SECTION 01 00 25

MEASUREMENT AND PAYMENT

Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for the various appurtenant items of work.

BID ITEM NO. 1 - MOBILIZATION, DEMOBILIZATION, AND FINAL CLEANUP

Payment for **Mobilization, Demobilization and Final Cleanup** will be made in two (2) equal payments at the **lump sum** allowance in the Bid Schedule, which price shall constitute full compensation for all such work. The scope of work for mobilization shall include, but not limited to, obtaining all bonds, insurance and permits, moving onto the site of all plant and equipment, submittal and approval of a schedule of values for lump sum items, and obtaining approval for all shop drawings and materials for signal equipment. Payment for demobilization and final cleanup shall occur when all required items per the Contract are fulfilled and the site is free of equipment and clean and ready for use by the public. T No measurement shall be made for this item.

BID ITEM NO. 2 - TEMPORARY TRAFFIC CONTROL

Full compensation for furnishing, placing, maintaining, and removing the **Temporary Traffic Control** will be paid for at the contract **lump sum** price, which price shall include furnishing all labor, materials, tools, equipment and incidentals for doing all work involved in furnishing traffic control system required for direction of public vehicular and pedestrian traffic through or around the work, including preparation and implementation of the traffic control plans, pedestrian routing plans, maintaining access to businesses, noticing, temporary facilities including temporary lighting, traffic control equipment, flaggers, signs, striping, walkways, plates, barriers, and temporary pavement marker tabs, and all other pedestrian and vehicular traffic control requirements as required or specified in these Construction Details, and no additional allowances will be made therefor. No measurement shall be made for this item.

BID ITEM NO. 3 – STORM WATER MANAGEMENT AND EROSION CONTROL

Full compensation for **Storm Water Management and Erosion Control** shall be paid for at the contract **lump sum**, which shall include full compensation for conforming to the provisions in this section, furnishing all labor, materials, tools, equipment, and any other work involved in Erosion Control including but not limited to, implementation and maintenance of all stormwater, sediment, and erosion control measures, following Best Management Practices, and all incidentals necessary to control stormwater pollution, sedimentation, and erosion, and no additional compensation will be made therefor. No measurement shall be made for this item.

BID ITEM NO. 4 – DEMOLITION

Full compensation for **Demolition** will be measured and paid for at the contract unit price per **square foot** and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals for performing all work involved in the removal of existing concrete sidewalk, pedestrian ramps and driveways, removal of existing roadway down to subgrade including but not limited to saw cutting, removal of concrete, removal of asphalt concrete, removal of existing concrete curb and gutter, removal of sign and fence elements and foundations, sand and base rock, excavation, stockpiling removed materials, grinding of pavement striping, removal of benches, receptacles, and other appurtenances, removal and safe storage of items to be salvaged, including but not limited to signs, hauling and disposal of removed materials, and cleaning of materials, as specified in these Construction Details and as shown on the Plans, and no additional allowances will be made therefor.

BID ITEM NO. 5 – ASPHALT FULL DEPTH CONFORM

Full compensation for **Asphalt Full Depth Conform** shall be paid for at the contract price per **ton** which shall include full compensation for furnishing all labor, materials, tack coats, tools, equipment, for installing an asphalt concrete plug and conform and as shown on the Plans, and no additional allowances will be made therefor.

BID ITEM NO. 6 – ASPHALT CONCRETE WALKWAY

Full compensation for **Asphalt Concrete Walkway** shall be paid for at the contract price per **ton** which shall include full compensation for furnishing all labor, materials, tack coats, tools, equipment, for installing an asphalt berm and compacted asphalt walkway as shown on the Plans, and no additional allowances will be made therefor.

BID ITEM NO. 7 – TYPE "A" CURB & GUTTER

Full compensation for **Type "A" Curb and Gutter** will be measured and paid for at the contract unit price per **linear foot**, which price shall include full compensation for furnishing all plant, labor, materials, tools and equipment and doing all the work involved in constructing curb and gutter complete in place, including sawcutting, subgrade preparation, aggregate base placement and compaction, formwork, expansion joints, scoring, and all incidentals, as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 8 – TYPE "E" CURB

Full compensation for **Type "E" Curb** will be measured and paid for at the contract unit price per **linear foot**, which price shall include full compensation for furnishing all plant, labor, materials, tools and equipment and doing all the work involved in constructing vertical retaining curbs complete in place, including sawcutting, subgrade preparation, aggregate base placement and compaction, formwork, expansion joints, scoring, curing, and all incidentals, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 9 – PEDESTRIAN CONCRETE (EXPOSED AGGREGATE)

Full compensation for **Pedestrian Concrete (Exposed Aggregate)** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing all plant, labor, materials, tools and equipment and doing all the work involved

in constructing the concrete flatwork complete in place, including setting and verification of grade, subgrade preparation; placing and compacted aggregate base, placing and finishing concrete, expansion joints, scoring, exposed aggregate finish, and all incidentals, as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 10 – CURB RAMP WITH DETECTABLE WARNING SURFACE (COLONIAL RED)

Full compensation for **Curb Ramp with Detectable Warning Surface (Colonial Red)** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing all plant, labor, materials, tools and equipment and doing all the work involved in constructing curb ramps including setting and verification of grade, furnishing and placing concrete, installing truncated dome detectable warning surface, expansion joints and broom finish and all other incidentals, as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor. The work limits for Minor Concrete (Curb Ramp) shall include all concrete work up to the sidewalk border. Sidewalk area outside of the ramp will be paid for under Pedestrian Concrete (Exposed Aggregate).

BID ITEM NO. 11 – CAST IN PLACE DETECTABLE WARNING SURFACE (COLONIAL RED)

Full compensation for **Cast In Place Detectable Warning Surface (Colonial Red)** shall be paid for at the contract unit price per **each** , which price shall include full compensation of installation of the truncated dome panels at existing curb ramps where grading modifications are not proposed, including, but not limited to site preparation and site clean-up, sawcutting, excavation removal, base rock, wet setting of truncated domes (3'x5')with minimum 4-inch concrete band, and all other labor, materials, tools, equipment and incidentals and all other work required to complete work in place as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 12 – VEHICULAR CONCRETE

Full compensation for **Vehicular Concrete** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing all plant, labor, materials, tools and equipment and doing all the work involved in constructing concrete complete in place, including setting and verification of grade, demolition, saw cutting, excavation for placement of aggregate base, subgrade preparation, dowels to existing concrete, reinforcing bars and wire mesh where required; furnish and place concrete pad and curb, expansion joints, scoring, broom finish, protection from vandalism, and all other work required to complete work in place as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 13 – 4-INCH THERMOPLASTIC STRIPING

Full compensation for **4-Inch Thermoplastic Striping** will be measured and paid for at the contract unit price per **linear foot**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of thermoplastic pavement markings, throughout the project limits, including surface preparation, layout, markings as shown on the Plans and Marin County Uniform

Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 14 – 6-INCH THERMOPLASTIC STRIPING

Full compensation for **6-Inch Thermoplastic Striping** will be measured and paid for at the contract unit price per **linear foot**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of thermoplastic pavement markings, throughout the project limits, including surface preparation, layout, markings as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 15 – CONTINENTAL CROSSWALK

Full compensation for **Continental Crosswalk** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of thermoplastic pavement markings, throughout the project limits, including surface preparation, layout, markings as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 16 – PAVEMENT MARKINGS

Full compensation for **Pavement Markings** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of thermoplastic pavement markings, throughout the project limits, including surface preparation, layout, markings as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 17 – STRIPING PARKING STALL NUMBER

Full compensation for **Striping Parking Stall Number** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of thermoplastic pavement markings, throughout the project limits, including surface preparation, layout, markings as shown on the Plans, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 18 – REINSTALL EXISTING SIGN ON NEW POLE

Full compensation for **Reinstall Existing Sign on New Pole** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for removing existing signs and posts and reinstalling said signs and posts in a new foundation, throughout the project limits, as shown on the Plans and Marin County Uniform Construction Standards Plans, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 19 – NEW SIGN ON NEW POLE

Full compensation for **New Sign on New Pole** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for installing new signs and posts, throughout the project limits, as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 20 – SELF-SERVICE PAY STATION RELOCATION

Full compensation for **Self-Service Pay Station Relocation** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and reinstallation of the salvaged self-service pay station devices, including removal and salvage of the existing devices, cutting of concrete anchor bolts and removal of foundation elements as needed to facilitate the proposed improvements, new foundation and anchor bolts, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 21 – FOUNTAIN RELOCATION

Full compensation for **Fountain Reconstruction** will paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete removal and reinstallation of the fountain, including utility disconnection and reconnection, new water supply piping, excavation, subgrade preparation, aggregate base placement and compaction, testing and disinfection, complete in place as shown on the Plans and no additional allowances will be made therefor. No measurement shall be made for this item.

BID ITEM NO. 22 – TYPE "A" CATCH BASIN

Full compensation for **Type "A" Catch Basin** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing a new storm drain inlet, layout, potholing, excavation, bedding, backfill, and placement, connection of new and existing pipes, demolition, frames and grating . as required at the location shown on the plans, complete in place and functioning system and any other work required for the catch basin, throughout the project limits, as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 23 – TRENCH DRAIN

Full compensation for **Trench Drain** will be measured and paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing a trench drain channel and grade, including layout, potholing, excavation, pipe bedding, compaction, backfill, connections as required at the location shown as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 24 – 12-INCH STORM DRAIN (HDPE)

Full compensation for **12-Inch Storm Drain (HDPE)** will be measured and paid for at the contract unit price per **linear foot**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing a 12-in storm drain pipe including layout, potholing, excavation, pipe bedding, compaction, backfill, connections to new and existing catch basins and storm pipe, asphalt/ concrete restoration as required at the location shown as shown on the Plans and Marin County Uniform Construction Standards, and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 25 – ADJUST UTILITY TO GRADE

Full compensation for **Adjust Utility to Grade** will be measured and paid for at the contract unit price per **each** and shall include full compensation for furnishing all labor, materials, tools, equipment, excavation, backfill, concrete, grade rings, debris platforms, asphalt or concrete pavement and mortar for the completion of adjusting all utility valve boxes, utility vaults, survey monument boxes, manholes and other utility structures to grade throughout the project limits, and all other related work per the Contract Documents.

BID ITEM NO. 26 – RESET NGS BENCHMARK

Full compensation for **Reset NGS Benchmark** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of benchmark well and brass disk, including coordination with the City's Land Surveyor, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 27 – RESET SURVEY MONUMENT

Full compensation for **Reset Survey Monument** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing, labor, materials, tools, equipment and other incidentals necessary for the complete layout and installation of benchmark well and brass disk, including coordination with the City's Land Surveyor, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 28 – BIORETENTION AREA

Full compensation for **Bioretention Area** will be measured and paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing bioretention area and planting, including subdrains, area drain, soil media, mulch, and planting as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 29 – BOLLARDS

Full compensation for **Bollards** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing bollards including layout, foundation, procurement and installation in accordance with the manufacturer's

recommendations and as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 30 – MISCELLANEOUS FURNISHINGS AND FENCING

Full compensation for **Miscellaneous Furnishings and Fencings** will be paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing permanent fencing, bike racks, waste receptacles, and tree grates, including layout, foundation and mounting elements, procurement and installation in accordance with the manufacturer's recommendations and as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 31 – IRRIGATION

Full compensation for **Irrigation** will be paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing the irrigation tubing, emitters, main lines, controllers, backflow devices, testing and set-up as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 32 – PLANTING

Full compensation for **Planting** will be paid for at the contract unit price per **lump sum**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing all permanent vegetation, plantings, and trees, including soil testing, soil amendments and/or imported planting soil, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. 33 – ELECTRICAL MANHOLE

Full compensation for **Electrical Manhole** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing the electrical manhole vault, including structure, rim, cover, excavation, bedding, and backfill, as shown on the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. A2.1 – ASPHALT GRINDING

Full compensation for **Asphalt Grinding** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in grinding down the crown of the roadway on Tracy Way and stockpiling grindings in accordance with the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. A2.2 – PLACE AND COMPACT ASPHALT GRINDING

Full compensation for **Place and Compact Asphalt Grinding** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved

in placing asphalt grindings on Tracy Way and compacting grindings to create a flat, firm, and unyielding subgrade surface in accordance with the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. A2.3 – GRAVELPAVE – TYPE 2

Full compensation for **GravelPave – Type 2** will be measured and paid for at the contract unit price per **square foot**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in procuring and placing the GravelPave – Type 2 fabric in accordance with manufacturer's guidance, the Plans and specified in these Construction Details, and no additional allowances will be made therefor.

BID ITEM NO. A2.4 – GRAVEL FILL

Full compensation for **Gravel Fill** shall be paid for at the contract price per **cubic yard** which shall include full compensation for furnishing all labor, materials to procure, haul, place, and compact gravel within the GravelPave – Type 2 fabric in accordance with the GravelPave manufacturer's recommendations and as shown on the Plans, and no additional allowances will be made therefor.

BID ITEM NO. A3.1 – LIGHTED BOLLARDS

Full compensation for **Lighted Bollards** will be measured and paid for at the contract unit price per **each**, which price shall include full compensation for furnishing and installing all labor, materials, tools, and equipment, and doing all work involved in installing bollards including layout, foundation, power source connection, conduit and wiring, pull boxes, testing and start-up, and installation in accordance with the manufacturer's recommendations and specified in these Construction Details, and no additional allowances will be made therefor.

END OF SECTION

SECTION 01 50 50

EROSION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
   1. Install all temporary erosion control devices per Plans and Specifications, and as directed by the Engineer.
   2. On-going maintenance of all stormwater, sediment, and erosion control measures

B. All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015
   1. Section 21, Erosion Control

1.4 SITE CONDITION

A. It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the City or Engineer prior to job site delivery.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. No soil amendments shall be required except as noted on the Plans.

B. Verification: Contractor shall verify:
   1. That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
   2. That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
   3. That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.2 FINAL INSPECTION AND ACCEPTANCE:

A. Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the City, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.3 CLEAN-UP

A. Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.

B. Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.

C. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

SECTION 02 21 13

MONUMENTS

PART 1 - GENERAL

1.1 MONUMENT PRESERVATION

A. The Contractor shall notify the Engineer seventy-two (72) hours prior to performing any work affecting a survey monument. The Contractor shall bear the expense of replacing any monument that may be disturbed without the direction of the Engineer.

B. It is the responsibility of the Contractor to save and protect any existing survey monuments, which are not identified for removal and replacement on the project plans. In the event that disturbance or destruction of a survey/benchmark monument is imminent, regardless of whether removal and replacement is indicated on the project plans, the Contractor shall contact the Engineer at least seventy-two (72) hours in advance.

C. Adjustments to monuments well structure may need to be done that include modifying the monument well structure below the grinding plane and raising to the finish grade, including all excavation, backfill, and temporary and permanent repair to the surrounding asphalt concrete surface.

1.2 ADJUSTING TO GRADE MONUMENT LID

A. After the pavement is reconstructed, for monuments that are protected in place, the monument ring and cover must be adjusted so that there will not be any perceptible difference in elevation between the finished pavement surface and the cover. Monument Covers must be adjusted to grade in accordance with Marin Uniform Construction Standards, as shown on the plans and as directed by the Engineer.

1.3 RESET MONUMENT

A. The resetting of the existing monuments shall be performed at the direction of the Engineer and shall be performed in the presence of the Engineer. The Contractor shall notify the Engineer at least seventy-two (72) hours prior to construction of monuments to set the straddlers for the new monuments. The Engineer will set up to four straddle nails or equivalent to control the location of the new monument. The Contractor shall set the monument in accordance with Uniform Construction Standard Dwg. No. 300. The Engineer will provide the “center punch” upon completion of the new monument construction and file appropriate documentation with the Marin County Surveyor’s office.

B. Adjustments to monuments may need to be done that include modifying the monument well structure below the grinding plane and raising to the finish grade, including all excavation (including removing and reconstructing concrete anchor block, if such exists), backfill, and temporary and permanent repair to the surrounding asphalt concrete surface.

C. If the specified notice is not given to the Engineer and/or the survey monument is disturbed or destroyed, the Engineer will have the original position of the survey monument re-established by a licensed surveyor and the associated land surveying costs will be at the Contractor's sole expense and will be deducted from the Contractor's pay letter.

PART 2 - SUBMITTALS -NOT USED-

PART 3 - MATERIALS -NOT USED-

PART 4 - CONSTRUCTION

A. Installation of city monuments shall be in accordance with the County of Marin Uniform Construction Standards.

PART 5 - QUALITY CONTROL -NOT USED-

END OF SECTION

SECTION 02 21 14

BENCHMARKS

PART 1 - GENERAL

1.1 BENCHMARK PRESERVATION

A. The Contractor shall notify the Engineer seventy-two (72) hours prior to performing any work affecting a survey monument. The Contractor shall bear the expense of replacing any monument that may be disturbed without the direction of the Engineer.

B. It is the responsibility of the Contractor to save and protect any existing survey monuments, which are not identified for removal and replacement on the project plans. In the event that disturbance or destruction of a survey/benchmark monument is imminent, regardless of whether removal and replacement is indicated on the project plans, the Contractor shall contact the Engineer at least seventy-two (72) hours in advance.

C. Adjustments to monuments well structure may need to be done that include modifying the monument well structure below the grinding plane and raising to the finish grade, including all excavation, backfill, and temporary and permanent repair to the surrounding asphalt concrete surface.

1.2 RESET BENCHMARK

A. The resetting of the existing benchmark shall be performed at the direction of the Engineer and shall be performed in the presence of the Engineer. The Contractor shall notify the Engineer at least seventy-two (72) hours prior to construction of the Benchmark to set the control points for layout of the new monuments. The Contractor shall set the benchmark in accordance with National Geodetic Survey “Benchmark Reset Procedures” guidelines. The Engineer will survey the location of the new Benchmark and will notify National Oceanic and Atmospheric Administration of the new benchmark information.

B. Adjustments to monuments may need to be done that include modifying the benchmark well structure below the grinding plane and raising to the finish grade, including all excavation (including removing and reconstructing concrete anchor block, if such exists), backfill, and temporary and permanent repair to the surrounding asphalt concrete surface.

C. If the specified notice is not given to the Engineer and/or the survey benchmark is disturbed or destroyed, the Engineer will have a new benchmark re-established by a licensed surveyor and the associated costs will be at the Contractor’s sole expense and will be deducted from the Contractor’s pay letter.

PART 2 - SUBMITTALS -NOT USED-

PART 3 - MATERIALS -NOT USED-

PART 4 - CONSTRUCTION

A. Installation of NGS benchmarks shall be in accordance with the National Geodetic Survey “Benchmark Reset Procedures” guidelines.

PART 5 - QUALITY CONTROL -NOT USED-

END OF SECTION

SECTION 02 40 00

DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Removing above-grade site improvements within limits indicated.

B. Disconnecting, capping or sealing, and removing site utilities.

C. Disposing of objectionable material.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing.

B. Section 31 20 00 – Earth Moving.

1.3 DEFINITIONS

A. ANSI: American National Standards Institute.

B. CAL-OSHA: California Occupational Safety and Health Administration.

1.4 SUBMITTALS

A. Follow Submittal procedure outlined in Section 01 10 00 – Supplemental General Requirements.

1.5 PROJECT CONDITIONS

A. Except for materials indicated to be stockpiled or to remain the City's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in a lawful manner.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the City. Avoid damaging materials designated for salvage.

C. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the City. If necessary, the City will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Material shall be approved by the City Engineer prior to placement of backfill excavations resulting from demolition operations with on-site or import materials

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.

B. Protect existing site improvements to remain during construction.

3.2 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the City.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by City or others unless authorized in writing by the City, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the City and utility company affected. Notify City and utility company affected two working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Securely closed ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick. Cut and cap of existing water main shall be per the City of Palo Alto Standard Detail WD-27.

3.4 SITE IMPROVEMENTS

A. Remove existing above, and below, grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.

C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

E. Remove and dispose of indicated furnishings, including benches, receptacles, and other appearances, including removal of foundation elements as applicable. Cut anchor bolts flush with existing finish grade surface to remain.

3.5 DISPOSAL

A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the City's property.

END OF SECTION

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GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This specification shall apply to all phases of work hereinafter specified, shown on drawings, or as required to provide a complete installation of electrical systems for this project. Work required under this specification is not limited to just the Electrical drawings. Refer to Civil and Landscape drawings as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.

1. Work Included: Furnish labor, material, services, and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation, and rough-in locations from the actual equipment or from the equipment shop drawings.

B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit, and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

A. Design, manufacture, testing, and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:

1. Institute of Electrical and Electronic Engineers - IEEE
2. National Electrical Manufacturers' Association - NEMA
3. Underwriter's Laboratories, Inc. - UL
4. National Fire Protection Association - NFPA
5. Federal Specifications - Fed. Spec.
6. American Society for Testing and Materials - ASTM
7. American National Standards Institute - ANSI
8. National Electrical Code - NEC
9. National Electrical Safety Code - NESC
10. Insulated Cable Engineers Association - ICEA
11. American Institute of Steel Construction - AISC
12. State and Municipal Codes in Force in The Specific Project Area
13. Occupational Safety and Health Administration (OSHA)
14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
15. California Electrical Code (where adopted)

16. Local Authority Having Jurisdiction (AHJ)
17. Published Electrical Standards and Codes (as applicable).

B. Perform Work in accordance with the California Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
1. Comply with all requirements for permits, licenses, fees, and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

A. Guarantee: Furnish a written guarantee for a period of one-year from date of acceptance.

B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawings and/or in the Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.

C. All Core Cutting, Drilling, and Patching:
1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

D. Verifying Drawings and Job Conditions:
1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

E. Shop Drawings/Submittals:
1. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic

format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or sytem(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.

2. The shop drawings/submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the drawings. Any drawings submitted without this approval will be returned to the Contractor for resubmittal.
3. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
4. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
5. Shop drawings shall be submitted on the following, but not limited to:
    a. Lighting fixtures, lamps and ballasts.
    b. Wiring Devices.
    c. Lighting control products/dimming system products.
    d. Pull boxes and underground vaults.
    e. Terminal cabinets.
    f. All other products called out on drawings that call for shop drawing submittal.

1.4 WORK IN COOPERATION WITH OTHER TRADES

A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical, and other trades. Provide the type and quantity of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical, and other systems or equipment.

B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conduit to the controls.

C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating, and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors,

circuit breakers, motor starter(s) and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.

B. Equipment and parts in need of correction, and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.

C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.

D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

E. Component Tests:
   1. Grounding systems, for resistance to earth. Provide additional grounding electrodes, if separately derived system ground resistance exceeds 25 ohms.
   2. Prior to energizing equipment, check the insulation resistance of feeders sized larger than #2 AWG with a 1000 volt DC “Megger”. Minimum insulation resistance values shall not be less than 50 mega ohms.

F. Functional tests:
   1. Perform all tests suggested by the equipment manufacturers.
   2. Verify that everything installed as part of the scope of work functions properly. Verify that any work performed did not adversely affect existing systems or equipment (e.g., that after removing a device from a branch circuit that the remaining existing branch circuit continuity was maintained).

1.6 IDENTIFICATION

A. Install nameplates on electrical equipment including:
   1. Circuit breakers, disconnect switches and starters whether provided under this division or some other.
   2. Where it is not obvious which piece of equipment is powered from a particular disconnect switch, provide nameplates for both disconnect switch and the powered equipment.

B. Describe item, control function, or sequence of operation on each nameplate.

C. Fabricate nameplates of laminated phenolic plastic, black front and back with white core for normal power equipment and signal. Provide red front and back with white core for emergency power equipment and fire alarm. Bevel edges. Engrave through outer layer to produce white letters and numerals. For control pilot devices, engraved metallic plates, filled with enamel, are acceptable. Fasten nameplates to equipment with no. 4 Phillips, round head, cadmium steel, self-tapping screws. Use 1/8-inch letters on circuit breakers, switches, and other control devices, and 1/4-inch letters on panelboards, switchboards, and other major electrical equipment. Submit label designations as part of corresponding equipment submittal.

D. Equipment identification is to indicate the following:
   1. Equipment ID abbreviation.

2. Voltage, Phase and Wires.
3. Power source.

1.7 FINAL INSPECTION AND ACCEPTANCE

A. After all requirements of the Specifications and/or the Drawings have been fully completed, representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.

B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

A. Drawings of Record: The Contractor shall provide, and keep up to date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable, and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating and maintenance and servicing instructions, as well as four (4) complete wiring diagrams for the following items or equipment:
1. Lighting control systems/dimming systems.
2. Transformers.

B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.10 INTERRUPTION OF SERVICES/SERVICE SHUTDOWN

A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc., required to perform work shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.

B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.

C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ).

2.2 RACEWAYS

A. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing, or sherardizing process.

B. Intermediate Metal Conduit (IMC) shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).

C. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces except as noted below. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.

D. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Used only as directed in writing by the Engineer.

E. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.

F. Non-metallic Conduit:
   1. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to UL requirements, listed for exposed and direct burial application.
   2. Conduit and fittings shall be produced by the same manufacturer.

G. Fire-rated MC Cable:
   1. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to UL 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with NEC, or CEC where adopted, Articles 695 and 700. Where adopted, cable sheath shall be suitable for use as a NEC or CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).
   2. Cable connectors shall be brass MC connectors.

2.3 FITTINGS

A. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system.

These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.

B. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.

C. Connector, coupling, locknut, bushings, and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.

D. Unless otherwise noted, all interior EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trade sizes of 2" and smaller. Insulated throat is not required for fittings, connectors, and couplings 1" and smaller.

E. All interior and exterior EMT fittings, connectors, and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be raintight-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If raintight-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage - provide rigid metallic or intermediate metallic conduits, fittings, connectors, and couplings as required.

F. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.

2.4 OUTLET, PULL, AND JUNCTION BOXES

A. Construction: Deep drawn or fabricated interlocked flat pieces with welded tabs, electrogalvanized sheet steel with electrogalvanized hardware. Do not use sectional or gangable boxes.

B. Size: Accommodate the required number and sizes of conduits, wires, splices, and devices, but not smaller than the size indicated or specified.

C. Plaster ring: Provide flush with wall or ceiling finish, except where otherwise indicated or specified.

D. Device boxes: For single switches and receptacles, provide boxes not less than 4 inches square by 1-1/2 inches deep. For 2 devices, provide boxes not less than 4-11/16 inches square by 1-1/2 inches deep.

E. Telecommunications boxes: No less than 4-11/16 inches square by 2-1/8 inches deep.

F. Special mounting: In cabinets, tile, concrete block, brick, stone, wood or similar material, provide rectangular boxes with square corners and straight sides. For single devices, provide boxes 4 inches high by 2-1/2 inches wide by 3-3/8 inches deep. For 2 or more devices, provide multi-gang, non-sectional box with tile or masonry ring.

G. Lighting fixtures: 4 inches octagon by 2-1/8 inches deep, minimum. Fit boxes for surface or pendant mounted fixtures with 3/8 inch malleable iron fixture stud.

H. Wet or damp locations, cast metal:
   1. Box: Malleable iron.
   2. Cover: Gasketed, weatherproof, malleable iron, with stainless steel screws.
   3. Hubs: Threaded.
   4. Lugs (cast mounting) manufacturers:
      a. Crouse-hinds: Type FD or FD, or equal
      b. Appleton: Type FS or FD, or equal

2.5 PULL AND JUNCTION BOXES OVER 300 CUBIC INCHES

A. General: For all pull and junction boxes over 300 cubic inches, provide code gauge, sheet steel boxes which meet NEMA 1 standards for panelboard and terminal cabinet box construction, with screw type covers.

B. Ground lug: Weld, before finish is applied, a grounding pad drilled for two bolted grounding lugs or two ground studs on the box interior.

C. Finish: Apply rust inhibiting prime coat and 2 coats of baked enamel, standard factory gray.

D. Hardware: Cadmium plated steel screws.

2.6 PRECAST CONCRETE BOXES

A. Provide high-density reinforced concrete pull and junction boxes with H-20 traffic rating. Boxes shall have end and side knockouts and be as manufactured by Christy, Brooks, or approved equal. Fabricate boxes with non-settling shoulders to facilitate maintaining grade during backfilling. Unless noted otherwise, provide galvanized steel checker plate covers with hold-down bolts, identified as follows:

System	Identification
Power - 100 volts to 600 volts	ELECTRICAL
Less than 100 volts	TEL, CABLE, FIRE ALARM, etc. as applicable

2.7 SUPPORTING DEVICES

A. Conduit supports:
   1. Wet locations:
      a. One hole galvanized malleable iron strap with galvanized malleable or cast iron clamp back, Oz/Gedney type 14-G.
   2. Dry locations:
      a. Galvanized steel straps, Oz/Gedney type 5-S and 14-S, T & B, Appleton or equal.
   3. Plumbers perforated strap is not acceptable.
   4. Hanger rod, 3/8 inch, minimum galvanized all thread rod or as detailed for specific use.

B. Anchor methods:
   1. Hollow masonry: Toggle bolts or spider type expansion anchors.

2. Solid masonry: Malleable iron expansion anchors or preset inserts.
3. Metal surfaces: Machine screws, bolts, or welded studs.
4. Wood surfaces: Wood screws, lag bolts.
5. Concrete surfaces: Self-drilling anchors or powder driven studs.
6. Raceway and fixtures shall not be supported solely from gypsum board ceilings.

2.8 CONDUCTORS – WIRE AND CABLE

A. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.

B. Type THHN/THWN-2 thermoplastic, 600V, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700.

C. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.

D. System Conductor Color Coding:

1. Power 120/208V
   a. Phase A = Black
   b. Phase B = Red
   c. Phase C = Blue
   d. Neutral = White
2. Power 120/240V
   a. Phase A = Black
   b. Phase B = Red
   c. Phase C = Orange
   d. Neutral = White
3. Power 277/480V
   a. Phase A = Brown
   b. Phase B = Orange
   c. Phase C = Yellow
   d. Neutral = Gray
4. Ground Conductors: Green
5. Isolated Ground Conductors: Green with continuous yellow stripe

E. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified by utilizing phase tape at each termination.

F. No conductors carrying 120V or more shall be smaller than #12 AWG.

G. Aluminum conductors shall not be used.

H. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be

used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles or block and tackle to install conductors are not acceptable.

2.9 WIRE CONNECTIONS

A. Connect wire to binding post screw, stud, bolt, or bus as follows:
   1. #10 AWG and smaller conductors, compression type, nylon, self-insulated grip spade lugs, T & B "Sta-Kon", 3m Scotchlok MNG, Panduit "Pan Term", or equal.
   2. #8 AWG to #750 MCM copper conductors, solderless copper lug type connectors, with hex head or Allen type compression set screws with configuration to suit application, T & B "Locktite", Burndy "GA", O-Z type "XL" or "XLH", or equal. Use two screw lugs for wire #4/0 and larger.

B. Wire splice:
   1. #10 AWG and smaller conductors, twist on solderless, insulated spring connectors, 3M "Scotchloks", T & B "Piggys" or equal.

C. Size, install and tighten wire terminal and splice connectors in accordance with manufacturer's recommendations.

2.10 TAPE

A. Wire splices: vinyl plastic electrical tape, 8.5 mil and 4.0 mil, scotch 33.

B. Conduit wrapping: 10 mil vinyl wrapping tape, minnesota mining and manufacturing company (3m) scotchwrap 50, plymouth 4611, or equal.

2.11 WIRING ACCESSORIES

A. Identify conductors with self-adhesive vinyl cloth markers, sized to fit the conductor insulation, with machine printed black marking, W.H. Brady, Thomas and Betts, or equal.

B. Wire ties:
   1. Nylon, adjustable, and self-locking.

2.12 WIRING DEVICES

A. Provide UL listed wiring devices for the voltage and current ratings specified. Devices shall be UL listed as Fed. Spec. Compliant and bear the UL Fed. Spec. Logo, with means for back and side wiring, white, ivory, or color to match existing area. Provide grounding type receptacles unless otherwise noted.

B. Identify each device with panelboard and circuit number, i.e., “A-15” indicated panel “A” circuit breaker “15”. Provide clear P-touch labels with black lettering for indoor wiring devices; phenolic laminated engraved labels for all outdoors installations.

C. For outdoor wiring devices, provide lockable, hinged metal cover suitable for wet locations, while-in-use, Taymac #MX3200, or equal.

D. Provide receptacles other than 120 volt single and duplex as indicated.

E. Listed manufacturers establish a standard of quality. Substitutions will be considered in accordance with this specification.

F. Key switches: equivalent to listed switches, activated with removable key.

G. Wall plates: type 302 stainless steel, satin finish, minimum 0.040 inch thick, single or multiple gang.

2.13 LIGHTING FIXTURES

A. General: Provide fixtures as indicated, factory wired, ready for field connection.

B. Provide fixtures UL approved for installation against low density ceilings where applicable. Do not use spacers.

2.14 LED LUMINAIRES

A. Components: UL 8750 recognized or listed as applicable.

B. Tested in accordance with IES LM-79 and IES LM-80.

C. LED estimated useful life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

D. 75 CRI minimum outdoor lighting, 90 CRI minimum indoor.

E. Kelvin temperature as specified.

2.15 LIGHTING CONTROL DEVICES

A. Provide lighting control devices (e.g., automatic time switch control device, motion sensor, occupant-sensor, photosensor, automatic daylighting control device) that meet the state of California, Title 24, State Building Standards, Part 6, California Energy Code, current edition, and that have been certified to the commission.

B. Provide dimmers that are compatible with the provided LED drivers.

2.16 PEDESTAL TYPE DISTRIBUTION AND CONTROL CABINETS

A. Circuit breakers
   1. Provide circuit breakers for miscellaneous branch circuits with frame sizes and ratings as shown on the plans.
   2. Bolt-on, thermal magnetic, molded case, with inverse time current overload, and instantaneous magnetic trips, trip-free, and trip-indicating. All poles of multi-pole device shall operate simultaneously during open, close, and trip operations. Provide circuit breakers indicated with the following ratings:

PART 3 - EXECUTION

3.1 RACEWAY SYSTEMS

A. Install all wiring in raceways. Install raceway systems, including conduits, hangers, hooks, and support channels parallel or perpendicular to structural members. Coordinate location of raceway systems with other divisions prior to commencing installation.

B. Rigid steel conduit: suitable for use in all locations. For underground installations tape wrap conduit completely with tape suitable for underground installations, double lap of Calpico 10 mil or equal.

C. Liquid tight flexible metal conduit: suitable for connection of equipment in damp or wet locations.

D. PVC conduit: suitable for use underground, with a minimum of 18 inches of cover. Fabricate field bends with an approved thermal bender and jig. For underground emergency systems encase conduit in concrete, minimum of 2" all around. Maintain separation between conduits using plastic spacers specifically designed for the purpose.

E. Clean and mandrel all under floor/ground raceways before wire is installed.

F. Conduit supports:
   1. Support all conduits at intervals not to exceed 10 feet.
   2. Support individual conduits with conduit hangers or clamp back and nest back, if required for entrance into the equipment.
   3. Support multiple conduits, 2 or more in parallel, with framing channel and pipe clamps.
   4. Cut ends of framing channel installed outdoors or in wet locations shall be painted with zinc rich paint.

G. Conduit bends:
   1. Electrical conduits: provide no more than (3) 90 degree conduit bends or the equivalent number of smaller radius bends in any conduit run between boxes or equipment.
   2. Telecommunications conduits: provide no more than (2) 90 degree bends or the equivalent number of smaller radius bend in any conduit run between boxes or stub, with radius 10 times the diameter of the conduit.
   3. Length of run: 400 feet maximum, less 100 feet for each equivalent 90 degree bend.
   4. Fabricate bends and offsets with a hickey or conduit bender designed specifically for use with the type of conduit to be bent, or use factory made bend.
   5. Radius of underground bends: minimum 10 times conduit radius.

3.2 BOXES AND CABINETS

A. Place outlet boxes in a location as close to that shown on the plans as possible. Coordinate location of boxes with other divisions.

B. Attach surface boxes with:
   1. Steel or malleable iron expansion anchors in concrete or solid masonry.

2. Wood screws in wood.
3. Toggle bolts in hollow walls or masonry.
4. Machine screws, bolts, or welded studs in steel.

C. For all surface mounted boxes or cabinets mounted in wet or damp locations provide weatherproof enclosures and at least 1/4 inch air space between box and mounting surface, per CEC 312.2.

3.3 INSULATED CONDUCTORS AND CABLES

A. Exercise extreme care when pulling conductors and cable into conduits to avoid kinking, twisting, nicking, or scratching of the insulation or the placement of extreme stress on the conductors or cable. When required, utilize UL approved pulling compounds to assist in pulling conductors.

B. Color code conductors by phase sequence A-B-C when looking into the front of the equipment from left-to-right, top to bottom or front-to-back. Provide conductors with the appropriate phase color or mark conductors with a minimum of 6 inches of phase tape on ends connected to terminals. Phase code conductors as listed:

VOLTAGE	PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND
120/208	BLACK	RED	BLUE	WHITE	GREEN
120/240	BLACK	RED	ORANGE	WHITE	GREEN
277/480	BROWN	ORANGE	YELLOW	GRAY	GREEN

C. Identify each conductor with its respective circuit number at each box or terminal.

D. Connections:
1. Utilize twist-on solderless connectors for splicing receptacle and lighting circuits #10 AWG wire size and smaller.
2. Splices and taps will not be permitted for other than receptacle and lighting circuits, or for wire larger than #10.
3. Terminate conductors at motors with bolted connections, insulated with plastic tape.

3.4 WIRING DEVICES

A. Connect wiring devices to circuits indicated using side or back wiring terminals.

B. Connect green grounding pigtail from receptacles to outlet box with screw.

C. Install wiring devices flush with the device plate fronts.

D. Align plates plumb with wall, and cover opening, without use of "jumbo" plates.

E. Install receptacles with grounding terminal up.

3.5 GROUNDING

A. Permanently and effectively ground all raceway systems, supports, cabinets, switchboards, control equipment, motor frames, lighting fixtures and other utilization apparatus.

B. Provide a ground wire in each conduit carrying circuits operating at 100 volts or higher bonded at each end to equipment. Size as shown on the drawings or per CEC.

C. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.

D. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.

E. Mechanical connectors shall not be used.

3.6 ELECTRICAL WORK FOR EQUIPMENT

A. Provide all connections to equipment requiring electrical supply.

3.7 LIGHTING FIXTURES

A. Install lighting fixtures complete with lamps, ready for operation.

B. Secure fixtures to the structure with brackets, flanges, and other mounting hardware suited for the fixtures and type of installation.

C. Clean lighting fixtures prior to final acceptance.

3.8 LIGHTING CONTROL DEVICES

A. Install in accordance with the manufacturer's instructions and the state of California, Title 24, state building standards, part 6, California Energy Code, latest edition.

B. Program system for proper operation and per owner's representative schedule of operation, maintaining compliance with Title 24.

C. Instruct owner's representative personnel in reprogramming and scheduling and maintenance of devices and lighting control panel.

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of existing trees and vegetation

B. Clearing vegetation, debris, trash and other materials within limits indicated

C. Grubbing of vegetation within limits indicated

D. Stripping of topsoil within limits indicated

E. Removing above-grade site improvements within limits indicated

F. Disconnecting, capping or sealing, and abandoning site utilities in place

G. Disconnecting, capping or sealing, and removing site utilities

H. Disposing of objectionable material

1.2 RELATED SECTIONS

A. Section 31 10 01, Plant Protection

B. Section 31 20 00, Earth Moving

C. Section 32 12 16, Asphalt Paving

D. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

A. ANSI A300: Industry Standards for Tree Care Practices

1.4 DEFINITIONS

A. ANSI: American National Standards Institute

B. CAL-OSHA: California Occupational Safety and Health Administration

C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

A. Do not remove or prune trees without first securing a permit from the appropriate agency.

B. Prune to the standards of ANSI A300.

1.7 PROJECT CONDITIONS

A. Except for materials indicated to be stockpiled or to remain the City's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Engineer. Avoid damaging materials designated for salvage.

C. Unidentified Materials;
   1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Engineer.
   2. If necessary, the Engineer will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to engineered fill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain during construction.

3.2 TREE REMOVAL

A. Remove trees designated for removal prior to the construction of new improvements in the vicinity:

1. When demolishing trees indicated to be removed within areas for new pavement or hardscape, remove tree, stump to a depth of two (2) feet below finish grade, and all roots located in the top twelve (12) inches of soil. Remove wood chips created from grinding process down to remaining stump then refill void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Import soil and compaction in future paved areas shall be in accordance with Section 32 12 16, Asphalt Paving and Section 32 13 13, Concrete Pavement.

2. When demolishing trees indicated to be removed within new landscaped areas, removal shall be done in one of the following ways:
   a. For trees located in accessible areas, remove tree and grind stump to four (4) inches below finish grade. Backfill the void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Do not remove existing roots.
   b. For trees located in inaccessible areas, cut stump flush with finish grade, and cover with 3 inches of bark mulch. Do not grind the stump and do not remove existing roots.

B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA tree work protection standards and ANSI A300 Standards.

C. All trees to be demolished shall be removed in such a way as to not damage branches, trunks, or root systems of adjacent trees.

3.3 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the Engineer.

B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the Engineer.
   1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Engineer.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Engineer or others unless authorized in writing by the Engineer, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the Engineer and utility company affected. Notify Engineer and utility company affected two working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Fill abandoned piping with cement slurry.

H. Securely close ends of abandoned piping with tight fitting plug or cement slurry minimum 6 inches thick.

3.5 CLEARING AND GRUBBING

A. Areas to be graded shall be cleared of existing vegetation, rubbish, existing structures, and debris.

B. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

D. Use only hand methods for grubbing within drip line of remaining trees.

3.6 SITE STRIPPING

A. Strippings and spoils shall be disposed at an off-site location.

B. Remove vegetation before stripping soil.

C. Surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be relatively shallow (i.e. less than 2 inches); deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots.

D. Remove trash, debris, weeds, roots, and other waste materials.

E. Stockpile soil materials designated to remain on site at a location approved by the Engineer at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

F. Do not stockpile soil within drip line of remaining trees.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 BACKFILL

A. Place and compact material in excavations and depressions remaining after site clearing in accordance with Section 31 20 00, Earth Moving.

3.9 DISPOSAL

A. Remove surplus soil material, unsuitable soil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION

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SECTION 31 10 01

PLANT PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preserve and protect existing trees, shrubs, and other plant materials to remain, including protecting plants on adjoining properties during site preparation work and construction.

B. Provide tree and shrub pruning and removal in accordance with these Specifications if required by the Contract Documents.

C. Layout and review of utility and irrigation trenches that occur in the Tree Protection Root Zone.

1.2 RELATED SECTIONS

A. Section 31 10 00, Site Clearing
B. Section 31 20 00, Earthwork
C. Section 32 84 00, Irrigation
D. Section 32 90 00, Planting

1.3 QUALITY ASSURANCE

A. Reference Standards:
   1. Ordinances and Regulations: All local, municipal, and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations, or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard than is required by the above-mentioned codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.

   2. International Society of Arboriculture, Guide for Plant Appraisal, latest version.

B. Pre-installation Conference:
   1. Conduct conference at the project site. Contractor shall review and identify with the Owner’s Representative the limits of Work and extent of plant materials and other improvements to be protected. Notify Owner's Representative of discrepancies between existing conditions and Drawings before proceeding with Work.
   2. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Tree-service firm's personnel, and equipment needed.
      b. Arborist's responsibilities.

c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.

C. At the Owner's discretion, an Arborist may represent the Owner to review the work of the Contractor in regard to plant protection. Arborist Qualifications: ISA Certified Arborist licensed to work in the State of California.

D. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.4 PROJECT CONDITIONS

A. Coordination: Coordinate this work with the work of other Sections to avoid delay and interference with other work.

B. Nuisances: Keep dirt, dust, noise and other objectionable nuisances to a minimum. Use temporary enclosures, coverings and sprinkling, and combinations thereof, as necessary to limit dust to lowest practicable level, except do not use water to the extent that it causes flooding or contaminated run-off.

C. Traffic: Conduct work to ensure minimum interference with vehicular and pedestrian traffic, and to permit unencumbered access to site and adjacent properties.
1. Do not close or obstruct streets, sidewalks, alleys, or other public passageways without permission from authorities having jurisdiction.
2. If required by governing authorities, provide alternate routes around closed and obstructed traffic ways.

D. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust toward protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.5 DEFINITIONS

A. Diameter at breast height (DBH): diameter of a trunk as measured at a height 54 inches above the ground line.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and as identified on the drawings or otherwise by a certified arborist.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

E. Structural Root Zone: A circular area with the tree trunk at the center and a radius equal to 3 times the diameter of the tree trunk measured at breast height (4.5 feet above ground line). This zone, where most of the structural roots exist, is based upon tree failure research conducted by E.T. Smiley at the Bartlett Tree Research Laboratory. Any structural (buttress) root, which has been severed or is rotten within this zone, can no longer provide adequate support to the tree and must be considered missing.

F. Dripline: The area of the ground directly beneath the vertical projection (shadow) of the tree's foliage canopy.

1.6 SUBMITTALS

A. Product Data: For each type of product.

B. Soil Analysis Report:
1. Provide soil analysis report for any top soil to be removed and stockpiled for reuse as planting soil. Soils analysis report to be performed by Wallace Laboratories LLC (310-615-0116), a certified soil analysis laboratory, and include agricultural suitability analysis and recommendations for amending the soil. Subsoil will not be approved as planting soil.

C. Samples: For each type of the following:
1. Organic Mulch: 1-quart of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Planting Soil: 1-quart of soil; in sealed plastic bags; for soils to be used within the protection zones.

D. Shop Drawings:
1. Include plans and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones. Indicate extent of trenching by hand or with air spade within protection zones.
2. Protection-Zone Signage

E. Qualification Data: For arborist and tree service firm.

F. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

G. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

H. Survey of Existing Conditions: Provide to Owner a Survey of Existing Conditions. Record existing conditions, including underground utilities, etc. on As Built Drawings by use of field measurements and preconstruction photographs. Make permanent record of measurements, materials, and construction details required to make exact reproduction.

I. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Approved planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
   1. Type: Wood and bark chips
   2. Size Range: ½’-2”
   3. Color: Natural Brown.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
   1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts; with 1-5/8-inch- OD top and bottom rails; with tie wires, hog ring ties, and other accessories for a complete fence system.
      a. Height: 72 inches
   2. Gates: Swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
   1. Text: “Tree Protection Zone. No Heavy Equipment.”
   2. Lettering: 3-inch- high minimum, black characters on white background.

E. Tree Branch & Trunk Protection: for branches trunks exposed to, or at risk of exposure to impact by construction equipment.
   1. 2x lumber

2. 1/2”-wide steel straps

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas in which work is to be performed. Report in writing to the Owner's Representative all prevailing conditions that will adversely affect the existing plant materials to remain. Do not proceed with work until a solution acceptable to the Owner’s Representative has been arrived at.

B. Survey of Existing Conditions: Record existing conditions, including underground utilities, etc. by use of measured drawings and preconstruction photographs.

C. Starting work constitutes acceptance of the existing conditions and the Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and defective work encountered.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain and/or be relocated. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

D. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

E. Install and maintain temporary fencing and other required protective devices and exclude construction activities from tree/shrub zones except as supervised by the Arborist / Owner’s Representative.

F. If tree/plant protection zones cannot be protected with fencing, a four-inch layer of mulch with minimum 1.25-inch-thick, metal strap linked plywood shielding shall be maintained in the tree/shrub zone where heavy equipment will be operated.

3.3 PROTECTION ZONES

A. Protect trees and shrubs against cutting, breaking, skinning and bruising of bark; permit no traffic or stockpiling within drip line.

B. Do not change earth surface within drip line of trees and shrubs except as approved in writing by the Owner.

C. Do not park vehicles or store materials, supplies, and construction equipment within Tree Protection Zone.

D. Verify details of protection-zone fencing before retaining last option in "Protection-Zone Fencing" Paragraph below.

Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect. Post may be steel driven type, or self-supporting type.
3. Access Gates: Install where required; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire

E. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, with signs each facing a different direction.

F. Where tree branches & trunks are exposed to, or at risk of exposure to impact by construction equipment, secure 2x lumber radially around tree branches and/or trunk to prevent damage. Secure lumber with steel strapping.

G. Maintain protection zones free of weeds and trash.

H. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION & TRENCHING

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as approved by certified arborist.
   1. Generally cutting of roots two inches or greater shall be avoided. Roots one inch and greater in diameter that must be cut shall be cut cleanly and obliquely with the cut surface facing down.
   2. Exposed and pruned roots shall be covered with light well-drained soil backfill and mulch over. The area shall be kept moist. Retain applicable subparagraphs below.
   3. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   4. Cut Ends: Do not paint cut root ends.
   5. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   6. Cover exposed roots with burlap and water regularly.
   7. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 AIR SPADING:

A. Air spading, or hand removal of soil or tunneling is required for excavation in the Tree Protection Zone of any trees for the installation of infrastructure where roots 2 inches in diameter and larger are encountered. The “critical root zone” is defined as any area around a tree in which a two-inch diameter root is encountered. The Arborist / Owner’s Representative shall define the critical root zone and the Contractor shall excavate using a pneumatic excavator (AIR-SPADE or equivalent) as follows:

B. Trenching for utility lines or other infrastructure may be done mechanically outside the Tree Protection Zone. As the equipment operator approaches the canopy radius, or for certain species up to 1.5 times the canopy radius out from

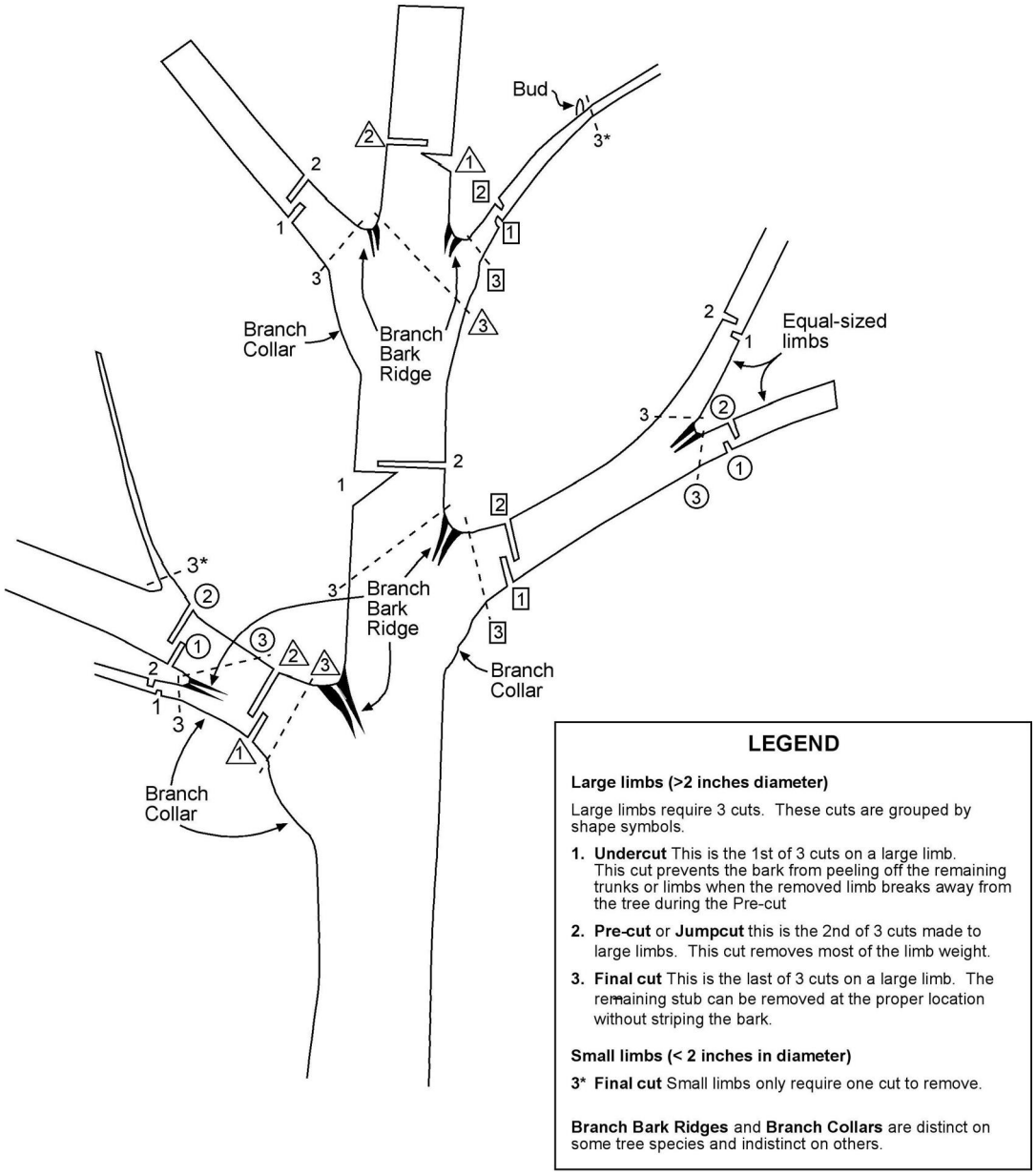
the base of the tree (Oaks, Poplars, Redwoods, etc.) the operator shall be assisted by a spotter who shall inspect the excavation for roots. If a root of two inches diameter is encountered the spotter shall halt mechanical excavation and pneumatic excavation shall proceed. If no other two inch or greater diameter root is encountered in an excavation of two feet forward and two feet deep, the single two-inch root may be cleanly cut proximal to (on the tree side of) any fracture or torn bark. Mechanical excavation may continue until a two-inch diameter root is encountered, and the pneumatic excavation, exploration is then repeated.

C. The Contractor shall control dust and the spread of soils excavated. The air-spade operator shall moisten the soil to field capacity and to a minimum probe depth of 2.5 feet with a watering needle (hydro-spear) 48 hours prior to pneumatic excavation. The spread of excavated soil shall be contained to the area adjacent to the trench path with upright plywood sheeting.

D. These specifications shall not be considered operating instructions or a requirement to use a specific pneumatic excavation product. It is the responsibility of the Contractor to read and understand the pneumatic excavator operation instructions and safety procedures (including the proper and safe use of air compressor, hoses, excavation tools, etc.) prior to operations.

3.7 TREE PRUNING

A. Obtain specific instruction from Arborist / Owner's Representative for pruning of trees, shrubs, roots or disturbance of soil within spread of tree branches. The Contractor shall utilize protection measures as outlined by Arborist / Owner's Representative, which may include directional drilling, or hand clearing to expose the roots.



B. Provide periodic watering for all planting within Contract limit and any adjacent areas affected by the work. Maintain moisture to a minimum 6" depth, minimum.

C. Using an approved pruning saw, provide selective tree limb pruning as accepted by the Landscape Architect if branches interfere with new construction. Limb diameter shall be limited to 5” diameter and shall be pruned just outside the branch collar in accordance with American National Standards Institute, (ANSI 300) and International Society of Arboriculture, (ISA) standards.

D. Approved branches to be shortened must be cut just above a fork with another living branch which is plus or minus 1/2 the diameter of the removed branch as shown in the pruning figure herein. Branches to be removed which exceed 2" in diameter shall be severed with a 3-step cut to prevent bark peeling. Final cuts must not injure the branch collar or branch bark ridge of the remaining branches and trunk.

E. Prune branches that are affected by temporary and permanent construction.
   1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees according to ANSI A300 (Part 1)

F. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

G. Cut branches with sharp pruning instruments; do not break or chop.

H. Do not paint or apply sealants to wounds.

I. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

J. Chip removed branches and stockpile in areas approved by Landscape Architect.

3.8 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 6inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.9 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.10 TREE & PLANT REMOVAL & REPLACEMENT

A. Field Verification: Before removing non-designated trees, shrubs, stumps, bushes, vines, rubbish, undergrowth and deadwood as shown on the Drawings and as specified, obtain verification from Owner's Representative.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

C. Backfill and compact areas excavated and open pits and holes resulting from removal operations. Comply with requirements herein and as specified in Earthwork, Section 02300 for backfill materials, compaction, and installation methods.

D. Remove all stumps and roots in their entirety. Tree trunks shall be removed minimum depth of 2 1/2 feet below existing grade or finish grade, whichever is deeper. Stump grinding is an acceptable method of removal of roots and stumps of trees and shrubs; however, the chip contaminated soil shall be replaced with approved clean planting soil in planting areas and with approved clean fill soil in all other areas.

E. Backfill and compact voids excavated and open pits and holes resulting from removal operations. Comply with Earthwork Specification for backfill materials, compaction and installation methods. Unless required otherwise, in planting areas backfill holes with clean approved planting soil compacted to 90% relative compaction to a minus 12 inches below finish grade and 85% relative compaction for the top 12 inches, except as required elsewhere to a greater degree by Civil or Structural Engineer. In non-planting areas backfill holes with approved fill soil compacted to 95% relative compaction.

F. Remove and replace trees indicated to remain that are more than 25% dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

G. Plant Replacement: Contractor shall replace trees cut or severely damaged due to the Contractor’s work as follows:
   1. An ISA Certified Arborist may be retained by the Owner to determine the condition of trees in question as to their ability to survive in a healthy condition and in their original shape, or a pruned aesthetically pleasing shape acceptable to the Owner. Comply with recommendations to rehabilitate as recommended by the Arborist, or to replace in accordance with the requirements below.
   2. Trees size shall be determined by Diameter at Brest Height (DBH). Replacement of trees and shrubs shall also include providing acceptable plant installation, automatic irrigation system and a minimum maintenance period of 120 days. If plant(s) is not acceptably maintained and is not healthy and thriving at the end of the 120-day maintenance period, the Contractor shall continue the maintenance work until such time that healthy tree(s) and/or shrub(s) is achieved.
   3. Replace any damaged planting in kind using "specimen" plants as follows and at no cost to Owner:
      a. Trees up to 3” DBH: Replace with 36" box size.

b. Trees 3” to 6” DBH: Replace with 72" box size.
c. Trees 6” to 12” DBH: Replace with 84" box size.
d. Trees 12” DBH and larger: Tree value shall be determined by Arborist using Council of Tree and Landscape Appraisers (CTLA) method. Replace damaged tree with largest available nursery boxed tree and cash difference between value of damaged tree and nursery stock replacement cost.
e. Shrubs: Replace with 15-gallon can size.

4. Plant and maintain new trees as specified.

H. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 3-inch uniform thickness to remain.

I. Soil Aeration: Where directed by arborist, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches (300 mm) deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.11 CLEANUP AND DISPOSAL

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

B. Clean excess soil may be distributed on site as accepted by Owner's Representative, if it does not adversely affect specified finish grades or percolation of water into planting soil.

C. Upon completion of work under this Section, remove all tools, equipment and temporary protections, enclosures, and structures.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation and/or embankment from existing ground to subgrade, including roadways, driveways, parking areas, concrete walkways and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 21 00, Utility Trenching and Backfill.

1.3 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 01 50 50, Erosion Control

C. Section 31 10 00, Site Clearing

1.4 RELATED DOCUMENTS

A. ASTM
   1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
   2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
   3. D2487, Classification of Soils for Engineering Purposes
   4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
   6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
   7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence

B. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction

C. Caltrans Standard Specifications
   1. Section 17, General
   2. Section 19, Earthwork

D. CAL/OSHA, Title 8.

1.5 DEFINITIONS

A. Excavation: Removal of material encountered above subgrade elevations.
   1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the City Engineer.
   2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the City Engineer. Unauthorized excavation shall be without additional compensation.

B. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

C. Fill: Soil materials approved by the City Engineer and used to raise existing grades.

D. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

E. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

F. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

G. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The City Engineer will determine if a soil material is unsuitable.

H. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

I. Utilities: onsite underground pipes, conduits, ducts and cables.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Samples:
   1. If required by the City Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to

use. Do not import materials to the Project without written approval of the City Engineer.

2. Provide materials from same source throughout work. Change of source requires approval of the City Engineer.

C. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.

1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

A. Provide an independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

B. Conform all work and materials to the recommendations or requirements in the project plans and meet the approval of the City Engineer.

C. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.

D. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

E. Perform excavation, filling, compaction and related earthwork under the observation of the City Engineer. Materials placed without approval of the City Engineer will be presumed to be defective and, at the discretion of the City Engineer, shall be removed and replaced at no cost to the City. Notify the City Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing.

F. The City Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the City Engineer, does not meet the requirements of these Technical Specifications and the City Report.

G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the City Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.

H. Finish subgrade tolerance at completion of grading:

1. Building and paved areas: ±0.05 feet
2. Other areas: ±0.10 feet

1.8 PROJECT CONDITIONS

A. Promptly notify the Engineer of surface or subsurface conditions differing from those disclosed in the Plans. First notify the Engineer verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Plans will be allowed unless the Contractor has notified the Engineer in writing of differing conditions prior to the Contractor starting work on affected items.

B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.

D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Engineer.

E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Caltrans Standard Specification Section 19. Expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.

B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

PART 3 - EXECUTION

3.1 GENERAL

A. Perform work in accordance with Caltrans Standard Specification Section 19, Earthwork, as modified by the Contract Documents.

B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

C. The use of explosives will not be permitted.

D. Grading and earthwork operations shall be observed by the Engineer for conformance with the project plans/specifications. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.2 CONTROL OF WATER AND DEWATERING

A. Excavations shall be dewatered in accordance with

Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Engineer and the Owner until backfilling is completed.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.

D. Obtain the Engineer's approval for proposed control of water and dewatering methods.

E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.

F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

G. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.

B. If the Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Engineer.

3.4 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Engineer, submit details and calculations to the Engineer. The Engineer may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Engineer.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.5 TOPSOIL STRIPPING

A. Remove topsoil in accordance with Section 31 10 00, Site Clearing.

3.6 EXCAVATION

A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.

B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.

C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.

D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.

E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.7 GRADING

A. Uniformly grade the Project to the elevations shown on plans

B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.

C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.8 SUBGRADE PREPARATION

A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.

B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.

C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.

D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.

E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.

F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

G. Obtain the City Engineer's approval of subgrades prior to placing pavement structural section.

3.9 FILL PLACEMENT AND COMPACTION

A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.

B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per City Engineer's recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.

C. Obtain the City Engineer's approval of surface to receive structural fill prior to placement of structural fill material.

D. Place structural fill on prepared subgrade.

E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to

withstand loads imposed and the horizontal structural system had been installed.

F. Do not compact by ponding, flooding or jetting.

G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the City Engineer.

H. Compaction requirements (unless specified otherwise by the City Engineer):
   1. Compact structural fills less than 5 feet thick to 90 percent compaction.
   2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
   3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the City Engineer.
   4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.10 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 31 21 00

UTILITY TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill for underground storm drain, electrical conduit, communication conduit, etc., and associated structures.

B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
   1. Select Backfill Material
   2. Aggregate Base
   3. Detectable Tape
   4. Trench Excavation
   5. Pipe Bedding
   6. Trench Backfill
   7. Trench Surfacing

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 33 41 00 – Storm Utility Drainage Piping

1.3 RELATED DOCUMENTS

A. ASTM
   1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. Caltrans Standard Specifications, 2015
   1. Section 19, Earthwork
   2. Section 26, Aggregate Bases

C. CAL/OSHA, Title 8

1.4 DEFINITIONS

A. AC: Asphalt Concrete

B. ASTM: American Society for Testing and Materials

C. Base: The layer placed between the subgrade and surface pavement in a paving system.

D. Bedding: Material from bottom of trench to bottom of pipe

E. DIP: Ductile Iron Pipe

F. Excavation: Consists of the removal of material encountered to subgrade elevations

G. Backfill: Material from bottom of pipe to subgrade

H. PCC: Portland Cement Concrete

I. RCP: Reinforced Concrete Pipe

J. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

K. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

L. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

M. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the l Engineer.
   2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Engineer. Unauthorized excavation shall be without additional compensation.

N. Utility Structures:
   1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
   2. Electrical manholes, pull boxes, vaults, etc.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 10 00 – Supplemental General Requirements.

B. Test Reports: Submit the following report for import material directly to the Owner from the Contractor's testing services:
   1. Compaction test reports for aggregate base.

1.6 QUALITY ASSURANCE

A. Conform all work and materials to the approval of the Engineer.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to

the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. The Contractor will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Engineer, does not meet the requirements of these Technical Specifications.

D. Soil Testing:
   1. Contractor to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
   2. Test results will be submitted to the Owner/Engineer

1.7 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Contract Documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.

B. Barricade open excavations and post with warning lights.
   1. Operate warning lights and barricades as required.
   2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
   3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control in conformance with Section 01 10 00 Supplemental General Requirements.

E. Environmental Requirements:
   1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
   2. Protect existing streams, ditches and storm drain inlets during work on this project.

F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

G. Transport all excess soils materials by legally approved methods to disposal areas.
   1. Coordinate with the Engineer.

2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES

A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
   1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner and/or utility agency immediately for directions.
   1. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.
   2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.

C. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.1 GENERAL

A. Import materials will be subject to approval of the Engineer.

B. For approval of imported fill material, notify the Owner at least 7 days in advance of intention to import material.

2.2 PIPE BEDDING AND BACKFILL

A. ASTM D2321, Class IA, IB or II.
   1. Clean and free of clay, silt or organic matter.

B. Class 2 Aggregate Base: In accordance with Section 26 of Caltrans Standard Specifications, ¾ inch maximum.

C. Sand: In accordance with Section 19-3.02F of Caltrans Standard Specifications.

D. Backfill: Shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

2.3 WARNING TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

1. Warning Tape Color Codes
    a. Red: Electric
    b. Orange: Telephone and Other Communications
    c. Blue: Water Systems

2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.4 DETECTION WIRE FOR NON-METALLIC PIPING

A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.5 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Engineer.

B. Poured-in-Place Structures:
1. Bedding: Bedding shall meet the approval of the Engineer. In general, bedding is required to be Class II Aggregate Base or Sand.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the recommendations of the l Engineer.

B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.

C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.

D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.

E. Prior to commencement of work, become thoroughly familiar with site conditions.

F. In the event discrepancies are found, immediately notify the Owner in writing, indicating the nature and extent of differing conditions.

G. Backfill excavations as promptly as work permits.

H. Do not place backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner.

I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

J. In excavations, use satisfactory excavated or borrow material.

K. Under grassed areas, use satisfactory excavated or borrow material.

3.2 SITE PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.3 EXISTING UTILITIES

A. Identity the location of existing utilities.
   1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.

2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Owner to clear the utility.

B. Protect all existing utilities to remain in operation.

C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.

D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
4. Report damage of utility line or subsurface structures immediately to the Owner.

E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.4 TRENCH EXCAVATION

A. General
1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:
1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or a right angles to the alignment of the sidewalk.

3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.

C. Trench Width:
1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
   a. The maximum trench width shall be inclusive of all shoring.
   b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.

2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Excavation Width at Springline of Pipe:
1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Engineer.

E. Open Trench:
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.5 CONTROL OF WATER AND DEWATERING

A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Engineer and the Owner until backfilling is completed.

B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

C. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

D. Maintain dewatering system in place until dewatering is no longer required.

3.6 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.7 PIPE BEDDING

A. Obtain approval of bedding material from the Engineer.

B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.

C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.

D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.8 BACKFILLING

A. Initial Backfill:
   1. Obtain approval of backfill material from Engineer.
   2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the l Engineer. Compact by pneumatic tampers or other mechanical means approved by the Engineer. Jetting or ponding of initial backfill material will not be permitted.

B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.

C. Installation of Tracer Wire:
   1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
   2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
   3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
   4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

D. Installation of Warning Tape
   1. Install tape approximately 1 foot above and along the centerline of the pipe.
   2. Where tape is not continuous lap tape ends a minimum of 2 feet.

E. Subsequent Backfill:
   1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
   2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Engineer. Compact by pneumatic tampers or other mechanical means approved by the
   3. Engineer. Jetting or ponding of subsequent backfill material will not be permitted.

F. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.

G. Utility backfill shall be inspected and tested by a Geotechnical Engineer, obtained by the Contractor, during placement. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Engineer and the Owner prior to proceeding with the Project.

H. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.9 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

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SECTION 32 11 00

PAVEMENT BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate base

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 01 50 50, Erosion Control

C. Section 31 20 00, Earth Moving

1.3 RELATED DOCUMENTS

A. ASTM:
   1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
   2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
   3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
   4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence

B. Caltrans Standard Specifications
   1. Section 24, Stabilized Soils
   2. Section 26, Aggregate Bases

1.4 DEFINITIONS

A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

C. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

A. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

B. Perform installation of base materials under the observation of the City Engineer. Materials placed without approval of the City Engineer will be presumed to be defective and, at the discretion of the City Engineer, shall be removed and replaced at no cost to the City. Notify the City Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.

C. Do not project the finish surface of aggregate subbase above the design subgrade.

D. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the City.

C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE

A. Material: Class 2, 1 ½ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

PART 3 - EXECUTION

3.1 GENERAL

A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

A. Do not place or compact subgrade if above optimum moisture content.

B. If the City Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the City Engineer.

3.3 AGGREGATE BASE

A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.4 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the City.

END OF SECTION

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SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hot Mix Asphalt for Asphalt Berms, Asphalt Walkway, and Asphalt Conforms

B. Tack coat

C. Hot Mix Asphalt Paving

D. Adjusting manholes, valves, monument covers and other structures to grade

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 31 20 00, Earth Moving

C. Section 32 11 00, Pavement Base Course

1.3 RELATED DOCUMENTS

A. ASTM
   1. D979: Standard Practice for Sampling Bituminous Paving Mixtures
   2. D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
   3. D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
   4. D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
   5. D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
   6. D3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

B. Caltrans Standard Specifications
   1. Section 39: Asphalt Concrete
   2. Section 92: Asphalt Binder
   3. Section 94: Asphaltic Emulsions

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials.

B. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness of hot mix asphalt: In-place compacted thickness of asphalt courses will be determined according to ASTM D3549.

D. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.
   1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D1188 or ASTM D2726.
      a. One core sample may be taken for every 1000 square yard or less of installed pavement, but in no case will fewer than 3 cores be taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Job-Mix Designs: Certificates signed by manufacturers certifying that each hot mix asphalt mix complies with requirements.

C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Tack Coat: Minimum surface temperature of 60 F at application.
   2. Asphalt Base Course: Minimum surface temperature of 40 F and rising at application.
   3. Asphalt Surface Course: Minimum surface temperature of 60 F at application.

PART 2 - PRODUCTS

2.1 HOT MIX ASPHALT

A. Type A In accordance with Caltrans Standard Specifications Section 39-2, Hot Mix Asphalt.

B. Hot Mix Asphalt Materials:
   1. Asphalt Binder: Grade PG 64-10 in accordance with Caltrans Standard Specification Section 92, Asphalt Binders.
   2. Tack Coat: Grade SS1 in accordance with Caltrans Standard Specification Section 94, Asphaltic Emulsions.

C. Aggregates: 1 inch max gradation for virgin aggregate and recycled asphalt pavement (RAP) in accordance with to Caltrans Standard Specification Section 39-2.02, Type A Hot Mix Asphalt.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. If necessary, perform subgrade preparation or remediation in accordance with Section 31 20 00, Earth Moving.

D. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.2 PAVEMENT GRINDING

A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.

B. Grind conforms as indicated.

3.3 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving in accordance with Caltrans Standard Specification Section 39-2.01C(3)(b) and in accordance with Section 32 11 00, Pavement Base Course.

B. Tack Coat: Apply uniformly and at specified rates between HMA layers, to vertical surfaces of curbs, gutters and construction joints, and to existing pavement, including planed surfaces, in accordance with Caltrans Standard Specification Section 39-2.01C(3)(f).
   1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SURFACE PREPARATION FOR PAVEMENT AT HOT MIX ASPHALT OVERLAYS

A. Pavement Irregularities: Level with hot mix asphalt, Type A, ½ inch max aggregate.

B. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying binder of paving asphalt to existing surface.

3.5 HOT MIX ASPHALT SPREADING AND COMPACTING EQUIPMENT

A. Provide spreading and compacting equipment in accordance with Caltrans Standard Specification Section 39-2.01C(2).

3.6 HOT MIX ASPHALT PLACEMENT

A. Place, spread and compact hot mix asphalt to required grade, cross section, and thickness in accordance with Caltrans Standard Specification Sections 39-2.01C (2), 39-2.01C(3), and 39-2.01C(8).

B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Caltrans Standard Specification Sections 39-2.01C(4)
   1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
   2. Clean contact surfaces and apply tack coat.
   3. Offset longitudinal joints in successive courses a minimum of 6 inches.
   4. Offset transverse joints in successive courses a minimum of 24 inches.
   5. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact in accordance with Caltrans Standard Specification Sections 39-2.01C (2).

B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D2041, but not less than 90 percent nor greater than 96 percent.

C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.

D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 HOT MIX ASPHALT BERMS

A. Construction: Place over compacted surfaces in accordance with Caltrans Standard Specification Section 39-2.01C(9). Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.

B. Shape: Place hot mix asphalt to curb cross section indicated.

3.10 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
   1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
   2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.

B. Install grade rings or blocking as needed to raise cover to finish grade.

C. Pour concrete collar:
   1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
   2. Top of Collar: Bottom of existing asphalt pavement.
   3. Apply tack coat to all exposed surfaces.
   4. Fill excavation with hot mix asphalt and, while still hot, compact flush with adjacent surface.

3.11 INSTALLATION TOLERANCES

A. Hot Mix Asphalt Pavement:
   1. Course thickness and surface smoothness shall be in accordance with Caltrans Standard Specification Section 39-2.01A(4)(i)(iii)
   2. Total Thickness: Not less than indicated.

B. Trench Patch:
   1. Compacted surface: Within 0.01 foot of adjacent pavement.
   2. Do not create ponding.

C. Adjust Covers:

1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
2. Do not create ponding.

END OF SECTION

SECTION 32 13 12

LANDSCAPE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete for plaza flatwork, sidewalks, and footings for posts and structures.

1.2 RELATED SECTIONS

A. Section 31 20 00, Earthwork

1.3 QUALITY ASSURANCE

A. Reference and Standards
   1. Perform work in accordance with all applicable laws, codes and regulations required by the City of Sausalito.
   2. Reference to "Standard Specifications" shall mean the current Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.
   3. The American Concrete Institute (ACI): "Manual of Concrete Practice," Parts 1, 2 and 3.
   4. The American Concrete Institute (ACI):“Recommended Practice for Concrete Formwork” (ACI 347R)
   5. The American Concrete Institute (ACI): "Hot Weather Concreting", 305R-99
   6. The American Concrete Institute (ACI): Guide for Concrete Slab construction, 302.1R-07
   7. The American Concrete Institute (ACI): "Standard Specification for Cold Weather Concreting, 306.1-90 (R2002)
   8. United States Voluntary Product Standard for Construction & Industrial Plywood (PS 1-95).
   9. American Plywood Association’s “Guide to Plywood Grades” (APA).
   10. West Coast Lumber Inspection Bureau’s “Standard Grading Rules No. 17” (WCLIB)
   11. Concrete Reinforcing Steel Institute (CRSI): “Manual of Standard Practice” and “Recommended Practice for Placing Reinforcing Bars”.
   12. American Welding Society: AWS A5.1 and AWS D1.1 and D1.2.
   13. Americans with Disabilities Act (ADA), Federal ADA/State of California Title 24 Standards.
   14. California Code of Regulations, Title 24, 2010 Edition, also known as California Building Code (CBC).

B. Stipulations
   1. Finish Surface Tolerance: 1/4-inch maximum variation in 10 feet.
   2. At no point shall paving surface fail to drain.
   3. Finish Concrete Surface Slip Resistance: Shall have a minimum slip resistance coefficient of 0.65 on concrete pavement with less than 5% slope and 0.8 on concrete pavement with more than 5% slope.

4. Walls retaining soil that retain 18 inches or more of soil shall receive Dampproofing per Caltrans Standard Specifications, Section 54.
5. Contractor shall pour adjacent slabs in a way that does not impact finish quality or construction (expansion) joint dimensional stability.

C. Testing and Inspection, per Section 01 45 00.

D. Conform to ACI 306, Section 5.13 during hot weather and cold weather.

E. Requirements of ACI 318 shall govern work, materials and equipment related to this Section; specifications herein set minimum results required, and references to procedures are intended to establish minimal guides.

F. The Contractor shall be responsible for quality of concrete in place and shall bear burden of proof that concrete meets minimum requirements. Contractor shall confirm that site soils do not contain elevated levels of sulfate that would require sulfate resistant concrete as outlined in ACI 306. If the site soils contain elevated levels of sulfate, it is the Contractor's responsibility to request mixes that meet the requirements.

G. Placing of concrete by means of pumping will be an acceptable method of placement providing that the Contractor can demonstrate that:
1. Specified concrete strengths will be met.
2. Equipment has a record of satisfactory performance under similar conditions and using a similar mix.
3. Trial batches have been successfully made.

H. Installer Qualifications: Concrete work shall be by firm with 5 years' experience with work of similar scope and quality.

I. Formwork Design Criteria: Formwork shall conform to ACI 347-04 and CBC.
1. Formwork:
   a. Shall prevent leakage or washing out of cement mortar.
   b. Shall resist spread, shifting, and settling.
   c. Shall reproduce accurately required lines, grades and surfaces within tolerances specified.
2. Safety: The Contractor shall be responsible for adequate strength and safety of all formwork including falsework and shoring.
3. Formwork allowable tolerances: Formwork shall produce concrete within tolerance limits recommended in ACI 347-04, unless otherwise noted.

1.4 TESTS

A. The Owner will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. Costs for such tests will be paid by the Owner. Contractor shall cooperate in arranging tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of samples at time of pour.

B. Should tests show that concrete is below specified strength, Contractor shall remove all such concrete, as directed by the Owner. Full cost of removal of low

strength concrete, its replacement with concrete of proper specified strength and testing, shall be borne by Contractor.

1.5 COORDINATION

A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades.

1.6 SUBMITTALS

A. Samples of all materials under this Division shall be supplied for testing as requested by the Owner.

B. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by the manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

C. Submit color additive manufacturer's color chart and sample chip(s), indicate color additive number, and required dosage rate.

D. Submit two full-scale mock-up (minimum 4' by 4') sample panels of all concrete finishes and color. The samples shall include curing compound if any is to be used, and include an expansion joint and a score joint, as indicated on the Drawings. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the Work.

E. Submit one-pint samples of aggregate for exposed aggregate finished concrete paving in color range as specified.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Supply ready mixed concrete throughout. Batch, mix and transport in accordance with ASTM C-94, "Specifications for Ready Mixed Concrete."

B. Mix and deliver concrete in quantities that will permit immediate use only.

C. Indiscriminate addition of water for any reason will be cause for rejection of the load.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Cement and aggregates shall have proven history of successful use with one another. Sources of cement and aggregate shall remain unchanged throughout work.

B. Mixes:
   1. Ready-mixed concrete shall meet requirements of ASTM C94.

2. The Contractor shall perform tests or assemble the necessary data indicating conformance with specifications.
3. For each mix, submit data showing that proposed mix will attain the required strength in accordance with requirements of Caltrans Standard Specifications, Section 90.
4. Instruct Laboratory to base mix design on use of materials specified and approved by the Owner's Representative.
5. Mix design shall include compression strength test reports per CBC Section 1905A.6.3.
6. Insure mix designs will produce concrete to strengths specified and of uniform density without segregation.
7. If mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard, without changing cement content.
8. Introduction of calcium chloride will not be permitted.
9. Mix design shall be in accordance with CBC Section 1905A.3.

C. Concrete Types (See Drawings for any other miscellaneous items not listed below):

TYPE	28-DAY STRENGTH	AGGREGATE SIZE	FINISH & COLOR	COMMENTS
Slab on grade	3,000	1" X #4	See Drawings	

2.2 FORMWORK MATERIALS

A. Curbs may be formed with approved metal form systems.

B. Chamfer Strips: Meadow-Burke Concrete Accessories, PVC type CSF ½-inch or as otherwise shown, all exposed corners.

C. Form Release Agent: Must not stain or otherwise adversely affect architectural concrete surfaces. "Nox-Crete Form Coating"; Industrial Synthetics Corp.'s "Synthex"; or equal.

D. Form Ties: Burke "Penta-Tie," or equal, cone and rod type with 1-inch break-back.

2.3 REINFORCING MATERIALS

A. New, free of rust, Billet steel bars: Current ASTM designation A615.

B. Bar Reinforcement: ASTM A615.
1. #3 and smaller: Grade 40.
2. #4 and larger: Grade 60.
3. Tie wire: #6 minimum, black and annealed.

C. Bar Reinforcement recycled content shall be a minimum of 75% recycled post-consumer steel.

D. Wire Fabric Reinforcement: ASTM A185. Size (6” by 6” / W1.4 By W1.4 (#10 ga. by #10 ga.)

E. All reinforcing steel, bolts anchors, sleeves, etc. shall be securely anchored in place before concrete is placed. All reinforcing details, fabrication and installation shall conform to ACI Standard 315, latest edition, except as noted. Stagger all splices where practical and not otherwise detailed. Minimum concrete protection for reinforcement shall be as follows unless otherwise noted:
   1. 3" clearance where concrete is placed against the earth.
   2. 2" clearance where concrete is exposed to earth or weather but placed in forms.

F. Accessories: Metal and plaster spacers, supports, ties, etc. as required for spacing, assembling and supporting reinforcing in place. Legs of accessories to be of type that will rest on forms without embedding into forms. Galvanized metal items where exposed to moisture, or use other approved non-corrodible, non-staining supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II, except if water or soil is high in sulfates use Type V Portland Cement as described above under Quality Assurance. Use one brand of cement throughout project.

B. Fly Ash: ASTM C618, Class Type C or Type F. Can use with pozzolan, ground granulated blast furnace slag and silica furme.

C. Aggregates: ASTM C33, materials from established sources with proven history of successful use in producing concrete with minimum shrinkage.

D. Water: Clear and potable, free from deleterious impurities.

E. Admixtures:
   1. Admixtures are optional; however, a water reducer or plasticizing admixture shall be included in the concrete mix and it must be compatible with color pigments where color pigments are required. Any proposed admixture shall comply with ASTM C494.
   2. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
   3. Accelerating admixtures and admixtures containing more than 0.05 percent chloride ions are not permitted. If an accelerator is used, it shall be an non-chloride accelerator.
   4. Liquid admixtures shall be considered part of the total water.

2.5 CONCRETE MIXES

A. Concrete mixes shall be approved and shall be in accordance with Caltrans Standard Specifications Section 90. Unless otherwise noted, mix shall contain not less than 590 pounds of cementitious material per cubic yard (Class "2", 3,000 psi,) Type II Portland cement and a maximum aggregate blend of 1" by #4.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast furnace slag, and silica fume as needed to reduce the amount of Portland cement by 15 to 40 percent. Limit by percentage of weight of cementitious materials other than Portland cement in concrete mix.

C. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Owner's Representative. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

2.6 ANCILLARY MATERIALS

A. Aggregate Base: Crushed aggregate, R-78 minimum, 3/4-inch maximum, conforming to Standard Specification 26.1.02A, Class 2.

B. Expansion Joint Material

C. Fiber Expansion Joint: A non-extruding resilient filler, saturated with high quality bituminous materials having preserving characteristics. Conform to ASTM-D1751-04.

D. Dampproofing: Per CALTRANS Standard Specifications, Section 54.

E. Curing Materials for non-colored Concrete:
1. Waterproof Paper: ASTM C171, Type 1.1.1.1, regular. Same as Sisalkraft Division of St. Regis Paper Co.'s "Orange Label", or equivalent.
2. Impervious sheeting: 4 mil white polyethylene laminated to 10 oz. Burlap, ASTM C171, Type 1.1.3, fungus-resistant.
3. Curing Compound: ASTM C309. Product: Sealtight 1100 Clear-Series by WR Meadows, Burke Azua Resin Cure by Edocol, or equal that will not discolor concrete or affect bonding of other finishes applied thereafter, and which restricts loss of water to not more than 0.500 grams per sq. centimeter of surface when tested per ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."

F. Grout: Premixed high strength non-shrink grout requiring only addition of water at the site. Burke's "Non-Ferrous, Non-Shrink Grout"; Master Builders "Masterflow 928 Grout", or equal.

G. Patching Mortar: Mix in proportions by volume of one part cement to two parts fine sand.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all concrete work true to line and grade as indicated on the drawings.

B. Correct irregularities to the satisfaction of the Owner's Representative.

C. Plain non-colored, exposed concrete shall contain lampblack, approximately 3/4 pound of lampblack per cubic yard, as accepted by Owner's Representative.

D. The intent of the Grading Drawings is to provide positive drainage and to maintain slopes on walkways as required by the Americans with Disabilities act and California Title 24 throughout the project site. Notify the Owner's Representative immediately of any discrepancies between the Drawings and actual field conditions and/or conflicts between the design and Code requirements.

3.2 PREPARATION

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

B. Provide subgrade preparation and the base material installation complete, including clearing, grading, excavation, filling and dewatering. Take every precaution to obtain a subgrade of uniform bearing power compacted to a minimum of 95% relative compaction as determined by the ASTM D1557 laboratory test procedure and in Sections 19 and 20 of the Caltrans Standard Specifications.

C. Subgrade shall be kept moist and shall not be allowed to dry out before placement of concrete. Place no material on muddy subgrade. Remove un-compactable material and replace with clean fill and compact as required.

D. Aggregate base, where indicated, shall be placed and compacted in conformance with Caltrans Standard Specifications 26-1.04 and 26-1.05.

E. Obtain approval of subgrade from Owner's Representative prior to placing steel and concrete.

3.3 FORMS

A. Forms shall be constructed in accordance with ACI 318, Section 6.1 and shall be of sufficient strength and sufficiently tight to prevent visible distortion or leakage of mortar and fines.

B. Curb and pavement edge forms shall extend full depth of concrete and shall be coordinated with installation of planting root barriers where required. Curves shall be formed with flexible metal or wood made up of thin laminations. Curve forms shall extend one stake space straight beyond tangent point. Where curbs and pavement are adjacent to areas to receive root barriers, provide smooth uniform edges. Remove any excess concrete as required to allow installation of root barriers without gaps between curbs and/or pavement and barriers

C. Maintain forms within the following tolerances.

1. Top of Form: Plus or minus 1/8 inch in 10 feet and no abrupt variations; at required elevation to plus 3/8 inch.
2. Face of Form: Plus or minus 1/4 inch in 10 feet longitudinal and no abrupt variations; perpendicular to surface plus or minus 1/8 inch.

D. Form Ties: Align form ties as accepted by Owner's Representative. Obtain approval of form work from Owner's Representative prior to placing concrete.

E. Forms may be reused upon cleaning and coating with parting compound to ensure separation from concrete without damage.

F. After concrete is placed, the following minimum times shall elapse before removal of forms.

1 Footing sides: 24 hours.

1. Curbs: 1 hour

3.4 REINFORCEMENT

A. All concrete footings, walls, grade-beams shall be steel reinforced unless specifically noted to be "not reinforced." If no reinforcement is shown, reinforce in same manner as that shown in similar places or as accepted by Owner's Representative.

B. Fabricate and place reinforcement as indicated on the Drawings and in accordance with ACI "Detailing Manual" SP-66. No reinforcement shall be placed prior to distribution of the approved shop drawings.

C. Secure reinforcement in position by suitable supports and by wiring at intersections with tie wire. Supports shall be of sufficient number and strength to resist crushing or displacement under full load. Metal shall not extend to surface of concrete.

D. At time of placing concrete, reinforcing shall be free of excessive rust, mill scale, or other bond reducing matter. Immediately before placing concrete, check and adjust position, support and anchorage.

3.5 CLEANING, PATCHING AND DEFECTIVE WORK

A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, mismatched color, or is otherwise defective, and, in the Owner's Representative's judgment, these defects impair proper strength or appearance of the work, the Owner's Representative will require its removal and replacement at the Contractor's expense.

B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, etc., with patching mortar colored and textured to match concrete. Remove ledges and bulges.

C. Compact mortar into place and neatly file defective surfaces to produce level, true planes. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.

D. Rock Pockets:

1. Cut out to full solid surface and form key.
2. Thoroughly wet before casting mortar.

3. Where the Owner's Representative deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, and replace.

E. Cleaning:
1. Insure removal of bituminous materials, form release agents, bond breakers, curing compounds, if permitted and other materials employed in work of concreting that would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

3.6 MIXING AND PLACING CONCRETE

A. Conform to applicable requirements set forth in Caltrans Standard Specifications Section 51-1.09 and Section 90.

3.7 JOINTS AND GROOVES IN FLAT WORK

A. Plane of joints shall be perpendicular to surface. Where new pavements join existing, joints shall align.

B. Sawn Contraction Joints:
1. General: Provide where shown. Saw cut straight, true, and uniform, 1/8 - inch wide and not less than 1/4 of slab thickness in depth , unless otherwise noted. Cut with a power saw fitted with an abrasive or diamond blade.
2. Commence saw cutting operations after concrete has cured long enough to resist damage by the saw cutting operations and early enough to avoid random contraction cracks.
3. Contractor shall coordinate form removal and sequencing of adjacent concrete placement to minimize unnecessary saw cutting of adjacent surfaces.
4. Contractor shall plan for the use of varying types of saw cutting apparatus to provide acceptable finishes in areas limited in accessibility.
5. Fill saw cut over-runs and inadvertent saw cutting of adjacent surfaces with cement mortar to match color and finish of sawn pavement.
6. If the joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Owner's Representative.

C. Expansion Joints in Flat Work: Provided at the location and intervals as shown on the drawings, and at all locations where concrete paving abuts buildings, curbs, walls, columns, or other structures, and not more than 16 feet on center. Specified and shown joint material shall be placed with top edge 1/8" below the paved surface and shall be securely held in place to prevent movement. Joint and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming.

3.8 FINISHING

A. Flatwork and Curbs
   1. Surface Finishes

B. Washed Exposed Aggregate Finish:
   1. Place concrete using specified aggregate/concrete mix, screed tamp and bull float to desired elevation. A compatible water-reducing retarding admixture may be added in warm weather if desired. Apply surface retardant as soon as screeding and floating is complete.
   2. If concrete is pumped into forms, lightly top seed surface of concrete with additional 3/8" size aggregate as required to match approved sample.
   3. Cover slab with acceptable curing cover to prevent drying out. If fog cure is employed, start no sooner than recommended by retardant manufacturer.
   4. Check retarded surface at regular intervals to determine optimum time for removing retarded surface mortar.
   5. Broom and wash aggregate surface to remove mortar to its optimum (approximately 1/8" to 1/16" at surface stone depth) to match sample.
   6. After aggregate is exposed, proceed with proper curing.

3.9 CURING

A. Cure non-colored exposed concrete in accordance with Caltrans Standard Specifications Section 90-7.

B. When applying Curing Compound, apply after initial set of fresh concrete when bleed water has evaporated from surface using a “Hudson-type” airless sprayer in accordance with manufacturer’s specifications.

C. Only water or curing compounds which impart no permanent color or gloss shall be used for curing concrete.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete for curb ramps, accessible parking stalls, and driveways

B. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.

C. Form construction and use in placing portland cement concrete pavement.

D. Joints for portland cement concrete pavement.

E. Finishing portland cement concrete pavement.

F. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 31 20 00, Earth Moving

C. Section 32 11 00, Pavement Base Course

D. Section 32 13 12, Landscape Concrete

1.3 RELATED DOCUMENTS

A. AASHTO Standard Specifications
   1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars

B. ASTM Standards
   1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
   2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
   5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
   7. C94: Standard Specification for Ready-Mixed Concrete

8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

C. Caltrans Standard Specifications
1. Section 10, General
2. Section 40, Concrete Pavement
3. Section 52, Reinforcement
4. Section 95, Epoxy
5. Section 90: Concrete

D. Caltrans Standard Plans:
1. Plan P1: Jointed Plan Concrete Pavement – New Construction
2. Plan P10: Concrete Pavement Dowel Bar Details

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing and Materials

C. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

A. Testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

C. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental– Supplemental General Requirements.

B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the City. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.7 PORTLAND CEMENT CONCRETE

A. In accordance with Caltrans Standard Specification Section 40, Concrete Pavement

B. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Owner's Representative. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

1.8 BASE MATERIAL

A. In accordance with Section 32 11 00, Pavement Base Course.

1.9 TIE BARS

A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60

B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.

C. Do not bend tie bars.

1.10 EPOXY

A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

1.11 PREFORMED COMPRESSION JOINT SEALANT

A. Material: ASTM Designation: D2628.
   1. Number of cells: 5 or 6.
   2. Lubricant Adhesive: ASTM Designation D2835.
   3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Engineer`.

B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

1.12 BACKER RODS

A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

PART 2 - EXECUTION

2.1 SUBGRADE

A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

2.2 PLACING

A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

2.3 SPREADING COMPACTING AND SHAPING

A. Conform to the following:
   1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.

2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

2.4 INSTALLING TIE BARS

A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:

1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

Temperature of Concrete	Required Class of Epoxy Resin
Lower than 40° F	A
40˚ F through 60˚ F	B
Above 60˚ F	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Engineer, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Engineer, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

2.5 JOINTS

A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.

1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
    a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
    b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall be become the property of the Contractor and shall be properly disposed of.
    c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

2.6 FINISHING

A. Finish concrete in accordance with Caltrans Standard Specification Section 40-1.03H, Finishing.

2.7 CURING

A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

2.8 SEALING JOINTS

A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning

the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 ± 1/32 inches and a minimum pressure of 90-psi.

4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary

to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 $\pm$ 1/32 inches and a minimum pressure of 90 psi.

2.9 PROTECTING CONCRETE PAVEMENT

A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

SECTION 32 13 75

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete curbs and gutters.

1.2 RELATED SECTIONS

A. Section 31 20 00, Earth Moving

B. Section 32 11 00, Pavement Base Course

C. Section 32 13 13, Concrete Pavement

D. Section 32 13 12, Landscape Concrete

1.3 RELATED DOCUMENTS

A. American society for Testing and Materials (ASTM)
   1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

B. Caltrans Standard Specifications
   1. Section 73: Concrete Curbs and Sidewalks
   2. Section 90: Concrete

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials

B. ACI: American Concrete Institute

1.5 SUBMITTALS

A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.

B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the City. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.

B. Certifications:
   1. Provide City at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
      a. Materials contained comply with the requirements of the Contract Documents in all respects.
      b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
   2. Settlement of type and amount of any admixtures.
   3. Provide City, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
   1. Conform construction of Portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
   2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall consider to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, Portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. Unless specified otherwise herein or on the Plans, Portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
   1. Compressive Strength:
      a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
      b. Curbs & Gutters: 3500 psi, minimum at 28 days.
   2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
   3. Water/Cement Ratio: 0.5

C. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Owner's Representative. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.
   1.

2.2 CURBS AND GUTTERS FORMS

A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.3 EXPANSION JOINT MATERIAL

A. Material for expansion joints in Portland cement concrete improvements shall be pre-molded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
   1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: ¼ inch

2.4 REINFORCEMENT AND DOWELS

A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GENERAL

A. Form, place and finish concrete curbs and gutters in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

B. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.3 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the City. Continue vibration until the material is sufficiently consolidated and absent of all voids

without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the City. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.5 EXPANSION JOINTS

A. Construct expansion joints incorporating pre-molded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.6 WEAKENED PLANE JOINTS

A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.7 FINISHING CONCRETE

A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
   1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
   2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave edge forms in place at least 24 hours after pouring.

3.9 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 48 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.

B. A cold joint to the existing curb is not acceptable.

3.10 FIELD QUALITY CONTROL

A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.

B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of existing traffic stripes and pavement markers

B. Cleaning and sweeping of streets before application of traffic stripes and pavement markings

C. Materials and application for traffic stripes and pavement markings

D. Materials and application for pavement markers

1.2 RELATED SECTIONS

A. Section 01 10 00, Supplemental General Requirements

B. Section 32 13 12, Landscape Concrete

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications
   1. Section 78, Incidental Construction
   2. Section 81, Miscellaneous Traffic Control Devices
   3. Section 84, Markings

B. Caltrans Standard Plans, 2015
   1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
   2. Plan A24A and A24B: Pavement Markings Arrows
   3. Plan A24C: Pavement Markings, Symbols and Numerals
   4. Plan A24D: Pavement Markings, Words
   5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
   6. Plan A24F: Pavement Markings, Crosswalks

C. California Manual on Uniform Traffic Control Devices

1.4 SUBMITTALS

A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:
   1. Traffic paint
   2. Pavement markers and adhesives

1.5 QUALITY ASSURANCE

A. Deliver certificates showing conformance with this specification to the Engineer with each shipment of materials and equipment to the Project site.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Engineer.

B. Thoroughly cure new asphalt concrete and Portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.3 TRAFFIC CONTROL SIGNS

A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.

B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.

C. Posts:
   1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
   2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.

D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.

E. Post Foundations: Conform to Caltrans Standard Plans.

2.4 SIGNS

A. Conform to manufacturer, style, size, and shape shown on the Plans.

PART 3 - EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

A. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.

B. Where markings are to be removed by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.

C. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.

B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.5 TRAFFIC CONTROL SIGNS

A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.

B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.6 SIGNS

A. Install in accordance with the manufacturer's instructions and as shown on the Plans.

B. Horizontal location shall be as shown on the Plans.

C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.7 PROTECTION

A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.

B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.8 RESTORATION OF EXISTING IMPROVEMENTS

A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.

B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 32 17 26

DETECTABLE WARNING SURFACING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing and placing cast-in-place detectable warning tile surfacing

1.2 RELATED SECTIONS

A. Section 32 13 13, Concrete Pavement

1.3 SUBMITTALS

A. Product Data: For each type of product, showing edge condition, truncated-dome pattern, texture, color, and cross section.

B. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering and wear.
      b. Separation or delamination of materials and components.

   2. Warranty Period**:** Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DETECTABLE WARNING SURFACE

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
   1. ADA Solutions cast-in-place or approved equal
   2. Material: Cast-fiber-reinforced polymer concrete tile.
   3. Color: Colonial Red
   4. Shapes and Sizes:
      a. See plans.

   5. Dome Spacing and Configuration: 2.3 to 2.4-inch spacing, in square pattern per the California Building Code.
   6. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DETECTABLE WARNING SURFACE

A. Cast-in Place Detectable Warning Tiles:
1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13, Concrete Pavement. Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch (3 mm) from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION

SECTION 32 33 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install all site furnishings shown on drawings and specified in accordance with the manufacturer's instructions and as shown on the drawings and as specified.

1.2 RELATED SECTIONS

A. Section 32 13 12, Site Concrete

1.3 REFERENCES

A. Perform work in accordance with all applicable laws, codes and regulations required by the City and the State of California.

B. Manufacturer’s Instructions:

Where required in the Specifications that materials, products, processes, equipment or the like to be installed or applied in accordance with manufacturer’s instructions, directions or specifications, or words to this effect, it shall be constructed to mean that said application or installation shall be in strict accordance with printed instructions furnished by the manufacturer of the material for use under conditions similar to those at the job site.

B. All site furnishings shall be anchored or otherwise secured to prevent movement, unless stated otherwise. Provide concrete footings, corrosion resistant clips, etc. as accepted by the Owner's Representative.

C. Reference Standards:

State of California, Business and Transportation Agency, Department of Transportation: “Standard Specifications.”
Manufacturers’ specifications and recommendations.

1.4 COORDINATION

A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in concrete and for the provision of connections, holes, openings, etc., necessary to the execution of the work of the trades.

1.5 SUBMITTALS

A. Trash Receptacles, including required leveling spacers.

B. Bike Racks

C. Tree Grates

D. Bollards

PART 2 - MATERIALS

2.1 TRASH RECEPTACLES

A. Model: CG32-PS (Waste, Recycling, Compost), color Forest Green to match existing Sausalito standard. Manufacturer –BEARSAVER/SECURR, PO Box 1438 Guasti, CA 91734, 909-212-5379.

2.2 BIKE RACK

A. Model: 696C Vroom Bicycle Rack Large, Casting in Ground, powder-coated aluminum, RAL 7026 Granite Grey; manufacturer: Vestre, 663 San Juan Avenue, Los Angeles, CA 90291, (212-634-9658).

2.3 TREE GRATES

A. Model: ADA-M6058, with two (2) holes for tree stakes, 100% recycled gray iron, 60” x 60,” RAL 7026 Granite Grey; contractor to submit shop drawings. Manufacturer: Ironsmith, 41-701 Corporate Way #3 Palm Desert, CA 92260, (800-338-4766).

2.4 BOLLARDS

A. Model: 99 622 Non-Illuminated System Bollard Tube, 7 ½” dimeter with B79817 Anchorage Kit, RAL 7026 Granite Grey; manufacturer: Bega, 1000 BEGA Way, Carpinteria, CA 93013, (805-684-0533).

B. Model: 71 127 Non -Illuminated Cap, 7 ½” diameter, RAL 7026 Granite Grey; manufacturer: Bega, 1000 BEGA Way, Carpinteria, CA 93013, (805-684-0533).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install manufactured items in accordance with the manufacturer's instruction and as shown in the drawings and as specified herein.

B. Perform all work in accordance with all applicable laws, codes and regulations required by the State of California and the City of Sausalito.

C. Set all work true and square, plumb, and level. Remove and replace any wood that splits during or after erection until acceptance. Keep nailing neatly lined up.

D. Fabricate wood in as long pieces as practical unless otherwise indicated. End joints shall occur at supports. Keep all work clean, accurately cut, closely fitted and set to the required lines and levels. Blunt exposed edges by sanding or with plane.

E. Place washer under the head and nut of bolts where same bear on wood, except head of carriage bolt. Drill bolt holes same diameter as bolt.

F. Size bolts to fit flush with nuts. Countersink nuts and bolts as detailed.

G. Hammers with scored faces shall not be used in nailing.

H. Supply all miscellaneous metal units and install as specified herein under the Sections entitled "Miscellaneous Metalwork" and "Galvanizing." Hot-dip galvanize all metal fastenings, angles, etc., after complete fabrication.

I. Galvanized metal that is cut, damaged, or modified after fabrication shall be immediately painted with Zinc-rich paint to prevent rusting.

J. Touch up paint any damaged surfaces to match original finish as accepted by Owner's Representative.

K. Set site furniture, level. Provide spacers under furniture to level as specified herein and acceptable to Owner’s Representative

L. Transport, store and handle precast units and manufactured items in a manner to avoid hairline cracks, staining or other damage. Store units free of the ground and protected from mud or rain splashes. Cover units, secure covers firmly, and protect the units from dust, dirt or other staining material.

3.2 TRASH RECEPTACLES

Install level and in accordance with the manufacturer's instruction and as shown. Provide spacers under receptacles to level as specified and acceptable to Owner’s Representative.

3.3 BIKE RACKS

A. Install in accordance with the manufacturer's instruction and as shown.

3.4 TREE GRATES

A. Install in accordance with the manufacturer's instruction and as shown.

3.5 BOLLARDS

A. Install in accordance with the manufacturer's instruction and as shown.

END OF SECTION

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SECTION 32 84 00

IRRIGATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work in this section consists of furnishing, layout and installing an irrigation system complete, including certification of irrigation system installation as required by the State of California Model Water Ordinance described herein.

1.2 RELATED SECTIONS

A. Section 31 20 00, Earthwork
B. Section 32 90 00, Planting

1.3 CALIFORNIA MODEL WATER EFFICIENT LANDSCAPE ORDINANCE REQUIREMENTS

A. Contractor shall be familiar with and follow the State of California Model Water Ordinance, California Code of Regulations, Title 23 Waters, Division 2, Department of Water Resources, Chapter 2.7. Also, the Contractor is responsible to follow all local water ordinances.

1. Pursuant to the requirements of the California Model Water Efficient Landscape Ordinance, the Contractor shall submit a Certification of Installation to the Local Jurisdiction /water purveyor as described in the construction documents and these specifications. Certification shall at a minimum include the following documents:

   PART 1. Project Information Sheet
   PART 2. Certification of Installation according to the landscape documentation package.
   PART 3. Irrigation Scheduling and Controller Programming
   PART 4. Schedule of Landscape and Irrigation
   PART 5. Landscape Irrigation Audit Report
   PART 6. Soil Management/Analysis Report with verifying implementation, see Planting Specification for analysis requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer's Specifications: Follow manufacturer's current printed specifications and drawings in all cases where the manufacturers of articles used in the Contract furnish directions covering points not specified or shown in the drawings.

B. Ordinances and Regulations: All local, municipal, and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations, or requirements of the same. However, when these Specifications

and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard, or larger size than is required by the above codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.

C. References, Codes and Standards:
1. State of California Model Water Efficient Landscape Ordinance
2. California Environmental Quality Act (CEQA)
3. Water Use Classification of Landscape Species (WUCOLS IV).
4. American Society of Irrigation Consultants (ASIC) Design Guidelines.
5. California Landscape Standards, California Landscape Contractors Association, (CLCA) Sacramento, California.
6. CAL-OSHA, Title 8, Subchapter 4-Construction Safety Orders and Subchapter 7-General Industry Safety Orders.
7. California Electric Code.
8. California Plumbing Code (UPC) published by the Association of Western Plumbing Officials.
9. NFPA 24, Section 10.4, Depth of Cover.
10. Underwriters Laboratories (UL): Electrical wiring, controls, motors and devices, UL listed and so labeled.
11. American Society of Testing Materials (ASTM).

D. Furnish without extra charge any additional material and labor when required by the compliance with all above mentioned codes and regulations, though the work be not mentioned in these specifications or shown on the drawings.

E. Experience: Assign a full-time employee to the job as supervisor for the duration of the Contract with a certified landscape technician, irrigation certification through CLCA or minimum of four (4) years of experience in landscape irrigation installation.

F. Labor Force: Provide a landscape installation and maintenance force thoroughly familiar with, and trained in, the work to be accomplished to perform the task in a competent, efficient manner acceptable to the Owner's Representative.

G. Explanation of Drawings:
1. Due to the scale of the Drawings, it is not possible to indicate all piping offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affected all of the work and plan accordingly and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities, and architectural features.
2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in arc dimensions exist that might not have been considered in engineering. Bring such obstruction or differences to the attention of the Owner's Representative. Notify and coordinate irrigation Work with applicable contractors for location and installation of piping and sleeves through or under walls, pavement, and structures. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary.

H. Trench Interference with Tree Root Systems:
   1. Prior to trenching, layout main and lateral line locations within Drip Line of trees and review locations with Owner's Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Owner's Representative.
   2. Mechanical Trenching is not allowed within dripline of existing trees to be protected except as approved by Landscape Architect

I. Coordinate plant locations with emitter locations.
   1. Adjust plant locations in relation to the subsurface emitter s as required to ensure that the plant roots receive the proper amount of water for it to thrive.
   2. Coordinate planting and irrigation and provide hand watering of emitter irrigated and drip irrigated areas as required to maintain moist root zones until end of plant establishment period.

1.5 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show, if applicable, existing above and below grade structures and utilities that are known to the Owner. Locate known existing installations before proceeding with construction operations that may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. Verify with Owner if As Built drawings are available.

B. If other structures or utilities are encountered, request Owner's Representative to provide direction on how to proceed with the Work. If a structure or utility is damaged, take appropriate action to ensure the safety of persons and property.

C. Verify location of existing irrigation systems to be removed and/or replaced. Maintain any existing systems as required by the Drawings and Specifications, including temporary retention of systems necessary to maintain existing on site and adjacent planting.

1.6 SUBMITTALS

A. Materials List:
   1. Submit required copies of the cut sheets and a complete list of materials proposed for installation, along with any proposed substitutions clearly identified and obtain the Owner Representative's written approval thereof before proceeding. Use only accepted materials and items of equipment.
   2. List all materials by manufacturer's name and model number.
   3. Submit to Local Water Purveyor with copy to the Owner Certification of Installation as required by the State of California Model Water Ordinance.

B. Substitutions:
   1. If the Contractor desires to substitute a product, he shall list each item and note it as a "substitution" and provide the following information:

      a. Descriptive information describing its similarities to the specified product.

2. If the product is approved and, in the opinion of the Owner's Representative, the substituted product does not perform as well as the specified product, the Contractor shall replace it with the specified product at no additional cost to the Owner.

C. Operations and Maintenance Manuals:
1. Prior to the final acceptance of the irrigation system, furnish three (3) individually bound Operation and Maintenance Manuals to the Owner's Representative for use by the Owner. The manuals shall contain complete enlarged drawings, diagrams and spare parts lists of all equipment installed showing manufacturer's name and address. In addition, each Service Manual shall contain the following:
   a. Index sheet indicating the Contractor's name, address and phone number.
   b. Copy of the Landscape Irrigation Audit
   c. Copy of the 12-month irrigation schedule and estimate of annual water consumption
   d. Copies of equipment warranties and certificates.
   e. List of equipment with names, addresses and telephone numbers of all local manufacturer representatives.
   f. Complete operating and maintenance instructions in sufficient detail to permit operating personnel to understand, operate and maintain all equipment.
   g. Parts list of all equipment such as controllers, valves, solenoids and heads.

D. As-Built Drawings:
1. Dimension the location of the following items from two (2) permanent points of reference such as building corners, sidewalks, road intersections, etc.:
   a. Connection to existing water lines/meter.
   b. Connection to electrical power.
   c. Gate valves.
   d. Routing of irrigation pressure lines (a dimension at least every 100 feet and as required to identify all changes in direction and location).
   e. Remote control valves.
   f. Routing of control valves.
   g. Quick coupling valves.
   h. All sleeve locations.
   i. Routing of all control wiring.
   j. Include all invert elevations below 12".
2. Deliver a reproducible As-Built Drawing to the Landscape Architect or Owner’s Representative within seven (7) working days before the date of final review. Delivery of the record drawings shall not relieve the Contractor of the responsibility of furnishing required information in the future.

E. Controller Plan:
1. Provide one Irrigation Diagram plan in each controller housing. The plan shall show the area controlled by each valve in different colors and for orientation, any major permanent structure such as buildings and roads.
2. Charts to be waterproof and hermetically sealed between two pieces of transparent 10 mil thick plastic and installed in each controller on the door

as accepted by the Owner's Representative no later than the time of the coverage test of the irrigation system.

F. Maintenance Material - supply the following tools to the Owner:
   1. Three (3) sets of specialized tools required for removing, disassembling and adjusting each type of irrigation, valve or other equipment supplied on this project.
   2. Two (2) keys for each type of equipment enclosure.
   3. Two (2) keys for each type of automatic controller.
   4. Two (2) keys for each type of valve (including square type key for valves larger than 2")
   5. Two (2) quick-coupler keys and matching hose swivels for each type of quick-coupling valve installed.
   6. All lock keys shall be keyed alike.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Furnish and deliver materials in manufacturer's packaging, bearing original legible labeling.

B. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of the pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented, cracked, or otherwise damaged shall be discarded and, if installed, shall be replaced with new piping.

1.8 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install main line trenching prior to acceptance by Owner's Representative of rough grades completed under another Section.

B. Coordination: Coordinate with the work of other sections to insure the following sequence of events:
   1. Sleeves and Conduits: Installation of all sleeves and conduits to be located under paving and through walls prior to placement of those materials.
   2. Bubbler Heads: Install after placement of tree, but prior to backfill with planter soil mix.
   3. On-Structure Equipment: Install piping and risers after waterproofing is accepted.
   4. Irrigation Head in Pots: Install riser and seal the penetration of the pot prior to backfill of pot with drainage materials and planter soil mix.
   5. Coordinate work schedule with Owner to avoid disruption of landscape maintenance of existing landscaping.
   6. Install piping prior to soil preparation (planting soil amendment installation).

1.9 WARRANTY

A. In addition to manufacturer's guarantees and warranties, work shall be warranted for one (1) year from date of final acceptance against defects in material, equipment, and workmanship. Warranty shall also cover repair of damage to any

part of the premises resulting from leaks or other defects in materials, equipment and workmanship to the satisfaction of the Owner.

B. Include a copy of the warranty form in the Operation and Maintenance Manual.

1.10 OPERATION

A. Routine: Inspect and adjust all spray heads and control valves including raising or lowering of spray head heights to accommodate plant growth and weather conditions.

B. Controller: Inspect regularly for power interruption and reset clock as required. Adjust station timing to accommodate changes in plant growth and weather conditions.

C. System Failure: Perform all repairs within one (1) operating period. Replacements to match removed products and materials in all respects. Report promptly all damage not resulting from Contractor's operations. Repair all damage caused by Contractor at no expense to Owner.

D. Climate Change: Set and program automatic controllers in response to seasonal requirements and requirements of newly planted materials.

PART 2 - PRODUCTS

2.1 PIPE

A. Pressure Main Line Pipe and Fittings: All PVC fittings shall bear the manufacturer's trademark name, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

B. All main line pipe shall be solvent welded and shall be schedule 40 unless shown otherwise on the Drawings.
1. PVC Pressure Rated Pipe: ASTM D2241 NSF approved Type I, Grade I, solvent welded PVC with an appropriate standard dimension ratio (S.D.R.).
2. PVC Scheduled Pipe: ASTM D1785 NSF approved, Type I,
3. Grade I, solvent welded PVC.
4. PVC Solvent-weld Fittings: ASTM D2466 Schedule 40, 1-2, II-I NSF approved.
5. Solvent Cement and Primer for PVC solvent-weld pipe and fittings: Type and installation methods prescribed by the manufacturer.
6. Connections between Main Lines and RCVs: Schedule 80 PVC (threaded both ends) nipples and fittings unless required otherwise by local jurisdiction.
7. Valves 2-inch and larger shall be flanged only.
8. Copper pipe shall be Type K or Red Brass where threaded joints are required and Type L otherwise.

C. All lateral line pipe shall be solvent welded and shall be schedule 40 unless shown otherwise on the Drawings.

2.2 CONDUITS & SLEEVES

A. Sleeving shall be Schedule 40 PVC pipe sleeves and a minimum of two times the aggregate diameter of all pipes contained within the sleeve. Provide vertical sweep for all electrical conduit on each side of hardscape and terminate ends at 12" minimum depth and 12" from hardscape surface.

2.3 BACKFLOW PREVENTION DEVICE – REUSE EXISTING

A. As required by Code and as shown on Drawings. Verify with Owner if Anti-freeze Jacket is required and provide as required.

B. Riser assemblies from main line burial depth to backflow preventers shall be Schedule 40 brass pipe.

C. All metallic pipe and fittings installed below grade shall be painted with two coats of Koppers #50 Bitumastic, or approved equal. Pipes may be wrapped with an approved asphaltic tape in lieu of the liquid-applied coating.

2.4 BACKFLOW PREVENTION DEVICE ENCLOSURE

A. “Smooth Touch” enclosure without sharp edges, by Strong Box, available from V.I.T., Escondido, CA (800) 729-1314 or equal. Coordinate size of enclosure with plumbing for minimum clearance and size. Enclosure to include concrete footing with hasp and staple to receive padlock. Padlock N.I.C.

2.5 CONTROLLERS(S):

A. Wall-mounted if located in Visitor Information Enclosure. Otherwise pedestal-mounted irrigation controller, as shown on drawings, and with the following minimum requirements.

B. Shall be weather – based and be compatible with rain shut off sensor.

C. Shall be user-friendly. The controller must have a minimum 20-character readout display describing actions or options, or a full visible panel of buttons, dials, or switches that control all different functions separately.

D. Shall have the ability to start a programmed sequence of valves a minimum of 5 times a day per program.

E. Shall have ability to easily and quickly change watering schedules due to change in weather.

F. Provide portable hand-held remote device compatible with controller and capable of operating all control valves.

G. Provide rain shut off device as manufactured by Control System manufacturer capable of shutting off all control valves. Locate in a location exposed to rain and hardwire to controller.

2.6 CONTROLLER GROUND

A. Provide each pedestal controller with its own ground rod. Separate the ground rods by a minimum of eight feet. The ground rod shall be an eight foot long by 5/8" diameter U.L. approved copper clad rod or as recommended by controller manufacturer. Install no more than 6" of the ground rod above finish grade. Connect #8 gauge wire with a U.L. approved ground rod clamp to rod and back to ground screw at base of controller with appropriate connector. Make this wire as short as possible, avoiding any kinks or bending. Install within pedestal housing base unless otherwise noted.

B. Provide each irrigation controller with its own independent low voltage common ground wire.

2.7 CONTROLLER ENCLOSURES

A. Type: Use one of the following (unless noted otherwise on the Drawings). Verify correct equipment to fit the specified equipment:
   1. Stainless steel, NEMA Type 3 rated, with back panel, padlocking hasp and padlock Rain Bird, Le Meur, "Strong Box" or approved equal. See Detail for pedestal construction.
   2. Rain Bird, “Non-Central” Controller Assemblies
      a. LXMM – ESP – LXM Cabinet, Powder Coated Steel
      b. LXMMPED – ESP-LXM Pedestal, Powder Coated Steel
   3. from Rain Bird Services Corporations “Package Systems" for “Central Control” projects. Available from Rain Bird Services Corporation (RBSC) (888) 444-5756.
   4. Le Meur, (714) 822-5100.
   5. "Strong Box" available from John Deere, (800) 347-4272.

2.8 MASTER CONTROL VALVE

A. Master control valve shall be a 24 VAC, industrial type, solenoid control valve, Griswold 2000 series or equal. Valve shall be equipped with spring loaded packless diaphragm, cast iron body and bronze trim. The valve shall be of the normally open type and shall be equipped with four-prong (cross) flow control. Valve shall be slow closing without chatter settings or adjustment. Valve shall have a mechanical self-purging internal control system with tapered, serrated, scrubbing rod through diaphragm for positive, variable port opening and cleaning. No solenoid port screens. Valve solenoid shall be corrosion-proof, molded in epoxy to form one integral unit with no connection shunts and shall be 24 VAC, 3 watt maximum.

2.9 FLOW SENSORS

A. Compatible with controller and as recommended by controller manufacturer.

2.10 ISOLATION VALVE

A. Valves 3 inches and smaller: 125 lb. WSP bronze gate valve with screw-in bonnet, non-rising stem and solid wedge disc, NIBCO T-113 K, or approved equal. Valves shall be line size.

B. Valves larger than 2”: shall have square nut stem and o-ring connections for key operation.

2.11 QUICK COUPLER VALVES:

A. Quick coupler valves shall be as listed on the Drawings with 10" diameter black box and black lid similar to isolation valve box described below.

2.12 BOX FOR ISOLATION & QVALVE & QUICK COUPLER VALVES

A. 10" diameter black plastic, Ametek, Brooks, Christy, Rain Bird with bolt down black lid marked "irrigation," or accepted equal. Avoid locating valve in paved areas. Provide H/20 Loading concrete box with bolt-down concrete lid if valve is located in paved area. Obtain location approval by Owner's Representative.

2.13 REMOTE CONTROL VALVE: AS SHOWN ON DRAWINGS AND WITH THE FOLLOWING MINIMUM REQUIREMENTS:

A. Remote control valves shall be those normally manufactured for irrigation systems and shall have a slow, consistent speed of closure through entire closing operation, including last portion. To ensure this, the effective diaphragm working area/valve seating opening ratio must be a minimum 3 to 1.

B. Shall be mechanically self-cleaning to help prevent diaphragm or solenoid port plugging. To ensure this, the flush rod should be tapered to vary the size of the port opening as the diaphragm raises and lowers, thus allowing trapped material to escape. Rod is to be finished with a serrated surface to help scrub trapped material out. Screens not acceptable.

C. Shall have removable valve seat so valve can be repaired without removal from irrigation line.

D. Shall have ability to operate manually without the use of wrenches or special keys.

E. Shall have one-piece solenoid that attaches directly to valve without shunts or clips that can be lost.

F. Shall have cross top handle to adjust maximum travel of diaphragm to allow "tuning" of valve and closure.

2.14 BOX FOR REMOTE CONTROL VALVE

A. Rectangular black plastic valve box - Ametek, Carson, Christy, Rain Bird or accepted equal with non-hinged bolt down. Box body shall have knock outs. Do not saw cut body. The minimum size box is as shown on Drawings. Increase box size as required to fit. Valve box lids are to indicate the controller letter and station number of valve as accepted by Owner’s Representative. Also refer herein to required polyurethane tag at valve solenoid control wire under Control Wires. Locate the identification in center of the lid. Provide separate box for each valve. Provide H/20 Loading concrete boxes with bolt-down concrete lids for all valves that occur in paved areas.

2.15 DECODERS

A. Controller shall interface with decoders, each capable of controlling 1, 2, 4 or 6 remote control valves. Provide a sensor decoder for flow sensor(s) on two wire path.

B. Wire connections from decoder output to solenoid shall be 14AWG. Wire distance from decoder output to solenoid under normal conditions shall not exceed 150 feet. Install in valve box secured and with bottom of decoder facing up.

C. Contractor shall indicate associated valve numbers on manufacturer provided label on decoder with permanent marker.

2.16 CONTROL WIRES

A. 14AWG for two-wire cable path shall be twisted and jacketed Paige P7072D wire,or approved equal within Sch. 40 PVC 1.25 inch conduit. Coated wire shall not be accepted as an equal. Acceptable equal products must consist of two separately PE jacketed wire twisted inside of a PE jacket.

B. Contractor shall install 14AWG wire cable for wire path length up to 10,000 feet, and 12AWG wire cable for wire path length up to 15,000 feet.

C. Wire jacket colors shall be such to facilitate the identification of various wire path zones: provide chart for wire type, color and associated valves

D. The controller shall provide a minimum of three, two-wire paths per output module. Contractor shall not connect any two wire path from one output module to another output module.

E. Wire connection from decoder output to solenoid shall be colored to match the associated decoder output station color; red and blue colored wires shall not be used for connection between decoder output and solenoid.

2.17 WIRE SPLICES

A. Provide polyurethane tag at valve solenoid control wire that shows the controller number and station number. Also refer to valve box lid identification

B. All connections and splices in the red/blue two wire path must be made with 3M DBR/Y-6 waterproof connectors installed per manufacturer’s instructions in valve box with open end of connector facing down.

2.18 SPRAY HEADS

A. Pop-up as shown on drawings and with the following minimum requirements:

B. Shall have approximately 30 psi water pressure coming out of nozzle to prevent "fogging" or misting. Shall have pressure-compensating devices.

C. Shall have ability to prevent low head drainage. Use heads with integral check valves.

D. EXAMPLE – Rain Bird 1800 Spray Body with SAM -PRS Series

E. Shall not have spray blocked by turf or shrubbery

2.19 SWING JOINTS

A. Bubblers: Use Dura, Lasco, Rain Bird or equal pre-assembled swing joints with O-rings.

2.20 QUICK COUPLING VALVE

A. Dura 1-inch 1-A2-1-11-18 pre-assembled swing joint with O-rings and Dura quick lock to receive stabilizing rod.

2.21 TREE BUBBLERS

A. As shown on drawings

2.22 IN-LINE DRIP IRRIGATION

A. As specified herein and as shown on the drawings and in accordance with manufacturer's recommendations. Provide all miscellaneous valves, filters fittings etc. required for a complete, operable system including the following:

1. Rain Bird XFD/XFS/XFCV with "Copper Shield" technology. Drip system in accordance with "RainBird Xerigation Low-Volume Landscape Irrigation Design Manual" and as shown on the drawings as required for a complete working system.
2. Pop-up operation indicator
3. Air/vacuum relief valves
4. Flush valves

B. Drip Valve Assembly: Size valve box large enough and deep enough to contain assembly and allow convenient access and easy removal of filter screen. Position filter pointed down, approximately 45 degrees.

C. Pressure regulator: Size regulator in accordance with flow rate. Do not over size. Use factory pre-set regulator at 30 PSI.

2.23 Y-STRAINER

A. "Y"-Strainer upstream of remote-control valves, Brass, 100 mesh.

2.24 RCV IDENTIFICATION TAGS:

A. Plastic or brass tags with valve number, approximately 2" by 2" with number imprinted, as accepted by Owner.

2.25 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent Cement and Primers for Solvent-weld Joints: Make and type approved by manufacturer(s) of pipe and fittings. Maintain cement proper consistency throughout use.

B. Pipe and Joint Compound: Permatex: Do not use on irrigation inlet port.

2.26 MISCELLANEOUS EQUIPMENT/ACCESSORIES

A. Sleeves and Conduits: See Drawings.

B. Key(s) for Quick-Coupling Valves:
   1. Type: Same manufacturer as Quick-Coupling Valve.

2.27 OTHER EQUIPMENT: AS SHOWN ON DRAWINGS AND REQUIRED FOR A FULLY FUNCTIONAL IRRIGATION SYSTEM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Sleeves and Conduits: Verify that all installed sleeving and conduits are undisturbed and are free of defects or errors introduced by the work of other sections.

B. Water Meter/Water Pressure: Test and verify that existing water pressure is the minimum pressure at maximum system g.p.m. to operate the irrigation system as indicated on the drawings.

C. Stub-outs: Verify that all stub-outs to be provided under another contract are correctly sized, located and installed as noted on Drawings.

D. Notification: Submit written notification to Owner's Representative within ten (10) working days of above inspections describing all acceptable and non-acceptable site conditions.

3.2 CONNECTIONS TO SERVICES

A. Provide and coordinate connection of irrigation controller to electrical power source.

3.3 INSTALLATION

A. Install irrigation system components in accordance with this Section, with the Drawings, with the manufacturer’s recommendations, and with established industry standards. The Contractor shall do nothing that may jeopardize any manufacturer warranty.

B. Automatic Controller:
   1. General: Install with lock box cutoff switch per local code and manufacturer's current printed specifications. Provide each controller with its own independent low voltage common ground wire.
   2. Connection to Valves: Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
   3. Labeling: Affix controller letter (i.e., "A") on inside of controller cabinet door with minimum of one inch (1") high permanent letter.

4. Irrigation Diagram: Affix a non-fading, waterproof copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two plastic sheets, 20 mil. minimum thickness. Use a legible reduced copy of the Record Drawing for the irrigation diagram clearly showing all valves operated by the controller, station, number, valve size, and type of planting irrigated. Color code area operated by each valve.

C. Control Wiring:
1. General: Install control two wire in Sch 40 PVC conduit in common trenches with irrigation mains and laterals wherever possible. Lay to the bottom side of pipe line. Provide looped slack at valves.
2. Extra Length: Provide 36 inches (36") extra wire at each remote control valve splice to facilitate the removal of the remote control bonnet to finish grade without cutting wires.
3. All connections and splices in the red/blue two wire path must be made with 3M DBR/Y-6 waterproof connectors installed per manufacturer's instructions in valve box with open end of connector facing down.
4. Any splices in the two wire path not associated with a decoder shall be housed in separate valve boxes with 36 inches loop of slack wire.
5. Contractor shall indicate two wire path directions in permanent marker within 6 inches of two wire splice on wire jacket or conduit.
   a. Incoming wire shall be marked 'controller' on wire jacket or conduit.
   b. Each outgoing two wire path shall be marked with connected valves on wire jacket.
6. Contractor shall ensure all connections to be watertight with no electrical leakage to ground or shorting between conductors.
7. Detection Wire: Install a bare #12 copper wire or greater on top of the PVC supply line for the purpose of possible future mine detection search.

D. Grounding
1. All grounding and installation of equipment specified shall be installed in compliance with the manufacturer's recommendations and in accordance with local, state, and federal requirements.
2. Both the controller and the decoders shall be grounded to ground rods or plates with less than 10 OHMS resistance.
3. Irrigation controller and pad shall not fall within the sphere of influence of a ground rod or plate.
4. At a minimum earth ground shall be connected at the first decoder of each wire path leaving the controller, and every twelve valve/decoder or 1,000 feet of two wire run (whichever is shorter), and at the last valve/decoder in any wire run exceeding 50 feet from main wire path.

E. Rain Shutoff Switch:
1. Install switch in area not affected by irrigation or rain shadow. Provide wires in rigid conduit as accepted by Owner's Representative.

F. Excavating and Trenching:

1. Prior to trenching, layout main and lateral line locations within Drip Line of trees and review locations with Owner's Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Owner's Representative.

2. Dig trenches wide enough to allow a minimum of three inches (3") between parallel pipe lines. Provide a minimum cover from finish grade as follows:
    a. 24-inches Deep: Over pipe on pressure side of irrigation control valve, control wires and quick-coupling valves.
    b. 36-inches Deep: Over all pipe and pipe sleeves under roadways, parking lots, entrance to parking lots and Fire-Access Lanes per NFPA 24, Section 10.4.4.
    c. 18-inches Deep: Over pipe on non-pressure side of irrigation control valve.
    d. Direct Burial PVC Piping Under Pavement: Provide a minimum of 4 inches of sand backfill on all sides and 24 inches cover to bottom of paving.

G. Conduits and Sleeves:
1. Coordination: Provide conduits and sleeves and coordinate installation with other trades.
2. Extent: Install conduits and sleeves where control wires and pipes pass under paving or through walls as shown on Drawings. Extend twelve inches (12") beyond edges of paving and walls and cap ends until ready for use.

H. Pipeline Assembly:
1. Install pipe and fittings in accordance with manufacturer's current printed Specifications.
2. Clean all pipes and fittings of dirt, scale and moisture before assembly.
3. Solvent-welded Joints for PVC Pipes:
4. Solvents: Use solvents and methods specified by pipe manufacturer.
5. Curing Period: Minimum of one (1) hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure.
6. Threaded Joints for Plastic Pipes:
7. Use Permatex on all threaded PVC fittings except spray heads and quick coupler valve ACME threads.
8. Joining: Use strap-type friction wrench only. Do not use metal-jawed wrench. Assemble finger tight plus one or two turns.

I. Laying of Pipe:
1. Bedding On-grade: Remove from trench all rocks or clods. Bed pipe in at least 2 inches of soil excavated from trench. Backfill on all sides of piping to provide a uniform bearing.
2. Snaking: Snake pipe from side to side of trench bottom to allow for expansion and contraction. Minimum allowance for snaking is one (1) additional foot per 100 ft. of pipe.
3. Moisture Restrictions: Do not lay PVC pipe when there is water in the trench. Do not assemble PVC pipe unless the pipe is dry.

J. Closing of Pipe and Flushing of Lines
1. Capping: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

K. Detection Wire and Warning Tape

1. Install a bare # 12 copper wire or greater on top of the PVC supply line for the purpose of possible future mine detection search.

L. Control Valves:
1. Install in valve boxes where shown on Drawings and group together where practical. Install box flush with finish grade, not necessarily level. If valve occurs in drainage swale, relocate out of drainage swale as approved by Owner's Representative.
2. Where two or more valves are installed adjacent to each other, provide at least six inches (6") separation. Align boxes in a row, perpendicular with pavement edge.
3. Permanently mark valve box lid with 2" black valve number and controller letter or with numbered metal tag inside box as approved by Owner's Representative.
4. Refer to control wiring for required spare wire in each valve box.

M. Install “Y”-Strainer upstream of remote-control valves at backflow preventer with two pressure gauges, one upstream and one downstream of each strainer/filter.

N. RCV Identification Tags:
1. Install in remote control valve box as recommended by manufacturer and as accepted by Owner’s Representative.

O. Pop-up Spray Heads
1. Place all irrigation heads in planting areas with top of heads set to finish grade or top of mulch as required.
2. Place part-circle pop-up heads two inches (2") from edge of and flush with top of adjacent walks, header boards, curbs and mowing bands or paved areas and 12 inches (12") from building foundations at time of installation.

P. Bubblers:
1. Coordinate installation with planting contractor to insure timely and proper placement of heads at new planting.

Q. In-Line Drip Irrigation
1. Coordinate plant locations with emitter locations. Refer to QUALITY ASSURANCE herein.
2. Coordinate hand watering of emitter irrigated and drip irrigated areas. Refer to QUALITY ASSURANCE herein.
3. Coordinate emitter spacing with planting types and plant spacing as accepted by Landscape Architect. Install emitters at uniform 18 inches on center maximum and 2 to 4 inches deep, except where emitter spacing and depth is shown otherwise.
4. Adjust spacing on slopes to prevent over watering at base of slopes.
5. Install system in accordance with manufacturer’s recommendations and as shown on the Drawings as required for a complete working system.
6. Provide air/vacuum relief valves at all high points on systems.
7. Provide filter as shown and as recommended by emitter manufacturer.
8. Tape pipe ends during installation and do not allow dirt or debris to enter pipe.

9. Use emitter line with the specified emitter flow rate and emitter spacing. Assemble dripper line to allow water to flow continuously and directly, with no dead ends or dead-end loops between control valve and flush valve.
10. Use fittings at sharp bends and do not allow dripper line to kink.
11. Install emitter line around perimeter of planter not more than 3 inches off edge for ground cover, 18 inches maximum for shrub planting.
12. Adjust alternate rows so emitters are spaced in a triangular pattern.
13. Collect water from multiple dripper lines and convey the water to automatic line flush valve.
14. Install flush valve at end(s) of collector laterals so that entire system will flush and be free of dirt and debris.
15. Flush valves shall be open when water is turned on for the first time and after a break in the main or lateral lines. Extend collector lateral as required and locate flush valve at convenient accessible location.
16. Flush the systems weekly through the first month of the maintenance period.
17. Thoroughly saturate soil prior to planting. Provide additional surface watering as required to keep plant root systems moist during planting establishment period.

3.4 MISCELLANEOUS EQUIPMENT

A. Install miscellaneous equipment with concrete footings, brackets, etc., as required and as recommended by the manufacturer.

3.5 FIELD QUALITY CONTROL

A. Testing of Irrigation System:
1. Make hydrostatic tests with risers capped when welded PVC joints have cured at least 24 hours. Center load piping with backfill to prevent pipe from moving under pressure. Keep all couplings and fittings exposed.
2. Install two (2) pressure gauges at opposite ends of main line system. Pump system up to a minimum of 125 psi the day preceding the scheduled test and verify that pressure is holding. Inspect system early following day and immediately notify Owner's Representative if the test confirmation must be postponed.
3. Apply continuous static water pressure of 125 psi in accordance with Caltrans Standard Specifications Section 20-2, except after a drop in pressure (5 psi maximum), then the pressure must stabilize and remain stable for a one (1) hour minimum period before acceptance of the test.
4. Leaks detected during tests shall be repaired and test repeated until system passes tests at no additional cost to Owner.

B. Irrigation Audit Report with Certificate of Completion
1. Per the requirements of the California Model Water Efficient Landscape Ordinance, the Contractor shall perform an irrigation audit and provide a report with certificate of completion to the local agency that may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or run off that causes overland flow, and preparation of an irrigation schedule. Irrigation audits shall be conducted by a CLIA Certified landscape Irrigation Auditor by the Irrigation

Association. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.

C. Adjustment of the System:
   1. Flush and adjust all irrigation heads for optimum performance and to prevent overspray onto walks, roadways and buildings. Adjust the arc and radius as applicable.
   2. Include as a part of the work any nozzle changes or arc adjustments necessary due to daytime windy conditions during grass establishment period. After grass has been established and watering can be performed during calm early morning or evening hours, make any required adjustments to nozzles and arcs.
   3. Set all irrigation heads perpendicular to finished grades unless otherwise noted on the drawings.
   4. When the landscape irrigation system is completed and before planting, perform a coverage test in the presence of the Owner's Representative to determine if the water coverage for planting areas is adequate.
   5. Test controllers individually in the presence of the Owner's Representative and the Landscape Architect. Demonstrate that all control valves operate electronically. Provide vehicles and radio equipment as necessary to expedite this process.
   6. Demonstrate to Owner's Representative that irrigation scheduling programmed into controller is adequate for plant requirements without causing runoff, and that scheduling capacities of controller are utilized.

3.6 IRRIGATION SCHEDULING AND CONTROLLER PROGRAMMING

A. Per the requirements of the California Model Water Efficient Landscape Ordinance All irrigation schedules and programs shall be developed, managed and evaluated to utilize the minimum amount of water required to maintain plant health.

B. Irrigation controller Scheduling and Programming Parameters to be conducted by a CLCA Certified Irrigation manager and submitted to the local agency as part of the Certificate of Completion.

C. Parameters used to set the automatic controller shall be developed for each of the following:
   1. Plant establishment period
   2. Established landscape period
   3. Temporary irrigated area (if applicable)

D. Each irrigation schedule shall consider for each station all of the following that apply:
   1. Irrigation interval (days between irrigation)
   2. Irrigation run times (hours or minutes per irrigation event to avoid runoff
   3. Number of cycle starts required for each irrigation event to avoid runoff
   4. Amount of applied water scheduled to be applied on a monthly basis
   5. Application rate setting
   6. Root depth setting
   7. Plant type setting
   8. Soil type
   9. Slope factor setting

10. Shade factor setting
11. Irrigation uniformity or efficiency setting

E. Total annual applied water shall be less than or equal to Maximum Applied Water Allowance (MAWA). Actual irrigation schedules shall be regulated by automatic irrigation controllers using current reference evapotranspiration data (CIMIS or soil moisture sensor data).

3.7 BACKFILL AND COMPACTING

A. General: After the system is operating and required tests and reviews have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for All Trenches: Regardless of the type of pipe covered, compact to minimum 95% density under pavements and 85% under planted areas.

C. Finishing: Dress off areas to finish grades. Re-dress any areas which subsequently settle.

D. Owner's testing agency will test backfill compaction in areas under paving.

3.8 MAINTENANCE

A. The entire irrigation system shall be under fully automatic operation for a period of 2 days prior to any planting.

B. The Owner's Representative reserves the right to waive or shorten the operation period.

C. Maintain/repair system for full duration of plant maintenance period.

3.9 REVIEWS PRIOR TO ACCEPTANCE

A. Notify the Owner's Representative in advance for the following reviews, according to the time indicated:
1. Supply line pressure test and control wire installation - 72 hours.
2. Coverage and controller test - 72 hours.
3. Final review - 7 days.

B. No reviews will commence without record drawings, without completing previously noted corrections, or without preparing the system for review.

3.10 FINAL REVIEW AND CLEANUP.

A. Operate each system in its entirety for the Owner's Representative at time of final review. Any items deemed not acceptable by the Owner's Representative shall be reworked to the complete satisfaction of the Owner's Representative.

B. Provide evidence to the Owner's Representative that the Owner has received all accessories and equipment as required before final review can occur.

C. Final acceptance and start of warranty period will occur no earlier than the end of the plant maintenance period.

D. For time of final review, Contractor shall arrange a meeting with the Owner's maintenance personnel to demonstrate the operation of the irrigation systems automatically in order to verify acceptance and to familiarize the maintenance personnel with the system and recommended programming.

END OF SECTION

SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide planting work and planting maintenance complete as shown on the drawings and as specified including staking and layout of the landscaping, including soil sampling as required by the State of California Model Water Ordinance.

1.2 RELATED SECTIONS

A. Section 31 10 00, Site Clearing
B. Section 31 10 01, Plant Protection
C. Section 31 20 00, Earthwork
D. Section 32 84 00, Irrigation

1.3 QUALITY ASSURANCE

A. Reference Standards:
   1. All local, municipal and state laws, codes and regulations relating to all portions of this work are to be incorporated as part of these Specifications. These specifications shall not be construed to conflict with any of the above codes, regulations or requirements. The Specifications and Drawings shall take precedence when they call for materials, workmanship or construction of a better quality or higher standard than required by the above mentioned codes and regulations. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.
   2. State of California Model Water Ordinance
   3. Bay Area Stormwater Management Agencies Association (BASMAA) Regional Biotreatment Soil Specifications.
   4. Public utility agency having jurisdiction over the project work.
   5. "American Standards for Nursery Stock," American Association of Nurseryman, 230 Southern Building, Washington, D.C. 20005.
   6. International Society of Arboriculture, Guide for Plant Appraisal, latest version.
   7. US Composting Council Compost Analysis Program (CAP)
   8. US Composting Council (USCC) Seal of Testing Assurance (STA) program.
   9. Test Methods for the Evaluation of Composting and Compost (TMECC)
   10. Manufacturer's recommendations.

B. Qualifications:
   1. Experience: Assign a full-time employee to the job as foreperson for the duration of the Contract who is certified landscape technician, certification through CLCA or minimum of five (5) years' experience in landscape installation and maintenance supervision, with experience or training in turf management, entomology, pest control, soils, fertilizers and plant identification

2. Labor Force: Provide a landscape installation and maintenance force thoroughly familiar with, and trained in, the work necessary to complete the tasks described herein in a competent, efficient manner acceptable to the Owner.

C. Requirement
1. Site Visit: At beginning of work, visit and walk the site with the Owner's Representative to clarify scope of work and understand existing project/site conditions.
2. Supervision: The foreperson shall directly supervise the work force at all times and be present during the entire installation. Notify Owner's Representative of all changes in supervision.
3. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and a labor force uniformly dressed in a manner satisfactory to Owner's Representative.
4. Protect all existing and new plants from construction activities, deer & rodents: Contractor shall be responsible for protection of all planting per Part 3.

D. Plant Material Standards:
1. Quality and Size of Plants: Conform to the State of California Grading Code of Nursery Stock, No. 1 grade. Use only nursery-grown stock which is free from insect pests and diseases.
2. Comply with federal and state laws requiring inspection for plant diseases and infestations, including Phytophthora. Submit inspection certificates required by law with each shipment of plants, and deliver certificates to the Owner. Obtain clearance from the County Agricultural Commissioner as required by law, before planting plants delivered from outside the County in which planted.

E. Soils & Amendment Testing
1. All soils & amendments to be tested for suitability by one of the following accredited soil testing laboratories (or approved equal). Components of the test shall include all major nutrients, pH, salinity, boron, sodium, micronutrients, copper, zinc, manganese and iron, adsorption rate, organic content and texture. The laboratory report shall include recommendations for adjusting fertilizer and amendment quantities.

Lucchesi Plant & Soil Consulting
Los Gatos, CA (408) 337-2575

Waypoint Analytical, Inc.
4741 E. Hunter Ave, Suite A, Anaheim, CA 92807; (717) 282-8777

Control Laboratories
42 Hangar Way, Watsonville, CA 95076; (831) 724-5422

Perry Laboratory
424 Airport Boulevard , Watsonville, CA 95076; (831) 722-7606

Wallace Laboratories, LLC
365 Coral Circle, El Segundo, CA 02345; (310) 615-0016

2. Upon approval of the laboratory's report by the Landscape Architect, the recommendations in the report shall become a part of the Specifications and the soil preparation procedures, quantities of soil amendment, fertilizer and other additives shall be adjusted to conform with the report at no additional cost to the owner. Note that there is a minimum quantity of organic amendment specified elsewhere in this specification section.
3. Significant issues with soil quality will require soil to be retested in the locations identified on Soil Analysis Plan, prior to proceeding with plant installation, to ensure that the recommendations in the report have been followed and the In-Situ Topsoil is horticulturally suitable as described in Part 2.

1.4 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms. Subsoil is defined as either existing site soil located below the topsoil prior to construction activities, or select fill used for rough grading during construction. Subsoil cannot be considered for use as planting soil.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

E. Planting Soil: Approved existing topsoil or imported planting soil, meeting the requirements herein. Subsoil cannot be considered for use as planting soil.

1.5 SUBMITTALS

A. The following shall be submitted to the landscape architect for approval prior to the installation of landscape materials and products.
   1. Manufacturer’s Technical data sheets for fertilizers, and all other products and materials listed herein.
   2. Manufacturer’s technical data sheets for amendments. Reports to be dated no more than 3 months prior to soil preparation.
   3. 1-pint samples of imported soils, organic amendments/compost, mulches, and cobbles.

B. Submit planting soil and organic amendment laboratory reports a minimum of 3

weeks prior to beginning soil prep. See below for required soil analysis reports.

C. Required Soil Analysis Reports. Reports to be dated no more than3 months prior to soil preparation.

1. Soil Analysis Plan: Contractor to submit annotated plan showing confirmed locations of all required soil tests. Each location is to be identified with a unique label.
2. Existing Planting Soil Analysis: After approval of the Soil Analysis Plan, rough grading, and topsoil placement, contractor to obtain 3 representative samples of in situ topsoil taken from approved site locations at depth of 4" to 6" below finish grade and submit to an accredited soils testing laboratory for “horticultural suitability" analysis, including particle size, infiltration rate, and evaluation of physical and chemical properties of soil and recommendations for adding amendments and fertilizers to the soil.
3. Subsoil Analysis: In addition to the above required soil samples, contractor to obtain one representative sample of any subgrade soil that is to receive a layer of imported planting soil over it. The laboratory report shall include the soil’s infiltration rate, total combined silt and clay content for determining the total allowable combined silt and clay content of the imported planting soil specified herein.
4. Imported Planting Soil Analysis: Contractor to submit a " horticultural suitability" analysis report from an accredited soils testing laboratory, including particle size, infiltration rate, and evaluation of physical and chemical properties of soil and recommendations for adding amendments and fertilizers to the soil. Soil to conform to requirements in Part 2.
5. Amended Planting Soil Analysis:_Significant issues with soil quality will require soil to be retested in the locations identified on Soil Analysis Plan, prior to proceeding with plant installation, to ensure that the recommendations in the report have been followed and the final Planting Soil is horticulturally suitable as described in Part 2.

D. The Contractor is responsible to follow all local water ordinances and make available to the local agency the soil analysis report and verification of its implementation as required.

E. Delivery Receipts upon request by Owner, provide delivery receipts for quantities of soil & amendments delivered to the site.

F. Representative photos of trees with measuring pole and plant species (unless trees or plants previously tagged at nursery by landscape architect). Identified and dated photos of trees and plants to be the trees and plants delivered to site and not a stock photograph.

G. Entire plant quantity delivered to the site. Plants to be reviewed prior to installation during a single site visit.

1.6 WARRANTY AND REPLACEMENT

A. Maintenance Period: See Part 3.

B. Warrant the work against weed growth for a period of four (4) months after

application of Pre-Emergence Weed Killer.

C. Warrant all plants to be in a healthy, thriving condition until the end of the maintenance period, and deciduous trees, shrubs and vines beyond that time until active growth is evident.

D. Replace all dead and damaged plants and plants not in a vigorous condition immediately upon discovery and as directed by the Owner's Representative and at no cost to the owner. Install replacement plants before the final acceptance of the maintenance period in the size specified.

E. Warrant all products, prepared soils and plant material installed and maintained by contractor against defects for a period of one year after final acceptance of the maintenance period.

PART 2 - PRODUCTS

2.1 SUBSOIL

A. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

2.2 EXISTING PLANTING SOIL (ON-GRADE):

A. Existing Planting Soil is defined as on-site topsoil that is either to be removed and stockpiled for reuse or to remain in place during construction. Satisfactory planting soil shall be free of subsoil, clay, lumps, stones, and other objects over 4" in diameter, and without weeds, roots, and other objectionable material. The soil shall be fertile, friable, natural, productive soil containing a normal amount of humus, and shall be capable of sustaining healthy plant life. Soil shall not be infested with nematodes or with other noxious animal life or toxic substances. Soil shall be obtained from well-drained, arable land, and shall be of an even texture. Soil shall not be taken from areas on which are growing any noxious weeds such as morning glory, equisetum, or Bermuda grass, etc.

B. If herbicide contamination is suspected then a radish/ryegrass growth trial must be performed. Consult with Landscape Architect prior to decision to test or not.

C. Amended Planting Soils are to conform with the following target levels. Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH value	6.5-7.9,		iron	4-15	mg/kg
lime	none	present	manganese	0.6-3.0	mg/kg
salinity (ECe)	0.5-3	milli-mho/cm	zinc	1-3	mg/kg
chloride	<150	ppm	copper	0.2-3.0	mg/kg
nitrate	20-30	ppm	boron	0.2-0.5	mg/kg
SAR	<3		magnesium	25-100	mg/kg
phosphorus	8-20	mg/kg	sodium	<200	mg/kg
potassium	60-180 mg/kg		sulfur	25-100 mg/kg	

D. If sufficient on-site surface topsoil is not available, contractor to provide imported planting soil as specified below. Placement of dissimilar soils shall be coordinated with irrigation zones by the contractor to maintain separate valves for dissimilar soils.

E. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

2.3 IMPORTED PLANTING SOIL (ON-GRADE):

A. Imported planting soil shall be screened and shall be free of subsoil, heavy or stiff clay, rocks, gravel, brush, roots, weeds, noxious seeds, sticks, trash, and other deleterious substances.

B. Imported Planting Soils are to conform with the following target levels. Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH value	6.5-7.9,		iron	4-15	mg/kg
lime	none	present	manganese	0.6-3.0	mg/kg
salinity (ECe)	0.5-3	milli-mho/cm	zinc	1-3	mg/kg
chloride	<150	ppm	copper	0.2-3.0	mg/kg
nitrate	20-30	ppm	boron	0.2-0.5	mg/kg
SAR	<3		magnesium	25-100	mg/kg
phosphorus	8-20	mg/kg	sodium	<200	mg/kg
potassium	60-180	mg/kg	sulfur	25-100	mg/kg

C. The silt and clay content of Imported Planting Soil shall not exceed that of the existing soil it is to be placed over. Except where otherwise required, it shall be a "Sandy Loam" as classified in accordance with USDA Standards with a combined total of between 25% to 40% Clay and Silt.

D. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

E. Following approval of the sample, provide a one-half cubic yard sample, which shall be stored at the site of work for comparison with sample and subsequent loads of soil. The comparison sample shall be protected by a cover until the installation of all soil has been completed and accepted.

2.4 ORGANIC AMENDMENT FOR PLANTING SOILS (ON-GRADE):

A. Ground Redwood or Ground Fir Bark with the following properties:

Percent Passing	Sieve Designation		
100	9.51 mm	3/8"	
50-60	6.35 mm	1/4"	
20-40	4.76 mm	No. 4	
0-20	2.38 mm	No. 8	8 mesh

Redwood Sawdust
Dry bulk density, lbs. per cu. yd. 260-280

Nitrogen stabilized - dry weight basis	0.4%	minimum
Salinity (ECe):	4.0	maximum
Organic Content:	90%	minimum
Reaction (pH):	4.0	minimum

Ground Fir and/or Pine Bark		
Dry bulk density, lbs. per cu. yd.	350	minimum
Nitrogen stabilized - dry weight basis,	0.5%	minimum
Salinity (ECe):	4.0	maximum
Organic Content:	90%	minimum
Reaction (pH):	4.0 minimum	

B. Submit sample, product's technical data sheet, and analysis report from an approved soils laboratory for approval by the Landscape Architect. The analysis report should include compliance to the specifications above and directions for product use.

2.5 PLANTS

A. Plant the variety, quantity and size indicated on drawings. The total quantities indicated on the drawings are considered approximate and furnished for convenience only. Contractor shall perform plant quantity calculations and provide all plants shown on the drawings.

B. Measure trees and shrubs with branches in normal position. Height and spread dimensions indicated refer to the main body of the plant, and not from branch tip to tip.

C. Take precautions to ensure that the plants will arrive at the site in proper condition for successful growth. Protect plants in transit from windburn and sunburn. Protect and maintain plants on site by proper storage and watering.

D. Install healthy, shapely and well rooted plants with no evidence of having been root-bound, restricted or deformed.

E. Tag plants of the type or name indicated and in accordance with the standard practice recommended by the American Association of Nurserymen.

F. Substitutions will not be permitted, except as follows:
   1. If proof is submitted to the Landscape Architect that any plant specified is not obtainable, a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price.
   2. Substantiate and submit proof of plant availability in writing to the Landscape Architect within 10 days after the effective date of Notice to Proceed.

G. Tree Form
   1. Trees shall have a symmetrical form as typical for the species/cultivar and growth form.
   2. Central Leader for Single Trunk Trees: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that compete with the central leader. Preferably,

the central leader should not have been headed; however, in cases where the original leader has been removed, an upright branch at least ½ the diameter of the original leader just below the pruning point shall be present.

3. Potential Main Branches: Branches shall be evenly distributed radially around and appropriately spaced vertically along the trunk, forming a generally symmetrical crown typical for the species.
4. Headed temporary branches should be distributed around and along the trunk as noted above and shall be no greater than 3/8" diameter, and no greater than ½ diameter of the trunk at point of attachment.

H. Tree Trunk

1. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.
2. Trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.
3. Tree trunk diameter at 6" above the soil surface shall be within the diameter range shown for each container size below, except where shown otherwise:

Container	Trunk Diameter	Soil level from Container Top
5 gallon	0.5" to 0.75"	1.25 to 2"
15 gallon	0.75" to 1.0"	1.75 to 2.75"
24" Box	1.5" to 2. 5"	2.25 to 3"
36" Box	>2.5"	2.25 to 3"
60" Box	>2.5"	3-6"

4. Tree trunks shall be undamaged and uncut with all old abrasions and cuts completely callused over. Do not prune plants prior to delivery.

I. Tree Roots

1. Trunk root collar (root crown) and large roots shall be free of circling and/or kinked roots. Contractor may be required to remove soil near the root collar in order to verify that circling and/or kinked roots are not present.
2. The tree shall be well rooted in the container. When the trunk is lifted the trunk and root system shall move as one and the rootball shall remain intact.
3. The top-most roots or root collar shall be within 1" above or below the soil surface. The soil level in the container shall be within the limits shown in above table.
4. The rootball periphery shall be free of large circling and bottom-matted roots.
5. On grafted or budded trees, there shall be no suckers from the root stock.

2.6 FERTILIZERS

A. General Landscape Fertilizers

Commercial fertilizer, pelleted or granular form, conform to the requirements of Chapter 7, Article 2, of the Agricultural Code of the State of California for fertilizing materials as follows:

1. Type A:
   6% Nitrogen, 20% Phosphorus Acid and 20% Potash, (6-20-20)
2. Type B:
   21 gram planting tablets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Agriform or 10gm BestPacks packets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Best Fertilizer Co.
3. Type C (Maintenance Fertilizer)
   Complete fertilizer 21% Nitrogen, 7% Phosphoric Acid and 14% Potash (21-7-14).
4. If commercial fertilizer having the above analysis is not obtainable, other similar commercial fertilizer may be used providing it meets the approval of the Landscape Architect.

2.7 IRON OR FERROUS SULFATE: DRY FORM.

A. Essential 20% Ferrous (Iron) Sulfate. A soluble product that can be broadcast or incorporated. Analysis of 20% Iron, 18% Sulfur.

2.8 EROSION CONTROL NETTING

A. New, with a uniform, open plain-weave, flame-retardant mesh. The mesh shall be natural brown-tan and made from unbleached single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Furnish jute mesh in rolled strips to meet the following requirements:
   1. Width: 48 inches, with a tolerance of one-inch wider or narrower.
   2. Not less than 78 warp ends per width.
   3. Not less than 41 weft ends per yard.

2.9 ROOT BARRIER

A. UB 18-2 as manufactured by Deep Root Corporation (800) 458-7668, Root Solutions, Inc. (800) 554-0914, or equal. Install a minimum of 6 panels/12 linear feet centered on each tree, where tree is within 8 feet of sidewalk, paving, or utilities.

2.10 TREE STAKES

A. Lodge pole pine logs, clean, smooth, un-treated.

B. Unless otherwise shown on drawings, provide two-inch (2") diameter by eight feet (8') long for trees less than 8' high and 1" caliper.

C. Unless otherwise shown on drawings, provide three-inch (3") diameter by eight to ten feet (8' - 10') long for trees greater than 8' high and 1" caliper.

D. 2” O.D. Lodge pole tree stakes, painted black

2.11 TREE TIES

A. Unless otherwise shown on drawings, provide rubber strap, 24-inch minimum length without sharp edges adjacent to trunk, V.I.T. cinch-tie, Dublin, CA,

(818)882-9530, or approved equal.

B. Black corded rubber tree ties w/ clips by greensleeves.com

C. Biodegradable VStrap webbing by Treestrap.

2.12 MULCH

A. Organic Mulch:
   1. Fir tree or pine tree bark, dark in color; 3/4-inch to 1-inch size.
   2. Decorative Fir bark, dark in color; Medium 1/2-inch to 1-1/2-inch size.
   3. Walk-On Bark; Coarsely shredded White Fir, Red Fir or Pine bark.
   4. Redwood Bark; Single grind (Coarse) Coast Redwood Bark (Gorilla Hair)
   5. Redwood Bark; Double grind (Fine) Coast Redwood Bark
   6. Cedar mulch by American Soil and Stone
   7. Forest floor bark mulch by American Soil and Stone

PART 3 - EXECUTION

3.1 PLANT PROTECTION AND REPLACEMENT

A. Inspect and protect all existing and new plants and trees against damage from construction activities, erosion, trespass, insects, rodents, deer, disease, etc. and provide proper safeguards, including trapping of rodent and applying protective sprays and fencing to discourage deer browsing. Maintain and keep all temporary barriers erected to prevent trespass.

B. Repair all damaged planted areas. Replace plants immediately upon discovery of damage or loss.

3.2 LIME TREATED SOIL

A. If site work includes Lime Treatment of the subsoil, the Contractor shall remove full depth of treated soil beyond 12” from structure(s) and replace with approved planting soil.

B. Following removal of lime treated material, scarify subgrade to a minimum depth of 6 inches and test for drainage.

C. Test subgrade in all planting areas for drainage by flooding with minimum 4-inch depth of water puddle and verify complete absorption of standing water within two hours. If standing water is still present after two hours, provide perforated pipe and drain rock "French Drain" system in bottom of non-draining planters and connect to storm drainage system, as accepted by Owner's Representative prior to backfilling with approved planting soil.

3.3 GENERAL PREPARATION OF PLANTING SOIL

A. Submit soil analysis report of amended soils from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

B. All planting soils to be amended as specified in soil laboratory analysis report(s).

C. Provide a minimum of 12” depth of amended planting soil in allplanting areas, or more where shown or specified otherwise. Install soil in maximum 12” lifts. Compact each lift prior to installing subsequent lifts.

D. Thoroughly wet down the planting areas to settle the soil and confirm irrigation coverage and operation. Allow soil to dry so as to be workable as described herein.

E. After the rototill work, float areas to a smooth, uniform grade as indicated on the drawings. Slope all planting areas to drain. Roll, scarify, rake and level as necessary to obtain true, even planting surfaces. Remove rocks, sticks and debris 2 inches or larger in shrub and ground cover areas. Secure approval of the grade by the Landscape Architect before any planting.

F. Prior to planting, soil shall be loose and friable to a minimum depth of [12”] with a relative maximum compaction of 85%. Rip and scarify any overly compacted and re-compacted planting areas (in two directions full depth of compacted soil) prior to planting.

G. Water settling, puddling, and jetting of soil and backfill materials as a compaction method is not acceptable.

H. Prior to planting, soil shall be moist, but not so moist that it sticks to a hand shovel. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.

I. Provide planting soil as a final lift in all planting areas within and adjacent to paved areas and other construction where native site soil has been covered by engineered fill and/or base rock. Unless otherwise shown or specified, finish grade in planting islands shall be crowned with a minimum 2% pitch to drain.

J. Finish Grade: Hold finish grade and/or mulch surface in planting areas1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc. The subgrade of the mulch in mulched planting areas shall be a minus 2 inches at a distance of 12 to 18 inch from the edge of pavement. Drag finish grade to a smooth, even surface. Grade to form all swales and berms. Pitch grade with uniform slope to catch basins, streets, curb, etc., to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly sloped between finish elevations. Slope surface away from walls so water will not stand against walls or buildings. Control surface water to avoid damage to adjoining properties or to finished work on the site. Take required remedial measures to prevent erosion of freshly graded areas.

K. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.

3.4 PREPARATION OF IN-SITU PLANTING SOIL

A. In-Situ Planting Soil is defined as top soil left in its original place and undisturbed during construction activities which is to receive new planting

B. Except within tree driplines, rip all planting areas in two directions full depth to a

minimum of 12“ into undisturbed native subsoil prior to amending. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Owner’s Representative to the specified depth to ensure proper percolation/drainage.

C. Inspect planting areas and remove all base rock and other foreign material. Verify placement of planting soil within dripline of trees with Owner's Representative.

D. Test depth of loose soil with hand shovel in presence of Owner’s Representative in several locations as directed.

E. After acceptance of the planting condition, uniformly mix and amend soil with required fertilizers, nutrients, etc. per specifications herein and recommendations given in soils reports.

F. In the case of a contradiction between the quantity of organic amendment required by the soils laboratory analysis and the specified quantity below, the greater of the two quantities shall take precedence. Spread organic amendment, iron and Type A fertilizer evenly over installed and rough graded on-site topsoil in all planting areas including ground cover and shrub areas at the following rates:
   1. Organic Amendment: 6 cubic yards per 1,000 square feet
   2. Fertilizer: Type A (6-20-20) at 20 lbs. per 1,000 square feet.
   3. Iron Sulfate: 10 lbs. per 1,000 square feet

G. Rototill above additives into soil 8-12” inches deep. Keep iron sulfate off pavement and other surfaces to prevent rust staining. Correct all rust damage to work.

H. Final planting soil shall have a pH range of 6.5 to 7.5.

3.5 PREPARATION OF IMPORTED PLANTING SOIL (ON-GRADE)

A. Uniformly distribute and spread Subsoil or select fill in planting areas to achieve rough grading and compact to a maximum of 85% relative compaction.

B. Except within tree driplines, rip all planting areas in two directions full depth to a minimum of12“into undisturbed native subsoil prior to backfilling. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Owner’s Representative to the specified depth to ensure proper percolation/drainage.

C. Thoroughly water-settle subsoil to required subgrade prior to installing Top Soil.

D. Prior to placing planting soil secure the Owner’s Representatives acceptance of the planting areas subgrade condition. Test depth of loose soil with hand shovel in presence of Owner’s Representative in several locations as directed.

E. After acceptance of the planting areas subgrade condition, uniformly distribute and spread planting soil backfill over scarified subgrade in planting areas as specified.

F. Mix and amend soil with required fertilizers, nutrients, etc. per specifications herein and recommendations given in soils reports.

3.6 ROOT BARRIER

A. Install in continuous sheet parallel and adjacent to curb or pavement edge as required on drawings and in accordance with manufacturer's recommendations. Set top of barrier approximately ½-inch above finished soil surface to allow concealment with mulch, as accepted by Owner's Representative

3.7 EROSION CONTROL NETTING

A. Verify finished grades and provide Jute Mesh and single grind Redwood bark mulch on all slopes 3:1 and steeper as accepted by the Owner's Representative. Install jute mesh loosely up and down the slope in accordance with manufacturer's specifications and as follows. Fit the soil surface contour and hold in place with 12-inch long, 11-gauge (minimum) steel wire staples driven vertically into the soil at 18- to 24-inch spacing. Jute mesh strips shall overlap along all edges at least 6 inches. Ends of side strips shall be buried into the soil at least 6 inches. Drive staples along edges to securely anchor mesh to ground.

3.8 TREE AND SHRUB PLANTING

A. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the Landscape Architect before plant holes are dug. Adjust location as required prior to planting.

B. Review location of plants in relationship to irrigation heads and adjust location(s) that interfere with the function of the spray heads. Adjust locations as required to ensure that the plant roots receive the proper amount of water in order for the plants to thrive.

C. Square Tree Pits
   1. Drilled tree pits shall be modified to a square pattern with pit walls scarified to promote root penetration.

D. Excavate tree, shrub and vine pits as follows:

	Width	Depth
Boxed Trees	Box + 24"	Box depth
Canned Trees (15 gc)	Can + 18"	Can depth
Canned Shrubs/Vines (1- 5 gc)	Can + 12"	Can depth

E. Test drainage of plant beds and tree pits by filling with water (minimum 6"). The retention of water in planting beds and plant pits for more than two (2) hours shall be brought to the attention of the Landscape Architect. If rock, underground construction work, tree roots, poor drainage, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Landscape Architect.

F. Break and loosen the sides and bottom of tree pits to ensure root penetration and water test hole for drainage as required above.

G. Excavate plant hole or tree pit keeping excavated planting soil layer on the surface when backfilling around the plant. Carefully set plants as detailed without damaging the rootball. Superficially cut edge roots vertically on three sides.

Remove bottom of plant boxes before planting. Remove sides of boxes after positioning the plant and partially backfilling.

H. Set plants in backfill with top of the rootball 1 inch above finished grade of adjacent soil. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole.

I. Backfill plant holes with mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement. Backfill remainder of the hole with soil mix and place plant tablets or packets (Type B fertilizer) 3 inches below finish grade and 1/2-inch from roots at the following rates:

1 gallon can plant	-	1 tablet or packet
5 gallon can plant	-	3 tablets or packet
15 gallon can plant	-	6 tablets or packet
24-inch box plant	-	6 tablets or packet
36-inch box plant	-	8 tablets or packet

J. Except for acid loving plants (Azaleas, Rhododendrons, Ferns, Camellias, etc.), use a soil mix of 2 parts soil from the hole, and 1 part amendment with iron added at the following rates:

1 gallon can plants	-	iron, 1/4 cup
5 gallon can plants	-	iron, 1/3 cup
15 gallon can plants	-	iron, 1/2 cup
24" box and larger	-	iron, 1 cup

1. Mix the iron, amendment and soil thoroughly for use in the top 8 inches of backfill around plants. For acid loving plants, mixture to be 1/2 soil from the hole and 1/2 amendment.

K. Remove any soil from top of plant rootballs and secure Landscape Architect's approval of rootball height prior to mulching.

L. After approval of rootball height, install mulch as required below.

M. Stake and/or guy trees as detailed. Drive stake(s) until solid (at least 12" beyond bottom of rootball) and remove excess stake protruding above top tree tie to prevent rubbing against branches. Avoid driving stakes through rootball. If subgrade does not accept stakes to a stable degree, delete stakes and guy the trees as specified herein and as detailed. Locate tree ties to avoid contact with tree branches. Locate top tie at tree flex point.

N. Build watering basin berms around trees and shrubs to drain through rootball. Water backfill until saturated the full depth of the hole.

3.9 GROUND COVER PLANTING

A. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or

other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.

3.10 MULCH

A. Mulch all tree, shrub and ground cover areas with organic mulch to a 3-inch depth, except mulch to 2-inch depth where planting with ground cover plants from flats.

B. Hold bark mulch away from base (trunk) of plant 4" or as directed by the Landscape Architect.

C. Individual trees and/or shrubs planted in non-irrigated areas shall, at minimum, receive bark mulch over their watering basin and berm.

D. Install rock mulch to depth as detailed, minimum 2-inches for full coverage of soil surface, whichever is greater.

3.11 WATERING

A. Water all trees, shrubs and ground cover immediately after planting. Apply water to all plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Provide supplemental hand watering of trees and shrubs, as required, to maintain a moist root zones throughout plant establishment period.

3.12 PRE-MAINTENANCE PERIOD REVIEW AND APPROVAL OF PLANTING

A. Maintain plants from time of delivery to site until final acceptance of landscape installation.

B. Receive approval of the installed planting prior to commencement of planting establishment maintenance period. Notify the Landscape Architect or Owner's Representative a minimum of seven (7) days prior to requested review. Before the review, complete the following:
   1. Complete all construction work.
   2. Present all planted areas neat and clean with all weeds removed and all plants installed and appearing healthy.
   3. Plumb all trees and tree and shrub supports.
   4. No partial approvals will be given.

3.13 PLANTING ESTABLISHMENT MAINTENANCE

A. General Requirements
   1. Maintenance Period: The planting establishment maintenance period required shall be 90 calendar days after all planting and irrigation is complete and as approved by Owner's representative. A longer period may be required if the plant material is not acceptably maintained during the maintenance period. The start of the maintenance period to be confirmed by Owner's representative. Contractor to notify landscape architect of start and end dates of maintenance period. The maintenance period may be suspended at any time upon written notice to the Contractor that the landscaping is not being acceptably maintained, and the day count

suspended until the landscape is brought up to acceptable standards as determined by the Owner Representative.

2. Planting establishment maintenance immediately follows, coincides with, and is continuous with the planting operations, and continues after all planting is complete and accepted; or longer where necessary to establish acceptable stands of thriving plants.
3. Protect all areas against damage, including erosion, trespass, insects, rodents, disease, etc. and provide proper safeguards. Maintain and keep all temporary barriers erected to prevent trespass.
4. Keep all walks and paved areas clean. Keep the site clear of debris resulting from construction or maintenance activities.
5. Repair all damaged planted areas, and replace plants immediately upon discovery of damage or loss.
6. Check irrigation systems at each watering; adjust coverage and clean heads immediately. Adjust timing of controller to prevent flooding.
7. Maintain adequate moisture depth in soil to ensure vigorous growth. Check rootball of trees and shrubs independent of surrounding soils and hand water as required.
8. Keep contract areas free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds at all times.

B. Tree and Plant Maintenance
1. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the Landscape Architect.
2. Keep watering basins in good condition and weed-free at all times.
3. Replace all damaged, unhealthy or dead trees, shrubs, grasses, vines and ground covers with new stock immediately; size as indicated on the drawings.

C. Fertilizing:
1. Upon approval and after submitting fertilizer delivery tags, maintenance fertilization shall begin 30 days after planting is complete. Fertilize all ground cover areas by broad-casting Type C (21-7-14) fertilizer at the rate of 5 lbs. per 1,000 square feet evenly throughout. Reapply every forty-five (45) days until acceptable.
2. Early spring and fall substitute a complete fertilizer such as 15-15-15 applied at the rate of 6 lbs. per 1,000 square feet, to help insure continuing adequate phosphorus and potassium.
3. Observe plant's color, and if a soil pH imbalance is suspected, take soil samples and obtain laboratory analysis for confirmation. Take necessary action recommended in laboratory analysis such as top dressing with soil sulfur, leaching soil, etc.

3.14 FINAL PLANTING REVIEW AND ACCEPTANCE

A. At the conclusion of the Maintenance Period, schedule a final review with the Owner, the Owner's maintenance person, and/or the Landscape Architect. On such date, all project improvements and all corrective work shall have been completed. If all project improvements and corrective work are not completed, continue the planting establishment maintenance period at no additional cost to

the Owner until all work has been completed. This condition will be waived by the Owner under such circumstances wherein the Owner has granted an extension of time to permit the completion of a particular portion of the work beyond the time of completion set forth in the Agreement.

B. Submit written notice requesting review at least 10 days before the anticipated review.

C. Prior to review, weed and restore all planted areas, plumb trees and tree supports, clear the site of all debris and present in a neat, orderly manner.

END OF SECTION

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SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site storm drainage system

1.2 RELATED SECTIONS

A. Section 31 21 00, Utility Trenching and Backfill

1.3 RELATED DOCUMENTS

A. ASTM
   1. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

B. AASHTO
   1. M294: Standard Specification for Corrugated HDPE Pipe

C. Caltrans Standard Specifications
   1. Section 51, Concrete Structures
   2. Section 70, Miscellaneous Drainage Facilities

D. Cities and County of Marin Uniform Construction Standards
   1. Standard 225

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Water Works Association

D. HDPE: High-density polyethylene

E. NPS: Nominal pipe size

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Product data for the following:
   1. Piping materials and fittings
   2. Trench drain systems
   3. Joint sealants

4. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates

C. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete inlets, frames and covers

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS (HDPE): 12 INCH THROUGH 48 INCH

A. Pipe shall be in accordance to AASHTO M294. Type S, smooth interior and corrugated exterior.

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.2 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Precast Structure: Cities and County of Marin Uniform Construction Standard

1. Type “A”
2. Rate for AASHTO H20 loading in traffic areas.

C. Frames, Grates and Covers: Cities and County of Marin Uniform Construction Standard
1. Type “A”
2. Galvanize steel frames, grates and covers
3. Grates and covers shall be non-rocking
4. Rate for AASHTO H20 loading in traffic areas

2.3 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.02F
1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket
1. Rubber Gaskets: ASTM C443
2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by Henry Company, or approved equal.

2.4 TRENCH DRAIN

A. General: Modular system of precast, cast iron trench drain sections, stainless steel grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.

B. Include the following components:
1. Channel Sections: Precast modular units, Evergrate or Approved Equal
2. Frame and Grate: Stainless steel grade and pentagon security bolt, Continuum style.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

B. Precast Structures: Install as indicated.
   1. Seal all joints and pipe entrances and exits.
   2. Place concrete in bottom and shape to convey flows as indicated.

3.3 TRENCH DRAIN INSTALLATION

A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

B. Install: As indicated and in accordance with the manufacturer's instructions.

3.4 PIPELINE FLUSHING

A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.5 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:
   1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
      a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
      b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.

   2. Ball, cylinder, or circular sections shall conform to the following:
      a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
      b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
      c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
      d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

   3. Pull-Through Device:
      a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
      b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

E. Deflection measuring Device:
   1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.

2. Obtain approval of deflection measuring device prior to use.

F. Deflection Measuring Device Procedure:
   1. Measure deflections through each run of installed pipe.
   2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
   3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.6 CLEANING

A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

END OF SECTION

SECTION 33 42 00

BIORETENTION AREAS

PART 1 - GENERAL

1.1 sECTION INCLUDES

A. Bioretention and biofiltration areas for storm water treatment, including treatment media, subdrains, and inlet structures.

1.2 Related Sections

A. Section 31 00 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 31 21 00 – Utility Trenching and Backfill

D. Section 32 84 00 – Irrigation

E. Section 32 90 00 - Planting

F. Section 33 41 00 – Storm Utility Drainage Piping

1.3 RELATED DOCUMENTS

A. AASHTO
   1. M288: Standard Specification for Geotextiles Used for Subsurface Drainage Purposes

B. D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 180Caltrans Standard Specifications
   1. Section 70, Miscellaneous Drainage Facilities

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. PVC: Polyvinyl Chloride

1.5 submittals

A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Product data for the following:
   1. Soil Mix
   2. Permeable drain rock
   3. Geotextile fabrics
   4. Area drains

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
   1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

B. Handling
   1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
   2. Handle precast structures according to manufacturer's written instructions.
   3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 AREA DRAINS

A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6-inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.

B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.2 BIORETENTION TREATMENT SOIL

A. Soil Mix:
   1. Biotreatment soil median in conformance with the Bay Area Stormwater Management Agencies Association (BASMASS) standards
      a. Soil mix shall consist of 60-percent to 70-percent sand and 30-percent to 40-percent compost
      b. Soil mix shall have a tested infiltration rate of a minimum of 5 inches per hour

B. Drainage Fill Material:
   1. Permeable Material: Conform to Section 68-2.02F(3) of Caltrans Standard Specifications, Class 2.

C. Geosynthetics: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M288
   1. Survivability Class: 1

2. Apparent Opening Size: No. 70 sieve maximum
3. Permittivity: 0.5 per second, minimum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Install only after unsatisfactory conditions have been corrected.

3.2 BIORETENTION AREAS

A. The Contractor shall excavate bioretention areas to the elevations and dimensions specified on the plans. Level surface of area of top of treatment soil shown on the plans shall govern actual length and width dimensions if shown on the plans. In-situ soils shall not be further compacted.

B. Direct the use of heavy equipment and construction traffic around rain gardens so as to avoid compaction, to the extent possible.

C. After initial site grading, the Contractor shall provide temporary protection from curb cuts and other potential inflow entrances so that runoff drainage does not enter the rain gardens during construction and installation.
   1. Bioretention areas may be used as sediment settling facilities during mass excavation and commensurate construction activities.
   2. Prior to commencing work in rain gardens, the Contractor shall remove and properly dispose of all accumulated sediments.

D. Excavated soils shall be placed with stockpiled fill and properly disposed and stabilized by the Contractor.

E. Subdrain installation:
   1. Subdrain shall be installed as indicated on the plans at an elevation within the drain rock layer shown on the construction details and connected to the overflow or outfall structure at the invert elevation shown on the plans.
   2. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the Project Designer or authorized representative. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with subdrain pipe materials.
   3. Drain rock layer shall be approved Class II Permeable Material. Crushed rock or aggregate base cannot be used within the treatment area, in, around or under the drain rock layer.
   4. Care shall be exercised to prevent natural or fill soils from intermixing with the drain rock surrounding the underdrain. All contaminated drain rock shall be removed and replaced with uncontaminated Class II permeable material.
   5. Attach subdrain piping to overflow structure.
   6. Install cleanouts at the ends of the subdrains. Install screw-on end caps set flush with the finished top of treatment soil.

F. Overflow drain structure:
   1. Install overflow structure at the elevation and location specified on the plans. Attach subdrain piping to overflow structure. Attach solid pipe from overflow structure outfall storm drain system at elevation and slope indicated on the plans.
   2. Rim elevation of overflow structure must be set above the elevation of the top of treatment soil by the amount indicated on the plans, typically 6 inches. Contractor shall verify that the rim elevation of the overflow structure is also a minimum of 2 inches below the lowest elevation of the treatment area perimeter so that storm flows will reach the overflow rim before the top of the treatment area perimeter.
   3. The overflow structure shall have an open bottom filled with drain rock if indicated on the plans. This should be installed where the overflow structure has a sump condition (subdrains lower than the outfall invert elevation). The overflow structure shall be installed such that the bottom of the structure is set a minimum of 6-inches below the undisturbed bottom of the treatment area. Drain rock in the overflow sump shall be installed up to the invert of the lowest pipe connected to the structure.

G. Filter media soil backfill
   1. Filter soil of the approved specification shall be installed to the elevation indicated on the plans. Care should be taken to ensure that the soil is not compacted and that no equipment is driven on the backfill. Walking on the backfill should be limited to what is absolutely necessary.

H. Planting soil, plantings, and mulch shall be installed per the plans. Non-floating bark / mulch shall be used, if indicated, to prevent removal of material and clogging of the overflow.

I. Testing of the treatment area should be conducted once the filter media is installed and all storm drain piping is connected. The area should allow an infiltration rate well above 5 inches/ hour to ensure that the treatment area will continue to function at 5 inches/ hour over the lifetime of the treatment area.

3.3 INSTALLATION AREA DRAINS

A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 - Trenching and Backfill

B. Precast Structures: Install as indicated.
   1. Seal all joints and pipe entrances and exits.
   2. Place concrete in bottom and shape to convey flows as indicated.

3.4 PIPELINE FLUSHING

A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.5 CLEANING

A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

B. Subdrain Piping:

1. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

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