CONSTRUCTION SPECIFICATIONS

SECTION 6 - TRENCH EXCAVATION

CS6-01. ITEM: Trench excavation shall include the removal of all materials or obstructions of any nature, and the control of water necessary to construct the work as shown. Unless otherwise indicated on the drawings or permitted by the City Engineer, excavation shall be by open cut.

The City of Dixon is a member of the Underground Service Alert (USA), one call program. The Contractor or any subcontractor shall notify members of USA two working days in advance of performing excavation work by calling the toll-free number 1- 800-227-2600. Excavation is defined as being 18" or more in depth below the existing grade surface.

During any of the trench excavation phases of work which may interfere with the normal traffic controls, Police, Fire and Solano County Dispatch shall be notified 48 hours in advance of the street closure. The type of obstruction expected shall be provided. These offices shall also be notified immediately upon the reopening of the street.

CS6-02. TRENCH WIDTH: Minimum trench width shall be the outside diameter of the pipe plus 24 inches as shown in Construction Details 3280 and 3290. Maximum trench widths at the top of the pipe shall be as shown on the plans for the designated type of bedding. If no maximum is shown, the Contractor shall conduct his operation to limit trench widths at top of the pipe to pipe outside diameter plus 24 inches for pipe 36 inches and larger, except with the specific approval of the City Engineer. If trench widths at the top of the pipe as shown on the plans or as specified herein are exceeded by any amount, for any reason, the Contractor shall provide, at his own expense, stronger pipe or improved bedding and backfill based on a design from the Design Engineer. This requirement shall be a consideration for pipe at manhole excavations and at boring and jacking excavations.

CS6-03. SHORING AND BRACING: The Contractor attention is directed to City of Dixon General Provisions section 7-7, “Trench Safety Plans” for additional requirements. The Contractor shall install sufficient shoring and bracing to insure the safety of workmen, protect the work, and protect adjacent improvements. Shoring and bracing shall comply with the rules, orders, and regulations of the California Division of Industrial Safety, latest revisions.

It shall be the duty of the Contractor to comply with Section 6500 of the Labor Code of the State of California and the California Division of Occupational Safety.

The Contractor shall submit a detailed plan to the City Engineer showing the design of shoring, bracing, sloping and other provisions to be made for worker protection from the hazards of cave-in during excavation or trenching. The Contractor shall contact the City a minimum of 24 hours prior to actual placement of shoring.

CS6-04. CUTTING OF PAVEMENT: When the trench is in an existing paved area, the pavement shall be sawed or scored on neat lines parallel and equidistant from the trench centerline. Pavement between the lines shall be broken and removed immediately ahead of the trenching operations. The width of pavement removed shall be sufficient that the trenching operation does not damage the edges of the pavement left in place. Asphalt concrete and concrete surfacing concrete shall be sawed to a neat line 6 inches wider on each side than the actual trench width.

Due to the uncertainty of the location of underground utilities, the pavement shall not be cut until the respective utility companies have marked the location of their facilities and the City Engineer has given final approval of the trench alignment.

CS6-05. MAXIMUM LENGTH OF OPEN TRENCH: At the end of each working day, there shall be a maximum of 300 feet of open trench in unimproved areas, excluding manhole excavations, for each operation unless the entire construction site is fenced off from public access and authorized by the City Engineer. The remainder of the trench shall be backfilled and compacted, and when in streets, opened to traffic as soon as possible If set forth in the Special Provisions for the interest of public safety and convenience, the entire trench and all excavations shall be backfilled and equipment relocated as directed at the end of each working day. The maximum length of open trench at the end of each working day for cast-in-place concrete pipe shall be for placing pipe the next working day, plus the trench in which pipe was placed during the previous 24 hours, unless otherwise permitted by the Engineer or set forth in the Special Provisions. The remainder of the trench shall be backfilled and compacted, and when in streets or highways, opened to traffic as soon as possible.

Open trenches in excess of 3 feet deep must be covered or fenced. Uncovered open trenches must be protected with barricades and flashers every 25 feet, and connected with reflective tape at the top and bottom of the barricade.

CS6-06. TRENCH PLATES: Trench plates are steel plates used for temporary cover of trenches and other excavations. All trench plates used in the City right-of-way shall have a skid resistance surface treatment. When backfilling trenches and excavations within a paved street section or within the concrete curb, gutter and sidewalk area, whether transverse or longitudinal, and the work cannot be properly completed within the same working day, trench plates with non-skid surface treatment will be required to maintain traffic flow. The following conditions shall apply:

1. All steel trench plates shall extend beyond the edges of the trench wall a minimum of twelve (12") inches.

2. All steel trench plates shall be fully supported around the perimeter to revent tipping.

3. Trenches and excavations shall be adequately shored or braced to withstand highway traffic loads.

4. All trench plates shall be tack welded together at the end of each day.

5. All trench plates shall be pinned in each corner to prevent movement.

6. Temporary paving or cold-mix asphalt concrete (cut-back) shall be placed around all edges of the trench plates.

7. A maximum of fifty (50 lineal feet of trench plating shall be allowed unless otherwise approved in writing by the City Engineer.

The following table shows a minimum required thickness for trench plates:

TRENCH WIDTH	MINIMUM PLATE THICKNESS
1.0 feet (0.3 meter)	1/2 inch (13 millimeter)
1.5 feet (0.45 meter)	3/4 inch (19 millimeter)
2.0 feet (0.6 meter)	1 inch (22 millimeter)
3.0 feet (0.9 meter)	1 inch (25 millimeter)
4.0 feet (1.2 meter)	1 1/4 inch (32 millimeter)

For trenches and excavations with spans greater than four feet (4'), a structural design shall be prepared by a registered civil engineer and approved by the City.

8. All trench plating shall be designed for HS20-44 Truck loading per the Caltrans Bridge Design Manual.

9. Trench plates shall maintain a skid resistant surface having a minimum coefficient of friction equivalent to 0.35 per California Test Method 342. A Rough Road Sign (W33) shall be used in advance of all trench plates.

10. Steel trench plate deformation may occur during loading, but if a steel plate is deformed without loading to at least 1/2 inch (1.2 cm) per 8 feet (2.4 meter) length, the plate shall be removed and replaced.

CS6-07. CONTROL OF WATER: When either ground water or surface run-off is encountered, the contractor shall furnish, install, maintain, and operate all necessary machinery, materials and equipment to keep excavation reasonably free from water until the placing of the bedding material, laying and jointing of the pipe, pouring of concrete, and placing of the shading material has been completed, inspected, and approved, and all danger of flotation and other damage is removed. Water pumped from the trench shall be disposed of in a manner subject to the approval of the City Engineer.

CS6-08. SPECIAL FOUNDATION TREATMENT: Whenever the bottom of the trench is soft or rocky, or, in the opinion of the City Engineer, otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed and replaced with crushed rock, gravel, or sand as directed by the City Engineer, so as to provide a stable and satisfactory base. On City contracts, if material more than 12 inches below the normal trench bottom as required for proper bedding of the pipe is ordered to be removed by the City Engineer, the excavation below that point and the imported material required to backfill the trench to that elevation shall be paid for as extra work.

If the necessity for such additional bedding material has been caused by an act or failure to act on the part of the contractor, or is required for the control of ground water, the contractor shall bear the expense of the additional excavation and bedding.

CS6-09. EXCAVATION METHOD: Methods used in excavation shall be such as not to cause damage to surrounding property or to unnecessarily damage pavement. Street pads for backhoe outriders and other equipment to prevent unnecessary damage shall be utilized. When excavation is in existing pavement, Contractor shall sawcut existing pavement 6 inches on each side of the trench after backfilling is completed, and shall remove excess asphalt prior to repaving.

CS6-10. PAYMENT: Full compensation for trench excavation as herein specified, including all equipment, labor, materials, de-watering, special trench foundation, special traffic considerations, sawcutting, and safety measures required, shall be included in the price bid per lineal foot of the respective sizes, grades, and types of pipes and conduits listed in the Proposal, and no additional compensation will be allowed therefore.

CONSTRUCTION SPECIFICATIONS

SECTION 7 - TRENCH BEDDING AND BACKFILL

CS7-01. ITEM: Trench bedding and backfill shall consist of furnishing, placing, compacting, dewatering and shaping backfill material around pipes and structures to the lines designated on the contract plans or specified or directed by the City Engineer and as shown on Construction Details 3280, 3290 and 3300.

CS7-02. BEDDING: Bedding shall be defined as that granular material supporting, surrounding and extending to 12 inches above the top of pipe and twelve inches below the pipe barrel for all pipe diameters 24 inches and less in diameter or as defined by the design on the approved plans.

For pipes larger than 24 inches in diameter, imported bedding material, as specified herein, shall extend to twelve inches below and be placed to the spring line of the pipe. Bedding material above the spring line of the pipe shall be either the herein specified imported bedding material, or selected job excavated material as approved.

Unless otherwise indicated on the drawings and in the Special Provisions, the pipe shall be placed on a firm, prepared bed of imported granular materials. All loose material shall be removed from the new trench bottom before placing the bedding material.

Bedding material shall first be placed so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of 0.4 times the outside diameter of the barrel.

The remainder of the bedding material shall be placed immediately after pipe joints have been completed, inspected, and passed by the City Engineer. The material shall be carefully placed so as not to disturb or damage the pipe, and shall be brought up evenly on both sides.

Pipe shall not bear on bells or joints. The trench shall be excavated at the pipe joints as necessary to provide at least 3 inches of bedding material below the bell. No wedging or blocking of the pipe will be permitted. Bell holes shall be cut out of the bedding such that the pipe bears evenly on the material.

Pipe bedding for all pipes shall be as provided below or shall be directed by the City Engineer if trench conditions vary from that shown on the contract plans as provided in Section CS6-02 of these specifications.

Where pipe is to be installed in new embankment, the embankment shall first be constructed to a height of 12 inches above the top of pipe and for a distance on each side of the pipe location of not less than 5 times the diameter of the pipe, after which the trench shall be excavated with sides nearly vertical and the pipe installed.

When water is encountered, the trench shall be kept dry until laying and jointing of the pipe and placing of the bedding material has been completed, inspected, and approved. The contractor shall place a minimum of 6 inches of pervious material or de-water the trench in a manner which has received prior approval of the Engineer.

Bedding material shall be 3/4 crushed stone in accordance with Section 72 of the California Standard Specifications and these specifications:

	Cal-Test	Requirement
Apparent Specific Gravity	No. 206	2.5 Min
Absorption	No. 206	4.2 Max
Durability Index	No. 229	52 Min

Crushed stone shall have a minimum cleanliness of 50% per Cal-Test No. 227.

Job excavated material may be used in lieu of the specified imported bedding material provided the job excavated material meets the requirements for bedding material as specified herein and is approved by the City Engineer. Should the contractor elect to use job excavated material in lieu of imported bedding material as specified, he shall furnish the City Engineer with certified copies of laboratory reports showing the material meets the requirements of these specifications.

CS7-03 INTERMEDIATE BACKFILL: Trench backfill above the bedding material shall be Class II aggregate base mechanically compacted to 95% of relative compaction in street rights-of-way or travel areas. Trench backfill above bedding material to 18 inches below the top of the trench in areas of horticulture may be job-excavated material mechanically compacted to 90% of relative compaction in maximum 2 foot lifts. The remaining 18 inches of backfill in areas of horticulture shall be mechanically compacted to 95% of relative compaction.

Backfill, for cast-in-place structures such as, but not limited to, manholes, transition structures, junction structures, vaults, valve boxes and reinforced concrete box conduits shall start at the surface upon which the base of the structure rests.

The City Engineer may designate the use of "Imported Select Backfill" in lieu of job-excavated material. If imported select backfill is required, the material and methods of payment shall be as specified in the Special Provisions.

CS7-04. OTHER BACKFILL REQUIREMENTS: Where cribbing is used in the trench, the fill shall be carried to a height sufficient to prevent the surrounding ground from cracking or caving into the trench before the cribbing is removed. Backfill around manholes and the pit excavated for boring operations shall be made in the same manner as above specified for trenches. However, whenever the excavated space between the outer wall of the manhole and the undisturbed earth is 12 inches or less, the backfill shall be bedding material, compacted to a relative compaction of 90 percent.

If, at any time during a period of one year from the date of final acceptance of the project, there is any settlement of the trenches requiring repairs to be made, the City Engineer shall notify the Contractor to immediately make such repairs at the Contractor's expense.

CS7-05. PAVEMENT REPLACEMENT IN EXISTING STREETS: In existing streets, trenches shall be paved with temporary or permanent paving on the same day after backfilling has been completed, no trench shall be left unpaved over a weekend or holiday. Temporary paving shall be maintained until permanent paving is placed and shall be replaced with permanent pavement no later than 30 days following backfill operations. Material for temporary paving shall consist of not less than 2 inches of premixed bituminous treated aggregate ("cut-back"). Permanent asphalt paving shall be 1 inch greater in thickness than adjacent existing pavement except that in no event shall the section be less than 4-1/2 inches of Asphalt Concrete and 8 inches of Aggregate Base. The finish grade of the replaced pavement shall be 1/8" above the adjacent pavement grade. Prior to placing permanent paving, the area shall be thoroughly cleaned and the opening saw-cut to a neat edge (See Construction Detail 3280). The subbase and base courses shall be thoroughly compacted and the edges shall be primed with an asphaltic emulsion (AR-4000) prior to placing the asphalt surface.

CS7-06. PAYMENT: Full compensation for trench bedding and intermediate and top backfill as herein specified, including all equipment, labor, materials, temporary cold patches, compaction, backfill materials, shaping and repairing trenches as required, shall be included in the price bid per lineal foot for the respective sizes, grades, and types of pipes and conduits listed in the Proposal, and no additional compensation will be allowed therefore.

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CONSTRUCTION SPECIFICATIONS

SECTION 8 - SURPLUS MATERIAL DISPOSAL

CS8-01. ITEM: Surplus materials, resulting from excavations or trenching operations that are not required for backfill or embankment construction or to satisfy right-of-way agreements as set forth on the plans and in the Special Provisions, shall become the property of the Contractor, who shall dispose of the surplus materials off the rights-of-way or easements unless permitted by the City Engineer to be disposed of otherwise.

CS8-02. DISPOSAL OF MATERIALS PERMIT: When any materials are to be disposed of outside the rights-of-way or easements, the Contractor shall obtain a written permit from the property owner upon whose property the disposal is to be made before any materials are deposited thereon. Excess materials shall not be deposited in any location which will block or restrict a natural or artificial drain or within the dripline of any trees.

CS8-03. PAYMENT: No separate payment will be made for disposal of surplus material unless otherwise noted on the proposal form and all compensation therefore is to be included in other contract items.

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CONSTRUCTION SPECIFICATIONS

SECTION 9 - AGGREGATE SUBBASE

CS9-01. ITEM: Under this item of the Proposal, the Contractor shall furnish Class 2 aggregate subbase material per section 25-1.02 A, 1/2 inch maximum grading, of the State Specifications complete in place as shown on the plans and as specified herein.

CS9-02. SPREADING: After subgrade has been approved, aggregate subbase shall be spread on the prepared subgrade to such depth that when thoroughly compacted, it will conform to the grades and dimensions shown on the plans. Where the required thickness is 6 inches or less, the aggregate subbase may be spread and compacted in one layer. Where the required thickness is more than 6 inches, the aggregate subbase shall be spread and compacted in two or more layers of approximately equal thickness, the maximum compacted thickness of any one layer not to exceed 6 inches. Aggregate subbase material shall be delivered to the roadbed as uniform mixtures and shall be spread in layers or windrows without segregation. Segregated materials shall be remixed until uniform.

CS9-03. COMPACTION: Each layer of aggregate subbase shall be inspected and approved by the City Engineer prior to the placing of the next layer. The relative compaction of each layer of compacted subbase material shall not be less than 95% as determined by the Test Method California #216. The final aggregate subbase layer must be inspected and approved by the City Engineer before placing any aggregate base.

CS9-04. TOLERANCES: The finished aggregate subbase shall not vary more than 0.05 foot above and below theoretical grade.

CS9-05. PAYMENT: Payment for laying aggregate subbase shall be either at the contract price bid per ton or at the contract price bid per square foot. The method used on any work will be shown by the list of quantities on the proposal and by the type of unit price requested in the proposal.

Payment shall include full compensation for furnishing the material, placing it on the roadway, applying water, finishing the surface, and performing all work and finishing all labor and equipment necessary to perform the work.

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CONSTRUCTION SPECIFICATIONS

SECTION 10 - AGGREGATE BASE

CS10-01. ITEM: Under this item of the Proposal, the Contractor shall furnish 3/4 inch Class 2 aggregate base material in place as shown on the plans and as specified herein.

CS10-02. MATERIAL AND PLACEMENT: Aggregate base material and method of placing shall conform to Section 26 of the State Specifications excepting modification as herein specified. The aggregate base shall conform to the grading provided for Class 2, 3/4 inch maximum as shown in the State Specifications.

CS10-03. SPREADING: After subgrade has been approved, aggregate base shall be spread on the prepared subgrade to such depth that when thoroughly compacted, it will conform to the grades and dimensions shown on the plans. Where the required thickness is 6 inches or less, the aggregate base may be spread and compacted in one layer. Where the required thickness is more than 6 inches, the aggregate base shall be spread and compacted in 2 or more layers of approximately equal thickness, the maximum compacted thickness of any one layer not to exceed 6 inches. Aggregate base material shall be delivered to the roadbed as uniform mixtures and shall be spread in layers or windrows without segregation. Segregated materials shall be remixed until uniform.

CS10-04. COMPACTION: The relative compaction of each layer of compacted base material shall not be less than 95% as determined by Test Method California #216.

CS10-05. TOLERANCES: The completed aggregate base shall not vary more than 0.05 foot above or below the theoretical grade.

CS10-06. GRADE AND INSPECTION: The final aggregate base layer shall be inspected and approved by the City Engineer before placing any asphalt concrete. The City Engineer may notify the Design Engineer, if deemed necessary, that a problem may exist and require verification of the finish grades prior to pouring of concrete and placing of pavement.

CS10-07. PROTECTION OF AGGREGATE BASE: Untreated base, once inspected and approved, must be protected from raveling and segregation by traffic. Areas once approved, but which are disturbed by traffic, must be re-compacted and retested prior to surfacing.

The Contractor may apply a penetration treatment approved by the City Engineer at his own expense to protect the untreated base.

CS10-08. PAYMENT: Payment for laying aggregate base shall be either at the contract price bid per ton or at the contract price bid per square foot. The method used on any work will be shown by the list of quantities on the proposal and by the type of unit price requested in the

proposal.
Payment shall include full compensation for furnishing the material, placing it on the roadway, applying water, finishing the surface, and performing all work and finishing all labor and equipment necessary to perform the work.

CONSTRUCTION SPECIFICATIONS

SECTION 11 - ASPHALT CONCRETE

CS11-01. ITEM: Under this item of the proposal, the contractor shall furnish asphalt concrete, Type "A" complete-in-place as shown on the plans and as specified herein.

CS11-02. MATERIAL AND PLACEMENT: Asphalt Concrete shall be a Type A (Modified) and shall conform to the Project Plans and provisions in Section 39 "Asphalt Concrete" of the Standard Specifications as amended by these Special Provisions.

Aggregate used in Asphalt Concrete shall conform to the ½" or ¾" Maximum, Medium grading requirements of section 39-2.02, and "Aggregate" of the Special Provisions as modified herein. The aggregate for Asphalt Concrete, Type A (Modified) shall be a minimum of 85% machined aggregate with a minimum of two fractured faces.

Asphalt Binder shall be a PG 64-16 grade. Steam refined paving asphalt conforming to Section 92, "Asphalt", of the Standard Specifications. Asphalt binder shall be mixed with the aggregate at a ratio of 4 to 7 percent of the dry weight of aggregate. The percentage of air voids in the mix design at optimum bitumen content shall be between three (3) and five (5) percent.

> "Asphalt concrete shall be spread and compacted in the number of layers and thickness indicated in the following table. All thicknesses shown are in the hundredths of a foot."

Total Design Thickness	Number of Layers	Top Layer Thickness ½" Maximum Medium Grading		Next Lower Layer Thickness 3/4" Maximum Medium Grading		All Other Layers Thickness 3/4" Maximum Medium Grading	
		MIN	MAX	MIN	MAX	MIN	MAX
20 or less	1	-----	-----	-----	-----	-----	-----
25	2	12	13	12	13	-----	-----
30 through 40	2	15	20	15	25	-----	-----
45 or more	*	15	20	15	25	15	40

* - At least 3 layers if total thickness is more than 0.45 foot and less than 0.90 foot
- At least 4 layers if total thickness is 0.90 foot or more

The Contractor shall provide to the Engineer for review and approval, an Asphalt Concrete mix design showing complete aggregate grading, void content, maximum density, unit weight, and Haveem Stability for each percentage binder used in the mix design determination. The mix design shall be submitted prior to commencement of work in accordance with "submittals" of these Special Provisions.

The amount of asphalt binder to be mixed with the aggregate for Type A (Modified) asphalt concrete will be determined by the Engineer based on data from California Test 367 provided by the contractor. The maximum tolerance for binder content shall be plus or minus 0.3% from the target binder content designated by the Engineer
.
As per Section 39-6.01, "General Requirements", of the Standard Specifications, asphalt Concrete shall be placed only when the atmospheric temperature is above 50 degrees F. All mixtures shall be spread at a temperature of not less than 260 degrees F and not greater than 300 degrees F. The initial rolling, or breakdown compaction, shall be performed immediately after placement.

When placing asphalt concrete, large aggregate that migrates to the surface during any handwork shall be returned to the paver box rather than scattered over the surface of the mat.

The first paragraph of section 39-5.01, "Spreading Equipment", of the Standard Specifications is amended to read:

"**Asphalt Concrete shall be spread with a self-propelled asphalt paving machine."**

Asphalt Concrete placed in layers less than 0.15-foot in compaction thickness or widths of less than 5-feet shall be spread and compacted with the equipment and by methods specified in said Section 39. All other asphalt concrete shall be compacted and finished in conformance with said Section 39, amended as follows:

CS11-03. COMPACTING EQUIPMENT: The Contractor shall furnish a sufficient number of rollers to obtain the specified compaction and surface finish required by these specifications.

Each roller shall have a separate operator; all rolling equipment shall be self-propelled and reversible. The minimum number, weight, and type of rollers required by be reduced or modified in accordance with provisions of section39-6.03, "Compacting," for low rates of production or when alternative is approved by the Engineer.

All rollers shall be equipped with pads and water systems, which prevent sticking of asphalt mixtures to the pneumatic or steel, tire wheels. A Parting agent, which will not damage the asphalt mixture, as determined by the Engineer. may be used to aid in preventing sticking of mixture to the wheels.

CS11-04. ACCEPTANCE TESTING: Section 39-6.03, "Compacting", of the Standard Specifications, is amended by deleting the fourth, fifth, and seventh through the tenth paragraphs and adding the following before the eleventh paragraph:
Asphalt Concrete and Asphalt Concrete Base shall be compacted to a relative compaction of not less than 95% and shall be finished to the lines, grades, and cross sections shown on the Project Plans. The Engineer shall determine when the asphalt concrete has obtained adequate

compaction to allow the asphalt concrete pavement to be open to public traffic.

Finish rolling or final compaction shall be completed while the temperature of the mixture is above (150) degrees F. A vibratory roller may used as a finish roller provided that it meets the requirement for a finish roller and it is operated with the vibratory turned off.

In-place-Density testing of the asphalt concrete will be based on Relative Compaction that will be determined by Cal-Trans Test Method #375. Lots will be established by the Engineer for asphalt concrete areas to be tested. If the density test results indicate that the relative compaction is less than 95.0 percent, the asphalt concrete represented by the lot shall be removed, except as otherwise provided below.

Asphalt concrete spreading operations shall not continue until contractor makes significant adjustments to his/her materials or procedures, or both, in order to meet the required compaction. The Engineer shall agree to the adjustments. However, if requested by the contractor and approved by the Engineer, asphalt concrete with a relative compaction of 90.0 percent or greater may remain in place and the contractor shall pay to the City an amount of reduced compensation for such lot(s) with low compaction. The City may deduct the amount of reduced compensation from any monies due, or that may become due, the contractor under the contract. The amount of reduced compensation the contractor shall pay to the City will be calculated using the total tons represented in the lot with low compaction values times the following reduced compensation factors:

Relative Compaction (Percent)	**Reduced Compensation Factor**
95.0 and above	**0.00**
94.0-94.9	**0.02**
93.0-93.9	**0.04**
92.0-92.9	**0.06**
91.0-91.9	**0.08**
90.0-90.9	**0.10**
89.9 and below	**remove and replace as directed by the Engineer.**

If the Contractor selects the batch mixing method, asphalt concrete shall be produced by the automatic batch mixing method as provided in Section 39-3.03 A (2), “Automatic Proportioning” of the Standard Specifications.

If the finished surface of the concrete does not meet required surface tolerances, as specified in Section 39-6.03, the Contractor shall, at his/her own expense, bring pavement surface within tolerance by the following method:

The Contractor shall apply tack coat and place an overlay of asphalt concrete in accordance with this Section of these Special Provisions. Said corrective work shall be at the Contractors expense

and no additional compensation shall be allowed.

The area to which the paint binder has been applied shall be closed to public traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

A drop off of more than 0.15- foot will not be allowed at any time between adjacent lanes open to public traffic. The Contractor shall schedule paving operations such that each layer of asphalt concrete is placed on all contiguous lanes of a traveled way each work shift. At the end of each work shift, the distance between the ends of the layers of asphalt concrete on adjacent lanes shall not be greater than 10 feet nor less than 5 feet. Additional asphalt concrete shall be placed along the transverse edge at the end of each lane and along the exposed longitudinal edges between adjacent lanes, hand raked and compacted to form temporary conforms. Kraft paper, or other approved bond breaker, may be placed under tapers to facilitate the removal of the taper when paving operations resume.

CS11-05. DESIGN MIX: For all paving projects, a proposed design mix shall be furnished to the City Engineer at least 48 hours in advance of any placement of asphaltic concrete. A Certificate of Compliance shall be furnished by the Contractor, if required by the City Engineer, at the Contractor's expense.

CS11-06. EXISTING PAVEMENT: Cut lines made on the existing pavement, both longitudinally and transversely, for the placing of new structural section, shall be straight and smooth and cut immediately prior to placing asphaltic emulsion. Edges shall be clean and free of dirt and dust prior to placing tack coat. Asphaltic emulsion shall be used as a tack coat or paint binder on existing pavement that is to receive an asphalt concrete overlay and also along the exposed edges of abutting pavement and concrete curbs and gutters. Its use may also be required between subsequent layers of asphalt concrete placed by the Contractor when ordered by the City Engineer. Asphalt emulsion shall conform to Section 94 of the State Specifications. If no item is included in the Proposal for asphaltic emulsion, payment shall be included in the price bid for asphalt concrete.

CS11-07. ADJUSTMENT OF IRON: Existing manholes, valve boxes, monument boxes, etc., shall be adjusted below grade before for grinding asphalt concrete as necessary and raised to 3/8 inch below finished grade, in accordance with City of Dixon Construction Details, after final pavement lift has been placed.

CS11-08. PAYMENT: Payment for asphaltic concrete pavement shall be at a price per ton of delivered and placed material or at a price per square foot for finished pavement. The method used on any work will be shown by the list of quantities on the Proposal and by the type of unit price requested in the Proposal.

Payment for asphaltic concrete pavement by either of the above two methods, as may be specified by the Proposal on that particular work, shall include full compensation for furnishing all the materials, loading, hauling, placing, compacting, marking existing items to be raised, adjusting iron below grade for grinding operations and above grade after placement of final

paving, traffic control, notifying agencies as required, and incidentals necessary for doing all the work involved in constructing asphalt concrete pavement.

CS11-09. PAVEMENT REINFORCING FABRIC: Pavement reinforcing fabric shall be placed as an interlayer between asphalt concrete and base material. The fabric to be used shall be a needle-punched, thermally bonded on one side, 100% polypropylene staple fiber fabric, which conforms to the following properties:

Tensile Strength, either direction (ASTM D4632)	101 lbs., minimum 450N
Elongation at Break, either direction (ASTM D4632)	50 (%), minimum
Mullen Burst Strength, (ASTM D3786)	200 psi, minimum, 1370 kPa
Weight, (ASTM D3776)	4.1 oz/y^2, minimum 140 gm/m^2
Asphalt Retention by Fabric, (ASTM D6140)	0.2 gal/y^2 or 0.9 L/m^2, 26.9 oz/y^2 residual minimum*, 914 gm/m^2

* - Binder requirements increase as weight of fabric increases. This value must be provided by the manufacturer.

The fabric shall have a demonstrated field performance of compatibility with recycling methods and construction reliability.

Prior to placing the fabric, the existing material to be covered shall be compacted to the design requirements and be free of loose material. Placing of the fabric shall be made only under the following conditions:

1. The ambient air temperature is above 50 degrees F.
2. The pavement is dry and pavement temperature is 40 degrees F.

The fabric shall be placed into an asphaltic binder tack coat, per these specifications, with a minimum of wrinkles that lap. Large wrinkles that overlap by more than ½" shall be slit and lapped in the direction of the paving. Burning and torching of wrinkles will not be allowed. All fabric shall be broomed in order to maximize pavement contact and remove air bubbles. All streets receiving fabric shall receive full coverage of the fabric, and the width of asphalt application will be the fabric width plus four inches. The fabric shall overlap with not more than two to six inches at the longitudinal joints and no more than two inches at the traverse joints. No joints shall be lapped with more than two layers of fabric. Traverse joints shall be shingled in the direction of the paving.

Fabric shall not be embedded in the asphaltic binder until the in-place binder has cooled to 180 degrees F or below as determined by non-contact thermometer. The equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment used to place the fabric is subject to approval of the Engineer.

Turning of the paving machine or other vehicles on the fabric shall be gradual and shall be kept

to a minimum to avoid damage of the membrane. Should equipment tires begin sticking to the fabric during pavement operations, small quantities of asphalt concrete shall be broadcast ahead to prevent pick-up of the fabric. The Contractor shall not decrease tack coat application rate in order to minimize pick-up of the fabric.

CS11-10. ASPHALT BINDER TACK COAT: The surface to receive the fabric shall be first cleaned of debris, dirt and rocks, then sprayed with paving asphalt to be used as a binder. The original asphalt shall have a minimum absolute viscosity of 2200 Poise at 140 degrees F. unless otherwise directed by the City Engineer. Binder shall be applied at approximately 33.6 oz/y^2 (1.14 kg/m^2 +/- 1.14 kg/m^2). Rate to be verified by scale tags. The Contractor's attention is directed to Section 92.1.04 "Applying Asphalt," of the State Standard Specifications. Good practice dictates that the asphalt binder to be spread in the range of 290 to 325 degrees F.

The asphalt binder tack coat application truck shall be equipped with a calibrated measuring rod and external truck mounted gauge which shows gallons used from the distributor truck. Tack rate in gallons is calculated using asphalt cement weight of 238 gallons per ton.

CS11-11. PAYMENT: Payment for furnishing all labor, materials, tools, equipment, and incidentals, and for completing all work involved in "Pavement Reinforcement Fabric" and "Asphalt Binder Tack Coat" including furnishing and placing of asphalt binder tack coat and pavement reinforcing fabric complete in place, sweeping the entire surface to be laid with fabric, as specified shall be paid at the contract unit price bid and no additional compensation will be allowed.

CS11-12. ASPHALT CONCRETE GRINDING: Grinding of existing asphalt concrete pavement shall conform to the provisions of Section 42-2, "Grinding," of the State Standard Specifications.

Asphalt grindings shall be disposed of as specified below:

1. Grindings shall be the property of the City of Dixon and shall be transported to locations specified within the City of Dixon, or

2. Grindings shall be the property of the Contractor who shall dispose of the same at approved locations outside of the City street right-of-way.

As grinding operations proceed, prior to allowing traffic onto streets, the Contractor shall immediately install and maintain cut-back ramp tapers or other approved transitions at all drop-off edges along intersecting streets and thoroughfares and as directed by the City Engineer until the asphalt concrete overlay pavement is installed.

Wedge Grinds - All streets to be overlaid shall receive 20 foot wide conform wedge grinds at the longitudinal paving limits and 6 foot wide wedge grinds along street edge before placement of asphalt concrete pavement overlay. Prior to all grinding operations, the Contractor shall adjust utility covers within the grinding areas before grinding plane. Wedge grind depths shall be at the

design overlay depth less 1/4 inch along gutter pans and at overlay depth at all other locations.

CS11-13. PAYMENT: Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in "Asphalt Concrete Grinding" including installation of temporary cut-back ramp tapers and delivery of asphalt concrete grindings to locations within the city limits, complete in place, as specified in the Special Provisions, as shown on the plans and as directed by the City Engineer shall be paid for at the contract price bid per each item of work and no additional compensation will be allowed thereof.

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CONSTRUCTION SPECIFICATIONS

SECTION 12 - ASPHALT CONCRETE SURFACE TREATMENT

CS12-01. ITEM: Under this item of the proposal, the contractor shall furnish and make an application or applications of asphaltic emulsion and screenings (chip seal); of a mixture of asphaltic emulsion, dry aggregates and added water (slurry seal); and of asphalt rejuvenating agent and sand (oil treatment) in accordance with the provisions of Section 37 of the State Standard Specifications.

CS12-02. GENERAL: Any surface to receive a surface treatment must be thoroughly cleaned of all dust and dirt and any loose materials. All sunken areas must first be patched and leveled up as directed by the City Engineer. All traffic striping to include paint, thermoplastic, buttons and reflectors shall be removed prior to any surface treatment.

CS12-03. CHIP SEAL: Chip seals shall only be permitted at the discretion of the City Engineer. Chip seal shall conform to the requirements of Section 37-1 of the Standard Specifications, except as modified below.

A. MATERIALS:

1. Latex Asphalt Emulsions: The asphalt emulsion used for the single seal coat shall be CRS-2h type meeting all of the requirements for such materials as specified in Caltrans Standard Specification Section 94, Table 2 - Requirements for Cationic Asphaltic Emulsion. The latex shall be SBR rubber and shall be 2 percent of the asphaltic residual content. Samples and certificates of compliance from the latex supplier shall be provided. The latex asphalt emulsion shall be applied to a 40-90 pen base.

   The Contractor will furnish a one-quart sample of asphaltic emulsion drawn from each tank load of material to be used on the project. Samples will be obtained in accordance with ASTM Method D140 or such other methods as are approved by the City Engineer. A certificate of compliance shall be furnished by the Contractor in accordance with Section 6-1.07 of Caltrans Standard Specifications for all asphaltic emulsion used under these specifications. Section 94 of the Caltrans Standard Specifications. Additional information relevant to the specifications shall be furnished if requested by the City Engineer.

2. Aggregate: (seal coat, chips or screenings) Aggregate for the chips or screenings for the seal coat shall comply in all respects to requirements in Section 37-1 of the Caltrans Standard Specifications for medium size (3/8" X No. 6). The aggregates for seal coat shall be surface damp at the time of application but excess water on the aggregate surface will not be

permitted. Wetting of the aggregate stockpiles on the day or days prior to application will be permitted; wetting of the aggregates on the day of application will only be permitted if approved by the City Engineer.

A certificate of compliance in accordance with Section 6-1.07 of Caltrans Standard Specifications shall be furnished by the Contractor for all aggregate used under this specification. The certificate of compliance shall include results of laboratory tests indicating the average gradation, maximum values for L.A. rattler loss and minimum cleanness value, all in accordance with Section 37-1.02 of the Caltrans Standard Specifications.

B. PLACEMENT:

The following sections of this specification describe requirements for the preparation, materials application and finishing of streets for the chip seal coat as part of a cape seal.

1. Preparation: Immediately before commencing the chip seal operations, all surface metal utility covers and frames (including survey monuments) shall to be protected from the chip seal. Covers and frames shall be uncovered and cleaned of chip seal material by the end of the same work day.

2. Applying Latex Asphaltic Emulsion: Latex Asphaltic emulsion for chip seal shall be applied in accordance with Section 37-1.05 of Caltrans Standard Specifications and all provisions thereof. The initial application rate shall be 0.27 gallons per square yard. The rate of application can be changed within a range of 0.20 to 0.35 gallons per square yard as directed by the City Engineer.

   The temperature of the latex asphaltic emulsion at the time of applicatshall range between 110 degrees Fahrenheit and 160 degrees Fahrenheit in accordance with Section 94 of the Caltrans Standard Specifications.

3. Spreading Aggregate: (Screenings) Immediately following the application of asphaltic emulsion, it shall be covered with screenings in accordance with Section 37-1.06 of Caltrans Standard Specifications. The initial spread rate shall be 22 pounds per square yard. The rate of application can be changed within a range of 20 to 30 pounds per square yard as directed by the City Engineer.

   If required by the City Engineer, a 300 ft. long test section shall be covered with each self-propelled spreader in order to check spread rate and to determine that the spreader is in good operating condition. A 20

percent tolerance rate will be permitted in spreading the aggregate.

4. Finishing: Rolling and sweeping shall be in accordance with provisions of Section 37-1.07 in the Caltrans Standard Specifications.

   Initial rolling shall begin immediately behind the chip spreader. Rollers shall be kept in continuous operation on the chip seal coat until the roadway is open to public traffic with a minimum of two (2) complete coverages. Chip spreading will not be allowed with less than two (2) operating rollers on the job. Rolling shall be discontinued as required by the City Engineer.

   Residential streets shall be swept within 24 hours after placing the chip seal. The sweeper shall be self-propelled with vacuum or rejentitive air pickup and spray bar(s) to reduce dust. Residential areas shall be swept a second time or more if necessary in the same manner as the first sweeping as directed by the City Engineer. Completion of sweeping shall be evidenced by the absence of loose chips in the street, gutters and driveways. Special attention shall be required in sweeping driveways clear of loose chips. The Contractor shall provide a sufficient number of sweepers to sweep all streets within 24 hours after spreading screenings (chips) for chip seal coat. Should the Contractor be required to sweep the street a second or more times, compensation for these additional sweepings will be provided on a force account basis.

5. Placing: The chip seal shall be allowed to age and cure under traffic for at least one week before placing the slurry mixture. A longer curing period shall be required if, in the opinion of the Engineer, the asphaltic emulsion used for the chip seal has not achieved a reasonable set which could result in damage to the cape seal if prematurely covered by the slurry mix.

CS12-04. POLYMER MODIFIED BLACK AGGREGATE SLURRY SEAL: Slurry Seal shall consist of mixing asphalt emulsion, aggregate, and water and spreading the mixture on a surface or pavement where shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

A. MATERIALS

The materials for slurry seal immediately prior to mixing shall conform to the following requirements:

POLYMER MODIFIED ASPHALT EMULSION

Polymer emulsified asphalt shall be a quick traffic, quick cure (QT-QC) type, shall be a homogeneous brown color throughout and show no separation after thorough mixing, shall break and set on the aggregate within five (5) minutes and shall be ready for cross-traffic within fifteen

(15) to forty five (45) minutes. The polymer asphalt emulsion, upon standing undisturbed for a period of twenty-four (24) hours, shall show no white or milky colored substance on its surface and conform to the requirements in Table I.

TABLE I

Test on Emulsion	**Test Method**	**Requirement**
Viscosity, SSF, @ 77 degrees F, sec	ASTM D244	15-90
pH		1 to 3
Distillation Residue %, Minimum		60
Test on Residue from Distillation Test		
Penetration, 77 degrees F., 100g, 5s	ASTM D5	40-80
Softening Point (Ring & Ball), degrees F	ASTM	130 +
Ductility, 77 degrees. F,(25C, 5 cm/Min., Minimum	ASTM D113	25
Fraass-Breaking Point (degrees C.) min.	DIN 52012	-18

WATER
Water shall be potable, free of harmful soluble salts and shall be of such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work.

AGGREGATE
Aggregate shall consist of sound, durable, crushed stone or crushed gravel and approved mineral filler. The material shall be free from vegetable matter and other deleterious substances. Aggregates shall be 100% crushed with no rounded particles, volcanic in origin and black in color, as supplied by George Reed, Table Mountain Plant, Sonora, CA., or equal. The use of gray or light-colored aggregate will not be allowed. The percentage composition by weight of the aggregate shall conform to the following grading:

Type II	
Sieve Sizes	**Percentage Passing**
3/8"(9.5- mm)	100
No. 4(4.75- mm)	90-100
No. 8(2.36- mm)	65-90

No. 16(1.18- mm)	40-70
No. 30(600- um)	25-50
No. 200 (75- um)	5-15
Theoretical asphalt content, % based on dry aggregate	7.5-13.5
Approximate application rate (Pounds/Square Yard)	14-18

The aggregate shall also conform to the following quality requirements:

Test	Test Method	Requirement
Sand Equivalent or ASTM D2419	California Method 217	60 Min.
Durability Index	California Method 229	55 Min.

Type III: The percentage composition by mass of the aggregate shall meet the following grading requirements when tested in conformance with California Test 202:

Type III	
Sieve Sizes	**Percentage Passing**
9.5-mm	100
4.75-mm	70 - 90
2.36-mm	45 - 70
1.18-mm	28 - 50
600-um	19 - 34
75-um	5 - 13

The Type lll aggregate shall conform to the following additional quality requirements:

Test	Test Method	Requirement
Sand Equivalent	ASTM D2419	65 Min.
Durability Index	California Test 229	55 Min.
Abrasion Resistance*	ASTM C131	30% maximum after 500

		revolutions
* Abrasion Resistance is to be performed on the parent aggregate before crushing.		
If the results of the aggregate grading do not meet the gradation specified, the microsurfacing represented by the test shall be removed. However, if requested in writing by the Contractor and approved by the Engineer, the microsurfacing may remain in place and the Contractor shall pay to the State $2.00 per tonne for the aggregate represented by the test and left in place.		

POLYMER

Styrene Butadiene Rubber latex polymer shall be added to the water/soap phase by injection prior to the mill manufacture of the asphalt emulsion by the emulsion producer. The polymer shall be BASF NX 1118 or approved equal. The amount of polymer solids shall be between 3 and 4 percent of the asphalt residual content and shall be certified by the emulsion producer on each load of emulsion delivered to the job site. No post or field addition of polymer will be allowed. Samples of polymer shall be provided and shall conform to the following requirements.

Test	Requirement
Total Solids, min %	60
Bound Styrene %	24 - 60
pH at 25 Degrees C	4.2 - 5.2
Brookfield Viscosity RVT	1000 - 4000
Residual Monomer %	0.08 max.

MINERAL FILLER

The mineral filler shall be either Portland cement or other approved mineral fillers, if required. Portland cement if used, shall be commercially available Type I-II and shall be free of lumps and clods.

B. MIX DESIGN

At least 7 working day before slurry seal placement commences, the Contractor shall submit to the Engineer for approval a laboratory report of tests and proposed mix design covering the specific materials to be used on the project. The percentage of asphalt emulsion proposed in the mix design shall be within the percentage range specified in Section 2.04 “Proportioning”.

The tests and mix design shall be performed by a laboratory capable of performing the applicable International Slurry Seal Association (ISSA) tests. The proposed slurry seal mixture shall

conform to the requirements specified when tested in accordance with the following tests:

Test	ISSA Test Method	Test Requirement
Slurry Seal Consistency, cm	T106	3 max.
Wet Stripping	T114	Pass
Compatibility	T115	Pass (a)
Cohesion Test, kg - cm within 1 hour	T139	20 min. (b)
Wet Track Abrasion, g/sq. ft.	T100	75 max.
(a). Mixing test must pass at the maximum expected air temperature at the project site during application.		
(b). Using project source aggregate asphalt emulsion and set-control agents if used.		

The laboratory report shall be signed by the laboratory that performed the tests and mix design and shall show the results of the tests on individual materials, comparing the test results to those required by the specifications. The report shall clearly show the proportions of aggregate, filler (as determined from the tests, minimum and maximum), water (minimum and maximum), asphalt solids content based on the dry weight of aggregate and set-control agent usage. Previous laboratory reports covering the same materials may be accepted provided they are made during the same calendar year.

PROPORTIONING

Asphalt emulsion shall be added at a rate determined by the mix design and in the range of the table above. A job mix design shall be submitted by the Contractor for approval by the Engineer that conforms to the specification limits, and that is suitable for the traffic, climate conditions, curing conditions and final use. This will include recommended application rate of slurry to suit the job conditions.

The Slurry Seal mixture shall be proportioned by the operation of a single start/stop switch or lever which automatically sequences the introduction of aggregate, emulsified asphalt,

admixtures, if used, and water to the pug mill.

Calibrated flow meters shall be provided to measure both the addition of water and liquid additives to the pug mill. If necessary for workability, a retarding agent, that will not adversely affect the seal, may be used.

Water, and retarder if used, shall be added to ensure proper workability and (a) permit uncontrolled traffic on the slurry seal no more than three (3) hours after placement without the occurrence of bleeding, raveling, separation or other distress; and (b) prevent development of bleeding, raveling, separation or other distress within fifteen (15) days after placing the slurry seal.

C. MIXING AND SPREADING EQUIPMENT

The Slurry Seal shall be mixed in a self-propelled mixing machine equipped with a continuous flow pug mill capable of accurately delivering and automatically proportioning the aggregate, emulsified asphalt, water and additives to a double shafted, multi-blade pug mill mixer capable of minimum speeds of 200 revolutions per minute.

A minimum of two operational mixing machines of 12 cubic yard capacity, or larger, shall be maintained on the project. The mixed slurry seal retention time in the pug mill shall be less than three seconds. No retention of mixed slurry seal shall be allowed within the pug mill by gate shut-off or other mechanical means. Any machines with pugmill retention or shut-off gates shall have them removed prior to being used on this project. The mixing machine shall have sufficient storage capacity of aggregate, emulsified asphalt, and water to maintain an adequate supply to the proportioning controls.

The mixing machine shall be equipped with hydraulic controls for proportioning the material by volume to the mix. Each material control device shall be calibrated, properly marked, preset and lockable at the direction of the Engineer. The mixing machine shall be equipped with a water pressure system and nozzle type spray bars to provide a water spray immediately ahead of the spreader box.

The mixing machine shall be equipped with an approved fines feeder that provides a uniform, positive, accurately metered, pre-determined amount of a mineral filler, if used, at the same time and location that the aggregate is fed.

The slurry mixture shall be uniformly spread by means of a controlled spreader box conforming to the following requirements:

The spreader shall be capable of spreading a traffic lane width and shall have strips of flexible rubber belting or similar material on each side of the spreader box and in contact with the pavement to prevent loss of slurry from the box. The box shall have baffles, or other suitable devices, to insure uniform application on super-elevated sections and shoulder slopes. Spreader boxes shall be maintained in such a manner as to prevent chatter (wash boarding) or other surface defects that will affect the esthetic value of the finished slurry seal mat.

The rear flexible strike-off blade shall make close contact with the pavement and shall be capable of being adjusted to the various crown shapes so as to apply a uniform slurry seal.

Slurry mixture, to be spread in areas inaccessible to the controlled spreader box, may be spread by other approved methods.

D. PLACEMENT

The slurry seal shall not be placed if either the pavement or the air temperature is below 55 degrees F (13C) and falling, but may be applied when both the air and pavement temperature is 45 degrees F (7C) or above and rising. The mixture shall not be applied if high relative humidity prolongs the curing beyond a reasonable time.

Before placing the slurry seal, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to remove all loose particles of paving, all dirt and all other extraneous material.

48 hours prior to the slurry seal operations, the contractor shall notify all residents, businesses and agencies with an approved written notice detailing the streets and limits of work to be done along, with the hours of work. The contractor shall also post all streets with temporary "No Parking - Tow Away" signs at 75 foot staggered intervals. These signs shall also state the day of the week and hours of no parking.

Immediately before commencing the slurry seal operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and paper or plastic. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. Covers are to be uncovered and cleaned of slurry material by the end of the same work day.

Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. The mixture shall be uniform and homogeneous after spreading on the existing surface and shall not show separation of the emulsion and aggregate after setting.

Adequate means shall be provided to protect the slurry seal from damage from traffic until such time that the mixture has cured sufficiently so that the slurry seal will not adhere to and be picked up by the tires of the vehicles.

For the purpose of this project, the construction zone is defined to include all stockpile staging areas and travel routes to/from streets where the slurry seal is to be applied.

The Contractor shall abide, at all times, to the State of California, Department of Transportation's "Manual of Traffic Controls for Construction and Maintenance Work Zones" as applicable to this project.

Any deviations shall not be made without prior written approval from the project engineer.

CS12-05. OIL TREATMENT: Oil treatment shall only be permitted at the discretion of the City Engineer. Oil treatment shall consist of application of asphalt rejuvenating agent to designated street pavements, application of sand, and subsequent sweeping of residual sand.

The mixture to be placed by the Contractor shall be two parts of the asphalt rejuvenating agent concentrate mixed with one part water. The water shall be potable and uncontaminated with any materials which may affect the performance of the asphalt rejuvenating agent mixture. Asphalt rejuvenating agent shall comply with the requirements of Section SS12-05 - Recycling Agent, of these Standard Specifications.

The application rate shall be as directed by the City Engineer but shall nominally be 0.080 gallons of asphalt rejuvenating agent mixture per square yard. The City Engineer reserves the right to vary the application rate without limitation to minimize excess unabsorbed mixture. No additional compensation shall be allowed the Contractor for complying with these requirements.

The Contractor shall apply the asphalt rejuvenating agent mixture in an acceptable, to City Engineer, workmanlike manner. Operators of the distribution truck shall be experienced, safe and capable in all aspects of the vehicle operations and placing of this mixture.

The distribution trucks shall be serviceable and properly equipped with distribution equipment to apply the mixture evenly and uniformly. Any vehicles having equipment which results in puddling, skips, bare spots or uneven application shall be removed from the work until properly repaired. Contractor to provide a 300 ft. long test run to verify proper working condition of distribution equipment.

Actions or performance of vehicles and/or operators, which results in material being deposited in any location, except upon the asphalt concrete of the scheduled street, shall result in the Contractor being required to clean up the unacceptable work at no additional cost to the City and perform the work in an acceptable manner.

Sand used for oil treatment shall be fine granular material naturally produced by the disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay and other deleterious substances. Sand shall be thoroughly suitable for absorbing excess asphalt rejuvenating agent and provide adequate traction for traffic.

The Contractor shall apply sand to the rejuvenated asphalt surface 45 minutes to one and one-half hours after the application of the asphalt rejuvenating agent, or as directed by the City Engineer. The sand shall be spread evenly and uniformly over the entire rejuvenated area with equipment and methods approved by the City Engineer.

The application rate shall be one to two pounds per square yard. The exact rate is to be determined in the field by the City Engineer.

The Contractor shall return to the job site two to five days after the application of the sand and

shall remove all loose sand by power brooms and hand brooms, as directed by the City Engineer.

CS12-06. REJUVENATING AGENT: Asphalt rejuvenating agent conforming to the following specifications shall be applied diluted 2 parts agent to 1 part water before the processed pavement is opened to traffic, preferably within 30 minutes, but in no event more than 8 hours after compaction. The exact rate of application will be determined by the City Engineer, in the range of 0.10 to 0.20 gallons per square yard. Determination based upon tests provided by contractor. Spreading equipment shall conform to Section SS12-04 of these Specifications.

Asphalt recycling or rejuvenating agent shall be "Reclaimite" as formulated and marketed by Witco Chemical, or equal. The asphalt rejuvenating agent shall be a petroleum resin-oil base emulsified with water for the purpose of rejuvenating asphalt concrete and shall conform to the following physical and chemical requirements.

Specification Designation	Test Method	Requirements
Viscosity, S.F., at 77 F.	ASTM D244-60	15-40 Sec.
Residue (1)	ASTM D244-60 (Mod)	60-65% Min.
Miscibility Test (2)	ASTM D244-60 (Mod)	No Coagulation
Sieve Test (3)	ASTM D244-60 (Mod)	0.10% Max.
Particle Charge Test	ASTM D244-60	Positive
Tests on Residue from	ASTM D244-60 (Mod):	
Viscosity, cs., 140 F.	ASTM D445	100-200 Sec.
Asphaltenes	ASTM D2006-65-T	100-200 Sec.
Maltenes Dist. Ratio	ASTM D2006-65-T	0.3-0.5
$\frac{PC + A}{S + A}$ (4)		

1) STM D244 Modified Evaporation Test for percent of residue is made by heating a 50 gram sample to 300 F until foaming ceases, then cool immediately and calculate results.

2) Test procedure identical with ASTM D244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.

3) Test procedure identical with ASTM D244 except that distilled water shall be used in place of 2% sodium oleate solution.

4) In the Maltenes Distribution Ratio Test by ASTM Method D2006-65-T:

PC	=	Polar Compounds	A	=	First Acidaffins
A	=	Second Acidaffins	S	=	Saturates

The materials shall have a record of satisfactory service as an asphalt rejuvenating agent; such satisfactory service being based on the capability of the material to increase the ductility and penetration of the asphalt binder in the pavement surface.

Certified weighmaster certificates shall be submitted showing weight of rejuvenating agent concentrate, the diluted mixture and any unused material to be returned.

CS12-07. SAND SEAL:

A. Description: This work shall consist of application of asphalt emulsion and screening in accordance with Section 37 and Section 94 of the State Standard Specifications.

B. Condition of Surface: Before any surface receives a seal coat, it shall be thoroughly cleaned of all dust and dirt and any loose material. The variation of the existing surface from the testing edge of a straightedge between any two contacts with the surface shall not exceed 3/16 inch. All depressed areas shall first be repaired. Method of repair shall be submitted and approved by the City Engineer prior to start of work.

C. Weather Conditions: Sealing shall not be attempted when surface temperature of pavement or ambient temperature is below 50 degrees F. or when rain is forecast.

D. Asphalt Binder: Asphalt Emulsion shall not be CRS-1h conforming to requirements for CRS-1 in Section 94 of the State Standards except that the Penetration at 75 degrees F. on the Residue from Distillation Test shall be between 40 and 90. The emulsion shall be delivered and applied at a temperature between 75 degrees F. and 130 degrees F.

E. Aggregate; Sand shall be free from clay or organic material, suitable fro the purpose of sand seals, and shall be of such size that twenty (20) percent shall pass a No. 30 sieve and not more than one (1) percent shall pass a No. 200 sieve. The sand shall have a minimum Fineness Modulus (FM) of 3.5.

G. Application of Sand Seal Emulsion; The spray truck shall be capable of spraying the oil consistently at rates in the range of 0.12 to 0.25 gallons per square yard and shall be maintained in good working order. The typical spray rate shall be 0.15 gallons per square yard.Each distributor truck shall be equipped, at all times, with its proper measuring stick and calibration card. On-site calibration of distributor trucks, for determining actual spread rate of asphalt emulsion, shall be performed when directed by the City Engineer. A two-axle, short wheel base, distributor truck is required for all cul-de-sac and radii.

NOTE: Computer controlled distributor trucks with spread rate and quantity printouts are required for asphalt emulsion application.

H. Temporary Traffic Striping and Markings: All permanent striping and markings shall not be applied to a sand seal surface until a minimum of 14 calendar days has passed. The Contractor shall be responsible for maintaining all temporary striping, markings, and construction signs. The Contractor shall review the temporary traffic control on a daily basis. All costs associated with maintaining the temporary traffic striping, and markings shall be paid for by the Contractor.

CS12-08. SEAL COATS:

A. Description: The work covered by this specification includes the design, testing and quality control for this proper production of the asphalt seal coat product and all materials, equipment and workmanship required for the application of seal coat to an existing asphalt concrete pavement.

B. Materials: The materials for Asphalt Seal coat immediately prior to mixing shall conform to the following requirements:

1. Asphaltic Emulsion: Asphaltic Emulsion shall be SS1h, conforming to the requirements in Section 94 of the California State Standards Specifications, “Asphalt Emulsions”. Table 1 or 2 of Section 94, with the exceptions of the penetration on residue from distillation which shall conform to the value of 20 to 60, or Clay stabilized emulsion, with a pH not greater than 7.0 and solids content of not less than 45 percent (45%). Two percent (2%) latex shall be added into the seal coat. The properties of the SS1h shall be determined in accordance with AASHTO designation T59 “Testing Emulsified Asphalt”.

   NOTE: Coat tar emulsion and Gilsonite products are not acceptable products.

2. Mineral Aggregate: Mineral Aggregate shall be one hundred percent (100%) passing a #16 mesh sieve and be clean of all decomposed materials or organic materials. The sieve analysis of the Mineral

Aggregate shall be determined in accordance with A.S.T.M. test Method C136 or Cal Test 202.

C. Mix Design: A mix design shall be submitted to the City a minimum of ten (10) working days prior to placement of the seal coat. The Contractor shall submit lab and test results and Manufacturer Certificate of Compliance covering proposed material.

Asphalt seal coats, as manufactured and tested by the Asphalt Seal Coat Manufacturers Association, shall be undiluted and conform to the following:

	MINIMUM	MAXIMUM	METHOD
Weight (per gallon)	9.0 pounds		A.S.T.M. D244
Con Penetration at 77 degrees F. dmm	340 mm	700	A.S.T.M. D217
% Non-Volatile	50		A.S.T.M. A-1*
Loss on ignition of insoluble residue %		16	
% Non-Volatile soluble in Triclorethylene	10	35	A.S.T.M. D2042
Solubility of residue in C2HCL	15	20	
Wet track Abrasion		35 gram loss	A.S.T.M. D3910
Mineral Aggregate Components	#16 Sieve 100% passing		A.S.T.M. C136
Dried Film Color	Black		
Dehydration, 96 hours at 100 degrees F.	0.6 min.		

Viscosity	75 KREB		A.S.T.M. D562
Accelerated Weathering (2 yr. Exposure)	No Deterioration		Fed Spec TT-C 555B

** Weigh 10 grams of homogenous product into a previously tarred, small ointment container. Place in a constant temperature oven at 325 degrees F. for 90 minutes. Cool, re-weigh and calculate the non-volatile components.*

The following mix design shall be incorporated in a two-step seal coat application process:

FIRST APPLICATION

- 100 gallons seal coat material
- 200 pounds silica sand (30 mesh)
- 2 gallons latex copolymers
- Appropriate gallons of potable water for dilution

SECOND APPLICATION

- 100 gallons seal coat material
- 2 gallons latex copolymers
- Appropriate gallons of potable water for dilutions

D. Surface Preparation: The surface preparation to receive the asphalt seal coat must be free of all foreign material and completely dry prior to seal coat application. Cleaning of the surface may be made by air, vacuum, mechanical sweeping, washing pr any other method approved by the City Engineer. All oil and grease deposits shall be removed prior to applying the seal coat. The application of an oil seal may be required prior to placement of the seal coat. The seal coat must not be applied without first obtaining the City Engineer s approval.

Cracks in excess of on-quarter inch (1/4") and less than one inch (1") in width must be sealed with an approved method prior to placement of the seal coat. The crack cleaned by routing or compressed air. Crack sealer shall be latex modified sealer compatible with the asphalt seal coat. Cracks wider than on inch (1") in width shall be patched with asphalt concrete per Section CS-11, “Asphalt Concrete” of these Standard Specifications.

On weathered surfaces or areas such that cleaning operations has left a film of dust, a tack coat of SS1h conforming to Section 94 of the State Standards Specifications shall consist of one (1) part SS1h and four (4) parts water or two (2) parts asphalt seal coat with one (1) part water and applied at a rate of 0.10 gal/sq. yd. The tack coat shall be completely dry prior to the placement of the asphalt seal coat. On new asphalt surfaces, asphalt seal coats shall not be placed on a new asphalt surface until after a sixty (600 day cure period or as directed by the City Engineer.

E. Application: Seal coats shall be applied in a two-step application process. Application of the seal coat shall be by mechanical means using a rubber faced

squeegee with the curved portion of the squeegee spreading the seal coat. The asphalt seal coat shall be applied in a uniform free flowing method, free of lumps and other solids. Potable water may be added per the manufacture s recommendation not exceeding ten percent (10%) by volume. If the seal coat is unsuitable after the addition of the water, the seal coat shall be rejected and removed from the project. Application rates will vary depending on the texture of the existing asphalt surface receiving the seal coat. The surface may require a second seal coat over the first seal coat if the surface is rough. The following application rates are to be used as a guideline. The City Engineer will make the final determination as far as the application rates to be used.

Asphalt seal coats shall be applied when ambient temperature and surface temperature is fifty degrees (50^{O}) and rising. Seal coats shall not be applied when ambient temperatures are in excess of eighty degrees (80^{O}) without the possibility of a pretreatment per the manufacture s recommendation. Seal coat shall not be applied within twenty-four (24) hours of rain or inclement weather. Traffic shall not be allowed on the seal coat for twenty-four (24) hours after the last application of the seal coat. All striping and markings shall not be applied to a seal coat surface until a minimum of 14 calendar days have passed. All asphalt seal coats shall be measured by the gallon before the addition of extra sand, binder, or water.

SURFACE TYPE	MINIMUM APPLICATION RATES
Smooth dense Surface	20 Gals. Per 1000 Sq. Ft.
Medium Surface with loss of fines	30 Gals. Per 1000 Sq. Ft.
Rough Aged Surface without cracks	40 Gals. Per 1000 Sq. Ft.*
Excessively Rough Surface	50 Gals. Per 1000 Sq. Ft.*

** The addition of #30 mesh sand with additional binder is recommended for the first coat. The addition of sand shall not exceed three (30 pounds per gallon with an approval of the City Engineer. Additional binder shall not consist of 1/10 gallon of SS1h.*

CS12-09. FOG SEAL:

A. Description: An application of a liquid asphalt to seal small cracks and surface voids and as a curing seal for Cement Stabilized Base Course.

B. Materials: The Contractor shall supply the asphalt material SS-1 in accordance with State Standard Specification Section 94, “Asphaltic Emulsions”.

C. Preparation; The City Engineer may request calibration certification of

Contractor's equipment before being used on the work. Prior to application of the Fog Seal, loose dirt or other objectionable material shall be removed from the prepared surface by brooming or by other methods acceptable by the City Engineer.

D. Construction: Fog Seal shall be applied only when the surface to be treated is dry, when the weather is not foggy or rainy, and when the surface temperature is above thirty two degrees (32^{O}) F. for application of cutback asphalts and shall be fifty degrees (50^{O}) F. for emulsions, or as otherwise approved by the City Engineer.

The asphalt material shall be applied by means of a self-powered pressure distributor equipped with the following control devices.

1. Tachometer.
2. Pressure gauge.
3. Adjustable length spray bar.
4. Positive displacement asphalt pump with separate power unit.
5. Heating coils and burner capable of applying even heat to the asphalt material.
6. Thermometer well and accurate thermometer.

Before applying asphalt material, the Contractor shall ensure that the application equipment meets the following adjustments and requirements:

1. The distributor vehicle will maintain a constant height of the spray bar as the tank is unloaded.
2. All spray bar nozzles are of the same manufacture, type, and size.
3. Clogged nozzles have been removed and cleaned with solvent.
4. All nozzles have been set in the spray bar so that the nozzle slots make the same angle (15^{O} to 30^{O}) with the longitudinal axis of the spray bar.
5. The spray bar has been adjusted to the correct height to ensure uniform application without streaking.
6. The spray bar has been provided with a positive shut-off to prevent dribbling.
7. The distributor is capable of maintaining a uniform speed.

The asphalt emulsion shall be uniformly applied without streaking. Joints and seams shall not be excessively overlapped. Structures, wheel guards, guardrail, and other roadway appurtenances shall not be spattered by the asphalt material. The Contractor shall remove, at his own expense, any spattering caused by his operation.

CS12-10. PAYMENT: Under this item of the Proposal, the Contractor shall bid a price per square yard for seal coats over asphalt pavement.

1. Chip Seal -- The contract price paid per square yard of chip seal shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the chip seal, complete in place, including cleaning the surface, spreading and mixing materials as required, protecting the chip seal until it has set and is ready for traffic, traffic control, and clean-up, all as shown on the plans, and as specified in these special provisions and any referenced standard specifications or manuals.

2. Slurry Seal -- The contract price paid per square yard of slurry seal shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the slurry seal, complete in place, including cleaning the surface, spreading and mixing materials as required, protecting the slurry seal until it has set and is ready for traffic, traffic control, and clean-up, all as shown on the plans, and as specified in these special provisions and any referenced standard specifications or manuals.

3. Oil Treatment -- Asphalt recycling (rejuvenating) agent will be paid for at the contract unit price per ton by certified weight. All other tasks under this item, including cleaning the surface, traffic control, sanding and clean-up will be paid for on a square yard basis.

4. Recycling Agent Concentrate -- Recycling agent concentrate will be paid for at the contract unit price per ton by certified weight. The certified weight shall be determined by weighing on sealed scales regularly inspected by the State Bureau of Weights and Measures. The unit price shall include full compensation for cleaning the surface, furnishing, applying the recycling agent, traffic control and clean-up.

5. Sand Seal, Seal Coat or Fog Seal -- The contract price paid per square yard of Sand Seal or Seal Coat shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the sand seal, complete in place, including cleaning the surface, spreading and mixing materials as required, protecting the fog seal until it has set and is ready for traffic, traffic control, and clean-up, all as shown on the plans, and as specified in these special provisions and any referenced standard specifications or manuals.

CONSTRUCTION SPECIFICATIONS

SECTION 13 - PORTLAND CEMENT CONCRETE CURB, GUTTER, & SIDEWALK

CS13-01. ITEM: The Contractor shall furnish Portland cement concrete median or planter curb; curb and gutter (vertical or rolled); sidewalk, driveway or alley; and any specialty item in place as shown on the contract plans and as specified herein. The materials and methods of placing concrete shall conform to Sections 73 & 90 of the State Specifications. Design and construction shall conform to City of Dixon Construction Specifications and Details.

CS13-02. AGGREGATE BASE MATERIAL: Aggregate base material when required as subgrade for concrete shall be Class 2, aggregate base as specified in Section CS10-02. of these specifications.

CS13-03. DESIGN MIX: For all concrete projects the design mix shall be Class 1 (6 sack), per the State Standard Specifications. If the special provisions require submittal of a design mix, the Contractor shall furnish copies of the mix design to the City Engineer at least 48 hours in advance to the placement of any Portland cement concrete. A Certificate of Compliance shall be furnished by the Contractor to the City Engineer after the completion of the project.

CS13-04. CONCRETE PLACEMENT: Concrete shall be placed within ninety (90) minutes after it has been mixed unless otherwise authorized by the City Engineer. It shall be placed on clean, thoroughly dampened surfaces free from mud, debris, frost, excess water or objectionable coatings. Concrete shall be worked into the corners of the forms and around all reinforcement and embedded items without permitting the materials to segregate. Concrete shall not be placed under adverse weather conditions such as rain, high wind or extreme temperatures. All concrete placing equipment and methods shall be subject to approval.

Slump shall not exceed 4" for all formed work, and 2" for extrusion machine use. Slump testing and test cylinders may be required at the discretion of the City Engineer at the Contractor's expense.

CS13-05. EXPANSION JOINTS, WEAKENED PLANE JOINTS: Expansion joints, weakened plane joints and score marks shall be placed in accordance with City of Dixon Construction Details unless otherwise shown on the contract plans. Score marks, grooves and other required impressions shall be carefully aligned to produce a final product of uniform size and shape.

CS13-06. FINISHING CURB AND GUTTER: Prior to removal of any forms, the surface shall be finished true to grade by means of a straightedge float.

In the construction of the perpendicular curb, and immediately after removing the front curb forms, the face of the curb shall be worked with a trowel to present a smooth even surface, followed with a final fine brush finish with brush strokes parallel with the top of the curb.

The face of the finished curb shall be true and straight, and the top surface of the curbs and gutters shall be of uniform width, free from humps, sags or other irregularities. Surface shall be fine brush finished in accordance with City of Dixon Construction Details.

It is further required that as soon as the surface of the gutter has set sufficiently to permit the introduction of a shallow stream of water without causing damage to the gutter surface, same shall be applied and all flow line irregularities shall be corrected before the concrete surface has taken initial set.

The letter "S" shall be stamped over each sanitary sewer service and the letter "W" shall similarly be stamped over each water service. Said letter size and letter style to be approved by the City Engineer. The letter shall be placed at top of curb on vertical curb, gutter and sidewalk and top of roll on roll curb, gutter and sidewalk.

CS13-07. FINISHING SIDEWALK: After the concrete for the sidewalk has been placed, the concrete shall be struck off to proper section. The surface shall then be wood floated in a longitudinal direction so that the final finished surface shall not vary more than one-eighth (1/8") from a ten (10') foot straightedge except at grade changes. The final finish shall be accomplished with a fine hair broom made with light continuous straight strokes perpendicular to the direction of the sidewalk. The City Engineer may modify the method of finish to fit the requirements of the job. All exposed surface edges shall be neatly rounded with an edging trowel. Surface markings and lines shall be made when specified by the City Engineer and in a manner specified by the City Engineer.

CS13-08. DAMAGE AND REPAIRS: All damage done or openings cut in concrete walks, curbs or gutters during the progress of the work shall be repaired by the Contractor to the satisfaction of the City Engineer. Any necessary patching due to faulty construction or failure of concrete to properly set shall be done to the satisfaction of the City Engineer without additional cost to the City.
Any damage done to A.C. pavement shall be repaired by saw cutting A.C. and replacing damaged section in accordance with Section CS11 of these specifications. The area to be replaced shall extend at least two feet out from the lip of gutter or as determined by the City Engineer. See Construction Detail 3130.

CS13-09. RECONSTRUCTION OF DRIVEWAYS: Driveways to be widened or reconstructed shall be removed to the edge of pavement. If adjacent A.C. is damaged it shall be replaced as described in CS13-08 and Construction Detail 3130. Existing curb, gutter and sidewalk shall be sawed to a minimum depth of one and one-half (1-1/2") inches at the limits indicated and the concrete between the sawed joints shall be removed cleanly with no spalling of the sawed edge. A minimum 5 foot of sidewalk shall be left between new driveway and existing joints or section must be removed to the joint.

CS13-10. GRADE AND INSPECTION: No alteration, repair or construction will be undertaken without having grade approval by the City Engineer. No concrete pouring will be undertaken until the forms and subgrade have been approved by the City Engineer. Should the

City Engineer deem necessary, the Design Engineer shall verify forms and subgrade prior to concrete pouring. The City Engineer may notify the Design Engineer, if deemed necessary, that a problem may exist and require verification of the finish grades prior to pouring of concrete and placing of pavement.

CS13-11. PAYMENT: Payment for placing concrete items shall be either at the contract price bid per lineal foot, at the contract price bid per square foot for curb, gutter and sidewalk and at the contract price per item for driveways and curb ramps. The method used on any work will be shown by the list of quantities on the proposal and by the type of unit price requested in the proposal.

The price bid on each of the concrete items shall include full compensation for preparing the subgrade; dampening the subgrade (furnishing the water); furnishing, placing and later removing necessary forms and form work; furnishing the concrete; finishing the concrete; curing the concrete; furnishing and placing expansion joint material; furnishing and placing dowels and reinforcement; and doing such other work as may be necessary to construct each of the concrete items as shown by the contract plans.

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CONSTRUCTION SPECIFICATIONS

SECTION 14 - BAR REINFORCING STEEL

CS14-01. ITEM: Under this item of the Proposal, the Contractor shall furnish and place the type and grades of bar reinforcing steel as indicated in the plans and specifications and as directed by the City Engineer.

CS14-02. MATERIAL AND PLACEMENT: Bar reinforcing steel and method of placing shall conform to Section 52 of the State Specifications.

CS14-03. PAYMENT: Payment for placing reinforcing steel shall be either at the contract price bid per ton or shall be included in the prices bid for other items of work and that no additional compensation will be allowed therefore. The method used on any work will be shown by the list of quantities on the proposal.

The quantity of bar reinforcing steel shown on the plans and Proposal shall be the final quantity for which payment will be made, as provided in Section 9-1.015 of the State Specifications. Payment for reinforcing steel shall include full compensation for furnishing all steel, for cutting and bending, for placing, for furnishing all wire, stirrups, hangers, and placement devices, for cleaning the reinforcement, and for insuring the proper placement of the steel reinforcement in the finished structure.

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CONSTRUCTION SPECIFICATIONS

SECTION 15 - PORTLAND CEMENT CONCRETE CURB RAMPS

CS15-01. ITEM: Under this item of the proposal, the Contractor shall construct handicap ramps for the physically handicapped in existing curb, gutter, and sidewalk as indicated in the plans and specifications. Design and construction shall conform to Construction Details 3140, 3150, 3160, 3170 and 3180.

CS15-02. DETECTABLE WARNING SURFACE: Detectable warning surfacing shall be installed on curb ramps as noted on the Construction Details. Where applicable, the surfacing shall extend across the full width and depth of the ramp landing. Detectable warning surfaces shall be Armor-Tile surface applied for existing curb ramp installations and Armor-Tile cast-in-place applied for new curb ramps, or City approved equal. All truncated domes shall be in-line configuration.

CS15-03. PAYMENT: Payment for constructing handicap ramps shall be at the contract price bid per each. The price bid for handicap ramps shall include full compensation for preparing the subgrade; dampening the subgrade (furnishing the water); furnishing, placing and later removing necessary forms and form work; furnishing the concrete; finishing the concrete; curing the concrete; furnishing and placing expansion joint material; furnishing and placing detectable warning surfaces (either surface applied or cast-in-place); furnishing and placing dowels and reinforcement; and doing such other work as may be necessary to construct the handicap ramps as shown by the contract plans.

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CONSTRUCTION SPECIFICATIONS

SECTION 16 - WATER SYSTEM

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PART 1 - GENERAL

CS16-01 ABBREVIATIONS & DEFINITIONS:

ARV: Air-and-vacuum relief valve

AWWA: American Water Works Association, 6666 Quincy Ave., Denver CO, 80235

Contractor: the entity performing the construction work described herein.

City Engineer: the City of Dixon City Engineer, as used herein means the Engineering Manager of the City of Dixon.

DCDA: Double Check Detector Assembly

Fabricated: refers to components to be installed in the water system that are made or assembled by the Contractor or its subcontractors.

fps: feet per second

gpm: gallons per minute

HDPE: high-density polyethylene pipe

Improvement Plans: plans prepared for the Owner detailing specific project improvements.

Inspector: all persons employed by the City of Dixon responsible for inspection of City improvements.

Manufactured: refers to components to be installed in the water system that are purchased pre-fabricated by the Contractor.

Owner: the entity sponsoring a project.

PE: polyethylene

psi: pounds per square inch

PVCP: polyvinyl chloride pipe

RP: reduced pressure backflow preventer

RPDA: reduced pressure detector assembly
Standard Detail Sheets: the City of Dixon Standard Details included in the Construction Specifications.

Construction Specifications: a section of the City of Dixon Engineering Design Standards and Construction Specifications, including this Section.

USA: Underground Service Alert

CS16-02 INTENT OF THE SPECIFICATIONS AND DETAILS: The size and configuration of the various components of the water system shall be as indicated herein, in the Standard Details, and in the approved Improvement Plans, if any. The work shall be completed in a competent manner to insure an operable and watertight condition.

CS16-03 RELATED WORK: Refer to the following sections of the Construction Specifications for additional requirements.

Section 4	Imported Borrow
Section 6	Trench Excavation
Section 7	Trench Bedding and Backfill
Section 8	Surplus Material Disposal
Section 9	Aggregate Subbase
Section 10	Aggregate Base
Section 11	Asphalt Concrete
Section 14	Bar Reinforcing Steel

CS16-04 STANDARDS: All construction of the water system shall conform to the AWWA Standards and the City of Dixon Engineering Standard Specifications and Details unless otherwise noted in this Section. The California Regulations Related to Drinking Water, CCR Title 17 and CCR Title 22 apply as well.

CS16-05 SUBMITTALS: The Contractor shall submit the following:

A. Paint color charts for selection by the City of Dixon.
B. Five (5) copies of shop and fabrication drawings for approval.
C. Certificates of compliance with specified standards for PVC pipe and elastomeric gaskets (see Section CS16-08.3.1).

CS16-06 INSPECTION:

6.1 Reference:

Refer to General Provisions Section G6-4**,** Inspection.

6.2 Designated Inspector:

The inspector for a project will be employed by the City of Dixon. Notification will be

made to the Contractor, either verbally or in writing, of who will be inspecting the project.

6.3 Access:

The State Department of Health Services, the City Engineer, and their authorized agents and inspectors shall at all times have access to the work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

6.4 Notification:

If the Specifications, the City Engineer instructions, laws, ordinances or any public authority require any work to be specially tested or approved, the Contractor shall give the City Engineer timely notice of readiness for inspection. If the inspection is by an authority other than the City Engineer, said notice shall include the time set for said inspection.

6.5 Exposure of Unauthorized Work:

If any work is performed without the approval or consent of the City Engineer, it must, if required by the City Engineer, be exposed for examination at the Contractor's expense, irrespective of whether the work exposed is found to be defective or not.

6.6 Exposure of Questionable Work:

Re-examination of questionable work may be ordered by the City Engineer, and if so ordered, the work must be uncovered by the Contractor. If such work is found to be in accordance with the Specifications and Improvement Plans, if any, the City will pay the cost of re-examination and replacement. If such work is found to not be in accordance with the Specifications and Improvement Plans, if any, the Contractor shall pay such cost, unless it can be shown that the defect in the work was caused by another contractor, and in that event the City shall pay such cost.

6.7 Obligations Not Relieved:

The inspection of the work shall not relieve the Contractor of any obligations to comply with the requirements of the Specifications and Improvement Plans, if any. Defective work shall be made good, and unsuitable materials may be rejected, notwithstanding that such work and materials have been previously overlooked by the City Engineer and accepted. If the work, or any part thereof, shall be found defective at any time before the final acceptance of the whole work, the Contractor shall within ten (10) calendar days make good such defect without compensation, in a manner satisfactory to the City Engineer. If the Contractor shall fail or neglect to make ordered repairs of defective work or to remove condemned materials from the work within ten (10) calendar days after direction by the City Engineer in writing to do such work or remove such materials, the City may make the ordered repairs or remove the condemned materials, by its own forces or by the use of others, and charge the cost thereof to the Contractor.

CS16-07 GUARANTEES AND WARRANTIES: Refer to General Provisions Section G4-11, Guarantee. Contractor also guarantees pipelines against leakage for the one-year guarantee period, which begins when the pipeline is accepted by the City. The Contractor shall repair all leaks and maintain the pipeline in a satisfactory operating condition during the guarantee period. Upon notice to the Contractor by the City of needed repairs, the Contractor shall undertake such repairs, including necessary dewatering, within forty eight (48) hours. Neither the guarantee nor the maintenance requirements shall apply to damage to the pipelines caused by an Act of God, negligence in the operation of the system, or acts of third parties.

-- End of Part 1 - General --

PART 2 - MATERIALS

CS16-08 PIPE AND PIPE FITTINGS:

8.1 Steel Pipe & Fittings:

8.1.1 Pipe & Fittings:

Steel pipe and fittings shall conform to AWWA C200 and be of the various wall thicknesses indicated in the Details, and Improvement Plans if any, but not less than one-quarter inch (¼") wall thickness. Welded steel pipe and fittings shall be electrically welded and fabricated from steel plate conforming to ASTM A283, Grade C or D, or ASTM A570, Grade 30 or 33. Seamless steel pipe and fittings shall conform to ASTM A53, and shall be Schedule 40, minimum. Fabrications shall conform to the configurations shown in the Details, and Improvement Plans if any.

8.1.2 Flanges for Steel Pipe & Fittings:

Flanges to be fitted onto steel pipe and fittings shall conform to AWWA C207, Class D, and may be ring or hub type. Blind flanges shall be flat faced. Nuts & bolts shall be ASTM A307, Grade B, and conform to AWWA C207. Gaskets shall be rubber, flat-faced, $^1/_8$" thick, suitable for potable water service and conforming to AWWA C207.

8.2 Ductile Iron Pipe & Fittings:

8.2.1 Ductile Iron Pipe:

Ductile iron pipe shall conform to AWWA C151. Joints shall be flanged type per AWWA C110 or C115. Provide standard thickness interior cement-mortar lining per AWWA C104. Provide standard thickness exterior coal tar coating per AWWA C151.

8.2.2 Ductile Iron Fittings:

Main pipeline fittings (including end caps, ells, tees and crosses) shall be ductile iron, conform to the requirements of AWWA C110 or C153, have flanged or mechanical joints, and be compatible with AWWA C900 (PVCP). Nuts & bolts shall be ASTM A307, Grade B, and conform to AWWA C110, Appendix A. Gaskets for flanged joints shall be rubber, flat-faced, $^1/_8$" thick, suitable for potable water service and conforming to AWWA C110. The interior of ductile iron fittings shall be coated with a cement mortar lining in accordance with AWWA C104. The exterior shall be coated with a petroleum asphaltic (coal tar) coating per AWWA C110 or C153, as applicable.

8.3 Polyvinyl Chloride Pipe (PVCP):

8.3.1 Water Main Pipe C900 and C905:

Water mains shall be PVC pressure pipe conforming to AWWA C900, Class 150, DR18, and AWWA C905, Class 165, DR25, unless otherwise noted. Where called for, C900 Class 200, DR14 or C905 Class 235, SDR 18 shall be installed. PVC shall be made of polyvinyl chloride compound 12454-B per ASTM D1784. PVC pipe outside diameters shall be iron pipe size. PVC shall be supplied in standard 20-foot lengths. Pipe joints shall be the bell-and-spigot type, self-centering, with O-ring elastomeric gaskets, conforming to ASTM D3139 and F477. The Contractor shall furnish certificates of compliance with the specified standards for the PVC pipe and elastomeric gaskets. Pipes used for distribution purposes must have a safety factor of 2.5, per AWWA C900

8.4 Polyethylene (HDPE) Pipe:

8.4.1 Up to and Including 1" Diameter:

PE pipe shall conform to AWWA C901, ASTM Designation D2239, PE 3408, SDR 7, and shall have a pressure rating of not less than 200 psi at 23°C. PE pipes up to and including one inch (1") in diameter shall be iron pipe size (IPS).

8.4.2 Over 1" Diameter:

PE pipe shall conform to ASTM Designation D2737, PE 3408, SDR 9, and shall have a pressure rating of not less than 200 psi at 23°C. PE pipes over one inch (1") in diameter shall be copper tubing size (CTS). PE pipe shall not be used for pipelines larger than three inches (2") in diameter.

8.4.3 Packaging of Polyethylene Pipe:

The pipe shall be coiled and packaged for protection against dirt and damage during shipment, handling and storage.

8.5 Brass Pipe:

Where called for, provide seamless red brass pipe suitable for use in water service lines and plumbing. Brass pipe shall conform to ASTM B43.

8.6 Pipe Couplings:

8.6.1 Mechanical Joint and Flanged Coupling Adapters:

Adapter bodies and end rings installed underground shall be ductile iron. Adapter bodies and end rings installed above ground may be fusion bonded epoxy-lined and coated steel or ductile iron. Bolts and nuts shall conform to AWWA C111, Appendix B. Gaskets shall be suitable for use with potable water and shall be suitable for the type of pipe being coupled. Anchor studs are not allowed when coupling to PVC pipe. All mechanical joints shall use restraints.

8.6.2 Compression Couplings:

Compression couplings (including straight, transition, reducing and end cap types) shall be ductile iron. Gaskets shall be suitable for use with potable water and shall be suitable for the type of pipe being coupled. Bolts and nuts shall conform to AWWA C111, Appendix B. All compression couplings shall use restraints.

8.6.3 Insulated Flanges and Couplings:

8.6.3.1 Insulation Points:

Install an approved, electrically insulating connection at the following locations:

1. At all pipe connections where dissimilar coating or lining materials occur.

2. At connections to other appurtenances where shown in the Details or Improvement Plans.

8.6.3.2 Flange Insulation Kits:

Kits shall consist of a central gasket, bolt sleeves, insulated washers and steel washers. The central gasket shall be reinforced. Insulating materials shall have sufficient strength to operate at the pressure rating of the pipe to which they will be coupled, and shall be suitable for direct burial. Flange insulating kits shall be submitted for use and approved by the City Engineer prior to use.

8.6.3.3 Insulated Mechanical Couplings:

Couplings shall be supplied with insulating boots. Insulating materials shall have sufficient strength to operate at the pressure rating of the pipe to which they will be coupled, and shall be suitable for direct burial. Insulated couplings shall be submitted for use and approved by the City Engineer prior to use.

CS16-09 VALVES:

9.1 General:

All sectionalizing valves four (3) inches and larger shall be flanged resilient wedge gate valves and conform to AWWA C509 or AWWA C515. Valve installations shall be complete with all gaskets, bolts and all else required to complete the valve in an operating, watertight condition. Valves shall have all ferrous interior surfaces fusion epoxy coated in conformance with the provisions of AWWA C550. Valves located underground shall have a coal tar coating in accordance with applicable provisions of AWWA C203, and all ferrous surfaces shall have a fusion bonded epoxy coating conforming to AWWA C550. All belowground valves shall be

provided with two inch (2") square operating nuts and have two (2) O-ring stem seals. Operating nuts shall be installed on the side of the valve closest to the curb. If the operating nut on belowground valves is deeper than 60", then a valve nut extension shall be installed (See Standard Detail 5190). Valves shall open when turned counterclockwise (left), and close when turned clockwise (right).

9.2 Gate Valves:

9.3.1 Below-Ground Gate Valves:

All below ground gate valves shall be of a resilient wedge design. They shall have a non-rising stem, and a cold water rated work pressure of 250 psi. Gate valves shall conform to the manufacturing standards set in AWWA C509 or AWWA C515. All below ground valves shall have a coal tar coating in accordance with applicable provisions of AWWA C203, and all ferrous surfaces shall have a fusion bonded epoxy coating conforming to AWWA C550

9.3.2 Above-Ground Gate Valves:

Shall have bronze body and shall be provided with a removable hand wheel.

9.3 Check Valves:

All check valves shall conform to the applicable provisions of AWWA C508, have the valve body and disc so proportioned that they will provide a passage fully equal in area of the nominal pipe size of the valve, when the valve is in the wide-open position, and shall have a pressure rating equivalent to that of the pipeline of which they are to become a part, or 150 psi, whichever is greater. Check valves shall be iron body, swing type, flanged, bronze fitted, have a bronze disc seating ring, and be furnished with an external lever and single weight or spring. Check valves shall be as manufactured by Eddy-Iowa, Bailey, or approved equal.

9.4 Air Release Valves (ARV):

All air release valves shall have the same pressure rating as the pipeline at the point of installation, and shall be Bermad Model 4415 or approved equal.

9.5 Butterfly Valves:

All butterfly valves shall conform to the applicable provisions of AWWA C504 and be the flanged (short body) type. Wafer-type valves shall be unacceptable. Valves shall be Class 150 pressure rating, show no leakage under 200-psi pressure. The use of butterfly valves is not permitted for underground us unless approved by the City Engineer.

CS16-10 FIRE HYDRANTS AND APPURTENANCES:

Hydrants shall be the wet-barrel type and have two 2½" outlets and one 4½" outlet. All outlets shall have National Standard threads and cast iron caps with bleed ports and chains. Hydrants shall be supplied with a factory-applied coat of “bright white” epoxy coating. Hydrant assemblies shall include break-off risers, break-off check valves and hub-end hydrant burys. Hydrants shall be Clow Valve Company, Model 960 three-way fire hydrant.

CS16-11 SERVICE LINE FITTINGS:

11.1 Service Saddles:

Saddles shall be sized for use on cast iron pipe size AWWA C900 PVC mains. Saddle bodies shall be the bronze, double-strap type. Saddles shall be provided with female iron pipe thread outlets per AWWA C800. Assembly hardware shall be silicon bronze or stainless steel. The gasket shall be of material suitable for use with potable water.

11.2 Curb Stops:

All curb stops shall be a lockable angle meter stop conforming to AWWA C800.See Details 5100, 5120, and 5200 for installation requirements.

11.3 Brass Fittings and Stops:

Brass tees, elbows, reducers, nipples, corporation stops, curb stops, and all other miscellaneous parts shall conform to the requirements of AWWA C800. All ¾-inch and 1" fittings for connecting to IPS PE pipe shall be Ford “Pack Joint” compression, Mueller "Insta-Tite" or approved equal. Fittings larger than 1" in size for connecting to CTS PE pipe shall be Ford "Pack Joint" or approved equal. .

CS16-12 WATER METERS:

Water meters shall be brass and conform to AWWA C700Water meters sized ¾” and 1”shall be Sensus Model SR-II. Water meters 1.5” and larger shall be Sensus Model OMNI C2. All meters shall have a 520 M smart point terminal. Meters are to read in cubic feet, and are to be furnished and installed by the City at the Owner's expense.

CS16-13 BACKFLOW PREVENTION ASSEMBLIES:

All backflow preventers shall be from the approved list of the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. Only reduced pressure principal and reduced pressure detector assemblies are acceptable for the required backflow protection as described in the City of Dixon Cross Connection Control and Backflow Prevention Ordinance (14.02.1550).

CS16-14 SAMPLING STATION:

Sampling stations shall be Steel Source Construction, Model SDMX-H FBE, powder coated RAL 6028 (Pine Green) and have the City logo etched on the back of the unit. Sample station shall be installed per Detail 5130.

CS16-15 COATINGS, LININGS & PAINT SYSTEMS:

15.1 Fusion Bonded Epoxy Lining and Coating Systems:

Fusion bonded epoxy systems shall conform to AWWA C213. The minimum thickness shall be 20 mils.

15.2 Epoxy Lining Systems:

Epoxy lining systems shall conform to AWWA D102, Section 3.2, "Inside Paint System No. 1 (Epoxy)." All storage tank coatings shall be submitted to and approved by the City Engineer prior to application.

15.3 Tape Coating:

Tape coatings are unacceptable for aboveground piping. Continuation of belowground tape coating to a minimum distance above the ground line as specified is acceptable.

15.3.1 Field-Applied Tape Coating:

Field-applied tape coatings shall conform to AWWA C209. The minimum thickness shall be 20 mils, and the minimum overlap shall be ½ inch.

15.3.2 Factory-Applied Tape Coating:

Factory-applied tape coatings shall conform to AWWA C214. The minimum tape thickness shall be 50 mils.

15.4 Above-Ground Painting:

15.4.1 Piping:

Aboveground epoxy painting shall conform to AWWA D102, Section 2.1, Outside Paint System No. 1, special color, and shall have three coats except the prime coat shall be a 3.0 mil self-priming epoxy. The total dry film thickness shall be seven (7) mils. Color shall be as specified herein, in the Standard Details, or in the Improvement Plans, if any. Intermediate paint coats shall be tinted to provide discernable contrast in the subsequent coat.

15.4.2 Miscellaneous Metal:

Unless otherwise specified herein, in the Standard Details, or in the Improvement Plans, if any, piping and exposed metal called to be painted shall be painted with industrial grade primer and enamel.

CS16-16 TRENCH BACKFILL AND SURFACING MATERIALS:

16.1 Pipe Bedding Material:

Sand for pipe bedding shall conform to the following specifications: imported granular material of which 100% shall pass the 3/8 inch sieve, 70-100 % shall pass the No. 4 sieve, 20-100 % shall pass the No. 30 sieve, and not more than 15% will pass the No. 200 sieve. The granular material shall have a minimum equivalent of 30 as determined by the Test Method No. Calif-217.

16.2 Native and Imported Backfill Material:

Refer to Construction Specifications Section CS7-03, Intermediate Backfill. All waterline trench backfill is classified as Intermediate backfill. Imported backfill shall be granular in nature, free of organic material and stones larger than one inch (1") in maximum dimension.

CS16-17 MISCELLANEOUS MATERIALS:

17.1 Polyethylene (PE) Film:

Polyethylene film for encasing (wrapping) ductile iron fittings, details, and miscellaneous metals shall conform to the requirements of AWWA C105. Minimum film thickness is 20 mils.

17.2 Tracer Wire:

All water lines, including mains, laterals, service lines, blow-offs, ARV, etc. shall have tracer wire. Tracer wire shall be #12 AWG copper clad steel, high strength with a minimum 450 lb. break load, with minimum 30-mil HDPE insulation thickness. Tracer wire for water line shall be coated shall be blue. Tracer wire shall be taped to the water line in five (5) foot intervals, and spooled neatly in water/valve boxes, and at termination points.

17.3 Warning Tape:

Warning tape shall be blue, 12" wide, 4-mil thick polyethylene backed with metal foil. Tape shall be labeled with black lettering to say "CAUTION - WATER LINE BURIED BELOW".

17.4 Hydrant Pavement Markers:

Reflective markers used to mark locations of fire hydrants shall conform to the requirements of Section 85, “Pavement Markers,” of the State of California, Department of Transportation Standard Specifications. Color shall be blue.

17.5 Reinforcing Bars:

Reinforcing steel shall conform to ASTM Designation A615 Grade 40 for deformed and plain billet steel bars for concrete reinforcement.

17.6 Concrete:

Concrete shall use Portland cement conforming to ASTM C150, Type II, and have a minimum cement content of five (5) sacks per cubic yard. Minimum compressive strength shall be 3,000 psi after 28 days.

17.7 Concrete Grade Boxes:

17.7.1 Air Release Valve (ARV) Boxes:

Provide lightweight fiberglass reinforced plastic meter box with nominal dimensions 17”x 30”, or approved equal with extensions as necessary to provide the required depth. Air vent enclosure and lid shall be Placer Waterworks Model PW/AE 3618-MN or

approval equal per Detail 5150.

17.7.2 Water Meter Boxes:

Provide lightweight fiberglass reinforced plastic meter box with nominal dimensions 13 x 24” or 17”x 30”, per referenced detail, or approved equal, with extensions as necessary to provide the required depth. Provide lightweight fiberglass reinforced plastic lid with round opening for Sensus "Smart Point" box lid-mounted meter sensor, per Detail 5100, 5120, and 5200

17.7.3 Water Valve Box:

Christy Model G-5 utility box with traffic cover marked "WATER" for isolation valves and “FIRE” for hydrant laterals, per Detail 5090.

17.7.4 Blow off Box:

Christy Model G-12 utility box with traffic cover marked "WATER", per Detail 5140.

17.8 Block or Brick Blocking:

Provide Utility-grade block or brick for blocks under grade boxes.

-- End of Part 2 - Materials --

PART 3 - EXECUTION

CS16-18 WATER-SEWER AND NON-POTABLE SEPARATION REQUIREMENTS:

The contractor shall follow the California Waterworks Standards, Title 22 CCR, 64572 for the separation requirements between water mains and sanitary sewer guidelines prepared by the State of California Department of Health Services. When installing water and sewer laterals in the same trench, do so in accordance with Section 1108 of the Uniform Plumbing Code.

CS16-19 TRENCH EXCAVATION AND BEDDING:

19.1 General:

Comply with Construction Specifications Section 6, Trench Excavation, and Construction Specifications Section 7, Trench Bedding and Backfill. Refer to Standard Detail Sheet 5000.

19.2 Trench Safety Requirements:

Refer to General Provisions Section G7-7, Trench Safety Requirements.

19.3 Grade & Alignment:

Comply with General Provisions Section G5-5, Surveying. Trenches shall be excavated true to line and grade.

19.4 Trench Preparation:

The bottom shall be smooth and free of all loose and objectionable material. Comply with Construction Specifications Section CS6-08, Special Foundation Treatment, *except* that excavation below the design pipe grade shall be the full width of the trench, backfilled with sand or aggregate base rock, and compacted to the in-place (in situ) density.

CS16-20 TRENCHLESS PIPE INSTALLATION:

Pipelines may be installed using trenchless technology only with the approval of the City Engineer. The Contractor shall confirm the location and depth of all utilities to be crossed by pipelines installed using trenchless techniques. Said utilities, if damaged, shall be repaired to the satisfaction of the utility owner at the Contractor's expense, and no additional payment will be allowed for such repairs.

CS16-21 PIPELINE INSTALLATION:

21.1 General:

Contractor shall provide all labor, material, and equipment to install all pipe and other appurtenant apparatus required to complete the potable water pipeline in an operating, watertight condition. Contractor shall furnish all supports, bracing, other materials and all work required for hauling, unloading, distributing, trenching, protecting, dewatering, placing, backfilling, disinfecting, cleaning and testing of the pipeline and appurtenances, and for resurfacing of roads and jobsite cleanup.

21.2 Handling of Materials:

During handling, loading, transportation and unloading, every precaution shall be taken to prevent injury to the pipe, fittings, valves and appurtenances. Coatings, linings and finishes shall be protected from damage. The manufacturer's recommendations for handling materials shall be followed. During transportation, storing and stringing, each joint of pipe shall rest upon suitable pads, strips, or blocks as recommended by the manufacturer and shall be securely wedged into place. Materials shall be carefully lowered into the trench. Any materials damaged beyond repair, in the opinion of the City Engineer or Inspector shall be replaced by, and at the expense of, the Contractor.

21.3 Cleanliness and Cleaning During Construction:

21.3.1 All materials shall be thoroughly clean before installation. The pipelines shall be kept clean and dry during construction. The Contractor shall follow the procedure set in most recent version of AWWA C651 during the installation of new water mains. The Contractors shall take precautions to prevent contamination of the interior of pipes, fittings valves and appurtenances by dirt, debris, animals, etc. entering the pipe. Any contamination shall be addressed in accordance with AWWA C651. After construction is completed, the main shall be disinfected using the continuous-feed method, per AWWA C651.

21.3.2 At the close of each workday and when pipe installation is not in progress, exposed ends of the pipeline shall be protected with approved temporary bulkheads furnished and installed by the Contractor. Temporary bulkheads shall not be removed until the trench is dry. Before work is stopped for the day, all joints shall be completed with the exception of joints adjoining structures.

21.4 Connections to Existing Mains:

21.4.1 Main-line connections shall be made with mechanical joint or compression couplings, with restraints. AWWA C651 procedures for flushing, disinfecting, and final connections to existing mains shall be followed. "Hot tap" connections are permitted for service connections up to two inches (2") in diameter, larger “Hot Tap” connections may be allowed at the approval of the City Engineer.

21.4.2 The Contractor shall coordinate the sequence and method of connection with the City Engineer and the Water Operations Division prior to making the connection. No exceptions shall be granted, and Contractors shall be held liable and prosecuted for any

damages and/or public health complaints for connecting to a Public Water System without knowledge or permission from the Water Purveyor.

21.4.3 The Contractor shall notify all affected users in writing at least 48 hours in advance of service interruption. The Contractor shall notify the City of Dixon at 707-678-7030, at least 96 hours in advance to schedule valve closures for service interruptions. Only City employed certified Operators are to operate existing valves.

21.4.4 Disinfection of materials and equipment used for connections to existing mains shall conform to AWWA C651Newly installed extensions of the water system are to remain physically isolated from the system, or shall be metered and backflow protected with a certified Reduced Pressure Principal assembly. Final connection is only permitted after the extension has been hydrostatic pressure tested, analyzed for bacteriological contamination, and required flushing has been performed. All testing must be documented and observed by the City Inspector and/or designated Certified Water Operator. All bacteriological analysis must be recorded as absent before a connection to the Public Water System will be allowed.

21.4.5 Existing mains to be abandoned in place shall be plugged with concrete.

21.5 Pipe Laying:

The pipe shall be placed firmly in the center of the trench and true to line and grade with no visible change in alignment at any joint, unless the alignment is shown to be curved in the Improvement Plans. Joint deflection for curved alignments shall not exceed the manufacturer's recommended maximum. On slopes, greater than ten percent (10%) the pipe bells shall be pointed up-grade and laying shall proceed up-grade. The pipe joints shall be assembled according to the manufacturer's recommendations, these Specifications, and as directed by the City Engineer or Inspector, but regardless of the method used the joints shall be watertight. Joint deflection shall not exceed 80% of the manufacturer’s recommended values. If it is necessary that a pipe be moved or that the alignment be adjusted after it has been installed, it shall be removed and rejoined as was accomplished in the original installation. Except as required for backfilling, the Contractor shall prohibit walking or working upon the pipe until backfilling of the trench has been completed. The Contractor shall provide temporary bridging over pipe trenches where it is necessary to provide crossings for workers and equipment, or access roads. The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage and shall, at his own expense, restore and replace the pipe to its specified condition and grade if it is displaced for any reason.

21.6 Pipe Bedding:

Comply with Construction Specifications Section CS7-02. Bedding material shall comply with Construction Specifications Section CS16-16.1. Bedding shall extend twelve (12) inches over the top of the pipe. Jetting of water pipe bedding is not permitted, See Standard

Detail 5000.

21.7 Steel Pipe:

21.7.1 Field Welding Steel Pipe:

Field welding of pipe joints and attachments shall conform to AWWA C206. If previously coated and/or lined, field welded joints shall be recoated and lined with approved coating and lining systems.

21.7.2 Below-Ground Coatings and Encasement:

Refer to Construction Specifications Section CS16-15, Coatings, Linings & Paint Systems, for acceptable materials. All buried steel piping, fittings and fabrications shall be coated. An electric holiday detector shall be passed about the entire circumference of tape-coated pipe to locate holidays and pinholes after coating and before installation. Any defective coating shall be repaired and retested. Fittings, piping and miscellaneous steel that will have concrete support pads or thrust blocks cast next to or around them shall be polyethylene encased per AWWA C105 using PE film per Section CS16-17.1. Fittings shall be clean of pipe bedding material, soil, etc., prior to PE encasement. Belowground nuts and bolts shall be stainless steel and PE film encased per Section CS16-17.1, or tape wrapped per Section CS16-15.3. Ends of the PE film shall be taped closed around the covered materials. Exposed bolt threads shall be stainless steel and coated with spray-on silicone sealant.

21.7.3 Above-Ground Painting:

Refer to Construction Specifications Section CS16-15, Coatings, Linings & Paint Systems, for acceptable materials. All above ground piping, fittings, and fabrications shall be painted with industrial primer and enamel unless otherwise noted. Color shall be as specified. Before painting, all piping shall be cleaned and free of mill scale. Paint shall be applied per the manufacturer's recommendations, and shall be checked for holidays and pinholes by an approved method.

21.7.4 Linings:

Refer to Construction Specifications Section CS16-15, Coatings, Linings & Paint Systems, for acceptable materials. All piping, couplings and fittings three inches (3") and larger shall be lined. All piping, couplings and fittings two and one-half inches (2½") and smaller shall be brass.

21.8 PVC Main Pipelines:

Elastomeric gaskets for PVC pipe joints, supplied loose, shall be stored in a cool, well-ventilated place, and shall not be exposed to the direct rays of the sun, until immediately before joint assembly. The joints shall be lubricated and assembled in accordance with the manufacturer's recommendations. There shall be no pulling of joints unless shown in the plans or approved by the City Engineer, and shall comply with the manufacturer's recommendations. Care shall be taken in fitting the pipe together to avoid twisting or otherwise displacing or damaging the gasket. After the joint has been assembled, the position of the gasket shall be verified by passing a feeler gauge around the complete circumference of the joint. If the gasket is displaced, the joint shall be disassembled, a new gasket installed, the pipe re-laid, and the position of the gasket rechecked. There shall be no service connections within two (2) feet of a pipe joint. No rubber-gasket joint shall be encased in concrete.

21.9 Main Fittings & Valves:

Fittings shall be supported independently of the pipe. Temporary supports under fittings or under pipe will not be permitted. Permanent supports under fittings may be precast concrete blocks or concrete foundations. Preassembling flanged fittings before installation in the trench will be permitted. Fittings shall be polyethylene encased per AWWA C105 using PE film. No rubber-gasket joint shall be encased in concrete. If necessary, the Contractor shall use long or special fittings to comply with this requirement. Fittings shall be clean of pipe bedding material, soil, etc., prior to PE encasement. Ends of the PE film shall be taped closed around the covered materials. Valves are to be set plumb. Provide a valve box at each valve per the Standard Detail 5190.

CS16-22 THRUST BLOCKS:

Concrete thrust blocks are required at all angle points, tees, terminal points of the line, and fire hydrants. Thrust block configurations shall be per Standard Details 5020, 5030, 5040, and 5050. Thrust blocks shall not cover joints.

CS16-23 BACKFILL:

23.1 Warning Tape:

Warning tape shall be placed in the same trench, directly over and not more than 12" above all main pipelines.

23.2 Tracer Wire:

All water lines, including mains, laterals, service lines, blow-offs, ARV, etc. shall have tracer wire. Tracer wire shall be taped to the water line in five (5) foot intervals, and spooled neatly in water/valve boxes, and at termination points.

23.3 Backfilling and Compaction:

Comply with Construction Specifications Sections CS7-03, Intermediate Backfill, and CS7-04, Other Backfill Requirements. Backfill shall be within 2% of the optimum moisture content per ASTM D-1557 for cohesive materials when compacted. Unless otherwise directed, pipe trenches shall be backfilled within 48 hours after the installation of the pipe. The Contractor shall backfill the trench prior to field-testing. Compaction of the backfill material shall be as shown in Standard Detail 5000. The Contractor shall use extreme care in compacting the backfill in the vicinity of the pipe to avoid damaging the pipeline. Jetting of trench backfill is not permitted in waterline trenches.

CS16-24 TRENCH RESURFACING:

Comply with Construction Specifications Section CS7-05, Pavement Replacement in Existing Streets, and Standard Detail Sheet 5000. Aggregate base construction shall conform to Standard Specification Section 10, Aggregate Base. Asphalt concrete construction shall conform to Standard Specification Section 11, Asphalt Concrete, except that asphalt surfacing shall be applied in two lifts. The first lift shall be to within 1½ inches of final grade and shall contain ¾-inch maximum aggregate. The second and final lift of asphalt paving shall contain ½-inch maximum aggregate. A fog seal coat may be required to be applied to the finished asphalt concrete in accordance with Section 37, "Bituminous Seals", of the Caltrans Standard Specifications.

CS16-25 APPURTENANCE INSTALLATION:

25.1 Backflow Prevention Assemblies:

Backflow preventers shall be installed per the following Standard Details:

5160 ¾" - 2" Reduced Pressure Backflow Preventer Installation
5170 Reduced Pressure Backflow Preventer Protective Enclosure
5180 3" - 10" Reduced Pressure Backflow Preventer Installation
5190 Reduced Pressure Detector Assembly Installation
5191 – Double Check Detector Assembly Installation

The City of Dixon requires all backflow to be Reduced Pressure Principal assemblies. A Double Check Detector Assembly (DCDA) may be used fr a fire protection service if the services does not contain chemical additives, and the facility and services is free of any

hazard as defined by the Cross Connection Control Handbook. If the fire suppression system contains, or may contain chemical additives, or the facility manufactures hazardous materials, a Reduced Pressure Detector Assembly will be required. All backflow prevention assemblies shall be tested immediately after they are installed. A certified AWWA backflow tester, with a valid gauge calibration certificate at the Contractor expense, shall test and provide a passing certification to the City prior to activation. Back flow assemblies 2" smaller require a protective enclosure and freeze protection provided at the Contractors expense.

25.2 Fire Hydrants:

Hydrants and aboveground piping shall be painted per Section CS16-15.4.2 above. A blue reflective marker shall be installed six inches (6") from the street centerline toward each hydrant, on a line from the hydrant perpendicular to the centerline of the street. For corner hydrants at intersections, markers shall be placed in each street. Fire hydrants are shown in the following Standard Details:

5060 Fire Hydrant Detail
5070 Fire Hydrant Installation for Developed Areas
5080 Fire Hydrant Installation for Open Areas

25.3 Air Release Valve and Blow off Installation:

Install ARVs and blow offs where shown in the Improvement Plans, per Standard Details 5140 and 5150. Reinforcement of the connection point to the pipeline shall be installed if required.

25.4 Service Connections:

Install service connections as shown in the Standard Detail Sheets at the locations shown in the Improvement Plans. The minimum service pipe size is one inch (1"). Trenches for service pipes shall be excavated, backfilled and resurfaced per these Standard Specifications. Trenchless installation is preferred under existing paved surfaces, and may be used in any location. PE pipe shall be installed in accordance with applicable provisions of AWWA C901. Adjacent taps into the water main shall be separated by at least one foot (1') and connections shall not be closer than two feet (2') from pipe joints and the end of the main pipe.

25.5 Sampling Stations:

Locate sampling stations where shown in the Improvement Plans or as directed by the City Engineer and install per Standard Detail 5130.

CS16-26 DISINFECTION:

26.1 Chlorination and Flushing:

Disinfection shall be in accordance with most recent version of AWWA C-651, Disinfecting Water Mains, by use of the Continuous-Feed unless other methods are specified and approved by the City Engineer and Water Purveyor. Method. The water main shall be completely filled with water then flushed to remove any particulates, then refilling the main with potable water that has been chlorinated to a minimum of 25 mg/L After a 24-hr holding period in the main, there shall be a free chlorine residual of not less than 10 mg/L.

26.2 Final Flushing:

Final flushing shall be in accordance with AWWA C651. All super chlorinated water must be flushed from the main until a system representative residual is achieved. De-chlorination pads or tablets shall be used when flushing into a storm drain.

26.3 Bacteriological Tests:

After final flushing and before the water main is placed into service, water samples will be collected and tested per AWWA C651 by City Water Distribution Operators at the Contractor's expense. Satisfactory result must be submitted from a Certified Laboratory prior to the final connection to the Public Water System.

26.4 Re-disinfection:

Should the laboratory test results indicate a presence of coliform organisms, the disinfection procedure shall be repeated.

26.5 Final Connections:

All final connections shall be made in accordance with AWWA C651. Final connections shall be made with mechanical joint or compression couplings with restraints. All final connections shall be disinfected, flushed, and sampled as described in AWWA C651.

CS16-27 FIELD HYDROSTATIC TESTING:

27.1 Preparation for Testing:

The Contractor shall submit the proposed testing procedure, in writing, to the City Engineer for review. Installation of all valves, fittings, appurtenances and thrust blocks shall be complete. Bedding to 12 inches over the top of the pipe shall also be completed. Testing shall not take place sooner than five (5) days after the placement of any mortar or concrete that will be subject to hydrostatic pressure during a test. Temporary bulkheads furnished and installed by the Contractor may be used when approved. After testing, the bulkheads shall be removed by the Contractor. Contractor shall supply all labor, equipment, materials,

bulkheads and recently calibrated measuring apparatus required to make the tests. The pipeline to be tested shall be slowly filled with water and left under normal operating pressure for at least 24 hours prior to the start of testing. Air shall be expelled from and through all services, blow offs and hydrants as well as ARVs. Chlorination levels in the pipeline to be tested shall be confirmed and verified before pressure testing any section of main connected to an existing main. The City will not be responsible for any damage, including damage to pipelines and appurtenances, due to testing.

27.2 Test Sections:

The pipeline shall be tested once the entire water system as shown on the Improvement Plans has been installed. Partial system testing is not permitted unless otherwise directed by the City Engineer. The system to be tested shall have only a single physical connection to the Public Water System that shall be metered and backflow protected.

27.3 Test Pressure:

Test pressure shall be no less than 150 pounds per square inch measured at the low point in the test section.

27.4 Test Duration:

Once the water line is pressurized, and all gauges have settled, the hydrostatic pressure test shall be maintained for four (4) hours. A City Inspector or a system Water Operator shall witness all tests.

27.5 Acceptance and Repair of Pipelines:

All leaks shall be corrected and any damaged, cracked or defective pipes, fittings, valves, hydrants and miscellaneous appurtenances shall be replaced. Regardless of the actual leakage from the pipe, the Contractor shall repair all visible leaks. After repairs, the system shall be hydrostatic pressure tested for the full duration. Repairs and re-testing shall continue until there is no observed leakage during the four (4) hour test. Leaks shall be repaired by and at the expense of the Contractor.

CS16-28 BACKFLOW PREVENTER ASSEMBLY TESTING:

An AWWA certified backflow tester, with a valid gauge calibration certificate, at the expense of the Contractor, shall test all backflow preventers. A “passing” City of Dixon backflow test form shall be completed by the tester and submitted to the City prior to activation and acceptance.

End of Section 15: Water System

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CONSTRUCTION SPECIFICATIONS

SECTION 17 - SANITARY SEWER SYSTEM

CS17-01. ITEM: The Contractor shall furnish all labor, materials, tools and equipment to construct and complete in an efficient and workmanlike manner the installation of the sanitary sewer mains and laterals in accordance with the approved plans, construction details and these specifications.

CS17-02. MATERIALS: The source and supply of materials shall be approved by the City Engineer.

A. GRAVITY SEWER PIPE: Sewer pipe shall conform to the requirements listed below. Ductile iron pipe shall be used in locations where depth, separation from other facilities, or some other special constraint is present, and shall be used only with the City Engineer's approval. SDR 26 PVC pipe may be approved by the City Engineer. Extra-strength vitrified clay pipe (ESVCP) shall be used in all other locations. A certification of compliance with the requirements of these specifications must be furnished by the pipe manufacturer to City Engineer prior to the Contractor commencing construction.

1. VITRIFIED CLAY PIPE (VCP):

SPECIFICATION: Vitrified clay pipe and fittings shall conform to and meet all of the requirements of ASTM C700 latest revision, for unglazed vitrified clay sewer pipe, extra strength, and shall conform to all materials data contained in the current Clay Pipe Engineering Manual published by the National Clay Pipe Institute.

JOINTS FOR VITRIFIED CLAY PIPE: Joints in vitrified clay pipe shall be of factory applied resilient type plastic compression type joints which conform to ASTM C425, latest revision. Compression couplings for plain end pipe shall conform to ASTM C594, latest revision.

2. DUCTILE IRON PIPE (DIP):

SPECIFICATION: Ductile iron pipe shall conform to ANS1 A21.51 (AWWA C151, latest revision) unless otherwise specified. Casting grade for pipe shall be 60-42-10. Laying length shall be the manufacturer's standard length.

The interior surface of all ductile iron pipe shall be cement-mortar lined and seal coated in conformance with AWWA C1O4, latest revision, and the exterior surface shall polyethylene wrapped in accordance with AWWA C105, latest revision.

Fittings shall be push-on, mechanical, or flanged-type ductile iron or cast iron and shall conform to ANSI 21.10 (AWWA C11O, latest revision) or ANSI 21.15 (AWWA C115, latest revision). Coating and lining requirements shall be the same as specified for pipe.

JOINTS FOR DUCTILE IRON PIPE: Joints shall be push-on or mechanical type and shall conform to ANSI 21.15 (AWWA C115, latest revision) with rubber gaskets unless otherwise specified. Coating and lining requirements shall be the same as specified for pipe.

3. POLYVINYL CHLORIDE (PVC) PIPE:

SPECIFICATION: Polyvinyl chloride pipe and fittings shall conform to the requirements of ASTM Designation D3034 as they apply to SDR 26 PVC sewer pipe using an elastomeric gasket joint in a bell and spigot assembly. The use of this pipe for sanitary sewer mains shall be restricted to 8- and 10-inch diameters and shall be used within residential areas only when approved by the City Engineer and where there is no possibility of commercial or industrial waste flowing through the pipe. Trench depths shall not exceed 15 feet and shall be a minimum of 6 feet.

JOINTS FOR PVC PIPE: Polyvinyl chloride joints shall be bell and spigot using an elastomeric gasket which meets the requirements of ASTM Designation D1869. No solvent weld joints will be allowed.

B. PRESSURE SEWER PIPE: Whenever the design of a sanitary sewer system includes the necessity of a sewage lift station and pressure mains, types of pipe shall be approved by the City Engineer on a case-by-case basis.

C. TRANSITION JOINTS AND BANDED RUBBER COUPLINGS: Transition joints between different pipe materials shall be made with an approved flexible coupling. Where necessary, proper adapters shall be used. Fittings shall be manufactured of the same materials as the pipe and installed in accordance with the Construction Details.

D. LATERALS: Pipe shall be of the same type and class as that used for the main. Joints and couplings for laterals shall be the same type and specifications as those used for the mains.

E. MANHOLES: Sanitary sewer manhole barrels, risers, cones, flat tops and grade rings shall be of precast reinforced concrete conforming to ASTM Designation C478 except that the Portland Cement shall be Type II modified cement. The manhole base, riser and cone shall have a minimum compressive strength of 4,000 psi at 28 days. Manholes shall be constructed in accordance with the Construction

Details.

Manhole frames and covers shall be Phoenix Iron works P-1090 or South Bay Foundry SBF-1900(Domestic) or equal and be installed in accordance with Construction Detail 4000.

Where a sewer manhole is constructed in a location to remain unpaved, the frame shall be constructed in accordance with Standard Detail 4050.

F. **CLEANOUTS:** Back of sidewalk cleanouts shall be constructed in accordance with Construction Detail 6020.

G. **CONDUCTOR PIPE:** Pipe used as a conductor pipe under a highway or railroad shall be welded steel pipe. Any protective lining and coating shall be as shown on the plans or specified in the Special Provisions.

Welded steel pipe shall be manufactured of steel meeting the requirements of ASTM Designation A245, Commercial Grade. The method by which the pipe is manufactured shall comply with one or more of ASTM Specifications: A-134, A-135, A-139 or A-211. The pipe shall be welded by either the electric-resistance or electric-fusion process, with either spiral seam welded joint or straight seam welded joint. All joints shall be butt welded.

H. When the conductor pipe is to be installed by boring and jacking, the wall thickness shall be 1/4 inch for sizes up to and including 24 inches in diameter, and 5/16 inch for sizes greater than 24 inches in diameter, unless otherwise specified.

CS17-03. INSTALLATION:

A. **SANITARY SEWER MAINS:** All sanitary sewer pipe installations shall be accomplished as specified herein except where modified by the requirements specific to the various types of pipeline materials as specified under Section CS17-02. PVC pipe shall be installed per manufacturer's recommendation and ASTM specifications or as otherwise directed by the City Engineer.

All sewer pipe shall be laid with a minimum of 12 inches vertical clearance from mainlines and 6 inches of clearance from all other improvements and utilities, unless otherwise approved by the City Engineer. Refer to the pipe cover requirements in Section 6 of the Design Standards for minimum cover requirements. Water and sewer lines shall meet minimum vertical and horizontal separation requirements as stipulated by the California State Department of Health Services under Section 64630, Title 22, of the California Administrative Code. Where the horizontal separation between sewer and water lines is less than 10 feet or where a sewer line crosses over the top of a water line, special requirements shall apply for the type of pipe used and the location of the joints.

All pipe shall be laid to conform to the prescribed line and grade as shown on the plans and each pipe length checked to the grade line which the Contractor establishes from the grade stakes.

The grade line shall be established before any pipe is laid in the trench. For pipes with slopes greater than 1%, the string line set for trenching purposes may be used as the grade line. For pipes with slope less than 1%, either: (1) a grade line shall be established in the bottom of the trench such that the top of each bell will touch the line when the pipe has been properly positioned or, (2) a grade line shall be established above the trench on firmly secured batter boards from which the grade of each pipe can be checked by using a grade pole.

Alternate use of commercial laser grade setting systems in lieu of string lines specified herein are acceptable when the following requirements and conditions are met:

1. The contractor shall have the responsibility of providing an instrument operator who is qualified and trained in the operation of the laser and said operator must adhere to the provisions of the State of California Construction Safety Orders issued by the Division of Industrial Safety. Attention is particularly directed to Sections 1516, 1800 and 1801 of said Orders for applicable requirements.

2. All laser control points shall be established bench marks or construction off-set stakes identified on cut sheets and set in the field for the work. Laser set up points shall be these control points or points directly from them by instrument.

Each length of pipe shall be laid “downstream” to “upstream” on contacted, approved bedding material as specified and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all bell and spigot joints. “Stabbing”, “Swinging In” or “Popping On” spigot ends of pipe into bell ends will not be permitted. After jointing is accomplished, all annular spaces between pipe and bell holes shall be packed with bedding material, taking care not to damage, move or lift the pipe from its bedding support.

Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping approved material under the body of the pipe. No wedging or blocking to support the pipe will be permitted.

A sewer line, unless otherwise approved by the City Engineer, shall be laid, without break, upgrade from point of connection to existing sewer and with the bell end forward or upgrade. Pipe shall not be laid when the City Engineer determines that the condition of the trench or the weather is unsuitable.

Sewer pipes, branches, stubs, or other open ends which are not to be immediately connected, shall be plugged or capped with a standard watertight plug or cap, as approved by the City Engineer for use in the particular installation. The plug or cap shall be placed on a standard end.

Pipe entering or leaving manholes or other structures shall have joints within 2-1/2 feet of the manhole base.

In all cases, flexibility of joints in or at the manhole base shall be preserved to prevent damage to the pipe by differential settlement.

All sewer line connections to manholes, trunk sewers, main sewers or side sewers shall be left uncovered until after the inspection has been made. After the approval of the connection, the trench shall be backfilled as specified. The City Engineer may require special pipe to be laid in areas that are potentially unstable or subject to settlement.

If the sewer is to be laid in an area that is to be filled, and the cover prior to filling is less than 5 feet, the pipe shall not be laid until the area has been filled to a level 5 feet above the proposed pipe and compacted to 90% relative compaction, unless otherwise authorized by the City Engineer.

B. **LATERALS:** Service sewers shall be installed as detailed on Construction Detail 6030 and at the locations shown on the contract plans. Unless otherwise specified, they shall be 4 inches in diameter, of the same material as the sewer to which they connect, and constructed to the property line or easement. A regularly manufactured "Y" fitting shall be used in the lateral sewer for each sewer and shall be inclined upwards at a minimum angle of 10 degrees from the horizontal. The ends of all service sewers shall be securely sealed by stoppers in such a manner that the stoppers can be removed for extending the line without damage to the pipe. All sewer service connections after capping shall have a 4" x 4" stake installed above the cap to at least one foot above finish grade behind the back of walk. The 4" x 4" stake shall be painted green to indicate a sewer service. Unless otherwise noted on the plans, the depth of cover of the sewer service at the easement or property line shall be 5 feet to 5 feet 6 inches below existing ground or edge of adjacent roadway, whichever is at the lower elevation.

Service sewers entering a manhole shall be set with the invert of the service sewer level with the crown of the outgoing pipe.

When a service sewer is to be connected to an existing lateral or trunk sewer, the Contractor shall make the tap into the existing sewer under the direct supervision of the City Engineer. Notice shall be given at least 48 hours in advance of the proposed time of the tap.

1. CONNECTIONS TO MAINS IN STREETS: All service sewers are to be constructed perpendicular to the street centerline, radially to manholes in cul-de-sacs and radially to the street centerline on curved sections of streets.

2. CONNECTIONS TO MAINS IN EASEMENTS: Service sewers are to be constructed perpendicular to the main to at least the easement line; a cleanout must be provided at the first point of deflection.

Unless otherwise noted on the plans, sewer service cleanouts shall be provided for all service sewers as per Construction Detail 6020. The cleanout will generally be within three feet of the back of the sidewalk or at the easement line if the service is located within a side or back of lot easement and shall not typically be located in the driveway. A concrete box shall be set to finish grade of the property. If the cleanout must be located in the driveway, a traffic rated box shall be placed. The cleanout and service shall be of like material and diameter.

In improved areas, the location of each service shall be permanently indicated by inscribing the letter "S" in the top of curb directly above the line when the service is perpendicular to the street centerline. The curb mark shall be placed at the same time the service is installed to ensure proper location.

Whenever lateral lines are to be installed as part of the contract for the construction of the sewer main, the use of saddles will not be permitted.

That portion of the lateral line to be placed under an existing curb and gutter and/or sidewalk shall be done by boring or cutting and replacing the existing curb and gutter and/or sidewalk. Sidewalk, curb and gutter shall be sawcut at the nearest score mark or deep joint.

C. MANHOLES:

1. MANHOLE CONSTRUCTION: All manholes shall be excavated and backfilled in conformance with the requirements of Section19-3 of the State Specifications and installed as specified herein. All embedment materials under, around and at least 3 inches over all pipelines located within 5 feet of structure bases shall be compacted without jetting prior to barrel section placements. All manholes shall be constructed to subgrade prior to jetting adjoining sewer pipeline trench and/or structure backfill where such method of compaction is permitted and used.

2. All joint surfaces of precast barrel and cone sections and face of manhole base shall be thoroughly cleaned prior to setting precast sections. The various sections shall be set in preformed plastic sealing gaskets of

material conforming to the requirements of FEDERAL SPECIFICATION SS-S-00210.

3. INSTALLATION OF GASKETS: Apply one coat of primer to clean, dry joint surface (both tongue and groove) and allow to dry. Remove the paper wrapper from one side only of the two-piece wrapper on the gasket. The outside paper will protect the gasket and assure against stretching. Before setting the manhole section in the trench, attach the plastic gasket strips end-to-end to the tongue or groove of each joint, forming a continuous gasket around the entire circumference of the manhole joint.

Handling of barrel sections after the plastic gasket has been affixed shall be carefully controlled to avoid bumping the gasket and thus displacing it or contaminating it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced if damaged and repositioned if displaced.

Care shall be taken to properly align the manhole section with the previously set section before it is lowered into position.

During cold or wet weather, pass direct heat over the concrete joint surface lightly until ice, frost and moisture are removed and surface to be primed is dry and warm immediately before application of primer. Direct heat shall also be passed over plastic gasket strips immediately prior to attaching them to joint surfaces and immediately prior to insertion of tongue and groove.

Precast concrete bases shall be required when SDR 26 PVC pipes are used. Cast-in-place concrete bases shall be 4,000 psi, 28 day concrete with 1-1/2" maximum size aggregate. It shall rest on firm, undisturbed soil and shall be of the dimensions shown on the Construction Details. The cast-in-place portion shall not be higher than 6 inches above the outside tops of the main incoming and outgoing pipes. Rebar, as required, shall be placed in the bottoms and sides of the cast portion, subject to inspection by the City Engineer. Minimum and maximum wall thickness for the cast-in-place sections shall conform to the following table:

Manhole Diameter	Minimum Wall Thickness	Maximum Wall Thickness
48 inches	5 inches	7 inches
60 inches	6 inches	8 inches
72 inches	7 inches	9 inches

Where the sewer lines pass through manholes, the pipe shall be laid continuously as a whole pipe. After the manhole base and precast sections have been placed and sufficient time has elapsed to allow all concrete and grout to set, the top half of the pipe within the manhole shall be carefully cut off and the sides mortared. All channels so formed shall be checked with a template and shall form a smooth flowing channel at all flow depths.

Temporary covers of 3/8 inch steel plate of sufficient size to adequately cover the opening shall be placed on the cone until the base is complete and the manhole casting shall then be installed. Suitably located ribs shall be welded to the underside of the cover to hold it in place during any grading operations.

The throat of the manhole shall be made of precast concrete rings of the proper inside diameter. The minimum depth of throat permitted shall be one 3 inch ring between the cone and the frame. The maximum depth permitted shall be 18 inches of rings between the cone and frame.

Connections to existing manholes shall be made by carefully breaking out an opening in the wall of the manhole, inserting the end of the pipe through the opening, and packing the opening around the pipe with a stiff mix of cement mortar thoroughly compacted. The mortar shall be composed of one part Type II Portland Cement and three parts clean sand. All connections shall be watertight.

Before any work is started on adjusting or repairing a manhole, the channels in the base shall be covered with strips of wood and the entire base covered with a heavy piece of canvas. This cover shall be kept in place during all work. Upon completion of the work, the wood strips and the canvas shall be removed from the manhole allowing no debris to fall or remain in the manhole.

D. DROP CONNECTIONS EXISTING MANHOLES: Drop sewer connections shall conform to Construction Details 6000 and 6010 of these specifications unless otherwise detailed on the plans.

E. ADJUSTING MANHOLES TO GRADE: The contractor shall adjust manholes and cleanouts to grade or elevation as indicated on the plans and as directed by the City Engineer. Adjustment may be made by utilization of precast grade rings or by a cast-in-place ring, in accordance with these specification.

When adjusting the manhole frame and cover to grade, the frame shall be wired to a 2"x4" piece of wood of sufficient length to span the excavation, and the throat

completed to the right level. Whenever the space between the bottom of the frame and the top of a ring is less than 3 inches, the void may be filled with concrete, poured against a suitable form on the side of the structure.

When adjusting an existing manhole to grade and the total depth of the throat from the top of the frame to the bottom of the throat exceeds 24 inch, the upper portion of the manhole shall be removed to the first full-size manhole section. The upper portion shall then be reconstructed as outlined above.

F. CLEANOUTS: Cleanouts shall be constructed as shown on Construction Detail 6020 of these specifications.

G. INSPECTION: The City Engineer shall at all times have access to the work during its construction, and the contractor shall provide proper and safe facilities for such access and inspection. The City Engineer shall be furnished with every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements and intentions of these specifications. All work done and all materials furnished shall be subject to his inspection and approval.

The work shall be done under the supervision and to the complete satisfaction of the City and in accordance with the laws of the State of California.

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

The Contractor, shall, at any time when requested, submit to the City Engineer properly authenticated documents or other satisfactory proof as to his compliance with the requirements of these Specifications.

H. TESTING OF SEWER LINES: All leakage tests shall be completed and approved after backfilling and prior to placing of permanent surfacing. All tests shall be performed at the expense of the Contractor. A test may be performed which enables the Contractor to determine the acceptability of the line prior to backfill.

1. CLEANING AND FLUSHING: Prior to performing a leakage test, the pipe installation shall be thoroughly cleaned. Cleaning shall be performed by the Contractor by means of an inflatable rubber ball. The ball shall be of a size that will fit snugly into the pipe to be flushed. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water introduced behind it. The ball shall pass through the pipe with only the

pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. If any wedged debris or damaged pipe shall stop the ball, the Contractor shall remove the obstruction. When a new sewer is connected to an existing line, cleaning and flushing shall be carried out to the first existing manhole downstream from the point of connection.

2. PVC DEFLECTION TEST: PVC pipe shall be tested consistent with ASTM standards. After the PVC pipe is installed, cleaned and ready to be air tested, according to these specifications, the pipe deflection shall be checked by means of a deflection mandrel, in the presence of the City Engineer. A rigid mandrel, with a circular cross section having a diameter, as indicated by the following table, shall be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel shall be equal to the nominal inside diameter of the pipe.

Nominal Average Diameter (Inches)	Average Inside Diameter (Inches)	Base Inside Diameter (Inches)	7.% Deflection Mandrel Diameter (Inches)
8	7.891	7.665	7.09
10	9.864	9.563	8.84

From the Uni-bell Plastic Pipe Association Handbook of PVC Pipe, Third Printing - May 1979.

Any section of PVC pipe that does not permit passage of the deflection mandrel will not be accepted, and said section shall be properly repaired and replaced, and remandreled, as directed by the City Engineer. All other testing shall be performed as required in these specifications for sanitary sewer pipe. If, because of the additional required testing, any section of PVC has to be repaired or replaced, that section shall be remandreled again as directed by the City Engineer. The additional deflection test shall be performed not sooner than 30 days after completion of densification and backfill.

3. MANHOLE VACUUM AIR TEST: Low-Pressure Air Testing of sanitary sewer systems shall include the Contractor air testing manholes in accordance with provisions of A.S.T.M. C1244-02, “Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test Prior to Backfill.”

LOW-PRESSURE AIR TEST: After completing backfill of a section of sewer line, the Contractor shall at his expense, conduct a Line Acceptance Test using low-pressure air. The test shall be performed using the equipment listed below, according to stated procedures and under the supervision of the City Engineer. All test results shall be logged and submitted to the City Engineer, prior to placement of permanent surfacing.

a. EQUIPMENT: Equipment used shall meet the following minimum requirements:

i. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing and blocking.

iii. All air used shall pass through a single control panel.

iv. Three individual hoses shall be used for the following connections.

a) From control panel to pneumatic plugs for inflation.

b) From control panel to sealed line for introducing the low pressure air.

c) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

b. PROCEDURE: At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe),the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed “acceptable” if the time required in minutes for the pressure to decrease from 3.5 to 2.5 9 pounds per square inch, gage (psig) is not less than the time shown for the given diameters in the following table:

Pipe Diameter in Inches	Seconds
4	122

6	184
8	245
110	306
12	367
15	460

For larger diameter pipe use the following formula:

Min. time in seconds = 30.6 x pipe diameter in inches

When the prevailing groundwater is above the sewer being tested, air pressure shall be increased 0.43 psi for each foot the water table is above the flow line of the sewer.

If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be repressurized to 3.0 psi and the test repeated.

For 6" and 8" pipe: If, during the 5 minute saturation period, pressure drops less than 0.5 psi after the initial pressurization and air is not added, the section undergoing test shall be “acceptable”.

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

House sewer laterals shall be considered part of the main to which they are connected and no adjustment of test time shall be allowed to compensate for the smaller diameter of the laterals.

The pressure gauge used shall be supplied by the contractor and certified to have been calibrated within six months of the test.

If the installation fails to meet this requirement, the Contractor shall, at his/her own expense, determine the source of leakage. He/she shall then repair or replace all defective materials and/or workmanship and perform the air test as many times as necessary to achieve an acceptable test.

c. SAFETY: The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely

important that the various plugs be installed and braced in such a way as to prevent blowouts. Since a force of 250 lbs. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurizing equipment should include a regulator set at 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing. If the test is not passed in two trials, the leak shall be located and repaired to the satisfaction of the City Engineer and the line shall be retested at the Contractor's expense.

The pressure gage used shall be supplied by the Contractor and shall have minimum divisions of 0.10 psi, and shall have an accuracy of 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm.

4. T.V. INSPECTION: Prior to acceptance of any sanitary sewer line by the City, said line shall be inspected internally by television as outlined below at the contractor's expense. Also, not less than 11 months after acceptance, prior to expiration of the one year warranty period, and during periods of highest groundwater (usually February through April), sewer mains and laterals shall be ball and flushed and TV retested.Contractor shall submit DVD disk and logs to the City after implementing any repairs required of retest.

   Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected by the contractor at his expense. For joint separations, low spots and chipped ends, the following maximum acceptable limits will apply for eight and ten inch pipes:

Joint separations -	½"
Low spots -	1" max. depth
Chipped ends -	1/4"

   a. The complete job is ready for television inspection when the following work has been completed:

      i. All sewer pipelines are installed and backfilled.

      ii. All structures are in place, all channeling is complete and pipelines are accessible from structures.

iii. All other underground facilities, utility piping and conduits are installed.

iv. Final street subgrading is complete and ready for asphaltic concrete surfacing.

v. Pipelines to be inspected have been preliminarily balled and flushed or cleaned with a high pressure cleaner.

vi. All other tests have been performed and deficiencies remedied.

b. When the above work is complete, the Contractor shall arrange for the television inspection.

c. The Contractor of the project will notify the City in writing as to the scheduled date of the television inspections.

d. After conditions i through vi as outlined above are met, the entire job will be initially televised and recorded. The DVD disk and reports shall be delivered to the City.

e. DVD disk video recording shall be color format and the audio and video portions shall be free of electrical interference and excessive background noise.

f. The audio report shall be recorded by the operating technician on the DVD disk as they are being produced and shall include the location of the sewer, the names or numbers of the manholes involved, the direction of travel and a description of all lateral locations and conditions in the sewerline as they are encountered and their locations.

g. In addition to the audio report, a written report shall be required listing all the information required in the audio report.

h. The Contractor will be notified in writing of any deficiencies revealed by the television inspection that will require repair. If corrective work is indicated and the Contractor wishes to view DVD disk recording, he shall contact the City to set a time for viewing with the City Engineer.

i. Corrective work shall be done. The cost shall be borne by the Contractor.

j. Those portions of the pipeline system that have been corrected must be retelevised and recorded and the DVD disks and reports delivered to the City.

k. The procedure outlined in conditions "A" through "G" above will be repeated until all deficiencies observed by television inspection have been corrected to the complete satisfaction of the City.

l. All DVD disk recordings and reports become the property of the City to be used as "As-Built" for future reference.

CS17-04. PAYMENT:

A. PIPE: Payment for sanitary sewer pipe complete in place shall be per lineal foot measured from the center of manhole to center of manhole following a line parallel to the grade of the sewer. Payment shall include the furnishing of all labor, materials, water, tools and equipment required to construct and complete in an efficient and workmanlike manner the excavation, bedding, backfill, furnishing and laying of pipe, dewatering, testing and all other work necessary to construct the sewer system in accordance with the plans and these specifications.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

B. STRUCTURES AND MANHOLES: The unit of measure for payment shall be per each unit. Payment shall be made at the bid price per item for each structure complete in place and shall be the average price for manholes of all depths and types indicated on the plans and in the Proposal. Payment shall include the cost of excavation, backfill, frames, covers, plates or reinforcing steel where required.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

C. DROP CONNECTIONS: The Contractor shall bid a unit price per each for constructing inside drop connections at existing manholes, which shall include excavation and all labor and equipment necessary for completion of the drop connection in accordance with the plans.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

D. **MANHOLE ADJUSTMENT:** Payment for adjusting manholes shall conform to Section 15-2.05A of the State Specifications, except that the unit price bid shall include all necessary excavation and backfill and that the unit price shall be the average of all depths and limits of adjustment required.

E. **CLEANOUTS:** The unit bid price for cleanouts shall include excavation, pipe precast concrete items, cast iron frame and cover, concrete backfill, and all other labor, equipment and materials necessary for completion of the cleanout in accordance with the plans and these specifications.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

F. **SERVICE SEWERS:** The unit bid price for service sewers shall include the furnishing of materials necessary for construction of the services and all labor and materials necessary to excavate the trench, connect to existing manholes or lateral sewer, bed, place and joint the pipe and fitting, backfill the trench, inscribe the letter "S" on the curb, install the cleanout and all other work necessary to produce a complete installation in accordance with the Construction Details and specifications. The unit price bid shall be the average price for service sewers of all lengths as indicated on the plans and in the Proposal.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

CONSTRUCTION SPECIFICATIONS

SECTION 18 - STORM DRAIN SYSTEM

CS18-01. ITEM: The Contractor shall furnish all labor, materials, tools and equipment to construct and complete in an efficient and workmanlike manner the installation of the storm drainage system in accordance with the approved plans, these specifications and the Construction Details.

CS18-02. MATERIALS: The source and supply of materials shall be approved by the City Engineer. A certification of compliance with the requirements of these specifications must be furnished by the pipe manufacturer to the City Engineer prior to the Contractor commencing construction.

A. STORM DRAIN PIPE: Storm drainage pipe shall conform to the requirements listed below:

1. REINFORCED CONCRETE PIPE (RCP):

SPECIFICATION: Reinforced concrete pipe shall conform to the specification of ASTM Designation C76, per latest revision. The class of pipe will be specified on the contract plans. Reinforcing shall be as specified in ASTM Designation C76. Portland cement used in the manufacture of reinforced concrete pipe shall conform to the requirements of the specifications for Type II Portland Cement, ASTM Designation C150.

JOINTS FOR REINFORCED CONCRETE PIPE: Joints shall be tongue and groove, bell and spigot, or other approved type as shown on the contract plans or specified in the Special Provisions. Each joint shall be sealed to prevent leakage. Sealing materials shall consist of either cement mortar, rubber gasketed joints, or resilient materials as shown on the plans and shall conform to Section 65-1.06A, 65-1.06B, and 65-1.06C of the State Specifications. Joints sealed with cement mortar or resilient materials shall be sealed both inside and outside.

If cement mortar is used in sealing the joint, the sealed joint shall be constructed, protected and cured in a manner approved by the City Engineer.

2. CAST-IN-PLACE CONCRETE PIPE: (may only be used with prior approval of the City Engineer, and submittal/ approval of a detailed soils investigation prior to approval of any improvement plans):

SPECIFICATION: Cast-in-place concrete pipe shall conform to the applicable portions of Section 63 of the State Standards.

The pipe shall be constructed of Class A Concrete and shall conform to the requirements of Class A Concrete of Section 90, entitled "Portland Cement Concrete" of the State of California, Standard Specifications, except as herein modified.

Concrete mixes shall be designed on the basis of the concrete attaining a strength at 28 days of at least 4000 P.S.I. During pouring, the Contractor shall prepare 2 standard 6" X 12" test cylinders for each 75 cubic yards or portions thereof poured each day. Casting, handling and curing of all cylinders shall be in accordance with ASTM Designation C-31. One of the two cylinders shall be tested at the end of seven days and one at the end of 28 days in accordance with ASTM Designation C-31. Cylinders shall be tested for strength by a recognized testing laboratory at the Contractor's expense and the test results shall be submitted to the City Engineer. Aggregate size shall not be more than 1/3 of the minimum pipe wall thickness.

Slump shall not exceed 3 inches as determined by the slump cone method of ASTM Designation C-143 or an equivalent slump as determined by Test Method California #533, unless otherwise permitted by the City Engineer.
JOINTS: Construction joints may be formed by either of the two following methods:

a. The joint shall be formed at about 45 degrees from the vertical. On all such joints, after cleaning, wetting, and freeing of all laitance, loose or defective concrete, coatings of foreign material shall be removed to assure a good bond.

b. After squaring off the end of the pipe, an excavation shall be performed along the sides and bottom of the joint of such size as to permit the placing of a concrete collar around the outside of the joint. This collar shall have a minimum thickness at the joint of 1-1/4 times the wall thickness of the pipe and shall lap the joint by at least 2 times the wall thickness.

3. CORRUGATED METAL PIPE: (CMP - may only be used with prior approval by the City Engineer)

SPECIFICATION: Corrugated metal pipe shall conform to Section 66 of the Standard Specifications. Each specific installation of the Standard

Specifications must be approved by the City Engineer. CMP shall not be permitted in the street right-of-way.

JOINTS: Joints shall conform to the "positive" classification unless otherwise specified.

4. NON-REINFORCED CONCRETE PIPE (CP - may only be used with prior approval by the City Engineer):

SPECIFICATION: Non-reinforced concrete pipe shall conform to specifications of ASTM designation C-14 per latest revision. The class of pipe shall be Class III, unless otherwise specified on the contract plans. Non-reinforced concrete pipe shall not be allowed in street right-of-ways.

JOINTS FOR NON-REINFORCED CONCRETE PIPE (CP): Joints shall be as specified in Reinforced Concrete Pipe, Section SS18-02.A of these Specifications.

B. MANHOLES: The Contractor shall construct the various sizes and types of concrete manholes as indicated on the plans and in accordance with the Standard Specifications.

1. CONCRETE MANHOLES**:**

SPECIFICATION: Manholes shall consist of cylindrical sections, all with joints and base construction as detailed on Construction Details 4010, 4020, 4030 and 4500. Precast manhole barrels, risers, cones, flat tops, and grade rings shall conform to ASTM Designation C478 with the additional requirement that the cement used shall be Type II. Manhole sections shall be manufactured without provision for steps. Manhole bases shall be cast-in-place. Stubs or couplings provided in precast bases shall be of the same material as the pipe to which they connect unless otherwise approved by the City Engineer.

CONES: Standard concentric cones conforming to ASTM Designation C478 shall be used on all manholes shown on the contract plans unless otherwise specified.

JOINTS: Joints in precast manhole barrels shall be made with mortar or with preformed plastic sealing gaskets conforming to Federal Specifications SS-S-00210 and installed as recommended by the manufacturer. All joint surfaces shall be thoroughly cleaned prior to placing the sealing compound or mortar. Interior of manhole shaft shall have all joints filled and mortared smooth.

FRAMES AND COVERS: Manhole frames and covers shall conform to Construction Detail 4000 unless otherwise stated on the plans or in the Special Provisions. Frames and covers shall be set 1/4" below the pavement finish grade unless otherwise herein specified or otherwise stated on the contract plans or in the Special Provisions.

2. SADDLE MANHOLES: Saddle manholes shall be constructed in accordance with Construction Detail 4030 and Section CS18-02 of these Specifications.

3. DRAIN INLET: Drain inlet types shall conform to Construction Details 4510 through 4570. The concrete box portion of the drain inlet shall be cast to the proper grade in a maximum of two placements of concrete. No provisions for steps shall be made in the drain inlet.

4. HEADWALLS, WINGWALLS, ENDWALLS, AND RAILINGS: All headwalls, wingwalls, and endwalls shall be of 4,000 psi reinforced Portland Cement Concrete constructed in accordance with the plans and Section 51 of the State Specifications. Temporary bank protection shall be provided by sack concrete rip-rap in accordance with Section 72 of the State Specifications.

5. DRAINAGE PUMP STATIONS: Drainage pump stations shall be allowed on a case-by-case basis with specific approval of the City Engineer.

6. GROUTING AND BANDING: All pipe installation and pipeline construction shall be in accordance with the manufacturer's specification for the particular pipe and fitting material.

CS18-03. INSTALLATION:

A. CONCRETE PIPE: Concrete pipe shall be laid without break upgrade from structure to structure. The first pipe laid shall be bedded to establish line and grade. Where joints are tongue and groove, the groove should be carefully washed with a wet brush and buttered with mortar. The tongue of the second pipe is then fitted into the groove end of the first pipe until the mortar is squeezed out onto the inner and outer surfaces. The inner surface of the pipe at the joint is then brushed smooth with a long handled brush to present a contour matching the inner barrel of the pipe and then a band of mortar at least 4 inches in width and three-quarters 3/4 inch in depth at the joint line shall be placed around the entire outside circumference of the pipe.

The external band shall then be protected by covering with a water proof building paper securely held in place.

External banding and internal pointing up shall stay a sufficiently long distance behind the pipe laying so that mortar joints will not be disturbed by the laying of the pipe.

All pipe shall be laid on a firm, flat surface that is free of depressions or irregularities and that is true to line and grade. Allowable deviation in profile shall be 0.05 foot per foot lineal for all diameters of drainage pipe. Pipe shall not be laid when the condition of the trench or the weather is unsuitable, at the discretion of the City Engineer. The pipe shall have continuous bearing throughout its length and no blocking up or wedging shall be permitted.

Immediately after the laying of each joint of pipe, trench bedding and backfill material per Section 7, "Trench Bedding and Backfill" of these Specifications, shall be placed on each side of the middle of the length of pipe and firmly packed around the lower portion of the pipe to firmly block it from moving when the next length of pipe is laid.

B. CAST-IN-PLACE CONCRETE PIPE (may only be used with prior approval by the City Engineer) : Cast-in-place concrete pipe (CIPCP) shall consist of Portland Cement Concrete placed in a prepared trench at the locations shown on the plans, as specified in these specifications and in accordance with any special provisions. The pipe shall be constructed with equipment specially designed for constructing cast-in-place concrete pipe. The Contractor may be required to furnish evidence of recent successful operation of the equipment proposed to be used. Equipment not acceptable to the City Engineer or not suitable to produce the quality of work as herein specified will not be permitted to operate on the work.

1. EXCAVATION: The trench shall be neatly excavated with vertical sides and semicircular bottom to the grades specified in the plans. Rate of departure from and return to established grade and the invert of the installed pipe shall not exceed 1 inch per 10 lineal feet with a maximum allowable departure of 1-1/2 inch. Rates for alignment shall not exceed 2 inches per 10 lineal feet with a maximum allowable alignment departure of 4 inches. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe.

   Excavated trench shall be checked for compliance with requirements for grade and alignment prior to placement of concrete. The Contractor shall

submit proposed method of grade and alignment control and checking of same for conformance with Specifications to the City Engineer, for approval prior to start of work. The Contractor shall supply manpower, equipment and materials, as are required to provide and confirm compliance with grade and alignment requirements.

2. PLACEMENT: The concrete shall be placed around the full circumference of the pipe in one operation by means of fixed forms and traveling forms. The internal fixed forms shall be of sufficient strength to withstand the vibrating or tamping of concrete. At the time of concrete placement, all soil in the trench will be adequately moistened so that water is not drawn from the freshly placed concrete. However, the trench form will be completely free of water, mud and debris. All forming devices, including the slipforms and hopper of the placement device, shall be thoroughly moistened. The trench shall be free from running water. Should water be encountered, proper dewatering procedures shall be utilized.

   Concrete shall not be placed when temperature of the concrete exceeds 90 degrees F or is less than 50 degrees F. The soil adjacent to the trench shall be at a temperature above freezing.

   The pipe shall be constructed in one placement, the entire cross section being placed monolithically. Inside forms shall be sufficiently rigid to withstand consolidation of the fresh concrete. Placement shall be such as to produce a homogeneous concrete mixture conforming to the test requirements of this specification. Effective consolidation means shall be applied to the fresh concrete over the entire circumference and from within the pipe shell. Consolidation means shall be capable of effectively placing and consolidating fresh concrete at production speeds. Methods of consolidating shall be capable of building up sufficient pressure to effectively bond the concrete to the surrounding earth and to keep loose sand, mud, and water out of the pipe shell.

   Under no circumstance will the Contractor be allowed to continue the pipe installation if the vibrators of the cast-in-place machine are inoperable. Portable vibrators or "stingers" shall only be used to supplement internal vibrators on the machine and not as a sole source to consolidate and distribute the concrete mix.

   The contractor shall make provisions for removing sloughed material, debris and any foreign objects from trench before and during placement of concrete such that buildup of material does not occur ahead of the machine.

3. STOPPAGE JOINTS: When pipe placement stops in excess of ninety (90) minutes, a construction joint shall be formed. The ends of the pipe that are to be in butt contact shall be left in rough condition. Number 4 reinforcing bars shall be embedded 12 inches minimum in the previous pour and 12 inches into the next pour and shall be placed 12 inches on center for pipe 42 inches in diameter or less and shall be placed 18 inches on center for pipe diameters in excess of 42 inches.

   Immediately before resuming concrete placement, the surfaces to be bonded shall be cleaned of all laitance, coatings, foreign materials, and loose or defective concrete, and thoroughly wetted.

   It is essential that concrete placement be done in a smooth and steady manner with as few starts and stops as possible. The contractor shall schedule materials and operate the pipe machine at speeds and in a manner that will achieve this.

   The Contractor shall provide an anchoring system for pull of the machine in a manner which will provide the least probability of causing deviations in grade and/or alignment.

4. PIPE DIMENSIONS AND TOLERANCES:

   a. The internal diameter of the pipe at any point shall not be less than 95 percent of the nominal diameter, and the average of any four measurements of the internal diameter made at intervals equal to pipe diameter, shall not be less than the nominal diameter.

   b. The minimum wall thickness for the various sizes of pipe shall conform to the following table:

Internal Diameter (Inches)	Minimum Wall Thickness (Inches)
30 or less	3
36	3-1/2
42	4
48	5
54	5-1/2

60	6
66	6-1/2
72	7
78	7-1/2
84	8
96	9
120	12

c. Offsets at form laps and horizontal edges shall not exceed the limits specified in the following table:

Internal Diameter (Inches)	Minimum Wall Thickness (Inches)
42 or less	1/2
48-66	5/8
72-84	7/8
96+	1

All form strut bearing plates shall be removed and any indentations exceeding 1/8 inch left in the concrete from such plates shall be cleaned, filled with mortar, and carefully troweled and cured.

5. CURING: Polyethylene film complying with ASTM C-171 shall be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film should be immediately covered with a minimum of 3 inches of moist loose soil to hold the film in place and to protect the pipe. The trench backfill shall not commence until the pipe attains 2500 psi compressive strength. The pipe shall be checked for compliance with grade and alignment and thickness requirements prior to placement of backfill.

A humid atmosphere within the pipe, as evidenced by condensation on the interior surface, shall be maintained for at least seven (7) days following placement, except for a maximum period of 24 hours which is allowed for removing forms and making all repairs. To prevent air drafts which may

dry the pipe and to maintain a humid atmosphere inside the pipe, all openings (ends, manholes, connector pipes) shall be kept closed or securely covered at all times except when actual work on the inside of the pipe is in progress. The pipe shall also be partially filled with water during the curing period, to allow higher humidity, when actual work is not being performed on the inside of the pipe.

6. REPAIR: Immediately after removal of the forms, the inside of the pipeline will be inspected for required repairs and conformance with all dimensional requirements including alignment and grade.

   The Contractor shall schedule his work force, by extended, staggered or multiple shifts, as required, to provide for dropping of forms within 2 to 6 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements. In no event shall work commence later than 24 hours from placement.

   All rock pockets, cracks less than 0.01 inches or indentations shall be cleaned, moistened and filled with 1:2 cement grout, epoxy material, rubberized mastic or other material approved by the Engineer.

   Cracks exceeding 0.01 inches in width may be cause for rejection and removal and replacement of that portion of the pipe. Subject to the approval of the Engineer, cracks exceeding these limits may be repaired using a pressure applied epoxy compound capable of providing structural correction to the area in addition to sealing the void.

7. FINISHING: Except for the form offsets, the interior surface of the pipe shall be equivalent to or better than a wood float finish. Form offsets shall be trimmed so as to provide a reasonable tapered slope from surface to surface. The bottom of the pipe below the metal forms shall be finished in a workmanlike manner and shall conform to the general circular circumference of the pipe without sags, dips and humps. All extraneous concrete shall be removed from the interior surface.

8. TESTS**:** Random tests shall be made of the wall thickness at the top, bottom and sides, approximately every 100 feet, on a daily basis by probes through fresh concrete or small holes drilled through the concrete. Holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made.

   Test cylinders shall be prepared and tested as per Section 90 of the State Standard Specifications. If the cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken

from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer. The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least 3 times the maximum nominal size of the coarse aggregate used.

The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested.

9. INSPECTION: An inspector of cast-in-place concrete pipe under the direct supervision of a Registered Civil Engineer experienced in the manufacture and placement of CIPCP shall be required at the expense of the Contractor for continuous inspection of the construction of the pipe. The inspection shall be certified in writing and signed by the Inspector and the Registered Civil Engineer. The certification to be done on a daily basis of operation shall include, as a minimum, the following:

   a. Review of trench and adjacent soil conditions and test results.

   b. Report on method of operation and compliance with these specifications.

   c. Report on concrete mix design used, transit method and machinery, and slump as poured.

   d. Report on visual appearance of the pipe as poured for smoothness, rock pockets, if any, and alignment and grade.

   e. Report on curing method.

   f. Report on method and timing of backfill.

   g. Review of concrete test results and adequacy of the finished product.

10. CONNECTIONS: Pipe connections to drainage manholes shall be made so that the pipe is flush with the inside face of the manhole. Mortar shall be used to seal and smooth the joints.

11. CAST PORTION: The Contractor shall cast the lower portion of drainage manholes in place. Minimum and maximum wall thickness for the cast-in-place sections shall conform to the following table in accordance

with Section 90 of the State Standard Specifications.

Manhole Diameter (Inches)	Minimum Wall Thickness (Inches)	Maximum Wall Thickness (Inches)
48	5	7
60	6	8
72	7	9

Inside diameters of cast-in-place portions shall equal the diameter of the manhole specified. Standard precast manhole riser sections and/or cones shall be placed above the cast-in-place section to bring the manhole rim to grade.

12. CAST-IN-PLACE GRADE ADJUSTMENT: Grade adjustment may be made by utilization of precast grade rings or, in new subdivisions only, by a cast-in-place ring. The latter shall have a minimum horizontal thickness of 4 inches and a maximum of 15 inches. The concrete pour shall not extend above the top of the base flange of the manhole frame. The minimum height of the ring shall be 3 inches and the maximum 12 inches. The manhole frame is to be set 14 inches below pavement finish grade.

CS18-04. TESTING OF STORM DRAINS: Testing of storm drains, if required by the City Engineer, shall be conducted after backfilling has been completed. If the testing is required, the following test shall be performed:

1. The line shall be plugged at the lower manhole and the section to be tested shall be plugged at the upstream manhole on all lines coming onto the manhole. Water shall then be introduced into the lower manhole to a depth 3 feet above the top of the pipe. The water shall be introduced into the line at least 4 hours in advance of the test to allow the pipe to become saturated. The water shall then be brought to the 3 feet mark above the top of the pipe in the lower manhole and the amount of water measured that is lost in a 4-hour test period. The leakage shall not exceed 20 gallons per diameter inch per 1000 feet of pipe for the 4-hour test period.

   Test sections showing leakage in excess of that allowed shall be repaired or reconstructed as necessary to reduce the leakage to that specified. Method of repair shall be at the discretion of the City Engineer.

2. T.V. INSPECTION: Prior to acceptance of any storm drain line by the City, said line shall be inspected internally by television as outlined below at the contractor's expense.

Contractor shall submit DVD disk and logs to the City after implementing any repairs required of retest.

Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected by the contractor at his expense.

a. The complete job is ready for television inspection when the following work has been completed:

   i. All storm drain pipelines are installed and backfilled.

   ii. All structures are in place, all channeling is complete and pipelines are accessible from structures.

   iii. Final street subgrading is complete and ready for asphaltic concrete surfacing.

   iv. Pipelines to be inspected have been preliminarily flushed or cleaned with a high pressure cleaner.

   v. All other tests have been performed and deficiencies remedied.

b. When the above work is complete, the Contractor shall arrange for the television inspection.

c. The Contractor of the project will notify the City in writing as to the scheduled date of the television inspections.

d. After conditions i through v as outlined above are met, the entire job will be initially televised and recorded. The DVD disk and reports shall be delivered to the City.

e. DVD disk video recording shall be color format and the audio and video portions shall be free of electrical interference and excessive background noise.

f. The audio report shall be recorded by the operating technician on the DVD disk as they are being produced and shall include the location of the sewer, the names or numbers of the manholes involved, the direction of travel and a description of all lateral locations and conditions in the storm drains as they are encountered and their locations.

g. In addition to the audio report, a written report shall be required listing all the information required in the audio report.

h. The Contractor will be notified in writing of any deficiencies revealed by the television inspection that will require repair. If corrective work is indicated and the Contractor wishes to view DVD disk recording, he shall contact the City to set a time for viewing with the City Engineer.

i. Corrective work shall be done. The cost shall be borne by the Contractor.

j. Those portions of the pipeline system that have been corrected must be retelevised and recorded and the DVD disks and reports delivered to the City.

k. The procedure outlined in conditions "A" through "G" above will be repeated until all deficiencies observed by television inspection have been corrected to the complete satisfaction of the City.

l. All DVD disk recordings and reports become the property of the City to be used as "As-Builts" for future reference.

CS18-05. PAYMENT:

A. PIPE: Payment for storm drain pipe shall be at a price per lineal foot from center of manhole to center of manhole or catch basin or from center of manhole to wall of outlet structure as the case may be. Measurement shall be along a line parallel to the grade of the storm drain.

Payment shall include full compensation for excavation, bedding, backfill, furnishing and laying of pipe, de-watering, testing, and all other work necessary to construct and complete in an efficient and workmanlike manner the installation of storm drain pipe in accordance with the contract plans and these specifications.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

B. MANHOLES:

1. CONCRETE MANHOLES: The contract unit price paid for reinforced concrete manholes shall include excavation, backfill and all labor, equipment and material necessary for completion of the structure in

accordance with the contract drawings and specifications. The unit price bid shall be the average price for manholes of all depths and types indicated on the plans and in the Proposal.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

2. SADDLE MANHOLES: The contract unit price paid for saddle manholes shall include excavation and all labor, equipment and material necessary for completion of the structure in accordance with the drawings and the specifications. The unit price bid shall be the average price for manholes of all depths as indicated in the plans and in the Proposal.

   Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

3. FRAMES AND COVERS: The cost of furnishing and placing manhole frames and covers shall be included in the contract unit price bid for manholes and/or other items of work.

   Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

C. DRAIN INLETS: Under the appropriate item(s) of the Proposal, the Contractor shall bid a price per each for constructing the respective types of drainage inlets as indicated in the plans and the Proposal. The price bid per drainage inlet shall include all excavation, materials and labor to place the complete unit as set forth on the plans and specifications. The unit price bid shall be the average price for drainage inlets of all depths for the type indicated in the Proposal.

   Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

D. INLET AND OUTLET STRUCTURES: Under the appropriate item(s) of the Proposal, the Contractor shall bid a price each for construction of inlet structures and outlet structures The price bid each for construction of inlet and outlet structures with racks shall include full compensation for all materials, labor, and equipment, to place the unit, complete, as shown on the plans and in the specifications. The unit price bid shall be the average for all sizes and types of rack shown on the plans.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

CONSTRUCTION SPECIFICATIONS

SECTION 19 - TRAFFIC STRIPE REMOVAL

CS19-01. ITEM: Under this item of the Proposal, the Contractor shall remove traffic striping. Stripes of widths other than 4" shall be converted to an equivalent length of 4" stripe for determination of quantities. Traffic stripe shall be defined as paint, thermoplastic, buttons, reflectors or any other striping material.

CS19-02. SPECIFICATION: Traffic stripe removal shall conform to Section 15-2.02B of the State Specifications and the following requirements.

Traffic stripe shall be removed by sandblasting or approved grinding methods. Pavement legends shall be ground into blocks, removing no more than 1/4" of asphalt depth, leaving no trace of legend. The block shall then be sealed with one coat of seal coat material in the shape of the block with neat edges.

Where buttons or reflectors are removed, the divot left by the removal of asphalt shall be filled with bituminous material and leveled off with the top of pavement leaving no bump, divot or excess materials.

CS19-03. PAYMENT: The unit price bid shall be per lineal foot for linear stripes, square foot for legends and per button for buttons and reflectors. Price bid for removal shall include full compensation for all material, tools, labor, traffic control and equipment to remove the striping and treat the surface as specified herein.

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CONSTRUCTION SPECIFICATIONS

SECTION 20 - STREET NAME SIGNS

CS20-01. ITEM: The work shall consist of furnishing and installing street name signs at locations shown on the contract plans or where directed by the Engineer.

CS20-02. SPECIFICATION:

A **PANELS:** Panels shall be made of 0.125" thick aluminum with 1-1/4" rounded corners, DG3 (diamond grade) reflective sheeting, and green EC reverse cut foreground. Street name sign panels shall be 9" x 30" minimum with 6" upper-case and 4.5" lower-case HWY GOTHIC MOD C style with ½" stroke width. No block numbers, arrows, or pictographs shall be allowed on signs. North, South, East, and West streets shall be abbreviated with an upper-case corresponding abbreviation followed by a period. Streets that are named after a letter of the alphabet shall have the direction spelled out using the criteria above, and no period shall be placed following the letter of the street. Abbreviations for street type classifications shall conform to the following:

Avenue	Ave
Boulevard	Blvd
Circle	Cir
Court	Ct
Drive	Dr
Lane	Ln
Parkway	Pkwy
Place	Pl
Road	Rd
Street	St
Way	Way

B **MOUNTING HARDWARE**: Street name signs shall be mounted to the top of sign poles. Street name signs shall be attached to street light poles using arm bracket and crosspiece as needed. Assembly shall be mounted to the light pole using adjustable electrolier mounting bands. Mounting hardware shall be approved by City Engineer prior to installation.

Street name signs shall be mounted as shown on Construction Detail 3240.

CS20-03. PAYMENT: The unit price or lump sum bid for the installation of signs shall include full compensation for all material, tools, labor, and equipment to install the signs as specified herein.

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CONSTRUCTION SPECIFICATIONS

SECTION 21 - TRAFFIC SIGNS

CS21-01. ITEM: The protection and maintenance of existing signs and the removal, protection, storage, and resetting of City of Dixon traffic signs that are affected by the work shall be the responsibility of the Contractor, as directed by the City Engineer or as specified in the Special Provisions.

CS21-02. SPECIFICATION: Signs shall be erected pursuant to the provisions of Section 56-2 of the State Specifications, unless otherwise modified by the City Engineer or in the Special Provisions. The Contractor shall furnish and install signs as shown on the contract plans. All signs shall be in conformance with the Manual on Uniform Traffic Control Devices with California Supplement; size and materials must be approved by the City Engineer if not shown on the contract plans.

A. METAL POLES: All metal pipe poles shall be minimum 2" nominal size, galvanized iron, Schedule 40, conforming to the provisions of A.S.T.M. A120 (standard installation).

B. WOOD POSTS: All wood posts shall be minimum 4" x 4", nominal size, and shall be construction grade pressure treated redwood, all-heart (special approval required).

C. SIGNS: All street signs shall be high intensity fully reflective sheeting on .080" min. aluminum plates.

D. MOUNTING HARDWARE: Signs shall be attached to sign poles using single clamp-on u-brackets. Signs shall be attached to street light poles using adjustable electrolier mounting sets.

E. BACK BRACING: Back bracing is required for all signs larger than 18" x 24" or where identified by the City Engineer.

Signs shall be mounted as specified in Construction Detail 3220.

CS21-03. CONSTRUCTION SIGNS: The Contractor shall furnish and install construction signs in accordance with the contract plans and the Manual on Uniform Traffic Control Devices with California Supplement of Traffic Controls. If required by the City Engineer, a Traffic Control Plan (TCP) shall be provided to the City and approved by the City Engineer prior to installation of construction signs or beginning of construction work within the City street right- of-way.

CS21-04. PAYMENT: The unit price bid for the installation of signs shall include full

compensation for all material, tools, labor, and equipment to install the signs as specified herein. The cost of furnishing and installing construction signs and preparation of the Traffic Control Plan (TCP) shall be considered to be included in payment for other items of work, unless a specific pay item is included in the proposal.

CONSTRUCTION SPECIFICATIONS

SECTION 22 - GUIDE MARKERS

CS22-01. ITEM: This item shall consist of furnishing and installing markers and delineators at the locations shown on the contract plans or where directed by the City Engineer.

CS22-02. SPECIFICATION: Guide markers shall conform to the applicable portions of Section 82 of the State Standards for markers and delineators and the following:

Flexible posts shall be used. Flexible posts shall be made from a flexible white plastic which shall be resistant to impact, ultraviolet light, ozone and hydrocarbons. Flexible posts shall resist stiffening with age and shall be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

Each marker shall have a reflector consisting of a 3" x 18" (minimum) strip of silver reflective sheeting.

Posts may be driven in place where soil conditions permit, provided the method of driving does not damage the posts. If ground conditions are such that the posts cannot be driven without damaging them, pilot holes may be drilled or the posts may be reinforced with a one foot minimum length of metal drive post attached at the bottom to facilitate driving. The standard length shall be 4 feet above ground with two feet in the ground.

CS22-03. PAYMENT: The unit price bid for the installation of signs shall include full compensation for all material, tools, labor, and equipment to install the sign as specified herein.

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CONSTRUCTION SPECIFICATIONS

SECTION 23 - ELECTRICAL

CS23-01. GENERAL: The electrical work to be done consists of furnishing all labor, materials, transportation, tools, equipment and appurtenances required for the complete installation of all electrical systems shown on the Plans, and as specified in these Specifications, the Special Provisions, Section 86 of the State Specifications, the National Electric Code (NEC) and the International Municipal Signal Association (IMSA).

All equipment, materials and supplies shall be new and of current manufacture unless otherwise specified. All equipment shall be complete and in operation to the satisfaction of the City Engineer at the time of acceptance of the work.

All incidental parts which are not shown on the Plans or specified herein and which are necessary to complete the traffic signal and street lighting systems shall be furnished and installed as though such parts where shown on the Plans or specified herein.

CS23-02. RULES AND REGULATIONS: Electrical equipment furnished shall conform to the standards of the National Electrical Manufacturers Association, the Underwriters' Laboratories, Inc., or the Electronic Industries Association, wherever applicable. All material and work shall conform, where applicable, to the requirements of the National Electrical Code; Title 8, California Administrative Code, Electrical Safety Orders; Rules for Over Head Electrical Line Construction, General Order No. 95 of the Public Utilities Commission; Standards of the American Society for Testing and Materials (ASTM); American National Standards Institute (ANSI); and City of Dixon ordinances governing such types of construction.

CS23-03. MAINTAINING EXISTING ELECTRICAL FACILITIES: All existing electroliers shall be maintained in operation until replacement electroliers are energized, as directed by the City Engineer.

All traffic signal heads and pedestrian signal heads installed but not operational shall be entirely covered with burlap and securely tied to prevent exposure of signal head face to vehicular or pedestrian traffic.

Where the modification of existing traffic signal intersections may require the temporary shutdown of traffic signals, the contractor shall take all steps necessary to keep traffic signal intersection downtime to a minimum. The work shall be scheduled so that the downtime of each intersection shall be four (4) hours maximum and shall occur between the hours of 9:00 a.m. and 3:00 p.m. The Contractor shall notify the City Engineer five (5) working days prior to any planned traffic signal intersection shutdowns.

CS23-04. FOUNDATIONS: Foundations for posts, standards, pedestals, and other appurtenances shall be Class 'A' Portland cement concrete conforming to Section 90 of the State Standard Specifications.

Foundations for standards shall be poured monolithically. The bottom of the standard shall be one to two inches above the top of the foundation. Grout shall be placed from the top of the foundation to the bottom of the standard. The exposed portion of the foundation shall be formed to present a neat appearance. Tops of foundations for posts and standards, except special foundation, shall be finished to curb or sidewalk grade as shown on the Plan or as directed by the City Engineer.

When a foundation is to be abandoned in place, the top of foundation, anchor bolts and conduits shall be removed to a depth of six inches (6") below the surface of sidewalk or unimproved ground. The resulting hole shall be backfilled with material equivalent to the surrounding material.

There shall be no greater than a 4:1 slope of native material within 5 feet of a signal controller/ service pad. A retaining curb or masonry block wall may be required by the City Engineer to achieve the required slope.

CS23-05. EXCAVATING AND BACKFILLING: The excavations required for the installation of conduit, foundations, and other appurtenances shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks and other improvements. All lawns or improvements disturbed in excavating shall be replaced or reconstructed with the same kind of material as found on the work or with materials of equal quality. The trenches shall not be excavated wider than necessary for the proper installation of the electrical appurtenances and foundations. Excavating shall not be performed until immediately before installation of conduit and other appliances.

The material from the excavation shall be placed in a position that will not cause damage or obstruction to vehicular and pedestrian traffic nor interfere with surface drainage.

Permission to cut or disturb the pavement in any street must be obtained from the City Engineer. The removal of existing pavement and concrete walks or driveways shall be by sawing the edges of the areas to be removed to a minimum depth of one and one-half inches (1 1/2") and digging out the old pavement or concrete. Whenever a part of a square or slab of existing concrete sidewalk or driveway is broken or damaged, the entire square or slab shall be removed and replaced.

Backfill material shall be placed in six inch (6") layers. Each layer of backfill shall be moistened and thoroughly tamped, tolled or otherwise compacted until the relative compaction is not less than ninety-five percent (95%). Compacting of backfill material by pounding or jetting will not be permitted.

Immediately following the completion of backfill at each location where pavement was cut, the

Contractor shall place the necessary temporary surfacing and follow up with the permanent paving at the expense of the Contractor. The reconstruction of the concrete walks and driveways shall be as specified in these Specifications. The type of concrete used and its color shall match the adjacent concrete construction. The cost of said concrete work will be at the expense of the Contractor. Concrete sidewalks shall have a minimum thickness of four inches (4") and the minimum thickness of concrete driveways shall be six inches (6").

All surplus excavated material shall be removed and disposed of within forty-eight (48) hours by the Contractor. All sidewalks and gutters shall be swept clean.

CS23-06. CONDUITS: Conduits shall be either mild steel, rigid, hot dipped galvanized or Schedule 40 polyvinyl chloride (PVC). PVC conduit shall not be concrete encased.

A. Requirements for Mild Steel, Rigid Conduit: The rigid steel conduit shall be thoroughly cleaned and all burrs removed. The use of thin-wall conduit is specifically prohibited for underground installation.

Exterior and interior surfaces of all conduit and fittings shall be uniformly and adequately zinc coated by the hot-dipped galvanizing process. The interior and exterior of a six inch (6") sample cut from the center of a standard length of conduit when tested, shall not show a fixed deposit of copper after four, one-minute immersions in the standard copper sulfate solution.

The interior of the conduit shall have a continuous coating of lacquer or enamel. Each length shall bear the label of Underwriters' Laboratories, Inc. Installation shall conform to appropriate articles of the Code.

Rigid steel conduits shall be not less than one and one-half inches (1-1/2") in diameter. Contractors, at their own expense and discretion, may be allowed to use larger size conduit, upon request. Where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. No reducing couplings shall be permitted in any run. All conduit bends, except factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent, with approved hydraulic bender, without crimping or flattening, using the longest radius practicable. All conduit ends shall be sealed with a slip on cap until wiring is started. When caps are removed, conduit ends shall be provided with approved conduit bushings.

Conduit stubs, caps, exposed threads and all standard screw joints shall be painted with zinc rich paint or an equal rust preventative paint.

All mild steel, rigid conduits, where exposed to a corrosive environment, must be OCAL. All conduit openings whether used or spare must be identified and sealed with duct seal.

B. Requirements for Schedule 40 Polyvinyl Chloride Conduit: Polyvinyl Chloride conduit (PVC) shall be ninety degrees (90') C rated and listed by Underwriters' Laboratories. Conduit shall conform to NEMA Standards and be in conformance with Article 347 of the National Electrical Code. Conduit, fittings and cement shall be produced by the same manufacturer, who shall have at least five (5) years experience manufacturing the product. Material shall have a minimum tensile strength of 7,000 psi at 73.4° F; flexural strength of at least 11,000 psi and a minimum compressive strength of 8,600 psi. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

All PVC conduits shall be not less than one and one-half inches (1-1/2") in diameter. Contractors, at their own expense and discretion, may be allowed to use larger size conduit, upon request. Where larger size conduit is used, it shall be for the entire length of the run. All conduit ends shall be scaled with a slip on cap until wiring is started. The slip on cap shall have a slot large enough for a pull rope. Unless otherwise specified, all PVC conduits shall contain one No. 10 green ground conductor.

C. Requirements for Conduit Installation: The installation of conduit in lawn areas shall be by approved boring method or by trenching. If trenching is used, Contractor shall first remove the sod prior to trenching. The removal of sod over jack holes or over trenches shall be done by a sod cutting machine. Removal of sod by other means shall not be accepted. Each strip of sod removed shall be rolled into a neat roll without damage. All sod removed shall be replaced within forty- eight (48) hours. The installation of conduits in paved streets shall be by approved jacking, drilling or trenching methods.

When installed under sidewalk, conduit shall be laid to a depth of not less than eighteen inches (18") below sidewalk grade. In all other areas, conduit shall be laid to a depth of not less than twenty-four inches (24") below the finished grade.

Conduit runs to be located under street pavement shall be installed within a minimum of twelve inches (12") and a maximum of eighteen inches (18") from and parallel to the lip of gutter, by using the “Trenching Installation of Conduit in Paved Streets" method. Installation of additional conduits at street intersections may be required, at the discretion of the City Engineer, to support known and potential future telecom requirements. All pull boxes shall be located behind sidewalks unless otherwise noted on the Plans.

When a conduit is shown on the Plans as lying in a straight line parallel to the curb line, sidewalk, or pavement edge, it shall not deviate more than six inches (6") to either side of that parallel line.

In order to verify that conduit is laid to the correct depth and in as straight a line as possible, the Contractor shall, as the minimum, leave conduit exposed at a spacing of not over seventy-five feet (75') and no such exposure shall be backfilled until approved by the City Engineer.

The bending of PVC conduit shall be by a hot box bender, and in lieu of jacking or boring, PVC conduit shall be installed by the drill rod method in which a drill rod is first installed and the PVC is pulled into the cavity made by the drilling rod as the rod is removed. At locations where conduit is not installed by the said trenching method, the conduit shall be installed by the drill rod method.

Before any wire is pulled in the conduit system, all conduit shall be swabbed out to remove any foreign material that is in the conduit. The removal of foreign material from the conduit with compressed air is acceptable.

Conduit entering controller or service cabinets shall be sealed to prevent the entrance of gases by the use of paraffin or other sealing compound approved by the City Engineer.

Five inch (5") conduit nipples shall be attached by use of a coupling to any conduit run which terminates inside signal standards. Top of nipple shall be two inches (2') above the finished grade of the signal standard foundation.

D. Trenching Installation of Conduit in Paved Streets: Conduit shall be placed under existing pavement in a trench approximately two inches (2") wider than the outside diameter of the conduit to be installed. Trench shall not exceed six inches (6") in width. Conduit depth shall not generally exceed twelve inches (12") or conduit trade diameter plus ten inches (10"), whichever is greater, except that at pull boxes the trench may be hand dug to a required depth. The top of the installed conduit shall be a minimum of nine inches (9") below finish grade.

The outline of all areas of pavement to be removed shall be cut to a minimum depth of three inches (3") with an abrasive type saw or with a rock cutting excavator specifically designed for this purpose. Cuts shall be neat and true with no shatter outside the removal area.

The trenching machine shall be shielded to prevent loose material from being thrown away from the machine. Loose material deposited on the pavement behind the cutting machine shall be removed from the pavement immediately and the pavement cleared to allow the passage of traffic. Only those traffic lanes occupied by the cutting machine and the cleanup operation shall be closed and they shall be opened as soon as the work has moved sufficiently to clear them.

The conduit shall be placed in the bottom of the trench and the trench shall be backfilled with commercial quality concrete containing not less than 564 pounds of Portland cement per cubic yard to not less than 0.10 foot below the pavement surface. The concrete shall be tamped or vibrated to provide a dense material free from excessive voids and rock pockets.

The top 0.10 foot shall be backfilled with asphalt concrete produced from commercial

quality paving asphalt and aggregates, and approved by the City Engineer.

Spreading and compacting of asphalt concrete shall be performed by any method which will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.

Excavation, installation of conduit and concrete backfill shall be completed within the same working day. Asphalt concrete backfill shall be completed within twenty-four (24) hours after excavation off trench.

Upon completion of all contract work, the trenches cut through existing pavement will be inspected and, if found necessary by the City Engineer, they will be brought to grade with an appropriate asphaltic concrete mix. In addition to bringing the trenches to grade, the City Engineer may require a twelve inch (12") wide seal coat centered over the trench pavement or between the trench pavement.

CS23-07. PULL BOXES: Pull boxes shall be installed behind the sidewalk at the locations shown on the Plans, or at locations designated by the City Engineer at site of work. As a minimum, pull boxes shall be located where two or more conduits intersect, at critical angle points, street crossings, and adjacent to the bases of all street lights poles. The distance between pull boxes shall not exceed 175 feet. Contractor may, at own expense, install such additional pull boxes as may be desired to facilitate the work.

For signal systems, or combined signal and low voltage lighting systems, reinforced concrete covers shall be inscribed 'Traffic Signals" and for lighting systems, reinforced concrete covers shall be inscribed "Street Lighting'. ('High Voltage' where applicable). If pull boxes are set in an area subject to vehicle traffic load they shall have a steel cover of suitable design to withstand such loads. The lid inscriptions shall be in conformance with Caltrans Standard Plan ES-8.

The bottom of all concrete boxes shall be left open and at least twelve inches (12") of crushed rock shall be placed below the box for drainage as shown on Plans or as directed by the City Engineer. The crushed rock shall be installed prior to the installation of the conductors.

Unless otherwise noted on the plans, all pull boxes containing three or less street lighting conduits shall be Caltrans Standard No. 3-1/2 size. A Caltrans Standard No. 5 pull box shall be used for all pull boxes containing either traffic signal conduit or four or more conduits, unless otherwise noted on the plans.

Pull box extension shall be furnished and installed where called for on the Plan. Where a pull box extension is to be installed over the ends of existing conduits, the conduit ends shall be raised or lowered so they will be a minimum of five inches (5") and a maximum of seven inches (7") below the underside of the pull box cover.

Pull boxes shall not be placed in curb ramp areas unless directed by the City Engineer.

CS23-08. CONDUCTORS: Unless otherwise specified, conductors shall be single conductor, solid or stranded copper of the gauge shown on the Plans. Wire sizes shall be based on American Wire Gauge (AWG). Copper wire shall conform to the applicable portions of ASTM Designations B3 and B8. Contractor shall use color coded wires, using a different color for each circuit with continuous color maintained throughout each circuit. Color coding shall be as required by the City Engineer or as detailed on the Plans or Special Provisions. Where permitted by the City Engineer, conductor of the same color may be used on different circuits. These conductors shall be identified with approved tags.

Traffic signal and multiple circuit lighting conductors shall be rated for 600 volt operation. Unless otherwise specified, the insulation for the conductors shall be Type THW or Type THWN.

CS23-09. WIRING: Pulling wires shall be done with special care to preclude injury to the insulation. Hand power only shall be employed in pulling wire. A UL or ETL listed inert lubricant shall be used in placing conductors in conduit.

Wires shall not be drawn into underground conduit until standards have been delivered and ready for erection.

Ends of spare conductors shall be taped and water sealed with Scotch Kote or approved equivalent.

All splices shall be Method B.

Field fuses shall be installed in the handhole of the standard. All ungrounded conductors shall be fused.

CS23-10. BONDING AND GROUNDING: All metal conduit systems, standards, pedestals, ballast and transformer cases, service equipment, anchor bolts, etc., shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Grounding shall be in accordance with all applicable codes and regulations. Bonding and grounding jumpers shall be copper wire or copper strap with a minimum cross sectional area equivalent to a No. 8 AWG.

Splices in ground wires shall be made with UL or ETL approved compression connectors.

Bonding wire or strap shall be secured to the lower section of metal standard by brass or bronze bolts three-sixteenths inch (3/16") or larger.

In conduit systems where rigid steel conduit and PVC conduits are mixed, the following requirements apply.

1. The rigid steel conduit shall have an approved grounding bushing installed at the conduit end(s).

2. The grounding conductors in the PVC conduit shall be attached to a grounding bushing which shall be attached to the rigid steel conduit.

If there is no rigid steel conduit, the grounding conductors must be attached to the 5/8" x 8'cooper ground rod.

CS23-11. ELECTRIC SERVICE: The locations of service points shown on the Plans are approximate only. Contractor shall coordinate to determine the precise locations from PG&E. Service conduits, service conductors, service grounds, metering and transformer pads where required shall be installed in accordance with PG&E requirements. Service equipment and enclosure shall be furnished and installed as detailed on the Plans or specified in the Special Provisions.

The service enclosure shall be Type IIIAF per the latest edition of the State of California Standard Plans Detail for Type III-A Series. For street lighting, a separate breaker shall be supplied for each circuit plus one spare. An internal twist-lock type PEU shall be installed with a plexiglass window on the side of the enclosure. A test switch shall be installed. For Traffic signals a separate breaker shall be installed for internally illuminated street name signs.

CS23-12. PANELBOARDS: Panelboards shall be as called for on the Plans. Each circuit breaker shall be permanently marked with its trip rating. Multipole breakers shall be common trip with a single handle. Unless otherwise specified, each circuit breaker shall be equipped with a device for padlocking the breaker in the 'on' or 'off' position. Panelboards shall be equipped with copper bus bars with sizes based on a current carrying capacity of not over one thousand (1,000) amperes per square inch of cross section.

Unless otherwise specified, enclosures of panel board shall be Anodized Aluminum.

CS23-13. STANDARDS: The locations of standards for traffic signals and street lights shown on the Plan are approximate only. The exact location of each standard will be determined by the Engineer prior to installation.

Each standard shall be anchored to the concrete foundation by galvanized steel anchor bolts, nuts, leveling nuts and washers in accordance with the Plans and the standards shall be installed in a true vertical position.

CS23-14. FIELD TEST: Prior to acceptance of the work, the Contractor shall test the following:

A. For continuity of each circuit.

B. For grounds in each circuit.

C. A megger test on each circuit. For traffic signal loops there must be a minimum of 200 meg. Ohms at 500 volts for one minute.

D. A functional test.

E. Unoccupied and occupied frequency of the loop must fall within the vehicle detectors maximum sensitivity range.

CS23-15. TRAFFIC SIGNAL TESTING AND ACTIVATION: Prior to the initial traffic signal activation, the Contractor shall perform the following functional tests in the presence of the City Engineer representative:

A. All vehicular and pedestrian indications shall individually be turned on momentarily and proper operation and phasing shall be checked.

B. The controller shall be turned on with the vehicle and pedestrian indications turned off, all pedestrian pushbuttons and inductive loop detectors shall be checked for proper operation and phasing.

C. All vehicular and pedestrian signal heads shall be properly adjusted and covered.

If any system component or circuit does not operate properly, it shall be repaired and retested prior to traffic signal intersection turn on. After the successful completion of all tests, the Contractor shall request through the City Engineer, a time and date for turn on.

Traffic signal intersection turn on may occur only between the hours of 9:00 a.m. and 2:00 p.m. on Monday, Tuesday, Wednesday or Thursday on a week with no scheduled holidays. The Contractor shall give the Engineer at least five (5) working days notice prior to the traffic signal intersection turn on.

The intersection turn on date shall be subject to the approval of the City Engineer. Contractor shall arrange to have a signal technician qualified to work on the controller and employed by the controller manufacturer or authorized representative present at the time of traffic signal intersection turn on.

In addition, Contractor shall provide sufficient personnel and equipment for the timely completion of the traffic signal intersection turn on. If in the opinion of the City Engineer the Contractor has not provided sufficient personnel and equipment, the City Engineer, may postpone the traffic signal turn on until such time as sufficient personnel and equipment are provided.

CS23-16. TRAFFIC SIGNAL CONTROLLER FUNCTIONAL TEST: A functional test shall be made on the new controller after installation. Contractor shall schedule the test upon the approval of the City Engineer.

Prior to the functional test, Contractor shall first verify that all equipment as shown on the Plans or called for under these specifications are installed and operable.

The functional test shall not begin on a Friday or on the day preceding a legal holiday. The test shall be made between 9:00 a.m. and 2:00 p.m. by the Contractor in conjunction with the service engineer of the controller manufacturer in the presence of the City Engineer and Traffic Signal Maintenance Section representatives.

Included as part of the functional test is the continuous satisfactory operation of the signal system for a period of not less than five (5) working days. During the five (5) day test period, the Contractor and the authorized service engineer of the controller manufacturer shall be available at the job site within four (4) hours after notification to correct any malfunction which might develop in the signal system or the controller.

CS23-17. INSPECTION: In order to facilitate inspection by the City Engineer, Contractor must observe the following procedure:

A. Prior to final electrical inspection, Contractor must ascertain that:

1. All standards are tightly secured.

2. All standards are true.

3. All standards are grounded with copper ground wire or strap with brass bolts and washers.

4. All conduit studs are bonded.

5. All exposed threads are painted.

6. All splices are taped and insulated in accordance with these Specifications.

7. Circuits are tagged with metal tags where required.

B. Concrete pull box covers shall be protected during construction. Damaged covers shall be replaced with new covers by the Contractor.

CS23-18. SALVAGE: All salvageable material and equipment removed from present installation which are not to be re-installed shall be delivered to the Municipal Service Center at 385 East Chestnut Street, Dixon, California.

The Contractor shall remove all signal heads, mounting brackets, luminaires, mast arms and appurtenances from all salvaged traffic signal and street lighting standards prior to delivery to the Municipal Service Center.

The Contractor shall provide for the safe transfer with no damage to the salvaged equipment. Any equipment broken or lost by the Contractor shall be replaced with equipment of equal quality at the expense of the Contractor.

CS23-19. LED SIGNAL INDICATIONS: Unless otherwise indicated, all new red, yellow, and green traffic signal indications and all pedestrian indications shall be the light emitting diode type and shall conform to the most recent specification of the State of California Department of Transportation. All purchases shall be from vendors and models listed on the Caltrans Qualified Product List, or approved equal.

CS23-20. EMERGENCY VEHICLE PREEMPTION (EVP): Emergency Vehicle Preemption equipment shall be 3M Opticom or approved equal.

Preemption cables shall be labeled in the following manner:

Phase 2&5	single gray band
Phase 4&7	double gray band
Phase 1&6	triple gray band
Phase 3&8	quadruple gray band

Labels shall consist of banded colored tape visible at the preemption detector, signal standard handhole, adjacent pull box and the controller cabinet. Cables in the controller cabinet shall have tie wrap labels with appropriate phasing descriptions.

CS23-21. VEHICLE SIGNAL FACES: All signal faces shall be aluminum, powder coated dark olive green with flat black door. Visors shall be 12" black aluminum tunnel type, powder coated black inside and out. Mountings for MAT and MAS signal sections shall be bronze metal, powder coated dark olive green.

CS23-22. SIGNAL SECTIONS: All signal sections shall be 12" mold-cast aluminum.

CS23-23. BACKPLATES: All vehicle signal sections shall have aluminum backplates with perforated louvers, flat black on both sides.

CS23-24. PEDESTRIAN SIGNAL FACES: Pedestrian signal faces shall be aluminum Type “A” with international symbols. Pedestrian head mounts shall be clam shell type with bronze mounting hardware, powder coated green/ black. All wiring shall be quick connect type (plug-in).

Pedestrian heads shall be mounted on the intersection side of the signal pole unless otherwise directed by the City Engineer.

Pedestrian signal mounts shall be made from galvanized steel pipe and fittings with bronze terminal compartment, powder coated dark olive green.

CS23-25. SIGNAL MOUNTING ASSEMBLIES: Terminal compartments (TV and SV) and mast arm slip fitters (MAS and MAT) shall be made from galvanized steel pipe and fittings with bronze terminal compartment, powder coated dark olive green.

CS23-26. PEDESTRIAN PUSH BUTTON: The pedestrian push button housing and signage shall meet ADA specifications for color and texture signage shall be black lettering on yellow background. The pedestrian push button shall meet ADA and Caltrans specifications. The push button housing shall be aluminum, adjustable to fit, and powder coated dark olive green. Pedestrian push buttons should be located no more than five feet (5') from the curb ramp.

CS23-27. VEHICLE DETECTOR MATERIALS: Loop wire shall be Type 1, RHW-USE, neoprene jacketed, cross-linked polyethylene insulated, #12 stranded copper.

Lead-in cable shall be Type B copper. Tinned copper shall not be permitted.

Vehicle detector handholes shall be Type A.

Front detector loops shall be Type D loops per State Standard Plan ES-5B.

CS23-28. VEHICLE DETECTOR INSTALLATION: All loop locations shall be verified by the City Engineer.

All loop wires shall be labeled with banded colored tape visible in the pull boxes.

Detector lead-in cables shall be clearly marked at both ends with input address by means of plastic tie-wrap labels.

Loop home run slots shall be double cut to accommodate the twisted pair (3-turns/foot), or as directed by the City Engineer. Sealant for filling slots shall be Hot Melt Rubberized Asphaltic Sealant or equivalent as approved by the City Engineer. All excess sealant shall be removed by squeegee after application

All loop wires shall terminate in the nearest pull box, not the handhole.

Detector Lead-in cables shall not be spliced between the termination point (the pull box adjacent to the loop detectors) and the controller cabinet terminals.

CS23-29. STREETLIGHT LUMINAIRES: Streetlight luminaires shall meet the following specifications unless otherwise approved:

1. Semi-cutoff, Type II or Type III lighting distribution.

2. Multi-voltage ballast (120/208/240/277) with lag type magnetic regulator.

3. Power door ballast assembly and plu-in starter.

4. Photocell receptacle (with shorting cap if applicable)

5. Glass lens.

6. Polyester fiber gasket breathing seal.

7. Voltage tap connection.

CS23-30. PHOTOELECTRIC CONTROLS: Photoelectric controls shall be twist-lock type, Type II, mounted either pole-top or in the electrical service pedestal as shown on the plans.

The Contractor shall supply all equipment, supplies, and material required for mounting the photoelectric cell.

A single photoelectric cell shall energize each circuit. If pole-mounted, the photoelectric cell shall be on top of the first pole in the circuit.

CS23-31. PAYMENT: The unit price bid for Electrical items of work shall include full compensation for all material, tools, labor, and equipment to install all Electrical work as specified herein.

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CONSTRUCTION SPECIFICATIONS

SECTION 24 - IRRIGATION AND LANDSCAPING

CS24-01. LANDSCAPING: Landscape planting shall consist of soil preparation, planting landscape materials and maintaining landscaping throughout a ninety day maintenance period unless otherwise specified, as specified on approved project plans and specifications, in these Specifications, Special Provisions and as directed by the City Engineer/ Public Works Director.

The Contractor shall be responsible to survey and become familiar with work site and all existing underground utilities, pipes and structures. Contractor shall take responsibility for all cost incurred due to damage of said utilities.

Contractor shall not willfully proceed with landscape construction as designed when it is obvious that unknown obstructions and/or rough grade differences exist that are beyond the scope of his responsibility. Upon acceptance of the site, the landscape contractor shall be responsible to complete improvements and install finish grades in accordance with project plans, specifications and special provisions.

CS24-02. CERTIFICATE OF COMPLIANCE: A Certificate of Compliance shall be furnished, upon request, to the City Engineer/ Public Works Director for each lot of material delivered to the work site and the lot so certified must be clearly identified in the certificate.

All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time, and shall be inspected as determined by the City Engineer/ Public Works Director (see project notes for inspection requirements). The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the plans and specifications and any such material not conforming to such requirements or other specifications shall be rejected whether in place or not.

CS24-03. SOIL PREPARATION: Soil preparation shall consist of clearing and grubbing, removing debris, weeds and stones larger than 1 inch in diameter within landscape areas, thoroughly tilling areas with amendments as specified, completing finish grading activities so that landscape areas conform to finish grade per landscape notes and applying specified weed control measures.

SOILS ANALYSIS: Prior to commencement of work, the contractor shall perform and submit a soils analysis to the City for all landscape improvement areas recommending required soil amendments to meet the following requirements:

Soil Elements	Acceptable Range
pH	6.6 - 8.0
CEC (Cation Exchange Capacity)	12.12 35.12 meg/112 g
SAR (Sodium Absorption Ratio)	less than 5.12
ESP (Exchangeable Sodium Percentage)	less than 5.12
EC (Electronic Conductivity)	2.0 - 2.5 mmmho/cm
SP (Sodium Percentage)	less than 45%
Percentage Organic Matter	2% - 5%

The minimum soil amendments in lawn area or sod areas shall consist of Type 1 organic mulch, applied at a rate of 10 cubic yards per 1,120 square feet and Soil Preparation Fertilizer applied at a rate of 30 lbs per 1,120 square feet. Amendments shall be rototilled into the top 8 inches of the topsoil.

Fertilizer Requirements:

Use	Nitrogen	Phosphorus	Potassium
Soil Preparation	6	20	20
Plant Maintenance	16	6	8
Tablets (21g, 5% max acidity)	20	10	5

Seed shall be treated with a pre-emergent fungicide, such as □thiram□ or approved equivalent.

After installation of irrigation systems, planting of materials and finish grading activities are complete and before application of approved shredded bark mulch, all landscape areas shall have pre-emergent herbicide applied in accordance with manufacturer recommendations.

CS24-04. PLANT STOCK AND GROUND COVER: Plants shall be the variety, quantity and size indicated on the plans. When total quantities are shown tabulated on the drawings, they shall be considered approximate and are furnished for convenience only. Contractor is responsible for installing all the plants shown on landscape plans and for computing the quantity of ground cover required within the area specified and at the specified spacing. Quality and size shall conform to the State of California Grading Code of Nursery Stock, No.1 grade. Nursery grown stock only shall be used, and shall be free of insect pests and diseases.

Plants shall be healthy, shapely and well rooted. Roots shall show no evidence of having been root bound, restricted, deformed or girdled. Plants shall have straight trunks with leader intact, undamaged and uncut. All old abrasions and cuts shall be completely calloused over. All plants shall be measured when their branches are in normal position and height measured from root crown to the top of plant. Trees shall be well tapered in the trunk so that when the nursery stake is removed, the tree supports itself upright without further staking and shall have a main leader. Tree branches shall be spaced vertically and alternately along the trunk and shall not be concentrated at a single location nor shall display severe branch crossing. All plants declared unsuitable shall be removed from the work site immediately and shall be replaced with specimens which conform to plans and specifications.

CS24-05. MULCH: Unless otherwise specified, all planted landscaped areas shall have a 4" section of fibrous, medium course shredded bark mulch. A cedar or redwood mulch is preferred; however, the contractor shall submit a sample to the City and obtain prior approval before delivering mulch to the work site. Unless specified on the plans, it shall be the Contractors responsibility to estimate required mulch quantities and provide delivery tags to the City to verify in-place quantity.

CS24-06. NINETY CALENDAR DAY MAINTENANCE PERIOD: Unless otherwise specified, after installation of landscape improvements and final inspection and acceptance of improvements by the City, the City shall submit to the Contractor in writing the starting and ending date of the 90 calendar day maintenance period. Maintenance shall include, but is not limited to watering, weeding, fertilizing, cultivating, spraying and pruning as necessary to keep the plant material in a healthy growing condition and to keep the landscape areas neat, attractive and clean of debris or other foreign material. As a minimum the Contractor shall visit site weekly to clean site of papers or other debris. Prior to the end of the 90 calendar day maintenance, the City shall make a final inspection of the landscape improvements. Any discrepancies found during final inspection shall be reported to the Contractor immediately and shall be corrected prior to the end of the maintenance period. Until all corrections are complete and accepted by the City, the Contractor shall be responsible for maintenance activities.

All trees and other plant material shall be guaranteed to take root, grow, thrive and be disease free for a period of one year after final acceptance of work. Any tree or plant materials that die back and lose form and size originally specified shall be replaced, even though they have taken root and are growing after the die-back. The City shall notify the Contractor in writing within 15 calendar days of required replacements. The Contractor shall at his own expense remove and replace all guaranteed plant materials which for any reason, fail to meet requirements of the guaranty. Replacements shall be made to the same specifications as required of original materials and shall carry the same guaranty from the time they are replaced.

CS24-07. SPECIALTY ITEMS - HYDRO-SEEDING: Any specialty or hydro-seeding item of work specified in the Special Provisions or shown on the plans shall be completed as required. The Landscape Architect or other designer shall specify either on the plans or in the special provision recommendation and requirements for such work items. The Contractor shall be responsible to complete specialty items of work as specified and provide the City with any submittals requested to insure compliance with specifications or Manufacturer's recommendations.

CS24-08. IRRIGATION: Irrigation work items shall consist of furnishing all required materials, equipment and labor necessary to construct, complete-in-place, a turn-key, fully operational and efficient irrigation system in accordance with the plans, specifications and Special Provisions. All irrigation materials provided shall be new and in excellent condition unless otherwise specified.

Unless otherwise specified in the Special Provisions, all taps on water supply mainlines shall be performed by the governing water agency, either the City of Dixon or California Water Service, at the Contractor's expense. All irrigation points of connections shall begin at service-side of water meter which shall comply with respective water agency standard specifications.

All required irrigation component parts and equipment, lines, spray heads, controllers, valves, boxes etc. shall be clearly identified on project plans for size and type. Irrigation component and part details may be referenced on the plans for additional information.

Irrigation systems shall be constructed utilizing the following specified parts and equipment as applicable and in accordance City Standard irrigation details:

Main line & Lateral lines piping-	PVC schedule 40, unless otherwise noted
Valves	Gate Valves- 3 inch and smaller shall be bronze, class 125 or 150 with threaded ends, non-rising stem, 0-ring stem or gasket or Teflon impregnated asbestos packing and handwheel operator.
Remote Valves-	Shall be specified as shown on City Standard detail.
Backflow & DCDA-	Shall be specified as shown on City Standard details.
Solvent Cement and Primer-	Shall be compatible with PVC pipe material and size and be proper consistency. No mixing of solvent with thinners will be allowed, and primers shall be used as recommended by solvent manufactures
Control Wiring-	Shall be 24 volt solid wire U.L. approved for direct underground burial. (White or red #14 UF direct lead and black #12 common ground.) 110 volt wiring shall be 2- #12, CU, THW, one black, one white. All wiring shall be identified with all weather tag as shown on City Standard details at all remote valves, and all other access points of connections. Buried control wiring shall be tied at minimum of 10 foot intervals, with one or more additional control wire which shall have a 24 inch coiled wrap in each remote valve box.
Valve Boxes. Controller Couplers & Misc. Equipment-	All other misc. equipment shall be identified on

either plan detail sheet or City Standard details.

IRRIGATION CONTROLLER CHART(S): The Contractor shall submit to the City 2-sets of all-weather laminated record drawing irrigation controller chart(s) depicting as-built irrigation system, all remote valve stations, and sprinklers. The chart shall plot site features including plot plan, buildings, non-irrigated interior areas, sidewalks, benches and all significant site features. The chart may be reduced to 8-1/2" x 11" or 11' x 17" in legible detail.

CS24-09. PAYMENT: Irrigation items of work shall be measured and payment made at the contract Lump Sum or Contract Unit price and shall include full compensation for furnishing all labor, materials, tools, equipment, incidentals and for doing all work involved in irrigation items of work including any specialty items, as shown on the plans and as specified in the Special Provisions or as directed by the City Engineer/ Public Works Director and no additional compensation will be made therefore.

Landscaping items of work shall be measured and payment made at the contract Lump Sum or Contract Unit price and shall include full compensation for furnishing all labor, materials, tools, equipment, incidentals and for doing all work involved in Landscape items of work including any specialty items or hydro-seeding and maintenance work, as shown on the plans, as specified in the Special Provisions or as directed by the City Engineer/ Public Works Director and no additional compensation will be made therefor.

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