

SPECIFICATIONS
Project No. 24013

Asphalt Playground Repair Parkview Elementary School

Oak Grove School District
Santa Clara County, California



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END OF SECTION

SECTION 12 93 00 – Site Furnishings

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provision of the Contract, apply to this Section.

1.2 SUMMARY

- A. The extent of work in this Section includes the provision and installation of the site furnishing equipment and structures with all miscellaneous hardware, foundations and appurtenances required for installation.

1.3 QUALITY ASSURANCE

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Unless otherwise specified, install all materials in accordance with manufacturer's recommendations.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for site furnishings conforming to requirements of Front-End Specifications.
- B. Product Warranty, spare or replacement parts, and/or care instructions shipped with components shall be delivered to Owner prior to substantial completion.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Store and handle products so as not to impede work of others.
- B. Protect products from damage or theft during delivery, handling, storage and installation.
- C. Contractor shall schedule delivery and receive site furnishings contained within this Specification whether purchased as part of this project or purchased by Owner as part of this project. This shall include unloading site furnishings, taking inventory and accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>
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1.	Basketball Post Single		
	Vertical pole	Porter Athletic	UPRT003520G0
	Backboard	Porter Athletic	207
	Goal and Net	Porter Athletic	00251H00
2.	Volleyball		
	Post with pulley reel and hooks	Porter Athletic	761100
	Sleeve cap	Porter Athletic	COVR0005500
	Outdoor ground sleeve	Porter Athletic	00402000

Contractor shall purchase touch-up paint for each color of powder coated products for use as needed after installation. Deliver un-used touch-up paint to Owner prior to substantial completion.

Manufacturer	- Local Representative	Phone	Website
Porter Athletic	-Porter Athletic	(888)277-7778	www.porterathletic.com/facility
Timberform	-Park Pacific	(888) 460-7275	www.parkpacific.com
Pole Tech	-Pole Tech	(800) 633-6733	www.poletech.com
LA Steel Craft Products	Ross Recreation	(707) 538-3800	
Partac Peat Corp.	Partac Peat Corp.	(800)247-2326	

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING:

- A. Coordinate construction timing with installation of site furnishings in conformance with other pertinent Sections of the Specifications.

3.2 INSTALLATION

- A. Site Furnishings: Install where shown on drawings, as detailed and per manufacturer instructions. All site furnishings shall be secured in a vandal resistant manner acceptable to the Architect.
- B. Sports Equipment: Install where shown on drawings, as detailed and per manufacturer instructions.
- C. Concrete Footings: Install footings with top of concrete sloped to drain at 1%. Install where shown on drawings and as detailed and per manufacturer's instructions.
- D. Sleeves: Install site furnishings, standards and posts into sleeves embedded into concrete bases for removal and replacement where indicated or detailed on drawings.

END OF SECTION 12 93 00

**SECTION 31 05 13
SOILS FOR EARTHWORK**

PART 1 GENERAL

1.1 SUMMARY

- A. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be a part of the contract documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.
- B. Related Sections:
 - 1. Section 31 22 13 - Rough Grading.
 - 2. Section 31 23 00 - Excavation and Fill.
 - 3. Section 31 23 23.13 - Backfill.
 - 4. Section 31 23 16.13 - Trenching.
 - 5. Section 32 12 16 - Asphalt Pavement.
 - 6. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

- A. The project Soils Report and any supplements to the Soils Report.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS

- A. Topsoil materials shall meet the requirements of Section 32 90 00 Planting.
- B. Class II Permeable Material shall meet the requirement of Caltrans Standard Specifications 68-1.025.

PART 3 EXECUTION

3.1 SOIL REMOVAL

- A. Conduct earthwork operations in accordance with the provisions of the Soils Report and any supplements to the Soils Report, and as directed by the Soils Engineer.

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END OF SECTION

**SECTION 31 10 00
SITE CLEARING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes removal of surface debris; removal of paving, curbs, sidewalks; removal of trees, shrubs, and other plant life; removal of underground storage tanks; and removal of abandoned utilities.
- B. Related Sections:
 - 1. Section 31 05 13 – Soils for Earthwork.
 - 2. Section 31 22 13 - Rough Grading.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that existing plant life designated to remain is tagged or identified.
- B. Removed materials are to be removed from the site and disposed of in a lawful manner.

3.2 PROTECTION

- A. Locate, identify, and protect utilities from damage that are to remain.
- B. Protect trees, plant growth, and features designated to remain.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs indicated and, in a manner, specified on the drawings or in these specifications. Remove tree and shrub root bulbs in their entirety and to a maximum root diameter of one inch.

3.4 REMOVAL

- A. Remove debris, rock, and extracted plant life from site to the limits indicated on the

drawings.

- B. Remove paving, curbs, and concrete from the site to the limits indicated on the drawings.
- C. Neatly saw cut edges at limits indicated for all pavement, curbs, and walkways to be removed.
- D. Excavate and remove any underground storage tanks and associated plumbing piping, as indicated on the drawings.

3.5 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Stockpile on site and protect from erosion.
- C. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

**SECTION 31 22 13
ROUGH GRADING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes removal of topsoil and cutting, grading, filling, rough contouring, and compacting as indicated on the drawings.
- B. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork.
 - 2. Section 31 10 00 - Site Clearing.
 - 3. Section 31 23 00 - Excavation and Fill.
 - 4. Section 31 23 16.13 - Trenching.
 - 5. Section 31 23 23.13 - Backfill.

1.2 REFERENCES

- A. The provisions of the project Soils Report and any supplements to the Soils Report shall be adhered to for rough grading of the site.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: as specified in Section 32 90 00 Planting.
- B. Other Fill Materials: shall adhere to the provisions of the project Soils Report and any supplements to the Soils Report.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 06 00 - Regulatory Requirements.
- B. Verify site conditions.
- C. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage utilities that are to remain.
- D. Notify affected utility companies to remove or relocate public utilities indicated on the plans to be removed or relocated by the utility company.
- E. Protect above and below grade utilities that are to remain.
- F. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- G. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 SOIL EXCAVATION

- A. Excavate soil from areas to be further excavated, relandscaped, or regraded. as shown on the drawings.
- B. When excavating through roots, for trees to remain, perform work by hand and cut roots with sharp axes.
- C. Remove excess soil from site.
- D. Benching Slopes: Horizontally bench existing slopes steeper than 1:4 (vertical: horizontal) to key placed fill material to slope to provide firm bearing as required by the Soils Report and any supplements to the Soils Report. Minimum horizontal bench shall be 2 feet wide.
- E. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 FILLING

- A. Install Work in accordance with the project Soils Report and any supplements to the Soils Report.
- B. Fill areas to contours and elevations with suitable materials.
- C. Place fill material on continuous layers and compact in accordance with the project Soils Report and any supplements to the Soils Report.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from buildings at a minimum slope of two (2%) percent unless noted otherwise.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Remove surplus fill materials from site.

3.5 TOLERANCES

- A. Section 01 40 00 - Quality Control Requirements.
- B. Top Surface of Subgrade: Plus, or minus 0.05 feet from required elevation on paved or walkway areas and zero (0) feet to minus 0.10 foot in building pad areas.

3.6 FIELD QUALITY CONTROL

- A. Testing and inspection shall be provided by the project soils engineer.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at the Contractor's sole expense.

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END OF SECTION

**SECTION 31 23 00
EXCAVATION AND FILL**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes excavating for building foundations, roads, parking areas, site grading, slabs-on-grade, landscaping areas, and for site structures.
- B. Related Sections:
 - 1. Section 31 05 13 – Soils for Earthwork.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 16.13 - Trenching.
 - 4. Section 31 23 23.13 - Backfill.

1.2 REFERENCES

- A. The project Soils Report and any supplements to the Soils Report.
- B. Local utility standards when working within 24 inches of the respective utility lines.

PART 2 PRODUCTS

- A. Bio-Retention Soils
 - 1. Permeable Class II Aggregate Base or crushed drain rock.
 - 2. Planting soil is 60% sand, 40% compost mix allowing 5"/hour percolation.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures.
- C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23.13 and 31 23 16.13.
- D. Slope banks with machine to angle of repose or less until shore.

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- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Grade top perimeter of excavating to prevent surface water from draining into excavation.
- G. Hand trim excavation. Remove loose matter.
- H. Remove lumped subsoils, boulders, and rock in accordance with the provisions of the Soils Report and any supplements to the Soils Report.
- I. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume Work.
- J. Correct areas over excavated with backfill and compact replacement as specified for authorized excavation.
- K. Remove excess excavated material from site.

3.3 FIELD QUALITY CONTROL

- A. The project Soils Engineer shall provide testing and inspection services.

3.4 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

**SECTION 31 23 16.13
TRENCHING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes excavating trenches for utilities from outside building to final connection point or public right-of-way or utility; compacted fill from top of utility bedding to subgrade elevations; and backfilling and compaction.
- B. Related Sections:
 - 1. Section 31 05 13 – Soils for Earthwork.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 00 - Excavation and Fill.
 - 4. Section 31 23 23.13 - Backfill.
 - 5. Section 33 40 00 – Storm Drainage Utilities.

1.2 REFERENCES

- A. The project Soils Report and any supplements to the Soils Report.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.5 COORDINATION

- A. Section 01 06 00 - Regulatory Requirements.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- C. Verify elevations of existing facilities prior to placing new Work.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Fill and Structural Fill shall be: As specified in the project Soils Report and any supplements to the Soils Report.

2.2 ACCESSORIES

- A. Filter Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tenax Corp., Tensar Earth Technologies, Inc. or equal.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Grades

1. Pipes shall be laid true to the lines and grades indicated.
2. The grade alignment of the pipe shall be maintained by the use of a string line parallel with the grade line vertically above the centerline of the pipe. This line shall be established on level batter boards at intervals of not more than 25 feet. Batter boards shall span the trench and be rigidly anchored to substantial posts driven into the ground on each side of the trench. Three adjacent batter boards must be set before laying pipe to provide a check on the grades and line. Elevation and position of the string line shall be determined from the elevation and position of offset points or stakes located along the pipe route. Pipe shall not be laid using side lines for line or grade.
3. As an alternative means of establishing alignment and grade, a "Laser-Beam" instrument may be utilized with a competent operator.

B. Location of Pipelines:

1. The location and approximate depths of the proposed pipe lines are shown on the Drawings.
2. An underground locate service shall be enlisted to discover the location of existing utilities regardless of if they are shown on the drawings.
3. The Architect/Engineer reserves the right to make changes in lines, grades, and depths of pipe lines and manholes when such changes are necessary.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- C. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities which are to remain.
- E. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATING

- A. Excavate subsoil required for utilities.
- B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock as directed by the Soils Engineer or other inspector.

- F. Correct over excavated areas with backfill and compact replacement as specified for authorized excavation.
- G. Stockpile excavated material on site. Remove excess material not being used from site.

3.4 TRENCHING

- A. Excavations:
 - 1. Excavation shall be dug so that the pipe can be laid and joined properly. The trench shall be made so that the pipe can be laid to the alignment and depth as shown on the Drawings, and it shall be excavated only so far in advance of pipe laying as permitted by the Architect/Engineer. The excavation shall not be more than two feet wider at the bottom than the outside diameter of the pipe or structure. If there is no interference with construction, or adjacent property, and if soil permits, the Contractor at his own expense shall be permitted to slope the side walls of the excavation starting at a point two (2) feet above the top of pipe.
 - 2. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on bedding material at every point between joints, except where pipe slings or other lifting tackles are withdrawn.
 - 3. Excavation Below Grade:
 - 1) Where excavation indicates that the subsurface materials at the bottom of the trench are in a loose or soft state, the Contractor shall be advised to excavate to a depth where suitable material is encountered, as directed by the Architect/Engineer.
 - 2) Where the bottom of the trench has been excavated by mistake to a greater depth than required, the Contractor shall refill this area using approved material. No additional compensation shall be given to the Contractor. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
 - 4. Excavation within 24 inches of existing utilities shall be governed by specifications of the Owner of the respective utility. The Contractor shall obtain these specifications and follow the same at no extra cost.
 - 5. Excavation and shoring shall adhere to the requirements and safety standards set by OSHA.
- B. Trenching in Advance of Pipe Laying: The trench for the pipe lines shall not be opened for a distance of more than 200 feet at any one time, unless authorized by the Architect/Engineer. At no time will the Contractor be permitted to leave more than 50 feet of trench open at the end of a working day. Adequate protection of open trench shall be provided by the Contractor, and the Contractor shall be responsible, therefore.

3.5 SHEETING AND BRACING

- A. General:
 - 1. Sheeting and bracing of all excavations shall conform to the latest statutes of the State of California governing safety of workers in the construction industry. When necessary, in the opinion of the Contractor, adequate sheeting and bracing shall be installed to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines and utilities. Any damage due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired at the

- Contractor's expense.
2. Sides of trenches in unsuitable, loose or soft material, five feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect employees working within them.

B. Sheeting Requirements:

3. Where excavations are made with vertical sides which require supporting, the sheeting and bracing shall be of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the Work, or adjacent structures, or diminish the working space sufficiently to delay the Work. Special precautions shall be taken where there is additional pressure due to the presence of other structures.
4. It shall be the Contractor's responsibility to select sheeting and bracing of sufficient dimensions and strength and type to adequately support the sides of trenches and excavations.
5. Sheeting and bracing shall be removed before the completion of the Work.

3.6 BACKFILLING

- A. Backfill trenches to contours and elevations shown on the drawings.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.
- C. Fill materials shall be as specified in the Soils Report and any supplements to the Soils Report.
- D. Employ a placement method that does not disturb or damage utilities in trench. Jetting of backfill materials to achieve compaction shall not be permitted.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Remove surplus fill materials from site.

3.7 TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Top Surface of Backfilling Under Paved Areas: Plus, or minus 0.05 feet from required elevations.
- C. Top Surface of General Backfilling: Plus, or minus 1/10 feet from required elevations.

3.8 FIELD QUALITY CONTROL

- A. Compaction testing will be performed by the project Soils Engineer.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements.

- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

**SECTION 31 23 23.13
BACKFILL**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building perimeter and site structure, filling and backfilling to subgrade elevations; fill under slabs-on-grade, paving; fill for over-excavation; consolidation and compaction as specified in the Soils Report and any supplements to the Soils Report.
- B. Related Sections:
 - 1. Section 31 05 13 – Soils for Earthwork.
 - 2. Section 31 23 00 - Excavation and Fill.
 - 3. Section 31 23 16.13 - Trenching.
 - 4. Section 32 96 00 – Landscape Planting.
 - 5. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- A. The project Soils Report and any supplements to the Soils Report.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Fill and Structural Fill as specified in the Soils Report and any supplements to the Soils Report.

2.2 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tensar Earth Technologies, Inc. or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 06 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify structural ability of unsupported walls to support loads imposed by the fill.

3.2 PREPARATION

- A. Compact subgrades to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact

to density equal to or greater than requirements for subsequent fill material.

- C. Roll subgrade surface to identify soft spots, fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations shown on drawings.
- B. Employ a placement method that does not disturb or damage other work.
- C. Maintain optimum moisture content of backfill materials to attain required compaction density.
- D. Backfill against supported walls and structures. Do not backfill against unsupported walls or structures.
- E. Backfill simultaneously on each side of unsupported walls and structures until supports are in place.
- F. Slope grade away from building at a minimum slope of two (2%) percent, unless noted otherwise.
- G. Make gradual grade changes. Blend slope into level areas.
- H. Remove surplus backfill materials from site.

3.4 TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Top Surface of Backfilling Under Paved Areas: Plus, or minus 0.05 feet from required elevations.
- C. Top Surface of General Backfilling: Plus, or minus 1/10 feet from required elevations.

3.5 FIELD QUALITY CONTROL

- A. The project Soils Engineer shall provide testing and inspection services.

3.6 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

**SECTION 31 23 23.14
CONTROLLED LOW STRENGTH MATERIAL**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes material for use in trench backfill where conditions require controlled density fill.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, general and supplementary conditions and Division 1 Specification Sections apply to this Section.
- B. Related Sections
 1. Section 31 23 16 13 – Trenching
 2. Section 31 23 23.13 – Backfill
 3. Section 32 11 23 – Aggregate Base Course
 4. Divisions 14, 15 and 16, as applies to excavating, trenching and backfill.

1.3 REFERENCES

- A. ASTM C-33
- B. ASTM C-231
- C. ASTM C-150, Type II
- D. ASTM C-260
- E. ASTM C-618, Class F
- F. California Building Code Section 1806A.11 – Pipes and Trenches.
- G. Soils Report

1.4 SUBMITTALS

- A. Refer to Section 01 34 00 for submittal procedures.
- B. Contractor shall submit concrete, mortar and grout mix designs, recent test data for submitted mixes, and test data for mix components confirming that the mixes meet the requirements of this section.

PART 2 GENERAL

2.1 COMPONENTS

- A. Controlled Low Strength Material (CLSM) mix shall be composed of a cementitious material, water, fine and coarse aggregate, and an admixture.

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- B. The cementitious materials shall be Portland cement in combination with fly ash.
- C. The admixture shall be an air-entraining agent.
- D. The proportions of all material used in the CLSM shall conform to the mix design.
- E. CLSM shall have an unconfined compressive 28-day strength from 50 psi to a maximum of 150 psi. CLSM with a 28-day compressive strength in excess of 200 psi shall be removed and replaced by the contractor as directed by the Engineer/IOR at no cost to the School District.
- F. CLSM shall have a minimum set time of 24 hours.

2.2 AGGREGATE CONTENT

- A. Aggregate need not conform to ASTM C-33. Any aggregates which produce performance characteristics of the CLSM may be submitted for approval.
- B. CLSM mixture shall contain no aggregate that is larger than 3/8 inch.
- C. The amount of material passing No. 200 sieve shall not exceed 12.0 percent.
- D. No plastic fines shall be present.

2.3 AIR CONTENT

- A. The air content by volume based on measurement immediately after discharge from the mixer shall be determined by ASTM C-231.
- B. The total calculated air content of the sample prepared in accordance with ASTM C-231 shall not exceed 6.0 percent.

2.4 COMPONENT MATERIALS

<u>Material</u>	<u>Weight</u>	<u>Sp. Gr.</u>	<u>Abs. Vol.</u>
Cement	30 lb	3.15	0.152
Fly Ash	300 lb	2.30	2.09
Water	317 lb	1.00	5.08
Course Aggregate	1645 lb	2.68	8.76
Fine Aggregate	1465 lb	2.68	9.835
Admixture	4 oz	===	1.08
Total	3757 lb	===	27.0 cu ft

2.5 COMPONENT STANDARDS

- A. Cement shall conform to ASTM C-150, Type II

- B. Fly Ash shall conform to ASTM C-618, Class F. The fly ash shall not inhibit the entrainment of air.
- C. Air entrainment admixture shall conform to ASTM C-260.
- D. Aggregates:
 - 1. Fine aggregate: #1 concrete sand.
 - 2. Course aggregate: #2 concrete sand – 3/8 pea gravel.
- E. Water shall conform to California State Specifications 90-2.03.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 1 – Administrative Requirements: Coordination and project conditions.
- B. Verify trench is ready to receive work.

3.2 DELIVERY TO SITE

- A. Provide the Engineer/IOR with delivery tickets for each truck load that show the CLSM mix, the batch quantity and time batched.

3.3 BATCHING, MIXING AND DELIVERING

- A. CLSM shall be batched at a Ready-Mix Concrete Plant and delivered to the job site by means of transit mixing trucks.

3.4 INSTALLATION

- A. CLSM shall be discharged from transit mix trucks by any reasonable means into the excavation to be backfilled.
- B. The CLSM shall be brought uniformly to the elevation of the:
 - 1. Underside of subgrade or asphalt concrete pavement.
 - 2. Underside of structural concrete.

3.5 FIELD QUALITY CONTROL

- A. The project Soils Engineer shall provide testing and inspection services.
- B. No equipment or traffic shall be allowed on the CLSM until the surface of the CLSM will withstand the weight of the equipment or traffic without damage or displacement.
- C. To prevent damage or displacement in traffic areas, provide steel plates that will span the trench until such time as the CLSM has obtained sufficient strength to support equipment and traffic loads.

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3.6 FORMING

- A. Forms shall conform to the requirements of Section 51 of Caltrans Standard Specifications, July 92 edition.

END OF SECTION

**SECTION 32 11 23
AGGREGATE BASE COURSE**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes aggregate base course.
- B. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 23.13 - Backfill.
 - 4. Section 31 23 16.13 - Trenching.
 - 5. Section 32 12 16 - Asphalt Pavement.
 - 6. Section 32 13 13 - Concrete Paving.
 - 7. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Class II Aggregate Base per Caltrans Standard Specifications, or Local Municipality.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify substrate has been inspected, gradients and elevations are correct and is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Place aggregate in maximum 6-inch layers and compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Compaction testing will be performed in accordance with ASTM D1557.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes asphaltic concrete paving, wearing, binder and base course; surface sealer; and aggregate base course.
- B. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork.
 - 2. Section 31 22 13 - Rough Grading: Preparation of site for paving and base.
 - 3. Section 31 23 23.13 - Backfill: Compacted subbase for paving.
 - 4. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

- A. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- B. ASTM D3381 - Viscosity Graded Asphalt Cement for Use in Pavement Construction.
- C. TAI - (The Asphalt Institute) - MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
- D. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual.
- E. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual.
- F. TAI - (The Asphalt Institute) - MS-19 Basic Asphalt Emulsion Manual, Section 8-7.

1.3 SUBMITTALS

- A. Product Data: Submit product information and mix design.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with The Asphalt Institute.
- B. Mixing Plant: Conform to The Asphalt Institute.
- C. Obtain materials from the same source throughout.
- D. Maintain one copy of each document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Asphalt Pavement: In accordance with The Asphalt Institute.

2.2 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 45 23 - Quality Control: Testing and Inspection Services: Provide mix design for asphalt.
- B. Submit proposed mix design for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify compacted granular base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

- A. Section 32 11 23 - Aggregate Base Course forms the base construction for Work of this section.

3.3 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with The Asphalt Institute.
- B. Apply tack coat to contact surfaces of curbs and gutters.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat on these surfaces.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with The Asphalt Institute.

3.6 PLACING FOG SEAL

3.7 CURBS

- A. Install extruded asphalt curbs of profile as indicated on drawings.

3.8 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from True Elevation: Within 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services
Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Immediately after placement, protect pavement from mechanical injury for 24 hours or until surface temperature is less than 140 degrees F.

3.11 SCHEDULES

A. Pavement sections for various locations and uses are to be as shown on the drawings.

END OF SECTION

SECTION 32 13 13 – CONCRETE PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.
- C. Specification Division 31, Earthwork, Soils and Earthwork, Rough Grading, and Excavation and Fill.
- D. Specification 32 11 23 Aggregate Base Course.

1.2 DESCRIPTION OF WORK:

- A. The extent of concrete work is shown on the landscape architectural drawings and details and shall include, but is not limited to, pedestrian concrete walkways, steps, ramps, curbs, mow bands, footings and walls.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - 2. ACI 318 Building Code Requirements for Structural Concrete.
 - 3. ASTM C150, for Type I, Type II or Type III Portland cement concrete.
 - 4. Chapter 19A, 2022 C.B.C.
- B. Certification: Weighmaster Certificate
- C. Duties of the Inspector: The inspector shall notify the Architect, Structural Engineer and the Division of State Architect at least 48 hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours. Comply with Section 4-333.1 and Chapter 7, Part I, Title 24, California Code of Regulations (CCR).
- D. Installer Qualifications:
 - 1. Experience: The concrete installing firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district

construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.

2. Licensure: The concrete installation firm shall hold a current, active C8 "Concrete Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
 3. Supervision: The concrete installing firm shall have a qualified and experienced concrete technician on site during concrete installation.
- E. "Colored" Concrete Installer Qualifications: Installer of "colored" concrete shall be qualified by Scofield. Contact local Scofield Representative or the Division Office (323) 720-3055 for a list of locally qualified installers.

1.4 SUBMITTALS:

- A. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- B. Design Mixes Submit written reports of design mixes to the Architect of each proposed mix for each class of concrete within thirty-five (35) days after the issuance of the "Notice to Proceed", but no later than ten (10) days prior to the first scheduled concrete pour. Do not begin concrete production until all design mixes have been reviewed by the Architect and independent testing facility.

Separate submittal data shall be submitted for each mixture for the following:

- 1) Concrete Paving – Pedestrian, steps, curbs, walls and footings.
 - 2) Concrete Paving – Vehicular.
- C. Job-site Samples: Contractor shall pour concrete samples as indicated below for each concrete color and finish specified on Drawings for written approval from Owner's Representative prior to installation as follows:
1. Two (2) foot by two (2) foot concrete flatwork.
 2. Two linear feet by width and height detailed for each concrete wall specified to include decorative tile if specified.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments.
- D. Expansion Joint for flatwork that does not have a stamp pattern: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.
- E. Expansion Joint for poured-in-place walls: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

2.2 REINFORCING MATERIALS:

- A. Reinforcing Bars (Rebar): ASTM A 615/A615M-22, Grade 60, deformed, except #3 and smaller may be Grade 40. Test in accordance with Section 1903A and 1910A.2, 2022 C.B.C., and conform to ACI 318-19.
- B. Supports for Reinforcement: Provide support for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type V, conforming to ACI 318-19 and test in accordance with Section 1903A, 2022 C.B.C.
- B. Fly Ash or other pozzolan can be used as a partial substitute for ASTM 150 Portland cement as follows:
 - 1. Fly Ash conforming to ASTM C618, Class F, the maximum Loss on Ignition (LOI) shall be less than 3%. Class C is not permitted.
 - 2. Slag, Ground Granulated Blast Furnace Slag Cement (GGBFS) shall conform to ASTM C989 or AASHTO M 302 Grade 100 or 120.
 - 3. Silica Fume: ASTM C1240, Standard Specification for Silica Fume used in cementitious mixtures.
 - 4. High-Reactivity Metakaolin (HRM): ASTM C618, aluminosilicate pozzolan.
- C. Water: Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement and shall be tested and verified through ASTM C1602.
- D. Admixtures: Admixtures certified by manufacturers to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with

other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

1. Air-Entraining Admixture: ASTM C 260.
 2. Water-Reducing Admixture: ANSI/ASTM C 494, Type A, and contain not more than 1% chloride ions.
 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F
 4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E
 5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D
- E. Crushed Aggregate Base Rock: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to current requirements of ASTM C33. Crusher-run stone or bank-run gravel will not be permitted.
- F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C-309, Type I, Class A unless other type acceptable to Architect. Comply with Volatile Organic Compounds (VOC) content limits, as required by Air Pollution Control Regulations on Architectural Coatings (less than 350 g/l).
- G. Curing Methods:
1. Moist Curing: continuous misting, sprinkling or ponding.
 2. Moisture-retaining cover curing: After wetting the concrete surface, cover with wet-curing blanket. Lay blanket in accordance with manufacturer's instructions, overlapping edges and extending edges twelve (12) inches beyond area of concrete to be cured. Remove air pockets. Repair any holes or tears that occur using sheeting material and waterproof tape.
 3. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Use as recommended by the manufacturer's written instructions.
- H. Color Materials:
1. Liquid lamp black shall be defaulting color for concrete not specified on drawings as "Natural" or "Colored". Add one pint of liquid lamp black per cubic yard of exterior concrete.
 2. Concrete specified as "Natural" shall have no color added.
 3. Concrete specified as "Colored" shall be LM Scofield Systems Chromix Admixtures for Color-Conditioned Concrete and/or Scofield Integral Color SG Standard Grade, to include Standard Colors, Custom Colors and Special-Order Colors for all concrete specified on drawing as "colored". Colored concrete shall be sealed per manufacturer with LM Scofield Cure seal-W with matte gloss finish, LM Scofield Cureseal-100 with glossy, wet-look, LM Scofield Lith chrome Color wax concrete curing compound or equal as selected by Architect or Owner's Representative. Contractor shall pour samples on site as necessary for architect and/or owner's representative to select final color(s) for project.

2.4 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete. Use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Comply with Section ACI 318-14. The compressive strength of concrete shall be proportioned by one of the following methods: Design Mix (Method B) or Pre-Test Mix (Method C).
- C. Submit written reports to Architect of each proposed mix for each class of concrete at least 10 days prior to the first scheduled concrete pour. Do not begin concrete production until mixes have been reviewed by Architect.
- D. Design mixes to provide normal weight concrete with the following properties:
 - 1. Concrete Paving – Pedestrian, steps, curbs, walls and footings:
 - a. 3,000 psi 28-day compressive strength
 - b. 0.60, maximum, water to cement (W/C) ratio
 - c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
 - d. Aggregate to be 1” maximum.
 - e. 28-day shrinkage, SEAONC Method: 0.050 maximum.
 - 2. Concrete Paving – Vehicular:
 - a. 4,000 psi 28-day compressive strength
 - b. 0.50, maximum, water to cement (W/C) ratio
 - c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
 - d. Aggregate to be 1” maximum.
 - e. 28-day shrinkage, SEAONC Method: 0.050 maximum.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Architect before using in work.
- F. Admixtures: Use only as indicated by approved design mix.
- G. Color Additive for concrete not specified as “colored”: add one pint of liquid lamp black per cubic yard of all exterior concrete which will be visible when cured.
- H. Color for concrete specified as “colored”: Color mixture as determined by manufacturer in accordance with color selected and sealed per manufacturer recommendations.
- I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

All concrete: Shall be four (4) inches, plus or minus one (1) inch.

2.5 CONCRETE MIXES:

Ready-Mix Concrete: Comply with ASTM C94. Measure, batch and mix concrete materials and concrete according to ASTM C-94. Furnish batch certificates, indicating project identification, name and number, date, mixture type, mixing time, quantity and amount of water added for each batch discharged and used in the Work to the Architect.

2.6 SACK FINISH MORTAR

- A. Mortar shall be composed of Portland cement, sand, and water proportioned and mixed as specified in this Section 51-1.135.
- B. Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions or shown on the plans.
- C. The proportion of cement to sand, measured by volume, shall be one to two (1:2) unless otherwise specified.
- D. Materials shall conform to the provisions in Section 90, "Portland Cement Concrete."
- E. The maximum size of sand shall not be larger than 0.5 of the size of the recess, hole or space where the mortar is to be placed.
- F. The mortar shall contain only enough water to permit placing and packing.
- G. Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent a bond between the mortar and the concrete surfaces and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing the mortar.
- H. The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other specified locations. After placing, all surfaces of mortar shall be cured by the water method as provided in Section 90-7, "Curing Concrete," for a period of not less than 3 days.
- I. Keyways, spaces between structural members, holes, spaces under structural members and other locations where mortar could escape shall be mortar-tight before placing mortar.
- J. No load shall be allowed on the mortar that has been in place less than 72 hours, unless otherwise permitted by the Engineer.
- K. All improperly cured or otherwise defective mortars shall be removed and replaced by the Contractor at the Contractor's expense.

2.7 WATERPROOF MEMBRANE:

Rolled, self-adhering waterproof membrane, composed of nominally 56-millimeter-thick layer of polymeric waterproofing membrane on a heavy duty, four-millimeter thick, cross-laminated polyethylene carrier film laminated together, MEL-ROL, product of W. R. Meadows/Sea Tight, or equal conforming to A.R.E.M.A. Specifications Chapter 29, Waterproofing.

PART 3 - EXECUTION

3.1 FORMS:

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Form removal shall comply with ACI 318 Section 26.11.2.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items build into forms. Comply with ACI 318 Section 26.11.2.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during

concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- E. Where concrete is installed at door thresholds and/or transitions to building interior spaces, 24" length, #3 smooth rebar dowels shall be installed 12" into the new concrete paving and 12" into the adjacent building structure, spaced at 18" on center with a minimum of two in each location. Epoxy to secure end of dowel set into building and lubricate end cast into new concrete paving.
- F. Where concrete is installed at door thresholds of modular buildings with steel framing, #5 rebar shall be welded securely to building floor plate, extending 12" into new concrete paving, spaced 18" on center with a minimum of two at each door threshold. Lubricate end cast into new concrete paving.
- G. Where concrete is installed adjacent to concrete walkways that are part of the building structural pad, 24" length, #3 smooth rebar dowels shall be installed 12" into the new concrete paving and 12" into the adjacent building structure pad, spaced at 18" on center spacing. Epoxy to secure end of dowel set into building structural pad and lubricate end cast into new concrete paving.

3.3 EXPANSION AND CONTROL JOINTS:

- A. Locate and install joints so as not to impair strength and appearance of the structure, and as acceptable to Architect.
- B. Continue reinforcement across expansion and control joints or install smooth rebar dowels.
- C. Control/score joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in two perpendicular directions, continuous and one third the depth of the slab.
- D. Control/score joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in on center. Align vertical wall score joints with horizontal paving joints whenever possible. Install ½" radius or chamfered edge at each side of joint as called for in drawings, continuous and 1 ½" in depth.
- E. Expansion Joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install expansions joints where walkways meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Install ½" asphalt saturated felt expansion joint material ¼" below the finish surface and continuously throughout the full depth of slab.
- F. Expansion Joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install expansions joints where walls meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Align vertical wall expansion joints horizontal paving joints whenever possible. Install ½" asphalt saturated felt expansion joint material ½" below the finish surface where ½" radius concrete edges are indicated and flush with base of chamfer were chamfer edges are indicated and continuously throughout the concrete section. Install ½" radius or chamfered edge at each side of joint as called for in drawings.

3.4 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strongly to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.5 PREPARATION OF FORM SURFACES:

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

3.6 CONCRETE PLACEMENT:

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in, in accordance with ACI 318-08. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Coordinate the installation of joint materials with placement of forms and reinforcing steel.
- C. General: Comply with ACI 304, and as herein specified.
- D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" in to preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction (expansion) joints, until the placing of a panel or section is completed.

- I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- K. Maintain reinforcing in proper position during concrete placement operations.
- L. Cold Weather Placing: Do not place concrete when air temperature is below 40 degrees F. or expected to fall below within 24 hours. Comply with ACI 306.
- M. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.
- N. Concrete flatwork over-pour: Over-pour is excess concrete spilling beyond the limits of the concrete forms. Contractors shall remove over-pour to allow for installation of tree root barriers, irrigation and similar landscape improvements.

3.7 FINISH OF FORMED SURFACES:

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture impaired by form facing material used, with tie holes and defective areas repaired and patched and fine and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. For "as-cast" concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams, repair and patch defective areas with fins or other projections completely removed and smoothed
- C. Related Unformed Surfaces: At tops of walls, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off smoothly and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 CONCRETE EXTERIOR FLATWORK FINISHES:

- A. Float Finish: Apply float finish to concrete slab surfaces to receive trowel finish and other finishes as hereinafter specified.
- B. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

- C. Round top edges of all exposed slabs, nosing, etc. with 3/8" radius edging tool, unless chamfered or otherwise noted.
- D. Non-Slip Broom Finish (NSBrm-Fn): Unless specified otherwise, apply non-slip broom finish to exterior concrete walks, platforms, steps and ramps, and elsewhere as indicated. Slopes less than 6% shall have a medium broom finish. Slopes 6% and greater shall be heavy broom slip resistant. Concrete finish to be stable, firm and slip resistant per CBC Section 11B-302 and 11B-403.
- E. Immediately after the trowel finishing, slightly roughen the concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with ACI 305R-10, Guide to Hot Weather Concreting.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days and above 50 deg. F.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and/or by combinations thereof, at contractor's option except as noted during hot weather.
- E. Cold Weather Requirements: Protect concrete from freezing conditions during the first seven (7) days after placement.
- F. Hot Weather Requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.10 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.11 RE-USE OF FORMS:

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

- B. When forms are extended for successive concrete placements, thoroughly clean surfaces remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.12 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
- C. Equipment and Enclosure Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Owner's Representative.
- B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, damp with water and brush-coat the area to be patched with a specified bonding agent. Place patching mortar, colored to match surrounding surfaces after bonding compound has dried. Surfaces exposed-to-view shall be sacked with colored mortar as directed by the Owner's Representative.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of Owner's Representative. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.
- D. Flush out from tie holes, fill with dry pack mortar.
- E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
- G. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate

reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions. The color of repair shall match surrounding surface color.

- H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing them with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Owner's Representative.
- J. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

3.14 WATERPROOFING SITE RETAINING WALLS:

- A. Contractor shall apply waterproof membrane to site retaining walls. Membrane shall continuously cover the surface in contact with soil, vertically from the footing to 2" above the finished grade level of the soil retained.
- B. Prepare surface as recommended by manufacturers by filling cracks, priming, filling joint and voids, penetrations and corners.
- C. Apply waterproof membrane as recommended by manufacturer.

3.15 SACK FINISH WALLS, STEP SEATING AND CURBS

- A. Sack finish shall consist of filling holes or depressions in the surface of the concrete, repairing all rock pockets, removing fins, and removing stains and discolorations visible from traveled ways. Sack finish, unless otherwise specified, shall be considered as a final finish where designated on the plans and details.
- B. Except as provided herein, form bolts and any metal placed for the convenience of the Contractor shall be removed to a depth of at least one inch below the surface of the concrete. All rock pockets and other unsound concrete shall be removed. The resulting holes or depressions shall be cleaned and filled with mortar. Form bolts projecting into the cells of box girders need not be removed unless deck forms are removed from the cells, in which case the bolts shall be removed flush with the surface of the concrete.
- C. Mortar used to fill bolt holes shall conform to the provisions in this Section for "Mortar." Other depressions and pockets shall be filled with packed mortar as directed by the Architect and the mortar shall be cured in conformance with the provisions in this Section.
- D. For exposed surfaces, integral concrete color (LM Scofield Chromix) cement shall be added to the mortar in an amount sufficient to result in a patch which, when dry, matches the surrounding concrete.
- E. If rock pockets, in the opinion of the Architect, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, the Architect may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. The Owner will employ a testing laboratory to perform other tests and to submit test reports.
- B. Reinforcing steel shall be supplied with heat number and mill analysis per ACI 318-89.
- C. Shrinkage Limitation: All concrete shall meet drying shrinkage limitations as follows:
- D. 0.032 percent at age 21 days, with tolerance of +25% for specimens taken during the course of the work.
- E. The use of aggregates with a proven history of compliance with the above limitations will be accepted as fulfilling this requirement. In the absence of satisfactory evidence, the laboratory shall prepare specimens (4" x 4" prisms 10" gage length, ASTM C-157-64T) and test for compliance prior to approval.

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SECTION 32 14 40

STONE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. The extent of work in this Section includes the provision and installation of the following paving materials, base foundations and appurtenances required for installation.
- B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:
 - 1. Boulders.
 - 2. Blue Fines
 - 3. Decomposed Granite.
 - 4. Stone Apron.
- C. Concrete for perimeter curbs is specified in Section 32 13 13.1 Concrete Work (Landscape).

1.3 QUALITY ASSURANCE:

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Protect from damage and intrusion of deleterious materials during delivery, handling, storage, and installation.

1.4 SUBMITTALS:

- A. Contractor shall submit a 1 quart sample indicating variation of size and color of stone paving to be installed.
- B. Contractor shall submit product data for boulders to be installed.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Store stone paving material in a secure location. Coordinate with General Contractor for available stockpile location.

1.6 PROJECT CONDITIONS:

- A. Protection of Work: Protect work from trespass until unstable surfaces have cured.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Boulders: Milky Way Boulder, size per plan, available from Quality Rock.
 - 1. Quality Rock Sales Rep: Mike McPhee
 - 2. Address: 17201 CA-120, Oakdale, CA 95361
 - 3. Office Phone: (209) 847-3370
 - 4. Cell: (209) 606-2547
 - 5. Email: rckman1@hughes.net
 - 6. Website: www.quality-rock.com
- B. Blue Fines: Blue Fines to be ¼" minus blue fines, a product of diabase stone, available from Lyngso Garden at (650) 364-1730, www.lyngsogarden.com.

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- C. Decomposed Granite: Shall be California Gold fines, or equal, gold color and shall consist of crushed aggregate screenings free from clay lumps, vegetable matter and deleterious material. The portion retained on the No. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96-77. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81 and AASHTO T90-81. California Gold Decomposed granite available from Felton Quarry at (408) 335-3445.
- D. Stone Apron: Gravel shall be Black La Paz Pebbles, 3" to 5" diameter in size, black in color available from Lyngso Garden (650) 364-1730, www.lyngsogarden.com.
- E. Weed block – Dimension 2EW or approved equal.
- F. Filter Fabric: Mirafi 140N geotextile fabric.
- G. Aggregate base: Class II conforming to aggregate base course specifications.
- H. Metal Edging shall be Duraedge Landscape Edging by JD Russell Company, 1/8" thick, 4" wide by 16' length, hot-rolled, standard flexible carbon steel landscape edging, fabricated in sections with stake pockets stamped, punched or welded to face of sections approximately 30" apart to receive stakes and double stakes at over-lap joints conforming to ASTM A 569. Painted finish to be Sherwin Williams H68GT85 powder coat paint electrostatically applied and oven baked, 1.5 mils thickness, brown in color. Contractor shall use corresponding steel stakes, 14" in length and finished to match edging. Contact JD Russell Company at (800) 888-7425.
- I. Landscape Edgings: Redwood header shall be construction heart redwood lumber, size per detail. Wood support stakes to be 2" by 2" by 16" length, nominal size. Use galvanized nails sized so as not to split wood and quantity as required to anchor edging securely in place.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Boulders:

1. Install as detailed on Drawings. Obtain approval from owner's representative for placement and orientation of boulders prior to backfilling and installing adjacent paved surfaces.

B. Blue fines:

1. Prepare and compact subgrade to 95% relative density.
2. Install and compact crushed aggregate base rock to a 95% relative density.
3. Mix Blue Fines with clean water to an oatmeal consistency so that it is spreadable, but not muddy.
4. Spread wetted Blue Fines in 3" to 4" thickness as indicated on plans and/or details.
5. Compact to 90% relative density after grading and wetting final lift.
6. Finish Blue Fines to a smooth, uniform plane, flush with adjacent finish grade elevations and fine mist spraying surface for compaction.

C. Decomposed granite:

1. Grade and compact subgrade to 95% relative density.
2. Apply soil sterilizer per manufacturer recommendations.
3. Prepare aggregate base material per plans and/or details and compact to 95% relative density.
4. Blending organic soil binder with decomposed granite:
 - a. Blend 12 to 16 pounds (confirm with manufacturer for exact blend for particular application) of soil binder per 1-ton of decomposed granite or crushed 3/8" or 1/4" minus aggregate screenings.

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- b. Thoroughly and uniformly mix soil binder throughout decomposed granite or crushed 3/8" or 1/4" minus aggregate screenings.
 - c. Bucket blending is not acceptable. Blending with a rake and/or shovel is not acceptable.
 - d. Blend material dry. Water will make material hard.
 5. Install decomposed granite fines to a minimum depth of four inches, unless shown otherwise on details and drawings.
 6. Install material in two-inch lifts.
 7. Thoroughly water to compact each lift until the entire depth is moist.
 8. Compact to 90% relative density after grading and wetting final lift.
 9. Allow material to dry, then spike and mat drag to obtain the desired finish.
 10. Note that precise grading is critical and is best accomplished with laser-equipped machinery.
 11. At end of landscape maintenance period, re-apply decomposed granite to areas that have settled and smooth surface to uniform plane, flush with adjacent finish grade elevations.
- D. Stone Apron:
1. Excavate and compact subgrade to 95% relative density.
 2. Install metal edging 18" clear of building wall as detailed.
 3. Install pebbles to uniform, even plane surface to top of metal edging.
 4. Water to compact.
- E. Metal Edging:
1. Install as shown on drawings and according to manufacturer's recommendations.

2. Anchor with steel stakes spaced approximately 30 inches on center spacing, driven below top elevation of edging at every stake pocket location into solid, soil.
3. Install straight sections true to the alignments as indicated, free of waves or bends, using strings as guides. Install curved sections true to the alignments as indicated, free of waves or bends.
4. Install plumb and vertical, parallel with finished grade.
5. Replace edging sections damaged by construction operations.

F. Landscape Edging:

1. Layout perimeter edging as shown on drawing with smooth, continuous transitions horizontally and vertically.
2. Where landscape edging contacts adjacent paved surface, top of edging shall terminate flush with top of adjacent paving material.
3. Top of landscape edging shall be installed $\frac{1}{2}$ " above finish grade in turf areas, 1" above finish grade in shrub planting areas and flush with surface of decomposed granite fines and rock or gravel paving materials.
4. Install per detail on drawings.

G. Weed block

1. Apply herbicide per manufacturer recommendations. Verify and comply with Owner's Representative for security measures and posting requirements.

H. Filter Fabric:

1. Lay fabric flat without wrinkles. Overlap edges by 12". Neatly cut to fit area to receive rock. Hold in place using landscape fabric staples.

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SECTION 32 15 40
CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of work includes the provision and installation of crushed stone or decomposed granite paving.

1.3 QUALITY ASSURANCE

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Protect material from damage and intrusion of deleterious materials during delivery, handling storage and installation.

1.4 SUBMITTALS:

- A. Contractor shall submit a one (1) quart sample indicating variation of size and color of stone paving to be installed only when specified product is being substituted as an equal.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Store paving material in a secure location. Coordinate with General Contractor for available stockpile location.

1.6 PROJECT CONDITIONS:

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- A. Protection of Work: Protect work from trespass until paving is compacted and ready for use.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Decomposed Granite:

1. Decomposed Granite Paving, California Gold Fines or equal: Shall be gold color and shall consist of crushed aggregate screenings free from clay lumps, vegetable matter and deleterious material. The portion retained on the No. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96-77. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81 and AASHTO T90-81. California Gold Decomposed granite available from Felton Quarry at (408) 335-3445.
2. Decomposed Granite Paving, Blue Fines or equal: Shall be Blue Fines, ½" minus or ¼" minus (depending on availability) or approved equal, blue-gray color and shall consist of crushed aggregate screenings free from clay lumps, vegetable matter and deleterious material, available from Lyngso Garden Materials, Inc., www.lyngsogarden.com, (650) 364-1730.

- B. Weed Barrier Fabric:

1. Marafi 140N (or approved equal) nonwoven geotextile composed of polypropylene fibers, inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids, meeting AASHTO M288 Class 3 for Elongation > 50. Apparent opening size (AOS) 70 US sieve (0.212 mm) minimum average per role per ASTM D4751, flow rate of 135 gal/min/ft² (5500 l/min/m²), and UV Resistance (at 500 hours) of 70% strength retained per ASTM D4355.

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- a. Staples: Shall be 6-inch 11-gauge galvanized steel standard landscape fabric garden staples, available through www.sandbaggy.com or equal.
- C. Pre-emergent:
1. Ronstar-G available from Horizon Distributors, Inc., www.horizononline.com.
- D. Redwood Headerboard:
1. Redwood header shall be construction heart redwood lumber, size per detail. Wood support stakes to be 1" by 2" by 16" length, nominal size. Use galvanized nails sized so as not to split wood and quantity as required to anchor edging securely in place.
- E. Stabilizer Binder:
1. Natural, organic, concentrated powder, and shall be non-toxic, non-staining, colorless, odorless, environmentally safe, derived from crushed seed hulls, manufactured for the purpose of binding decomposed granite or crushed 3/8" or 1/4" minus aggregate. Stabilizer Binder is available from:
 - a. Stabilizer Solutions, Inc., phone (602) 225-5900. www.StabilizerSolutions.com, contact Peter Herrera, Supplyside Products, supplysideog@gmail.com.
 - b. Pleasanton Trucking, phone (925) 260-0496, contact Tom Bonnell.
 - c. TMT Enterprises, Inc., phone (408) 432-9040, www.tmtenterprises.net.

PART 3 - EXECUTION

3.1 BLENDING STABILIZER BINDER AND DECOMPOSED GRANITE:

- A. Blend Stabilizer Binder:
1. Stabilizer binder must be thoroughly pre-mixed with decomposed aggregate at the approximate rate of 15 pounds of stabilizer binder per 1 ton of aggregate.

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Verify with stabilizer binder manufacturer for exact stabilizer rate for specific material, climate and project conditions. Drop spreading of stabilizer binder over pre-placed aggregate or mixing by rototilling is not acceptable. Stabilizer binder shall be mechanically pre-mixed per manufacturer's recommendations using an approved mechanical blending unit to adequately blend stabilizer with aggregate (Bucket blending is not an approved blending apparatus). Always blend dry stabilizer and dry aggregate.

3.2 BASE PREPARATION:

A. Subgrade: Prepare in accordance with geotechnical engineer recommendations and as detailed on Drawings.

1. Do not install decomposed granite during rainy conditions or below 40 degrees Fahrenheit and falling.
2. Prepare subgrade and baserock per Drawings, compact to 95% relative density (unless indicated otherwise on Drawings).
3. Install rigid edging, concrete or redwood header per Drawings.
 - a. Layout perimeter edging as shown on drawing with smooth, continuous transitions horizontally and vertically.
 - b. Where landscape edging contacts adjacent paved surface, top of edging shall terminate flush with top of adjacent paving material.
 - c. Top of landscape edging shall be installed ½" above finish grade in turf areas, 1" above finish grade in shrub planting areas and flush with surface of decomposed granite fines.
 - d. Pre-emergent:

B. Pre-emergent:

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1. Mix and apply soil pre-emergent per manufacturers' recommendations without disturbing sub grade preparation and avoiding over spray onto proposed or existing turf areas.

C. Baserock Installation: Install baserock per Drawings and Specification Section 32 11 12.1 Aggregate Base Courses (Landscape).

D. Weed Barrier Fabric:

- a. Roll on weed barrier uniformly over subgrade to receive decomposed granite.
- b. Overlap edges six (6) inches minimum
- c. Install landscape staples as required to hold fabric in place prior to installation of aggregate base.

3.3 CRUSHED STONE SURFACING INSTALLATION:

A. Decomposed Granite with Stabilizer Installation:

1. Prior to installation, thoroughly presoak surface on which stabilized decomposed granite surfacing is to be placed.
2. Install stabilized decomposed granite paving in two (2) inch maximum lifts. Spread decomposed granite with a rake and compact with water to saturate full depth of granite, approximately 25-45 gallons per 1 ton. Water will activate the stabilizer binder product. Allow for 5/8" to 3/4" loss in compaction for a 2" lift. Adjust this allowances as depth of lift is increased.
3. Water heavy with a hose to ensure the water goes through the entire depth of the decomposed granite material. Test for penetration by random core inspection. Too much water cannot be applied as it is more important to achieve optimum water content. For large projects, water can also be applied to the stock-piled decomposed granite, turned over to mix and add additional water.

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4. Roll and compact within six (6) to 72 hours, or until such time the decomposed granite is able to accept compaction from a 1 to 5 ton roller without separation, plowing or any other physical compromise of the aggregate.
5. If the surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.
6. Compact stabilized aggregate to 95% relative compaction by equipment such as; a 2 to 5-ton double drum roller making 3 to 4 passes. Do not begin compaction for 6 hours after placement and up to 72 hours. DO NOT use a vibratory plate compactor or vibration feature on roller, as vibration separates large aggregate particles. If pumping or pancaking of surface occurs, surface is still too wet to roll.
7. Take care in compacting surface when adjacent to planting and irrigation systems, use 8" or 10" hand tamp. Installation of Stabilized Aggregate more than 3" thick shall be installed in lifts. If 4" thick compacted (2) 2" lifts. If 5" thick compacted (2) 2.5" lifts. If Stabilized Aggregate is pre-moistened before installation entire 4" or 5" lift may be installed.
8. Lightly spray surface area following compaction. Do not disturb aggregate surface with spray action.
9. Re-apply decomposed granite mixture and compact as necessary to achieve finish surface and gradients specified on Drawings.
10. Allow decomposed granite to dry completely. Drying time may vary depending on amount of water used and weather conditions. Once completely dried, the surface should be smooth, uniform and solid. No evidence of chipping or cracking. Cured and compacted surface should be firm throughout profile with no spongy areas. Loose material will not be present on the surface after installation, but may appear after use. Surface should remain stable underneath the loose granite on top. Significant irregularities in surface shall be repaired to the uniformity of the entire installation.

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11. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Surface shall slope to drain upon completion and shall not have depressions or humps greater than ¼ inch in ten feet.
12. Loose material shall not be present on surface after installation, but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a “natural” look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.4 REPAIRS:

- A. Excavate damaged area and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. For aggregate with stabilizer binder, pre-blend the dry required amount of stabilizer binder with the proper amount of aggregate in a concrete mixer. Add water to the pre-blended stabilized aggregate. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
- D. Apply moistened aggregate to excavated area to finish grade.
- E. Compact with an 8” to 10” hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

END OF SECTION 32 15 40

(LRM REVISED 01/07/2026)

SECTION 32 17 00 - PAVEMENT SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Parking lot striping.
- B. Disabled loading zone striping and disabled parking symbol.
- C. Traffic symbols.
- D. Curb painting.
- E. Traffic and parking control signage.
- F. Sport Court striping.

1.2 RELATED SECTIONS

- A. Section 32 12 16 - Asphalt Pavement.
- B. Section 32 13 13 - Concrete Paving.

1.3 QUALITY ASSURANCE

- A. Materials and work of this section shall conform with Local Municipality Public Works standards and specifications.

1.4 REGULATORY REQUIREMENTS

- A. Conform to regulations of Bay Area Air Quality Management District and California Air Resources Board regarding use of paint.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do no painting when surface and air temperatures are below 40 degrees F or below those temperatures recommended by the paint manufacturer.

PART 2 - PRODUCTS

2.1 STANDARD CATALOG PRODUCTS

- A. Symbol Marking Paint and Traffic Marking Paint: Water borne product conforming to State Specification 8010-426-30; Dunn-Edwards Traffic Paint W801, Sinclair 160 Vinyl Traffic Paint, or equal product.
 - 1. ISA Symbol Background: Color - Blue. Size: As indicated in the drawings.
 - 2. Parking Stall Striping, Traffic Symbols and Disabled Loading Zone Striping and Lettering: Color - White. Width for all striping: Three inches, or as indicated in the drawings. Blue border around access aisle.

3. Disabled Stall Curbs: Color - Blue. Width for all striping: Three inches, or as indicated in the drawings.
4. Sport Court Striping: Color - White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine receiving surfaces and verify that surfaces are proper for installation.
- B. Do not start work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, oil, grease, and other foreign matter from the areas of the pavement and curbs to be painted.
- B. Do not apply traffic paint to surfaces which are excessively dirty, damp, and cold.

3.3 INSTALLATION

- A. Apply parking lot as a 4-inch-wide solid line. Apply loading zone striping as 8-inch-wide solid line.
- B. Stripe parking stalls to the dimensions as shown on the Drawings; traffic symbols shall be as shown. Stripe loading zone to dimensions shown on Drawings.
- C. Paint the ISA parking symbol in each accessible parking stall as indicated on the Drawings and in accordance with the American National Standard Institute Figure A117.1.
- D. Paint horizontal and vertical face of curbs abutting accessible parking stalls. See Drawings for extent of painted curbs.
- E. Apply traffic paint with atomizing spray type striping machine equipped with separate thermostatically controlled heating devices for each paint pot and capable of applying paint whereby the lines and markings have clear-cut edges, true and smooth alignments and uniform thicknesses.
- F. Apply paint with completed lines and marking clean, sharp and to dimensions.
 1. Ragged ends of segments, fogginess along the sides or objectionable dribbling of paint along the unpainted portions of the strips will not be permitted.
 2. The finished paint shall have an opaque, well painted appearance with no black or other discolorations showing through.
- G. Set posts for parking sign plumb in minimum 12-inch diameter concrete footings with top of footing 6 inches below finished grade and bottom of footing minimum 36 inches below finished

grade. Slope top of concrete for water runoff. Cap top of pipe.

- H. Secure signs to posts with saddles and vandal-proof nuts.
- I. Install parking control signs with bottom of upper sign 60 inches above finished grade. Install accessible parking signs with bottom of upper sign 80 inches above finished grade. Install lower signs in two sign assemblies with top within 1 inch of bottom of upper sign.

3.4 PROTECTION

- A. Exercise reasonable precautions to protect the paint, as applied, during drying time. Remove objectionable tracking.

END OF SECTION 32 17 00

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SECTION 32 31 00 – ORNAMENTAL STEEL FENCING AND GATES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The contractor shall provide all labor, materials and appurtenances necessary for installation of the welded ornamental steel fence system defined herein.

1.02 RELATED WORK

- B. Section 31 11 00 – Clearing and Grubbing
- C. Section 32 05 23 – Concrete for Exterior Improvements

1.03 SYSTEM DESCRIPTION

- A. The manufacturer shall supply a total fence system of Montage II® Welded and Rackable (ATF – All Terrain Flexibility) Ornamental Steel Genesis™ design. The system shall include all components (i.e., panels, posts, gates and hardware) required.

1.04 QUALITY ASSURANCE

- A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 SUBMITTAL

- A. The manufacturer's literature shall be submitted prior to installation.

1.06 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 – MATERIALS

2.01 MANUFACTURER

- A. The fence system shall conform to Montage II® Welded and Rackable (ATF – All Terrain Flexibility) Ornamental Steel Genesis™ design, extended picket bottom rail treatment, 3-rail style manufactured by Ameristar Fence Products, Inc.

2.02 MATERIAL

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90.

- B. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
- C. Provide caps for all posts.

Table 1 – Minimum Sizes for Montage II Posts

Fence Posts		Panel Height		
2-1/2" x 12 Ga.		Up to & Including 6' Height		
3" x 12 Ga.		Over 6' Up to & Including 8' Height		
Gate Leaf	Gate Height			
	Up to & Including 4'	Over 4' Up to & Including 6'	Over 6' Up to & Including 8'	
Up to 4'	2-1/2" x 12 Ga.	3" x 12 Ga.	3" x 12 Ga.	
4'1" to 6'	3" x 12Ga.	4" x 11 Ga.	4" x 11 Ga.	
6'1" to 8'	3" x 12 Ga.	4" x 11 Ga.	6" x 3/16"	
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	
10'1" to 12'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	
12'1" to 14'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	
14'1" to 16'	6" x 3/16"	6" x 3/16"	6" x 3/16"	

2.03 FABRICATION

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly.
- C. The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
- D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.
- E. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 11ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gate leaves over 6'.

Table 2 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

PART 3 – EXECUTION

3.01 PREPARATION

- A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

- A. Fence posts shall be spaced according to Table 3, plus or minus 1/2". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footings having a minimum depth of 36", unless noted otherwise in architectural drawings. The "Concrete" section of this specification shall govern material requirements for the concrete footings.
- B. All posts are to be capped. All caps are to be tack welded to posts.

Table 3 – Montage II – Post Spacing By Bracket Type										
Span	For INVINCIBLE® 8' Nominal (91-1/2" Rail)				For CLASSIC, GENESIS, & MAJESTIC 8' Nominal (92-5/8" Rail)					
Post Size	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Industrial Flat Mount (BB301)*		Industrial Line 2-1/2" (BB319) 3" (BB320)		Industrial Universal 2.5" (BB302) 3" (BB303)		Industrial Flat Mount (BB301)		Industrial Swivel (BB304)*	
Post Settings ± 1/2" O.C.	94-1/2"	95"	94-1/2"	95"	96"	96-1/2"	96"	96-1/2"	*96"	*96-1/2"
*Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel. When using the BB301 flat mount bracket for Invincible style, rail may need to be drilled to accommodate rail to bracket attachment.										

3.03 FENCE INSTALLATION MAINTENANCE

- A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

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- A. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings and architectural drawings shall identify the necessary gate hardware required for the application. Gate hardware shown in the manufacturer's drawings shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations. Additional gate hardware shown on the architectural drawings shall be provided by and installed by the contractor.
- B. For gates the exceed 6' in length, gate posts are to be filled with concrete.

3.05 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION 32 31 00

SECTION 32 31 13 - CHAIN-LINK FENCING AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Chain-Link Fences: Industrial.
 2. Gates: Horizontal slide and swing.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
1. Fence and gate posts, rails, and fittings.
 2. Chain-link fabric, reinforcements, and attachments.
 3. Gates and hardware.
- B. Samples for Initial Selection: Manufacturer's color charts or 6-inch lengths of actual units showing the full range of colors available for components with factory-applied color finishes.
- C. Samples for Verification: For each type of chain-link fence and gate indicated.
1. Polymer-coated steel wire (for fabric) in 6-inch lengths.
 2. Polymer coating, in 6-inch lengths on shapes for posts, rails, wires, and] gate framing and on full-sized units for accessories.
- D. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.
1. Strength test results for framing according to ASTM F 1043.
- Qualification Data: For Installer.
- E. Maintenance Data: For the following to include in maintenance manuals:
1. Polymer finishes.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Pre-installation Conference: Conduct conference at Project site to comply with district requirements.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chain-Link Fences and Gates:
 - a. Allied Tube and Conduit Corporation
 - b. American Fence Corporation
 - c. Anchor Fence, Inc.
 - d. United States Steel

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Height indicated on Drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
 - 1. Steel Wire Fabric: Metallic coated wire with a diameter of 0.148 inch.
 - a. Mesh Size: 1 inch.
 - b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 2 oz./sq. ft. with zinc coating applied after weaving.
 - c. Polymer Coating: Minimum 7 mil PVC plastic resin finish. ASTM D 668, Class 2 over metallic-coated steel wire.
 - 1) Color: Black
 - d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - e. Furnish one piece fabric widths for fencing up to 12 feet high.
 - 2. Steel Wire Fabric: Metallic coated wire with diameter of 0.148 inch.
 - a. Mesh size: 3-1/2 inch by 5 inch, prewoven. Acceptable supplier: Security Contractor Services (408) 295-8556 or approved equal.
 - 3. Selvage: Knuckled at both selvages.

2.3 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
1. End, Corner and Pull Posts - Up to 7 foot fabric height: 2.375" OD steel pipe, 3.65 lbs. Per lin. Ft., or 3.5" x 3.5" roll formed sections, 4.85 lbs. per lin. ft.
 2. End, Corner and Pull Posts – Over 7 foot fabric height: 2.875" OD steel pipe, 5.79 lbs. Per lin. Ft., or 3.5" x 3.5" roll formed sections, 4.85 lbs. per lin. ft.
 3. Line Posts – Up to 7 foot fabric height: 1.90: OD steel pipe, 2.70 lbs. per lin. ft., or 1.875" x 1.625" C- sections, 2.28 lbs. per lin. ft.
 4. Line Posts – Over 7 foot to 8 foot fabric height: 2.375" OD steel pipe, 3.65 lbs. per lin. ft., or 2.25" x 1.875" H-sections, 2.64 lbs. per lin. ft.
 5. Line Posts – Over 7 foot fabric height: 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.
 6. Top Rail: 1.66" OD steel pipe, 2.27 lbs. per lin. ft., or 1.625" x 1/25" roll-formed sections, 1.35 lbs. per lin. ft.
- B. Swing Gate Post: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
1. Leaf width up to 6 feet: 2.875" OD steel pipe, or 3.5" x 3.5" roll formed, 4.85 lbs. per lin. ft.
 2. Leaf width over 6 feet to 13 feet: 4.00" OD steel pipe, 5.79 lbs. per lin. ft.
 3. Leaf width over 13 feet to 18 feet: 6.625" OD steel pipe, 18.97 lbs. per lin. ft.
 4. Leaf width over 18 feet: 8.625" OD steel pipe, 28.55 lbs. per lin.ft.
- C. Horizontal-Slide Gate Post: According to ASTM F 1184.
1. Openings up to 12 Feet: Steel post, 2.875" OD steel pipe, 4.64-lbs. per lin. ft.
 2. Openings Wider than 12 Feet: Steel post, 4.00" OD, 8.65 lbs. per lin. ft..
 3. Guide posts for Class 1 horizontal-slide gates equal the gate post height, 1 size smaller, but weight is not less than 3.11 lb/ft.; installed adjacent to gate post to permit gate to slide in space between.
- D. Coating for Steel Framing:
1. Metallic Coating:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
 - b. Thermally bonded (PVC) plastic resin finish over metallic coating (galv) not less than 10 mils. Color to match chain link fabric.

2.4 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
1. Location: Extended along top and bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:

1. Metallic Coating: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Matching chain-link fabric coating weight.

2.5 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for single and double swing gate types.
 1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
 1. Gate Fabric Height: 2 inches less than adjacent fence height.
 2. Leaf Width: As indicated.
 3. Frame Members: Tubular Steel: 1.90 inches round.
- C. Frame Corner Construction:
 1. Welded or assembled with corner fittings and rivets, and 3/8-inch diameter, adjustable truss rods for gate panels.
- D. Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A153, and in accordance with the following:
 1. Latches, forked type or plunger-bar type permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
 2. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 7 foot nominal height.
 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it open position until manually released.
 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with a single padlock.

2.6 INDUSTRIAL HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F 1184 for single or double slide gate types. Provide manufacturer's standard heavy-duty inverted channel track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

2.7 FITTINGS

- A. General: Comply with ASTM F 626.

- B. Post and Line Caps: Provide for each post.
 - 1. Line post caps with loop to receive tension wire or top rail.
 - C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.
 - D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
 - E. Tension and Brace Bands: Pressed steel.
 - F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post. Bars shall be 3/16" x 3/4".
 - G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
 - H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
 - I. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
- 2.8 CAST-IN-PLACE CONCRETE
- A. Materials: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water. Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94/C 94M.
 - 1. Concrete Mixes: Normal-weight concrete, 2% to 4% air entrained with not less than 3000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.
 - B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.
- 2.9 POLYMER FINISHES
- A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.

- B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 2b.
- C. Metallic-Coated Steel Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.
 - 1. Polymer Coating: Not less than 10-mil- thick PVC finish.
- D. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line or as indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
 - 1. If diameter is not indicated, excavate holes for posts to diameters as recommended by manufacturer, but not less than 4 times the largest cross section of post.
 - 2. **Use Sonatube or equal formwork to 6" below grade**
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Extend concrete 2 inches above grade; shape and smooth to shed water. Protect aboveground portion of posts from concrete splatter.
 3. Center and align posts in holes 3 inches above bottom of excavation.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 10 feet o.c. maximum.
- E. Post Tops: Provide weather tight closure cap with loop to receive top rail. One cap for each post.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 6 feet or higher, on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
1. Top Tension Wire: Install tension wire through post cap loops.
 2. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Bottom Rails: Install, spanning between posts.
- J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage (except at Tennis Courts, which shall be 1 inch), unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c. At gates, install fabric with stretcher bars at vertical edges and top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches o.c.
- L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 13

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SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide complete, automatically controlled, spray sprinkler, turf rotor, bubbler and/or drip underground irrigation system as shown on Drawings.
- B. This Section includes but is not limited to: excavating, backfilling, finish grading, piping, valves, sprinklers, specialties, controls, and wiring for automatic control irrigation system.
- C. Related Sections include the following:
 - 1. Specification Section 32 91 00 Temporary Tree and Plant Protection.
 - 2. Specification Section 31 23 33 Trenching and Backfilling.
 - 3. Specification Section 32 13 13.1 Concrete Work (Landscape).
 - 4. Specification Section 32 92 00 Turf Planting

1.3 DEFINITIONS

- A. Certified Landscape Irrigation Auditor (CLIA): a person certified to perform landscape irrigation audits by the Irrigation Association Certification Board.
- B. Lateral (Circuit) Piping: Downstream from control valves to sprinklers, rotors, emitters and specialties. Piping is under pressure during flow.

- C. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. The following are industry abbreviations for plastic materials:
 - 1. ASME: American Society of Mechanical Engineers.
 - 2. ASTM: American Society for Testing and Materials.
 - 3. AWG-UF: American Wire Gauge - Underground Feeder
 - 4. NFPA: National Fire Protection Association.
 - 5. PSIG: Pounds per Square Inch Gauge.
 - 6. PVC: Polyvinyl Chloride Plastic.
 - 7. SDR: Standard Direct Ratio.
 - 8. V: Volt

1.4 PERFORMANCE REQUIREMENTS

- A. Location of Sprinklers, Rotors, Emitters and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent, head to head, water coverage of turf and planting areas indicated with uniform coverage and minimum over-spray onto paving and no spray onto buildings and structures.
- B. Minimum Working Pressures: The following are minimum rated pressure requirements for piping, valves, and specialties, unless otherwise indicated:
 - 1. Irrigation Main Piping: 200 psig.
 - 2. Lateral (Circuit) Piping: 150 psig.

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C. Irrigation Schedule: In accordance with DSA Title 24, Part 11 – Outdoor Water Use Requirements, Contractor shall prepare two (2) – three (3) irrigation schedules, one for plant establishment, one for the established landscape and one for temporarily irrigated areas if applicable. Each schedule shall indicate the number of gallons used and shall target the Estimated Total Water Use (ETWU) and not exceed the Maximum Applied Water Allowance (MAWA) calculated on the Irrigation Plan “California Water Efficient Landscape Worksheet.” Irrigation Schedule shall be submitted at substantial completion. After acceptance of substantial completion, Contractor shall laminate schedule in plastic and place in controller enclosure prior to final completion and end of maintenance. In preparing the Irrigation Schedule, the Contractor shall consider the following:

1. Irrigation interval (days between irrigation).
2. Irrigation run times.
3. Number of cycle starts 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.

1.5 SUBMITTALS

- A. Product and Project Data: With-in 14 days after award of the contract, furnish the Owner's Representative with submittal data on all items intended for installation. Substitute equipment or material installed without the approval of the Owner's Representative will be removed and replaced with specified items at this Contractor's expense. Submit manufacturer's technical data and installation instructions for irrigation components conforming to requirements of Division 1, Section 01 33 00 Submittal Procedures. Include pressure ratings, rated capacities, and settings of irrigation components. Submittal shall include the following:
1. Backflow device including cage and/or blanket.
 2. Booster Pump.
 3. Master control valve.
 4. Flow Sensor(s).
 5. Hydrometer.
 6. Main, lateral (circuit) and sleeving pipe.
 7. Pipe fittings, primer and cement.
 8. Tracer wire and/or warning tape.
 9. Isolation valves.
 10. Remote control valves.
 11. Valve boxes.
 12. Sprinklers, rotors, bubblers, drip emitters.
 13. Swing joints.
 14. Tree bubbler drain tubes.

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15. Controllers. Include wiring diagrams, enclosures and mounting methods.
 16. Control wires. Include splice kits and conduit.
 17. Valve identification tags.
 18. Irrigation Wiring Diagram: Contractor shall prepare and submit an irrigation wire diagram showing location of control wire, common wire, spare control wire and spare common wire with quantities noted at each run shown on copy of irrigation plan in a legible size and format.
 19. Irrigation installation firm qualifications in accordance with "quality assurance".
 20. Name and contact information of certified irrigation auditor performing the irrigation audit for this project.
- B. Coordination Drawings: During the course of construction, maintain orderly set of irrigation drawings and details on project site during installation of irrigation system. Record daily changes showing piping and major system components. Measure and neatly record dimensions for all mainlines, control wire runs, and all other pertinent information facilitating maintenance and extension of the irrigation system to within one (1) foot horizontally and six (6) inches vertically. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures. Up to date coordination drawings shall be available for review prior to meetings with the Owner's Representative.
- C. Submittals at Substantial Completion:
1. Irrigation Record Drawings. Contractor shall record information gathered on "Coordination Drawings" onto a clean set of Irrigation Plans for documentation of as-built conditions.
 2. Controller Legend: Upon approval of record drawing submittal, prepare two (2) legible, reduced to 11" by 17" in size, non-fading, waterproof copies of the Record Irrigation Drawings, laminated between two (2) .020 mm (minimum) plastic

sheets, printed on front side only. Attach one (1) copy to door of controller or enclosure and deliver one (1) copy to Owner. Plan sheet shall include the following information:

- a. Installing Contractor's company name, phone number and address.
 - b. Color coded zone identification by valve.
 - c. Zone start time.
 - d. Zone water duration.
 - e. Type of planting irrigated.
 - f. Valve size, station numbers and controller designations.
 - g. Installing Contractor's company name, phone number and address.
 - h. Color coded zone identification by valve.
 - i. Zone start time.
 - j. Zone water duration.
 - k. Type of planting irrigated.
 - l. Valve size, station numbers and controller designations.
3. For landscape areas 2,500 square feet and larger, contractor shall retain the services of a third party Certified Landscape Irrigation Auditor to perform a landscape irrigation water audit and prepare an irrigation audit report compliant with project reviewing agency Water Efficient Landscape Ordinance and at a minimum, per MWELO 492.12 including, but not limited to inspection, system tune-up, system test with distribution uniformity, correcting over-spray or run-off and configuring controllers with application rate, soil type, plant factors, slope, sun exposure and other factors necessary for accurate programming. Submit preliminary report at substantial completion, allow for adjustments during maintenance and submit report confirming irrigation installation is compliant with project reviewing agency and MWELO at final completion.
 4. Submit Irrigation Schedule for review and approval in accordance with DSA Title 24, Part 1 at substantial completion. Once approved, laminate in plastic and place inside controller enclosure for final completion at end of maintenance period.

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5. Contractor shall provide the owner with one (1) quick coupler key with hose swivel per each five (5) quick couplers, deliver to Owner's Representative.
6. Irrigation System Leak Test Results.
7. Irrigation backflow preventer certification from factory-authorized representative.
8. Booster pump installation written certification from factory-authorized representative.
9. Central control installation certification from factory-authorized representative.
10. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include data for the following:
 - a. Automatic-control valves.
 - b. Sprinklers, rotors and/or emitters.
 - c. Controllers.

1.6 QUALITY ASSURANCE

A. Governing Agency Requirements:

1. For projects subject to review and approval by local governing agencies, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance at a minimum and shall conform to local codes and/or ordinances, whichever may be more stringent.
2. For projects under review of DSA, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance requirements at a minimum.

B. Installer Qualifications:

1. Experience: The irrigation installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
2. Licensure: The irrigation installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
3. Supervision: The irrigation installation firm shall have a qualified and experienced irrigation technician on site during irrigation installation.
4. Drip Irrigation: The irrigation installation firm shall have contracted for and successfully complete construction of a minimum of five (5) drip irrigation installations within the past five (5) years of similar size and complexity.

C. Manufacturer Qualifications: Provide underground irrigation system as a complete unit. Each type component produced by a single acceptable manufacturer, including heads, valves, controls and accessories.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Pipe crossings beneath fire Lanes: Comply with NFPA 24-10, Depth of Cover at Fire Access Lanes.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination"

G. All work and materials shall be in strict accordance with the latest rules and regulations of the State Fire Marshall, Safety Orders of the Division of Industrial Safety, National

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Electrical Code, California Administrative Code, part 4, Title 24, "Basic Mechanical Regulations" and other applicable state or local laws or ordinances. Nothing in these drawings or specifications is to be construed as permitting work which does not conform to the codes or regulations.

- H. Contractor shall provide all licenses, fees and other charges required for completion of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's Representative's written permission.
- B. Interruption of Existing Irrigation Service: Do not interrupt existing to remain irrigation service. Prior to demolition work and prior to beginning irrigation work, review project site and meet with Owner Representative to review locations and connections of existing to remain irrigation system. Coordinate with General Contractor to ensure existing irrigation remains in place and operable through the duration of construction. In the

event existing irrigation is shut off or damaged during construction, contractor shall provide temporary connections or modifications to continue water service to existing to remain planting material or turf to maintain in a healthy growing condition throughout construction. In the event water service is not available, contractor shall apply water through manual delivery means as necessary. Obtain approval from Owner's Representation two days in advance of any planned disruptions in water service.

1.9 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.10 MAINTENANCE

- A. Irrigation maintenance shall coincide with planting maintenance, refer to Specification 32 90 00 "Planting". In the event planting is not part of this work, maintenance shall begin at written approval from Owner's Representative of substantial completion, run ninety (90) calendar days and until receipt of Owner's Representative's written acceptance of completion of punch list items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Use new materials of brands shown on Drawings, specified herein or approved equal.
- B. Use existing materials if shown on Drawings.
- C. Substitution of sprinklers, rotors, drip, valves and controllers will not be allowed due to variation in flows, precipitation rates, friction losses, and sizing and maintaining consistency with client equipment standards.

2.2 PIPES, TUBES, AND FITTINGS

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- A. Above Grade Irrigation Mainline Piping: Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.
 - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - 3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.

- B. Mainline Piping: (unless specified otherwise on Drawings):
 - 1. Class 200 (C900), gasketed, purple reclaimed water PVC pipe, ASTM D-2241, NSF approved (size 6" and larger).
 - 2. Class 315 purple reclaimed water PVC pipe, ASTM D-2239, NSF approved (size 2-1/2" to 4").
 - 3. Schedule 40 purple reclaimed water PVC pipe, ASTM D-1785, NSF approved (size 2" and smaller).
 - 4. Fittings to be schedule 80 PVC.

- C. Lateral Line Piping (unless specified otherwise on Drawings):
 - 1. Schedule 40 purple reclaimed water PVC pipe, ASTM D 2466, NSF approved.
 - 2. Fittings to be schedule 40 PVC.

- D. Sleeves (unless specified otherwise on Drawings):

1. For irrigation piping, use schedule 40 purple PVC pipe, NSF approved, size and quantity as required for irrigation piping unless otherwise specified on drawings..
2. For irrigation wiring, use schedule 40 PVC pipe, UL listed, NEMA TC-6, ANSI/UL651, ASTM F512, for outdoor, direct bury applications, PVC, size and quantity as required, unless otherwise specified on Drawings.
3. Fittings to be schedule 40 PVC.

2.3 Valves:

A. BACKFLOW PREVENTION DEVICE:

1. As indicated on the Drawings.

B. BOOSTER PUMP:

1. As indicated on the drawings.

C. ISOLATION VALVES:

1. As indicated on the drawings.

D. QUICK-COUPLING VALVES:

1. As indicated on the drawings.

E. REMOTE CONTROL VALVES:

1. As indicated on the drawings.

F. VALVE BOXES:

1. In paved areas, use Christy or Carson concrete utility box, size as required.

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2. In planting areas, use Carson plastic underground enclosure with locking lid, bolt and washer, size as required, color to be green for potable water and purple for non-potable water systems.
3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.
4. Valve box lid shall be labeled "IRRIGATION".

G. PULL BOXES AND SPLICE BOXES:

1. In paved areas, use Christy concrete utility box, size as required.
2. In planting areas, use Carson plastic underground enclosure with locking lid, bolt and washer, size as required, color to be green for potable water and purple for non-potable water systems.
3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.
4. Box lid to be labeled "IRRIGATION".

- H. WIRE MESH AT VALVE BOXES:
 - 1. 1/2 inch by 1/2", 16 gauge, galvanized wire mesh hardware cloth.
 - I. VALVE IDENTIFICATION TAGS:
 - 1. Shall be plastic yellow in color for potable water systems and purple in color for recycled water systems with 1 1/8" stamped black letters indicating controller/station number.
 - J. SAND BACKFILL:
 - 1. Shall consist of natural sand, manufactured sand, existing of native material, or combinations thereof, and shall conform to ASTM C-40 Organic Impurities, ASTM D-2419 Sand Equivalent and a pH value between 4.5 and 9.
 - K. VALVE BOX ROCK:
 - 1. Shall be 3/4" or smaller drain rock or pea gravel unless specified otherwise on Drawings.
 - L. VALVE BOX SUPPORT BRICK:
 - 1. Shall be common red brick unless specified otherwise on Drawings.
- 2.4 AUTOMATIC-CONTROL SYSTEM:
- A. CONTROLLER: As indicated on Drawings.
 - B. AUTOMATIC CONTROLLER GROUNDING:
 - 1. Contractor shall install grounding recommended by manufacturer for installation method detailed on this product.
 - C. 24 VOLT WIRING:

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1. All 24 V line to be #14-1 AWG-UF. Control wire insulation to be red in color and spare wire to be yellow in color. 24 V common wire to be #12-1 AWG-UF, insulation to be white in color and spare common insulation shall be black in color.

D. SPLICING MATERIALS:

1. Shall be Splice-Kote, Dura Seal heat shrink waterproof nylon wire connectors, or 3M "DBY" connectors.

2.5 TRACER WIRE/DETECTABLE WARNING TAPE:

A. Install tracer wire or detectable warning tape as indicated on Drawings.

B. Tracer Wire: #8 solid Bare Copper Wire.

C. Detectable Warning Tape: Electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Griffolyn Co., or equal, two (2) inches in width, continuously imprinted "caution buried water line"

2.6 CONCRETE THRUST BLOCKING:

- A. Shall be clean, Portland Cement Concrete, cast in place, five sacks of cement per cubic yard mixture with a 28-day compressive strength of 2,500 PSI.

2.7 SPRINKLERS AND/OR EMITTERS:

- A. As indicated on the drawings. Drip system fittings shall be of same manufacturer and/or as recommended by manufacturer.

2.8 SPRINKLER SPECIALTIES:

- A. As indicated on the drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 "Earthwork" for excavating, trenching, and backfilling.
- B. Install piping and wiring in sleeves under sidewalks, roadways, and parking lots, and under or through footings and building walls.
 - 1. Install piping sleeves by boring or jacking under existing paving if possible.
 - 2. Install quantity and size of sleeves required for the project for irrigation piping, PVC for irrigation pipes and conduit for electrical wires.
 - 3. Sleeves shall extend twelve (12) inches beyond edges of paving and walls with ends capped.
- C. Provide minimum cover over top of underground piping according to the following:
 - 1. Irrigation Mainline Piping: Minimum depth of 24 inches below finished grade to top of pipe.
 - 2. Lateral Piping: Minimum depth of 18 inches below finished grade to top of pipe.
 - 3. Sleeves containing control wires, mainline and/or lateral piping beneath standard paving: Minimum depth of 24 inches from finish surface to top of sleeve.
 - 4. Sleeves containing control wires, mainline and/or lateral piping beneath vehicular paving including fire lanes/emergency vehicle access (EVA): Minimum depth of 36 inches from finish surface to top of sleeve.
 - 5. Drip Irrigation: Install drip and/or emitter lines and tubing as detailed on Drawings.
- D. Excavate trenches with vertical sides, uniform bottom, free of deleterious materials, and wide enough for pipes to lay side by side, fully supported on bottom. Minimum 3'

clearance between pipes. Twelve (12") inch minimum width for mainlines and six (6") inch minimum width for lateral lines.

- E. Trenches with irrigation pipe and/or control wiring to be backfilled with sand to six (6) inches minimum above top of pipe. Continue backfilling in six (6) inch layers with soil free of rocks or waste materials. Compact soil to a density equal to the surrounding undisturbed soil, but not less than 90%. Any subsequent depressions filled at the Contractor's expense. Particular attention is directed to firmly tamp and moistening around sprinkler heads and quick-couplers.

- 1. For Irrigation pipe three (3) inches and larger in size, install additional six (6) inch depth sand beneath piping.

- F. Trenches and backfill installed under paving, asphalt concrete or concrete shall be backfilled with sand and compacted in layers equal in density to the adjacent undisturbed soil or to 90% compaction, using manual or mechanical tamping devices. All trenches shall be left flush with the adjoining grade.

- 1. The Contractor shall set in place, cap and pressure test pressurized mainline under paving prior to the paving installation.

- 2. For irrigation pipes three (3) inches and larger in size, install additional six (6) inch depth sand beneath piping.

3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.

3.3 PIPING APPLICATIONS

- A. Install components having pressure rating equal to or greater than system operating pressure.
- B. Piping in control valve boxes and above ground may be joined with flanges instead of joints indicated.

- C. Above Ground Irrigation Mainline Piping: Use any of the following piping materials for each size range:
 - 1. NPS 4 and Smaller: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
 - 2. NPS 5 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
- D. Underground irrigation main piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, Schedule 40 PVC solvent-weld.
- E. Underground Irrigation Lateral (Circuit) piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, schedule 40 PVC solvent-weld.
- F. Mainline pipe sizes 6" and larger shall use gasketed pipe with bell fittings. Where solvent weld joints are required, contractor shall additionally install concrete thrust blocking.
- G. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
- H. Mainline Fittings and Couplings: Schedule 80, PVC pipe, solvent weld up to 4" and gasketed with bell fittings 6" and larger pipe.
- I. Risers to Aboveground Sprinklers and Specialties: ASTM A-120 Schedule 40 galvanized steel pipe with 150 lb. banded galvanized malleable iron fittings.
- J. Double Swing Joint Assembly:
 - 1. Install double swing joint at all sprinkler heads and quick couplers.
 - 2. Elbows shall be PVC Class 1220, Schedule 40.
 - 3. Install as follows:

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- a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
 - b. Screw on elbow and a 6 inch long nipple.
 - c. Screw on another elbow and a 2 inch long nipple and install riser vertically to head, or quick coupler valve.
 - d. Swing joint must offset to the right.
- K. Sleeves: Schedule 40 PVC pipe and socket fittings; and solvent-cemented joints.
- L. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:
1. Couplings:
 - a. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - b. Underground Piping NPS 2 and Larger: AWWA transition coupling.

2. Fittings:
 - a. Aboveground Piping: Plastic-to-metal transition fittings.
 - b. Underground Piping: Union with plastic end of same material as plastic piping.

M. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following.

1. Underground Piping:
 - a. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 - b. NPS 2-1/2 and Larger: Prohibited except in valve box.
2. Above ground Piping:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
3. Piping in Valve Boxes or Vaults:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
4. Dielectric fittings are specified in Division 22 Plumbing.

3.4 VALVE APPLICATIONS

A. Backflow Prevention Devices:

1. New and relocated backflow devices must be tested at time of installation. Contractor shall have test performed by a Certified Backflow Tester who has a current State of California Contractor's license C-36 or General Contracting License.
2. For new backflow preventer installation, a Certified Tester shall test and provide results and certification to the Owner's Representative within five (5) days of the date of testing and to provide any testing data or certification required by the

local water provider. A Department of Public Health sticker shall be placed on backflow device before the system is accepted by the Owner's Representative.

3. Install per local codes and water purveyor requirements.
 4. A Department of Public Health sticker shall be placed on backflow device before the system is accepted by the Owner's Representative.
- B. Underground Gate/Ball Valves: Install in control-valve box as detailed on drawings.
 - C. Remote Control Valves: Install in control-valve box as detailed on drawings.
 - D. Drain Valves: Install in control-valve box as detailed on drawings.
 - E. Install each valve in a separate valve box (unless noted otherwise in Drawings and details) and in appropriate locations as shown on Drawings. Allow 12 inches between valve boxes and between valve boxes and walls or walks or landscape edges. Boxes shall be arranged perpendicular and parallel to each other and aligned in a row.

3.5 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings. Piping shown on drawings is diagrammatic. General arrangement of piping shall be followed as near as practical. Where piping is shown running continuously in paving and adjacent to planting area, intent is to install piping within planting areas where practical.
- B. Install pipe sleeves at all points where pipes pass through concrete, asphalt or masonry. In footings, allow 1 inch clearance around pipe, and in other locations allow ½ inch. Each end of sleeve shall extend twelve (12) inches beyond edge of paving or structure above. Provide removable non-decaying plug at each end of sleeve to prevent intrusion of earth and debris.
- C. If drain valves are used, install piping at minimum uniform slope of 0.5 percent down toward drain valves.

- D. Install piping free of sags and vertical bends.
- E. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections. Pipe bending shall not exceed manufacturer recommended radii.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- H. Install dielectric fittings to connect piping of dissimilar metals.
- I. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- J. Lay piping on solid sub-base, fully and evenly supported by bedding, uniformly sloped without humps or depressions.
- K. Install PVC piping in dry weather when temperature is above 40 degrees F (5 degrees C). Allow joints to cure at least 24 hours at temperatures above 40 degrees F (5 degrees C) before testing unless otherwise recommended by manufacturer.
- L. Snake pipe a minimum of one (1) additional foot per one hundred (100) feet of pipe to allow for expansion and contraction.
- M. Cap or plug openings as soon as lines have been installed to prevent intrusion of debris.
- N. Install concrete thrust blocking, at a minimum, on pressurized mainline three (3) inches and four (4) in size at changes in direction, connections or branches from mainline and dead ends and as necessary to prevent pipe movement thrusts created by internal water pressure. Concrete shall be placed directly on the fitting perpendicular to the line of thrust and also against the undisturbed earth. The amount of concrete shall be in accordance to the pressure, angle and soil type. Refer to pipe manufacturer for calculating exact size of thrust blocking material, 2022 CPC and IAPMO installation standards.

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- O. Joint Restraints: Install joint restraints per manufacturer recommendations on pressurized mainlines six (6) inches and larger at changes in direction, connections or branches from mainline and dead ends and as necessary to prevent pipe movement thrusts created by internal water pressure.
- P. After installation of pipe lines and sprinkler risers, and prior to installation of sprinkler heads, automatic valves and quick couplers, thoroughly flush all lines with a full head of water to remove any foreign material, scale, sediment, etc.

3.6 TRACER WIRE

- A. Install as detailed along all new irrigation mainline piping on bottom of trench, carefully run to avoid stress from backfilling and shall be continuous throughout the mainline pipe runs. Fasten tracer wire to mainline at eight (8) foot intervals with tape. Take precautions to ensure tape is not damaged or misplaced during backfill operations.
- B. Tracer wire shall follow mainline pipe and branch lines, originating in irrigation valve box at gate, ball or remote control valve located closest to irrigation point of connection and run to ball, gate and/or remote control valves at the end of mainline runs or shall loop entire system where mainlines are looped.
- C. Record locations of tracer wire origin and terminations on project record drawings.

3.7 DETECTABLE WARNING TAPE

- A. Install tape with printed side up, directly over mainline pipe and on top of sand backfill, 18 inches below grade. Take precautions to ensure tape is not damaged or misplaced during backfill operations.

3.8 JOINT CONSTRUCTION

- A. Refer to Plumbing Specifications Division 22 for basic pipe joint construction.
- B. Install threaded pipe joints as follows:

1. Use pipe joint sealant for all plastic to plastic and plastic to steel joints, do not apply to sprinkler inlet ports.
 2. For PVC, hand tighten only. Do not over tighten threaded joints. Thread until fitting stops, then add a half turn.
 3. Use pipe joint compound and/or Teflon tape for all steel to steel joints.
- C. Install gasketed joint per manufacturer recommendations (printed on pipe material) and using the lubricant supplied with the pipe.

3.9 VALVE INSTALLATION

- A. Underground Gate/Ball Valves: Install in valve box as detailed on drawings.
- B. Underground, Manual Control Valves: Install in manual control valve box as detailed on drawings.
- C. Remote Control Valves: Install in control valve box as detailed on drawings.
- D. Drain Valves: Install in control valve box as detailed on drawings.
- E. Install each valve in a separate valve box (unless noted otherwise in Drawings and details) and in appropriate locations as shown on Drawings. Allow 12 inches between valve boxes and between valve boxes and walls or walks or landscape edges. Boxes shall be arranged perpendicular and parallel to each other and aligned in a row.

3.10 SPRINKLER INSTALLATION

- A. Locate part-circle sprinklers to maintain a minimum distance of six (6) inches from adjacent paving and edges and twelve (12) inches clearance from walls, fences and other structures, unless otherwise indicated on Drawings.
- B. Spray sprinklers shall not be installed less than 24" from non-permeable surfaces unless the adjacent non-permeable surface is constructed to drain entirely to the landscape area.

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C. Swing Joint Assembly:

1. Install triple swing joint at all sprinkler heads and quick couplers.
2. Elbows shall be PVC Class 1220, Schedule 40.
3. Install as follows:
 - a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
 - b. Screw on elbow and a 6 inch long nipple.
 - c. Screw on another elbow and a 2 inch long nipple.
 - d. Screw on another elbow and install riser vertically to head, or quick coupler valve.
 - e. Swing joint must offset to the right.

D. Sprinkler Installation:

1. Install sprinklers heads as shown on drawings and details.
2. Install plumb to finish grade.
3. Tool tighten all sprinkler body covers and nozzles.

3.11 DRIP/EMITTER INSTALLATION

- A. Minimum cover sub-surface drip tubing: drip and/or emitter lines shall be installed as detailed with drip tubing installed four (4) inches grade and below the mulch top dressing layer.
- B. Minimum cover of tubing to individual shrubs: shrub bubbler tubing shall be installed to a depth of (4) inches and rising to the surface at target shrub rootball. No more than one (1) inch of tubing shall be exposed at shrub rootball.
- C. Backfill after lines have been reviewed, tested for leaks and approved by Owner's Representative.
- D. Assembling drip system shall keep pipe and tubing free from dirt and debris, pipe ends shall be cut square, deburred and cleaned.
- E. Flush piping prior to installing remote control valve assembly (control zone kit assembly).
- F. Follow manufacturer recommendations.

3.12 AUTOMATIC-CONTROL SYSTEM INSTALLATION:

- A. Exact location of controllers shall be reviewed and approved by Owner's Representative.
- B. Provide connection to nearest available 110 volt electrical service.
- C. Contractor shall install grounding system per manufacturer recommendations.

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- D. Prior to installation of hardscape, coordinate and install electrical supply and control wire conduit, size and quantity as required for each controller and spare wiring. Install pull boxes and conduit from clock location.
- E. Control wiring shall be neatly coiled beneath controller terminal strip and labeled with corresponding station number. Controller terminal strip cover plate shall fasten securely in place.
- F. Contractor is responsible to provide fully automatic system operated by specified controller(s). Contractor shall install quantity of red wiring equal to the number of stations on the specified irrigation controller(s), plus five (5) yellow spare control wires for each controller, a common white wire and a spare common black wire. Example, 24 station clock shall have 24 control wires, 5 spare control wires and 2 common wires installed with mainline and running through all associated valve boxes. Wires shall be installed per plans and details from remote control valve(s) to controller(s).
- G. Example of mainline that is not looped and terminates in 3 locations with a 24 station clock and 18 stations used:
 - 1. Wire quantities shall be:
 - a. 18 red control wires for stations 1-18
 - b. 6 red control wires for un-used stations 19-24
 - c. 1 white common wire
 - d. 1 black spare common wire
 - e. 5 yellow spare wires
 - 2. Wire runs:
 - a. 18 red control wires (stations 1-18) shall run from controller to corresponding valve.
 - b. 6 red control wires (un-used stations 19-24) shall run from controller with 2 running down each of the 3 mainline terminations and looping through each valve box.

- c. 1 white common wire shall run from controller and connect to each valve associated with that controller.
 - d. 1 black spare common wire shall run from controller and connect to each valve associated with that controller.
 - e. 5 yellow spare control wires shall run from controller and loop through each valve box associated with that controller.
 - 3. Contractor shall label all wires with water-proof marking with corresponding station number or as spare control wire, spare common wire or spare stations 19-24.
 - H. Wiring path is not shown on drawings and shall run from specified controller(s) to irrigation pull box if shown, then to the nearest irrigation mainline location, follow mainline (existing and/or new) to each remote control valve. Indicate wire location on record drawings where it does not follow mainline. Common and spare wires shall loop through entire system. Wiring may be shown on drawings only where required for future irrigation extensions.
 - I. Wiring may be shown on drawings only where required for future irrigation extensions.
 - J. Irrigation Central Control system is standard for this project.
 - K. Irrigation Central Control System must be compatible with owners central control software and hardware. Contractor shall ensure controller communicates properly with project central computer and receives daily downloads for weather updates.
- 3.13 CONNECTIONS/ELECTRICAL WIRING
- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. Ground equipment according to Division 16 Section.
 - C. Connect wiring according to Division 16 Section.

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- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. 24 volt splices to be made with 3M Co. #3577 splice kit, as to manufacturer's instructions. Splices to be made only at valve box or pull box.

3.14 REMOTE CONTROL VALVE WIRING

- A. Wires shall be installed in electrical conduit between controller and pull box. Pull box to be located in ground nearest controller. Top of box to be flush with finish grade.
- B. Provide separate irrigation wire sleeves under concrete or asphalt for irrigation wires, size and quantity as required, 24" minimum cover in planting areas and 36" minimum cover under fire lanes and pavements. All wires from the pull box shall be direct burial. The wiring shall be bundled and secured to the lower side of the irrigation pipe at 10 foot intervals with plastic electrical tape.
- C. Wires from the pull box shall be direct burial. The wiring shall be bundled and secured to the lower side of the irrigation pipe at ten (10) foot intervals with plastic electrical tape. Provide a minimum of 24 inches excess of coil of control wires in each 100 feet of run to controller. Sufficient slack shall be left in the wire to provide for expansion and contraction.
- D. Provide 24 inches excess of coil of control wires in each 100 feet of run to controller.
- E. Provide 24 inches excess of coil of control wires in each valve box and pull box.
- F. Control wires to be buried a minimum of 24 inches below finish grade.
- G. Wiring shall be tested for continuity, open circuits and unintentional grounds prior to connecting to equipment.
- H. Install irrigation wire splice boxes where wire splices are necessary.

3.15 LABELING AND IDENTIFYING

- A. Valve Identification Tags: Install valve identification tag on each remote control valve with corresponding controller station number.

3.16 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service for Irrigation Pumps and Central Control Systems: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
- B. For landscape projects 2,500 square feet and larger, after substantial completion, Contractor shall schedule an Irrigation Audit to be performed by a third-party certified landscape irrigation auditor. Contractor shall make necessary adjustments, if any, during maintenance period and provide written certification of installation from certified landscape irrigation auditor as part of final completion and end of maintenance.
- C. Perform the following field tests and inspections in the presence of the Inspector and/or Owner's Representative with 72 hours advance notice. Contractor shall record date, time, names of those present and results and submit to Owner's Representative prior to requesting substantial completion review:
 - 1. Leak test of pressurized mainline: After installation of mainline and prior to installing remote control valves, quick coupling valves or other valve assemblies and prior to backfilling trenches, test the mainline for leaks as follows:
 - a. Testing shall occur with trenches open. Center load piping with small amounts of backfill between fittings to prevent pipe displacement, arching or slipping. Fittings to be visible for testing.
 - b. Exercise care in filling the system with water to prevent excessive surge pressure and water hammer
 - c. Test pressurized mainline piping under hydrostatic pressure of 125 psi for six (6) continuous hours, minimum, with no more than five (5) psi drop in pressure. Coordinate with Owner's Representative for initial observation of beginning test and observation after test.
 - d. Correct deficiencies revealed by test and repeat pressure test to the satisfaction of the Owner's Representative.

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2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Coverage Test: When the irrigation system has been completed, the Contractor, in the presence of the Architect and Owner's Representative, shall perform a Coverage Test to determine if the coverage of water is complete and adequate, the sprinkler heads and/or emitters function according to manufacturers' data and according to the intent of the construction documents. Replace irrigation components not performing satisfactorily and/or respace sprinklers and/or nozzles and/or emitters as necessary to provide complete irrigation coverage of plant material.
 - a. For new turf areas, Contractor shall demonstrate irrigation coverage over amended planting area and prior to installation of sod and/or seeded turf.
4. Substantial Completion Review: At substantial completion of this Section, work shall be reviewed for conformance with the Drawings and Contractor shall make recommended repairs and/or corrections in a timely manner and prior to final completion.
 - a. At substantial completion, Contractor shall submit documentation per 1.5 "Submittals at substantial completion" to Architect for review and acceptance.
 - b. At substantial completion, Contractor shall deliver spare parts to Owner's Representative per 1.5 "Submittals at substantial completion".
 - c. At substantial completion, contractor shall submit Certified Landscape Irrigation Auditor preliminary report on irrigation system.
5. Final Completion Review: After substantial completion repairs and/or corrections have been completed and at the end of the maintenance period, work shall be reviewed for final completion and approved by Owner's Representative in writing.

- a. At final completion, Contractor shall submit Certified Landscape Irrigation Auditor final report confirming irrigation installation is compliant with DSA MWELo requirements.

3.17 CLOSING IN UN-INSPECTED WORK

- A. The Contractor will pay all costs necessitated by required opening, restoration and correction of all work closed in or concealed before inspection, testing as required, and approval by authorized inspections.

3.18 STARTUP SERVICE

- A. Verify that controllers are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- C. Complete startup checks according to manufacturer's written instructions.

3.19 MAINTENANCE SCHEDULE

- A. Fine tune and adjust irrigation system weekly coinciding with the landscape and/or turf planting maintenance period.
- B. Adjust settings of controllers within WELo water budget and with seasonal changes.
- C. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- D. Adjust sprinklers so they will be flush with, or not more than 1/2 inch above, finish grade.
- E. Fill irrigation trenches due to settling.

3.20 CLEANING

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- A. Completely flush dirt and debris from piping before installing sprinklers and other devices.
- B. After completion, cleanup and remove all resultant debris from site.

3.21 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controller and automatic control valves. Refer to Division 1 Section "Demonstration and Training."

3.22 GUARANTEE (Project Close-out Item)

- A. Furnish a written Guarantee to the Owner, dated from the date of Final Acceptance, against defective workmanship, materials or components and guaranteeing repair or replacement for a period of 1 year; further guarantee restoration of all damage caused by leaks in the Irrigation System for a like period.
- B. Guarantee that the entire installation was made in accordance with the drawings, specifications and manufacturer's recommendations, using designated materials and installation procedures.
- C. Submit duplicate copies of the Guarantee for approval by the Owner's Representative. Approval is mandatory before final payment and acceptance.
- D. The guarantee for the irrigation system shall be made in accordance with the form attached at the end of this Section. The guarantee form shall be retyped onto the Contractors letterhead and contain the information shown.

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse or neglect excepted.

We agree to repair or replace any defects in materials and workmanship which may develop during the period for one (1) year from the date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice.

The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system and equipment in operating conditions. This shall not relieve the Contractor of his responsibilities under this Guarantee.

In the event of failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project: _____

Location: _____

Name of Contractor: _____

Signed: (Authorized Signature) _____

Print Name of Authorized Signature _____

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Ad-
dress: _____

Phone: _____ Date of Ac-
ceptance: _____

END OF SECTION 32 84 00

(LRM REVISED 01/06/2026)

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SECTION 32 91 00

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Furnish all labor, materials, equipment, facilities, transportation and services to complete tree protection and related work as shown on the drawings and/or specified herein.
- B. Description of Work:
 - 1. Protection of existing trees and vegetation to remain.
 - 2. Trimming of existing trees.
 - 3. Maintenance of existing trees during construction.
 - 4. Removal and re-installation of existing trees.
 - 5. Contractor shall retain the services of a certified arborist to perform routine visits and oversee the protection of the existing trees within the project area during demolition, construction and maintenance and to especially review and recommend treatment when roots are encountered and to perform routine maintenance during the construction phase.
- C. Traffic:

1. Do not interfere with or close public ways without permission of the Owner's Representative.
2. Do not interfere with adjacent private properties without permission of the Owner's Representative.

D. Site Utilities:

1. Advise utility companies of excavation activities before starting excavations.
2. Locate and identify underground utilities passing through work area before starting work.
3. In event unidentified underground utilities are encountered during work, advise utility owner immediately before proceeding. Add any new utility information to project record drawings for actual location.
4. Protect all existing-to-remain utilities.
5. Do not interrupt existing utilities without advance notice to and approval from the Owner's Representative.

1.3 SUBMITTALS

- A. Qualification Data: For qualified tree service firm.
- B. Existing Conditions: Submit documentation of existing trees and plantings indicated to remain and/or relocate, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 1. Use sufficiently detailed photographs.
 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

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- C. 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.
- D. Written Maintenance Recommendations: From certified arborist, for care and protection of trees affected by construction during and after completing the Work and for removal and re-installation of existing trees.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by the International Society of Arboriculture (ISA) and having performed similar services for a minimum of five (5) years.
- B. Certified Arborist Written Recommendations: Contractor shall retain the services of a reputable Arborist certified by the International Society of Arboriculture (ISA) for review and prepare written recommendations for existing to remain shrubs and trees within the project area under the following circumstances. Contractor shall submit the written recommendations to the Owner's Representative for review. Contractor shall implement Arborist recommendations.
 - 1. Grading, excavation, trenching or any other similar work is required that may disturb roots of existing to remain trees over six (6) inches in diameter measured three (3) feet above finish grade.
 - 2. Pruning is required on branches more than two (2) inches in diameter for existing to remain trees over six (6) inches in diameter measured three (3) feet above finish grade.
 - 3. Damage to existing to remain tree(s) has occurred during construction to any part of the tree.
 - 4. Construction is required within ten (10) horizontal feet of a tree and/or shrub to remain, with a trunk diameter over six (6) inches in diameter measured three (3) feet above finish grade.

- C. Certified Arborist Over-sight: Certified Arborist shall perform site inspections, provide over-sight and written summary of visit to Owner's Representative prior to demolition and construction work within the dripline of existing to remain trees with a trunk diameter over six (6) inches in diameter measured three (3) feet above finish grade and provide routine maintenance as required to maintain healthy, viable trees throughout the construction process. Certified Arborist shall provide over-site for recommended pruning for branches two (2) inches and larger in size for existing to remain trees.
- D. Contractor shall be liable for the loss in value due to damaged trees and for repair costs resulting as determined by the Client. Due to the irreplaceable nature of many existing trees and vegetation, the liability to the General Contractor shall be set at \$1,500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture will be used to compute the actual value. Other vegetation lost due to construction activity and/or neglect shall be replaced by General Contractor in kind with similar size, potted plant stock to match existing prior to construction.

1.5 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. 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.

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- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.6 Definitions

- A. Caliper: Caliper on young trees is taken six (6) inches above the soil level and measured by a diameter across the tree trunk. For a tree exceeding a four (4) inch caliper, the diameter measurement is then taken at twelve (12) inches above the soil level. For a mature tree, the caliper is taken at chest height, generally 4-1/2 to 5 feet above the soil level. The measurement is taken using a tree caliper, a utensil in the shape of an "F" with an adjustable cross arm to slide and rest up against the trunk to measure the precise distance of the trunk width.
- 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 defined by a circle concentric with each tree with a radius equal to the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

PART 2 - PRODUCTS

2.1 TREE PROTECTION PROTECTIVE FENCE

- A. Existing vegetation and/or trees to remain on the site shall be protected with a five (5) foot high orange plastic snow fence. Fence shall be mounted on two (2) inch diameter lodge pole posts driven into the ground every six (6) feet to a depth of at least two (2) feet. Fence shall be erected and installed around the perimeter dripline of each shrub, tree or groups of shrubs or trees to remain.
 - 1. Snow Fence: Orange, UV resistance, 3-inch thickness, 60 inches in height, oval mesh, extruded thermal plastic polymer, Tenax or equal, fence fabric.
 - 2. Lodgepole: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated Douglas Fir or lodgepole pine, free of knots, holes, cross grain, and

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other defects, two (2) inches in diameter by length required, and pointed at one end.

3. Signage: Each tree fence shall have a prominently displayed 8.5 inch x 11 inch sign stating "Warning – Protection Zone".
- B. During planting and irrigation operations, protective fencing is not required beneath existing to remain trees and shrubs that fall within the newly landscaped and/or irrigation area.

2.2 TOPSOIL

- A. Natural or cultivated top layer of the soil profile or manufactured topsoil; 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 one (1) inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.
- B. Import topsoil shall be obtained from a local and come from a site similar to soil characteristics as the project site.
- C. On-site topsoil shall be naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of the original, undisturbed surface soil containing organic material necessary nutrients and minerals to sustain plant growth.

2.3 NITROGEN STABILIZED ORGANIC AMENDMENT

- A. 0-1/4 inch nitrogen-stabilized organic amendment contributing at least 270 pounds of organic matter per cubic yard. Greenwaste compost is acceptable if recommended by soil analysis lab. Compost shall be obtained from a supplier participating in the Seal of Testing Assurance (STA) program of the U.S. Composting Council.

2.4 ORGANIC MULCH

- A. Refer to specification section 32 90 00 "Planting" and match organic mulch material to use in non-bio-retention planting areas.
- B. If specification section 32 90 00 "Planting" is not issued as part of this project, provide the following mulch for non-bio-retention planting areas:
 - 1. Organic Mulch for non-bio-retention planting areas: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of organic bark from Vision Recycling. Mahogany Wood Chip, available from Vision Recycling (510) 429-1300, www.visionrecycling.com, 41900 Boscell Road, Fremont, CA

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94538. Color to be Mahogany. Submit sample to Owners Representative's for review and approval.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prior to demolition and construction, Certified Arborist shall review existing to remain trees and vegetation and prepare a written report(s) as required for the protection, treatment and maintenance of existing trees and vegetation throughout the phases of the Project.
- C. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Inspections: Engage a qualified arborist to direct plant protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain, to over-see removal and re-installation of existing plant material and to prepare inspection reports.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
- C. 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.
- D. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas if indicated within Drawings.

1. Apply 3-inch minimum thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTIVE FENCE INSTALLATION

- A. 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. Install fencing in a manner that will prevent people from easily entering protected area 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. Plastic Protection Zone Fencing: Neatly install protection zone plastic fabric by securing to posts with plastic bands or steel wires, a minimum of two per post, additionally if required to withstand typical construction activity.
 2. Posts: Set or drive posts into ground at least two (2) feet without concrete footings and no more than six (6) feet on center spacing. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner's Representative.
 3. Access Gates: Install as necessary; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Owner's Representative. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than two signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.

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- D. Maintain protection-zone fencing and signage in good condition as acceptable to Owner's Representative 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. Temporary access is permitted for landscape irrigation and planting operations.

3.4 ARBORIST SUPERVISION

- A. For construction within ten (10) horizontal feet of a tree and/or shrub to remain, with a trunk diameter of twelve (12) inches or larger measured three (3) feet above original finish grade, Contractor shall retain the services of a reputable Arborist certified by the International Society of Arboriculture (ISA) to review the tree(s) and/or shrubs(s), the work to be performed and provide written recommendations to minimize the impact on existing trees and/or shrubs to remain. Submit recommendations to Owner's Representative for review.
- B. Contractor shall implement Arborist recommendations.
- C. Contractor shall consult Arborist for further recommendations if tree(s) and/or shrub(s) appear in failing health until final completion and acceptance of landscape work.

3.5 EXCAVATION

- A. General: Excavation and trenching shall be performed at a minimum, in accordance with these specifications and per Drawings and Details and in accordance with recommendations from project Arborist retained by Contractor.

- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots 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.
- 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.

3.6 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.

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- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil

3.7 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. 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.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible.

- B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

3.8 CANOPY PRUNING

- A. General Pruning Procedures:

1. Prune trees according to ANSI A300 (Part 1).
2. Cut branches with sharp pruning instruments; do not break or chop.
3. Do not apply pruning paint to wounds.

- B. Pruning Goals (Prune as follows and under the direction of Certified Arborist):

1. Prune trees to remain to compensate for root loss caused by construction damage. Provide subsequent maintenance during landscape irrigation and planting maintenance period and until “final completion” as recommended by Certified Arborist.
2. Prune to remove dead wood, promote proper structure, thin and open canopy, and for general health for the specific tree species.
3. Prune for clearance from structures, pathways and driveways and streets and for a balanced canopy.

C. Shrubs, Vines, and Ground Covers:

1. Prune, thin, and shape shrubs according to standard horticultural practices.
2. Prune to remove injured or dead branches from shrubs.
3. Cleaning: Chip removed branches and dispose of off-site.

3.9 IRRIGATION

- A. Irrigate existing vegetation and/or trees to remain and those relocated during hot and/or dry periods and as required to maintain material in a healthy, vigorous condition.

3.10 REMOVE AND RE-INSTALL EXISTING PLANT MATERIAL (CALIPER 6” AND SMALLER)

- A. Plant material noted on Drawing to be transplanted shall be carefully removed from planting area and planted in new location indicated on Planting Plan. Removal shall consist of digging around the dripline of each plant to be transplanted and to the depth where roots are present. Plant and rootball shall be carefully moved to new planting pit.
- ~~B.~~ Re-install transplanted plant material to location indicated on Drawing.

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- C. Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Excavate approximately planting pit sizes twice the width of the planting pot and equal to the depth of the planting pot.
 - 1. Carefully install root ball without damaging root ball or plant.
 - 2. Set rootball onto compacted native soil so the rootball sits one (1) inch above adjacent finish grade.
 - 3. Backfill with planting soil consisting of one part nitrogen stabilized organic amendment thoroughly mixed with four parts on-site topsoil.
 - 4. Place planting soil around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil.
 - 5. For trees, stake tree(s) per tree planting detail.

3.11 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner's Representative.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.

5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the maintenance period or are damaged during construction operations that the Owner's Representative determines are incapable of restoring to normal growth pattern.
1. Provide new trees of same size and species as those being replaced for each tree that measures three (3) inches or smaller in caliper size.
 2. Provide new trees of 48" box size and species as those being replaced for each tree that measures greater than three (3) inches. In addition, the liability to the General Contractor shall be set at \$1,500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture must be used to compute the actual value.
 3. Plant and maintain new trees as specified in Section 32 90 00 "Planting."
- C. Soil Aeration: Where directed by the Owner's Representative, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill two (2) inch diameter holes a minimum of 12 inches (300 mm) deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.
- 3.12 REMOVAL OF EXISTING TREES:
- A. Contractor shall remove and demolish from the site trees and vegetation indicated on the Drawings. Additional trees and vegetation conflicting with work require written approval by Owner or Architect.
 - B. Tree removal shall include branches, leaves, roots, stumps and stump grindings to a minimum depth of 18" below proposed subgrade. Exact depth shall be determined in accordance with and as required for building and hardscape work included under this contract.

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- C. Contractor shall fill depressions caused by tree removal with topsoil or site soil.
- D. Properly dispose of any vegetation debris in a legal and acceptable manner off project/site property.

3.13 MAINTENANCE OF EXISTING SHRUBS AND/OR TREES DURING CONSTRUCTION

- A. Irrigate existing shrubs and/or trees to remain and those relocated during hot and/or dry periods and as required to maintain material in a healthy, vigorous condition.
- B. Do not store equipment, materials or vehicles beneath existing to remain trees.
- C. Contractor shall exercise caution when working around tree canopies to ensure branches are not torn or broken, bark is not damaged and canopy remains intact.
- D. Protect tree and/or shrub root systems from damage caused by runoff or spillage of noxious materials while mixing, placing or storing construction materials. Protect root system from ponding, eroding or excessive wetting caused by dewatering operations.
- E. Monitor existing to remain trees and/or shrubs to remain for pests and diseases and signs of distress. Retain the services of a Certified Arborist to review and remedy signs of distress, pests and/or disease.
- F. Maintain protective fencing at original location in vertical, undamaged condition until all contractors and subcontractors are complete.
- G. The project Certified Arborist shall be notified of any damage that occurs to a protected tree during construction and proper treatment shall be administered as recommended by the Certified Arborist.

END OF SECTION 32 91 00

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SECTION 32 92 00

TURF PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Sodding.
- B. Related Sections include the following:
 - 1. Specification Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.
 - 2. Specification Section 31 05 13 "Earthwork" for excavation, filling and backfilling, and rough grading.
 - 3. Specification Section "Subdrainage" for subsurface drainage.

1.3 DEFINITION:

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.

- C. **Manufactured Topsoil:** Soil produced off-site by homogeneously blending nutrients, minerals, soils or sand with stabilized organic soil amendments to produce surface planting soil capable of sustaining plant growth.
- D. **Planting Soil:** On-site topsoil, import topsoil or manufactured topsoil.
- E. **Subgrade:** Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.
- F. **On-site Topsoil:** Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil and plant lab.
- G. **Substantial completion for landscape and irrigation:** Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.
- H. **Final completion for landscape and irrigation:** Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

1.4 SUBMITTALS

- A. **Product and Material Data:** For each type of product specified. Submit manufacturer's technical data and installation instructions for landscape products conforming to requirements of Section 01 33 00 Submittal Procedures to include, but not be limited to:
 - 1. Analysis of proposed soil amending materials by Soil Testing Laboratory, made according to methods established by the Association of Official Analytical Chemists, where applicable.

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2. Certification of turfgrass sod, identifying source, including name and telephone number of supplier.
 3. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
 4. Planting soil amendments as recommended by Soil Testing Laboratory.
- B. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner's Representative upon delivery.
- C. Qualification Data: For landscape Installer prior to performing work.
- D. Planting Schedule: Indicating anticipated planting dates for turf installation.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Experience: The turf installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
 2. Licensure: The turf installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
 3. Supervision: The turf installation firm shall have a qualified and experienced turf technician on site during turf installation.
- B. Soil Testing Laboratory Qualifications: Testing lab shall be one of the following:
1. Lucchesi Plant & Soil Consulting, located in Los Gatos, CA (408) 337-2575
 2. Waypoint Analytical California, Inc. located in Anaheim, CA (714) 282-8777

3. Or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity (CEC) or total exchangeable cations (TEC); sodium absorption ratio; deleterious material; pH; soluble salts, boron, mineral and plant-nutrient content of planting soil.
 1. Report suitability of planting soil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.
 - D. Pre-installation Conference: Conduct conference at Project site with General Contractor and/or Owner's Representative to comply with requirements in Division 1 Section "Project Management and Coordination"
 - E. Protect all lawn areas from damage or trespass by maintaining temporary barriers or protective fencing during construction and maintenance. Barrier and/or fencing material and installation method shall be approved by the Owner's Representative prior to installation.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Sod: Harvest, deliver, store, and handle sod according to requirements in Turf Producers International's (TPI) "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."
- 1.7 PROJECT/SITE CONDITIONS
- A. Prior to placing topsoil, Contractor shall collect and submit soil samples representative of on-site topsoil and/or import topsoil proposed for use in all planting and lawn areas to Soil Testing Lab for analysis and soil amending recommendations. Submit test

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results analysis and recommendations to Owner's Representative for review and approval prior to beginning work.

- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- C. Irrigation system shall be installed and operable before beginning planting operations.

1.8 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Sodded Lawns: Maintenance period shall be a minimum of ninety (90) days from date of Owner's Representative written approval of Substantial Completion and when there are no visible joints, roots are thoroughly knit to the soil and sod appears to be uniformly healthy and green in color.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, edging and spraying for insects and disease and other operations. Roll, re-grade, and re-plant bare or eroded areas with specified sod to produce a uniformly smooth lawn. Implement pest management as necessary to controls pests, including gophers.
- C. Watering: Provide and/or maintain temporary piping, hoses, and lawn-watering equipment as necessary to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of mulch.
 - 2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one third (1/3) of grass height. Remove no more than one third (1/3) of grass-leaf growth in initial or subsequent mowings. Do

not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow and edge before turf reaches three and one-quarter (3-1/4) inches high.
 2. Cut to two and one-half (2-1/2) inches high.
 3. Remove all clippings.
- E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.
1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.
- F. Maintain protective barriers in place, erect and secure and clear of lawn edges to allow for uniform growth and for trimming and so as not to block irrigation spray pattern.

1.9 WARRANTY

- A. All work executed under this Section shall be warranted free of defects and poor workmanship for a period of one (1) year after date of Final Completion.
- B. Turf planting shall be warranted to be in healthy and thriving condition during Warranty period, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.
- C. Repair and/or re-sod turf areas not in vigorous condition immediately upon notification by Owner's Representative during Warranty period.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod

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Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Not less than 2 years old, free of weeds and undesirable native grasses and machine cut rolls to pad thickness of 5/8 inch, rolled, 4' wide and 90' length.

- B. Turfgrass Species: Sod of grass species as follows, with not less than 90 percent germination, not less than 95 percent pure seed, and free of weed seed:
 - 1. Mixture of 90% tall fescue blend and 10% blue grass blend.
 - a. Available through Delta Bluegrass Co., www.deltabluegrass.com, (800) 637-8873
- C. Delivery, Storage and Handling: Sod shall be harvested, delivered and installed within a period of 24 hours. Sod shall be kept moist, fresh and protected at all times.

2.2 PLANTING SOIL

- A. Prior to placing bid, Contractor to coordinate with General Contractor, Demolition and/or Grading Contractors and verify quantity and source of planting soil for turf planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of six (6) inches of planting soil in turf planting areas and rough grading in accordance with these specifications, details, notes, grading and drainage plans.
- B. Coordinate with General Contractor, Demolition and/or Grading Contractors for removal and replacement of any lime treated soils and replacement with planting soil prior to planting turf to depth required to remove lime treatment.
- C. On-site topsoil: Reuse existing topsoil or existing surface soil, found in the top twelve (12) inches, excavated and stockpiled on-site. Verify suitability of existing and/or stockpiled surface soil to produce planting soil by submitting a sample to Waypoint Analytical California, Inc. (408) 727-0330, or approved equal. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 6.0 to 7.0, representative of productive soils in the

vicinity, a range of 4 to 20 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR) shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm.

D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:

1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.

Class	Particle Size Range	Maximum %	Minimum %
Coarse Sand	0.5 – 2mm	15	0
Silt	.002 - .05 mm	30	10
Clay	< .002 mm	25	10

Other Classes			
Gravel	2 – 13 mm	15	0
Rock	½ - 1 inch	5% by volume with none > 1 inch	
Organic		15	0

2. Chemistry – Suitability Considerations

Salinity:	Less than 3.0 dS/m @ 25 degrees C.
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Saturation Extract Conductivity (ECe)	
Sodium: Sodium Adsorption Ratio (SAR)	Less than 1.00 ppm
Boron: Saturation Extract Concentration	Less than 6.00 ppm
Reaction: pH of Saturated Paste:	5.5 – 7.5 <u>without</u> high lime content.

3. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.
4. Soil testing: Contractor shall submit to the Owner’s representative for approval, certification from an agricultural soils testing laboratory, Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, that the import topsoil provided conforms to the specifications prior to delivery of import or placement of on-site topsoil. Soil testing shall have been performed on import topsoil source within the previous year.

2.3 FERTILIZER AND SOIL AMENDMENTS

- A. Contractor shall collect and submit two samples of proposed planting soil, representative of the top six (6) inches of planting soil, to a locally known soil testing laboratory, Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, for analysis and amendment recommendations. Soil samples shall be taken from proposed planting areas or topsoil source. Sample shall be taken to a depth of 8 inches. Contractor shall amend per soil testing laboratory recommendations. Soil amendments in this specification are provided for bidding purposes only.

- B. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.
- C. Soil Preparation: As specified in soil laboratory recommendation. The following materials and quantities are given for bidding purposes only. Contractor shall amend soil using products, quantities and methods specified by Waypoint Analytical California, Inc., or approved equal.
 - 1. 6-20-20 granular fertilizer.
 - 2. Soil sulfur.
- D. Soil Conditioner: 0-1/4 inch nitrogen-fortified organic amendment contributing at least 270 pounds of organic matter per cubic yard.

2.4 HERBICIDES

- A. Contact Owner's Representative for local, State and Federal policies and procedures for regulating application of chemical controls. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.
- B. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove broad-leaf weeds from existing turf.
- C. Non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove herbacious vegetation in areas indicated.

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2.5 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to sodded areas.

2.6 LANDSCAPE EDGINGS/HEADERBOARD

- A. Wood Strip Edging: Of sizes shown, and as follows:
 - 1. Wood Material: Construction heart redwood, 2 by 6 in size, length as required.
 - 2. Stakes: Construction grade, rough sawn, wood, 2 by 2 by 16 inches long in nominal size, with galvanized, wood, screws for anchoring edging to wood strip edging.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

3.2 PREPARATION

- A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- C. Install protective barriers and/or fencing as necessary.

- D. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides, pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.
 - E. Import Planting Soil Installation:
 - 1. Replace lime treated soils, if any, with acceptable planting soil
 - 2. Remove and dispose of stones larger than one (1) inch in any dimension, vegetation and foreign inorganic material from surface to receive import topsoil.
 - 3. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported topsoil layer to subgrade.
 - 4. Place topsoil on loosened material in six (6) inch layers. Crossrip first import topsoil layer to a depth of eight (8) inches and blend import topsoil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate topsoil and compact to 85% density.
 - 5. Continue placement of import topsoil after blending first layer with native soil in six (6) inch layers and rolling lightly to consolidate and compact each layer of topsoil.
 - 6. Place topsoil to the lines and grades in accordance with grading Drawings.
 - F. Verify installation of planting soil to minimum depth of six (6) inches and rough grading completed to proper slopes and elevations.
- 3.3 SOIL AMENDING AND FINE GRADING (Amend per Soil-Testing Laboratory recommendations. The following recommendations are given for bidding purposes only.)
- A. Soil Preparation: Loosen subgrade of planting beds by crossripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch

in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.

- B. Soil Amending: (Amend per Soil-Testing Laboratory recommendations. The following recommendations are provided for bidding purposes only.) Add the following and thoroughly till into the top six (6) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.
1. 6 cubic yards nitrogen fortified organic soil amendment.
 - a. In order to comply with MWELD 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than six percent (6%) organic matter in the top six (6) inches are exempt from adding compost.
 2. 14 pounds all-purpose granular fertilizer (6-20-20).
 3. 15 pounds soil sulfur.
- C. Compaction: After amending, compact soil to 85% density.
- D. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges.
1. There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.
 2. In sodded turf areas, grade surface to one (1) inch below adjacent paved surfaces, utility boxes, tops of curbs, etc.

- E. Moisten prepared lawn areas before planting if planting soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil conditions.
- F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted planting soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
 - 3. Hold sod clear of all tree trunks and tree staking, create a circular edge 12" clear of all tree trunks.
- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist planting soil to a minimum depth of 1-1/2 inches below sod.

3.5 SELECTIVE BROADLEAF WEED KILL

- A. Refer to herbicide manufacturer recommendations. Apply selective broadleaf herbicide where indicated prior to disturbing on-site soil per manufacturer recommendations. Re-apply as necessary for complete weed kill by end of maintenance period.

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3.6 MAINTENANCE SCHEDULE

- A. Protection: Protect work from damage, erosion and trespass. Maintain construction fencing in proper condition. Remove temporary fencing and/or barriers prior to final completion and at end of maintenance period.
- B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis, each week during plant establishment and monthly thereafter. Adjust and repair the irrigation system and its components as necessary for turf establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.
- C. Fertilizing (confirm with Soil and Plant Laboratory, or approved equal, recommendations): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.
- D. Weed Control: Maintain turf planting areas in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. Contractor shall obtain written approval from project owner prior to application of herbicide. No herbicide shall be used without the Owner Representative's prior consent. Use only approved herbicides, use in accordance with manufacturer's recommendations and per Pest Control Advisor's recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions. Review and perform weekly during maintenance period.
- E. Lawns: Maintain lawns by watering, fertilizing weeding, trimming, mowing and other operations such as rolling, re-grading and replanting as required to establish a smooth, acceptable lawn, free of weeds, bare spots and rocks. All lawn areas shall be mowed

regularly when grass reaches a height of three and one-quarter (3-1/4) inches and a minimum of two (2) days prior to end of maintenance period.

- F. Disease, Pest and Insect Control: Disease, pest (including moles, gophers and geese) and insect damage shall be controlled by the use of fungicides, insecticides, pesticides, poisons and/or mechanical means. Contractor shall obtain written approval from project Owner prior to application of fungicides, insecticides, poisons, pesticides and/or mechanical means and shall abide by all posting requirements prior to application. Review and perform weekly during maintenance period.

3.7 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION

- A. Contact Owner's Representative a minimum of 48 hours prior notice for review and approval of the following prior to proceeding with subsequent work:
 - 1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.
 - 2. Layout: Layout of all plants, headerboard and other major elements shall be directed and/or approved by the Owner's Representative.
 - 3. Substantial Completion Review (Pre-maintenance): At substantial completion of this Section, work shall be reviewed for conformance with the Drawings. Written approval shall mark beginning of the maintenance period.
 - 4. Final Completion Review: At the end of specified maintenance period, work shall be reviewed for conformance with Drawings including additional requirements stipulated during maintenance period shall be extended at Contractors sole cost as directed by the Owner's Representative.
 - 5. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.

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- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory and upon written approval of Owner.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period

END OF SECTION 32 92 00

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**SECTION 33 40 00
STORM DRAINAGE UTILITIES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes gravity site storm sewerage drainage piping, fittings and accessories, and bedding; bio-retention facilities connection of drainage system to municipal sewers and on-site points of connection; and catch basins, area drains, and cleanouts.
- B. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork.
 - 2. Section 31 23 00 - Excavation.
 - 3. Section 31 23 16.13 - Trenching.
 - 4. Section 31 23 23.13 - Backfill.
 - 5. Section 33 49 13 - Storm Drainage Manholes, Frames, and Covers.
 - 6. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- A. AASHTO M36 (American Association of State Highway and Transportation Officials) - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.
- B. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- C. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- D. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- E. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- H. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- I. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- J. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- L. ASTM D7613 - Polypropylene Liner.
- M. Class II Permeable Materials - To meet the requirements of Caltrans Standard Specification 68-1.025.
- N. ASTM D6707 - Mirafi Filter Fabric.

1.3 SUBMITTALS

- A. Section 01 34 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating pipe, pipe accessories, and fittings.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents:
 - 1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Operation and Maintenance Data: Procedures for submittals.

1.5 COORDINATION

- A. Section 01 50 50 - Temporary Facilities and Controls.
- B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, municipal sewer utility service, and on-site points of connection.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Sewer Pipe Materials:
 - 1. Cast Iron Pipe: ASTM A74, Service type, inside nominal diameter of 4 to 12 inches, bell and spigot end.
 - 2. Cast Iron Pipe Joint Device: ASTM C564, rubber gasket joint devices.
 - 3. Concrete Pipe: ASTM C14, Class 3; unreinforced; inside nominal diameter of 10 inches, bell and spigot end joints.
 - 4. Concrete Pipe Joint Devices: ASTM C443, rubber compression gasket joint.
 - 5. Reinforced Concrete Pipe: ASTM C76, Class III or IV; inside nominal diameter of 12 to 60 inches, bell and spigot end joints.
 - 6. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint.
 - 7. Plastic Pipe: ASTM D2751, SDR 26, Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter of 4 to 24 inches, bell and spigot style solvent sealed joint end.

8. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) SDR-26 material; inside nominal diameter of 4 to 24 inches, bell and spigot style rubber ring sealed gasket joint.
9. Corrugated Steel Pipe: AASHTO M36; nominal diameter of 12 to 60 inches, end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.
10. Corrugated Steel Pipe Coupling Bands: Galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.
11. Perforated Plastic Pipe: ASTM D3034, PVC with perforations.

B. Liner:

1. 30 mil polypropylene liner.

2.2 ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Grout: Specified in Section 03 30 00.

2.3 CATCH BASINS AND PLANT AREA DRAINS

- A. NEW - As specified on the drawings.
- B. EXISTING – Adjust as specified on the drawings. For inlets in pedestrian areas, ensure grates are ADA compliant. Replace non-compliant grades as necessary.

2.4 CLEANOUTS

- A. As specified on the drawings.

2.5 BEDDING AND COVER MATERIALS

- A. Bedding: Fill as specified by pipe manufacturer and approved by Soils Engineer.
- B. Cover: Fill as specified in the project Soils Report and any supplements to the Soils Report.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 06 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with bedding material.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 16.13 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Perforated pipe shall be installed with perforations down.
- D. Install trench fill at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.
- E. Refer to Section 31 23 23.13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- F. Refer to Section 33 49 13 for manhole requirements.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.
- C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 INSTALLATION – BIO-RETENTION FACILITIES

- A. Form bottom of excavation smooth to correct elevation.

- B. Install welded seam 30 mil polypropylene liner in basin bottom.
- C. Install Class II permeable material minimum 2" under perforated pipe.
- D. Install remainder of Class II permeable material.
- E. Install Mirafi Filber Fabric over permeable materials.
- F. Install top soil.

3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.
- C. Compaction testing will be performed in accordance with ASTM D1557.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

3.8 INSTALLATION, FLUSHING & CLEANING

- A. All new pipe installed and existing pipe connected to shall be flushed, cleaned and videoed for at least 200 feet downstream, or to the next downstream inlet or manhole, whichever is farther, of last point of connection to ensure clean and functioning system.

3.9 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Where pipe is damaged or displaced, take remedial measures as directed by the Architect/Engineer including, but not limited to, retesting of joints, relaying pipe or replacing pipe. Provide remedial measures at no additional cost to the Owner.

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END OF SECTION

SECTION 33 49 13
STORM DRAINAGE MANHOLES, FRAMES, AND COVERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular precast concrete manhole sections with tongue-and-groove joints, covers, anchorage, and accessories.
- B. Related Sections:
 - 1. Section 31 23 00 - Excavation and Fill.
 - 2. Section 31 23 23.13 - Backfill.
 - 3. Section 03 30 00 - Cast-In-Place Concrete.

1.2 REFERENCES

- A. ACI (American Concrete Institute) 318 - Building Code Requirements for Reinforced Concrete.
- B. ASTM A48 - Gray Iron Castings.
- C. ASTM A536 - Ductile Iron Castings.
- D. ASTM C39 - Test Method for Compressive Strength of cylindrical Concrete Specimens.
- E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- F. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.3 DESIGN REQUIREMENTS

- A. Equivalent strength shall be based on structural design of reinforced concrete as outlined in ACI 318.
- B. Design of lifting devices for precast structures shall conform to ASTM C 913.
- C. Design of joints for precast structures shall conform to ASTM C 913.

1.4 SUBMITTALS

- A. Section 01 34 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.
- C. Product Data: Submit manhole covers, component construction, features, configuration,

and dimensions.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with local municipality Public Work's standard.
- B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 01 63 10 - Product Requirements: Product storage and handling requirements.
- B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and drainage structures.
- C. Store precast concrete manholes and drainage structures to prevent damage to the Owner's property or other public or private property, and any property so damaged shall be repaired at the Contractor's expense.
- D. Clearly mark each precast structure by indentation or waterproof paint to indicate the date of manufacture, manufacturer and identifying symbols and/or numbers shown on the Contract Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 MANHOLES, FRAMES, AND COVERS

- A. As specified by the local municipality.

2.2 COMPONENTS

- A. As specified by the local municipality.

2.3 CONFIGURATION

- A. As specified by the local municipality.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 06 00 - Administrative Requirements: Coordination and Project Conditions.
- B. Verify items provided by other sections of Work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into Work.

- D. Verify excavation for manholes is correct.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures under site conditions known to result in loads heavier than that for which the structure was designed.
- C. Inspect precast concrete structures immediately prior to placement in the excavation to verify that they are internally clean and free from damage. Remove damaged units from the construction site and replaced, at no additional cost to the Owner.

3.3 INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate for manholes and drainage structures in accordance with Section 31 23 00 in the location and to depth shown. Provide clearance around the sidewalls of the structure as required for construction.
 - 2. If groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in a dry trench.
 - 3. Where the possibility exists of a watertight structure becoming buoyant in a flooded excavation, take necessary steps to avoid flotation of the structure.
- B. Place base pad, trowel top surface level.
- C. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- D. Backfill excavations for manholes and drainage structures in accordance with Section 31 23 00.
- E. Form and place manhole cylinder plumb and level, to correct dimensions and elevations.
- F. Cut and fit for pipe.
- G. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- H. Set cover frames and covers level without tipping, to correct elevations.
- I. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND DRAINAGE STRUCTURE INSTALLATION

- A. To ensure safety, lift precast structures at the lifting points designated by the manufacturer.
- B. When lowering manholes and drainage structures into the excavations and joining pipe to

the units, take precautions to ensure that the interior of the pipeline and structure remains clean.

- C. Set precast structures so that they firmly and fully bear on crushed stone bedding, compacted in accordance with the provisions of Sections 31 23 00 and 31 23 23.13, or on other support system shown on the Contract Drawings.
- D. Assemble multi-section structures by lowering each section into the excavation. Lower, set level, and firmly position the base section before placing additional sections.
- E. Ensure joint integrity by removing all foreign materials from joint surfaces and verifying that sealing materials are placed properly. Avoid misalignment by using guide devices affixed to the lower section.
- F. Joint sealing materials may be installed at the site or at the manufacturer's plant.
- G. Verify that manholes and drainage structures installed satisfy required alignment and grade.
- H. Remove knockouts or cut structure to receive piping so as not to create openings more than that required to receive pipe. Fill annular space with mortar.
- I. Cut pipe to finish flush with interior of structure.
- J. Shape inverts through manhole as shown on the Contract Drawings.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Control: Testing and inspection services.
- B. Field tests will be used to evaluate and approve cast-in-place concrete in accordance with Section 03 30 00.
- C. Vertical Adjustment of Existing Manhole and Drainage Structures:
 - 1. Where required, adjust the top elevation of existing manholes and drainage structures to suit finished grades shown on the Contract Drawings.
 - 2. Reset existing frames, grates and covers, carefully removed, cleaned of all mortar fragments, to the required elevation in accordance with the requirements specified for installation of castings.
 - 3. Remove the concrete so as not to damage the existing vertical reinforcing bars when removal of an existing concrete wall is required. The vertical bars shall be cleaned of all concrete and bent into the new concrete top slab or spliced to required vertical reinforcement, as shown on the Contract Drawings.
 - 4. Clean and apply sand-cement bonding compound on all existing concrete surfaces to receive cast-in-place concrete. Sand-cement bonding compound and its application shall be in accordance with Section 03 30 00.

END OF SECTION