

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

Includes the following sections:

- 32 10 00 00 Bases, Ballasts, and Paving
- 32 13 13 00 Concrete Paving
- 32 15 00 00 Aggregate Surfacing
- 32 17 26 00 Tactile Warning Surfacing
- 32 31 13 00 Automated Vehicle Gates
- 32 84 00 00 Planting Irrigation
- 32 90 00 00 Planting

<b>BASES, BALLASTS, AND PAVING</b>	<b>32 10 00</b>
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Roadway and parking pavement sections are to be designed by a licensed Geotechnical Engineer pursuant to the Traffic Index associated to the roadway or parking lot, in accordance with Caltrans Highway Design Manual, latest edition, for a 20-year life. Materials and installation shall conform to the Caltrans Standard Specifications and Plans, latest edition, unless otherwise required by the University’s Representative. Traffic signs and pavement markings shall conform to California’s September 26, 2006 adoption of the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD).

<b>CONCRETE PAVING</b>	<b>32 13 13</b>
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When the scope of the work is limited to relatively small areas, the guidelines specified in the University’s Standard Specification Section 01 73 29 Cutting and Patching shall take precedence.

Refer to Drawings section of Campus Design Guide for typical sidewalk details.

There are two types of standard finishes for sidewalks and flatworks: exposed aggregate with smooth perimeter and broom swept. Consult the University’s Representative for the appropriate locations.

Exposed aggregate sidewalks and flatwork

1. General Requirements: Application of the following exposed aggregate concrete specification is primarily intended to be used in conjunction with new building construction or extensive hardscape developments where an accepted uniform concrete finish and overall appearance for exterior concrete hardscape is desired. This specification, therefore, applies to the new sidewalks, pathways, courtyards and plaza areas of and surrounding new campus buildings. Additionally, when existing campus facilities are undergoing renovation and replacement of sidewalks, pathways, courtyards and similar areas, evaluation of utilizing this specification is required.
2. Scope of Work: Exterior concrete sidewalks, pathways, courtyards and plazas shall conform to the following design criteria:

- a. Consist of concrete panels with 12-inch wide smooth banded perimeter sections surrounding interior sections of exposed aggregate.
  - b. Width, length and spacing of individual concrete panel sections to be a function of the surrounding physical requirements and constraints and shall attempt to incorporate the desired architectural theme of the campus improvement.
3. Materials:
- a. Course aggregate: Cache Creek 3/8 inch x number 8 pea gravel, (1,650 lbs., 9.94 cubic feet, +/- 5 percent by volume).
  - b. Stone color: Red, black, brown and a minor amount of white evenly distributed.  
NOTE: Contractor to coordinate with the University's Representative regarding mix and finish. This may require, at the discretion of the University's Representative that a sample panel be provided by the Contractor for evaluation and approval by the University's Representative.
  - c. Reference mix design: Mix Number X8W6041A (Teichert Cache Creek Plant), or equal. Note to Design Professional: A reference site to serve as a control sample for finished appearance of this mix design is present in sidewalks located on the south and west sides of Hunt Hall on the UC Davis Campus.

Broom swept, smooth finish sidewalks and flatwork

- 1. General Requirements: Application of the following smooth finish concrete specification is primarily intended to be used at minor walkways. Verify locations with the University's Representative.
- 2. Finish: Medium broom finish swept perpendicular to direction of path.

<b>AGGREGATE SURFACING</b>	<b>32 15 00</b>
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Refer to the University's Standard Specification [Section 32 90 00 Planting](#).

<b>TACTILE WARNING SURFACING</b>	<b>32 17 26</b>
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Truncated Domes:

Materials: Tek-Way concrete dome tiles with integral color and spacing at 2.35 inches on center, or equal (no known equal).

Color:

- 1. At new locations where all connecting crosswalks are to be new installations, the charcoal/black color shall be selected.
- 2. At locations connecting to existing truncated dome installations to remain, the color shall be selected from the manufacturer's standard colors to match existing.

**AUTOMATED VEHICLE GATES****32 31 13**

## General requirements:

1. Automated vehicular gates shall comply with the following:
  - a. UL325 Safety Standards
    - i. Per UL 325, vehicular gate operators are not authorized for use by pedestrians, thus an alternate entry point must be provided if pedestrians are to gain access to a secured area.
  - b. ASTM F2200 Gate and Fence Standards.
  - c. Manufacturer product literature demonstrating the gate mechanism has been tested to 200,000 cycles without breakdown.
  - d. Five year limited warranty against defects in materials and workmanship
  - e. Minimum of ten years of experience in the manufacture of hydraulic gate operators of the type specified

## Design requirements:

1. Vehicular gates shall utilize a ground mounted V-track roller system the entire gate travel length. Pipe track roller systems are not acceptable.
2. Operation shall be by means of a metal rail passing between a pair of hydraulically driven solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds (136 kg) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing 1500 pounds (680 kg) to 8000 pounds (3629 kg). Gate panel velocity shall not be less than 1.0 foot (.30 m) per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.
3. Gate operator shall be HySecurity Model - 222 1 HP, hydraulic, sized appropriately for the gate design, with extruded 6061-T6 aluminum, 3/16 inch thick drive rail, or equal.
  - a. All components shall be housed in a 16 gauge minimum, zinc plated, lockable steel enclosure with textured TGIC polyester powder coat finish, proven to withstand 1000-hour salt spray test
  - b. Chassis: 1/4" (6.35 mm) steel base plate, and 12 Ga. (2.66 mm) sides and back welded and ground smooth all joints welded and ground smooth
  - c. Chain drive gate operator systems are not acceptable.
4. V - Groove wheels shall be 6 inch hardened, solid steel, with 2 inch hub, utilizing two sealed bearings.
5. Drive wheels shall be two 6" (152 mm) Dia. metal hub with polyurethane tread.
6. Drive release must instantly release tension on both drive wheels, and disengage them from contact with the drive rail in a single motion, for manual operation
7. Tension spring shall be 2-1/2" (63.5 mm) heavy duty with 800 pound (363 kg) capacity
8. Hydraulic hose shall be 1/4" (6.35 mm) synthetic rated to 2750 PSI
9. Hydraulic valves shall be individually replaceable cartridge type, in an integrated hydraulic manifold

10. Wire loops shall be Service Wire Company 12AWG USE-2, RHH, RHW-2, or equal.
11. Access on the exterior side of the gate shall be provided by both, UCDFD Standard Knox switch and Schlage Locknetics 653-0505-WP or equal key switch mounted in an 8 inch x 8 inch square housing, (Pedestal CEO model # MC-CS-8-E or equal) on a goose neck pedestal.
  - a. Pedestal shall be protected on both sides parallel to the flow of traffic by 4 inch or 6 inch concrete filled steel bollards.
  - b. If system is configured with credentialed exiting (Key/Card), interior pedestal shall be configured as described above.
  - c. For specific requirements for gate controls, consult the University's Representative.

Minimum Standard electrical requirements

1. 1 HP, 56C, TEFC, continuous duty pump motor, with a service factor of 1.15, or greater. Standard voltages available, single or three phase
  - a. inherent entrapment sensor;
  - b. built in "warn before operate" system;
  - c. built in timer to close;
  - d. liquid crystal display for reporting of functions;
  - e. 26 programmable output relay options;
  - f. anti-tailgate mode;
  - g. built-in power surge/lightning strike protection;
  - h. menu configuration, event logging and system diagnostics easily accessible with a laptop and software;
  - i. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems or network interface

<b>PLANTING IRRIGATION</b>	<b>32 84 00</b>
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General notes and design requirements

1. Design of irrigation systems shall be based on hydrozones and plant requirements. Areas with differing exposures and groups of plants with different water needs shall not be grouped into the same irrigation zone.
2. While design of water efficient irrigation systems is recommended, use of drip irrigation may not be approved for certain areas where future disturbance is anticipated (in utility corridors, high traffic areas etc.). Use of high efficiency spray systems where appropriate, is encouraged.
3. Irrigation stations with low precipitation rate, multi-stream spray heads must not be designed for maximum flow rate. Design to 70 percent of pipe capacity.

The Campus has developed a Standard Specification Section 32 84 00 Planting Irrigation. The specification shall be modified by the Design Professional to meet project requirements. An electronic copy (Word document) is available, contact the University's Representative.

**PLANTING****32 90 00**

## General notes and design requirements

1. Planting design shall carefully consider site microclimate conditions. Plants shall be grouped into zones based on their compatibility with regard to microclimate, water requirements, size etc. Placement of plants and their relationship to the irrigation system components such as spray heads shall be considered during design.
2. The exterior of all buildings that adjoin landscape areas must incorporate a maintenance border consisting of a minimum 30 inch x 3 inch section of crushed, clean, 3/4 inch-1inch rock with a steel header. Sample of rock to be submitted to University's Representative for approval.
3. Where vines are specified, an appropriate support structure must be designed to support vine growth. Smooth walls, columns, and vertical wires are not acceptable as support structures.
4. If soil drainage rates or subsurface conditions are anticipated or arise during construction, additional subsurface drainage in planting areas will be required. Subsurface drain system shall include 3 inch or 4 inch diameter, perforated, schedule 40 PVC drain pipe, and clean out risers.
5. Trees planned within plazas, parking lots, or other paved areas on site where the proposed supporting landscape area is less than 150 sf. must include modular suspended pavement systems such as Silva Cells (Deep Root) or Strata Cells (City Green) or equal. Uncompacted soil volume minimum for each new tree is 750 cubic feet.
6. See Appendix A of the University Standards for seed mix type and application rates.

The Campus has developed a Standard Specification Section 32 90 00 Planting. The specification shall be modified by the Design Professional to meet project requirements. An electronic copy (Word document) is available, contact the University's Representative for additional information.

The following standard specification is intended to be edited according to the specifics of the project. Brackets [ ] and areas shaded in gray [e.g. format] indicate requirements that are optional depending upon the type of system being provided or per instructions associated with the [ ] and project requirements. Consult with University's Representative and campus stakeholders.

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Design Professional to check for coordination with LEED requirements, University's Sustainability Initiative and Model Water Efficient Landscape Ordinance for applicable requirements.

SECTION 32 84 00  
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY DESCRIPTION

A. Scope of Work

1. Provide irrigation systems as shown on the Drawings and described herein.

B. Related Work

1. Division 26 - Electrical: Power connection for controller.

1.2 SUBMITTALS

A. Material List

1. Complete manufacturer's technical data and installation instructions shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.

B. Record Drawings

1. The original record drawings shall be submitted to the University's Representative for approval prior to making the controller chart. Refer to Section 01 78 39 Project Record Documents.
2. Drawings shall include dimensions from two permanent points of reference such as building corners, sidewalks, or road intersections for the location of the following items:
  - a. Connection to existing water lines.
  - b. Connection to existing electrical power and splice locations.
  - c. Relocated existing equipment.
  - d. Gate valves.
  - e. Routing of sprinkler pressure lines.
  - f. Sprinkler locations
  - g. Sprinkler control valves.
  - h. Routing of control wiring.
  - i. Quick coupling valves.
  - j. Other related equipment as directed by the University's Representative.

C. Controller Charts

1. Controller charts shall be prepared by Contractor.
2. Provide one controller chart for each controller supplied.
3. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow when rolled up.
4. The chart shall be a reduced drawing of the actual as-built system and shall be readable when reduced.
5. The chart shall be a black line print and different colors shall be used to indicate the area of coverage for each station.
6. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 mils if required by University's Representative.

7. As-built record drawings and controller charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals

1. Contractor shall prepare Operation and Maintenance Manuals in accordance with Section 01 78 00 Close-out Submittals.
  - a. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
  - b. Catalog and parts sheets on all major material and equipment items installed under this contract (not necessary for campus standard irrigation equipment).
  - c. Guarantee statement.
  - d. Complete operating and maintenance instructions on all major equipment.

E. Equipment to be Furnished

1. Furnish the following tools:
  - a. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve provided on this project.
  - b. Two keys for each automatic controller.
  - c. Two quick coupler keys and matching hose swivel per project.
2. This equipment shall be furnished to University before final inspection can occur. Evidence that the University has received material must be provided to University's Representative.

1.3 QUALITY ASSURANCE

- A. Manufacturer's directions and detailed drawings shall be followed in all cases where points are not shown in the Drawings and Specifications.
- B. Drawings are generally diagrammatic and indicative of the work to be installed and do not show all offsets, fittings, sleeves, and other parts which may be required. Contractor shall carefully investigate the structural and finished conditions affecting all work and plan accordingly, furnishing such fittings, and other appurtenances as may be required to meet such conditions.. The Work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- C. Before commencing irrigation system installation, Contractor shall resolve obstructions, grade differences or discrepancies in area dimensions that might not have been considered in engineering and shown on the Drawings.

1.4 COORDINATION AND SCHEDULING

- A. Contractor shall notify University's Representative in advance for the following observation meetings, according to the time indicated, and shall provide documentation to University's Representative that the following meetings occurred and their outcome.
  1. Pre-job conference - 7 days.
  2. Sleeve inspection – 48 hours.
  3. Pressure supply line installation and testing - 48 hours.
  4. Automatic controller installation - 48 hours.
  5. Control wire installation - 48 hours.
  6. Lateral line and sprinkler installation - 48 hours.
  7. Coverage test (prior to any planting installation) - 48 hours.
  8. Final inspection - 7 days.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. PVC Pressure Main Line Pipe and Fittings
  1. Pressure main line piping for sizes 4 inches and larger shall be C-900 with mechanical joints.

2. Pressure main line piping smaller than 4 inches inside sleeves, shall be PVC Schedule 40.
3. Pressure main line piping for sizes 3 inches and smaller shall be PVC Schedule 40 with solvent welded joints and with Schedule 80 fittings.
4. Pipe shall be made from NSF approved Type I, Grade I PVC compound conforming to ASTM resin specification D1785. All pipe shall meet requirements as set forth in Federal Specification PS-21-70.
5. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.
6. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be Christy's Red Hot Blue Glue, or equal.
7. All PVC pipe must bear the following markings and shall be visible upon installation.
  - a. Manufacturer's name.
  - b. Nominal pipe size.
  - c. Schedule or class.
  - d. Pressure rating in PSI.
  - e. NSF (National Sanitation Foundation) approval.
  - f. Date of extrusion.
8. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable Iron Pipe Size (IPS) schedule and NSF seal of approval.

B. PVC Non-Pressure Lateral Line Piping

1. Non-pressure buried lateral line piping shall be PVC schedule 40 with solvent-welded joints.
2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
3. Except as noted above, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in these specifications.
4. For all sprinkler head installations use schedule 80 thread nipples and risers, and schedule 40 fittings.

C. PVC Sleeves:

1. PVC sleeves shall be Schedule 40 with solvent weld joints. Install sleeves at 24 inches depth to top of pipe. Backfill sleeve trench with sand. Depth exception may be considered at concrete walks with prior approval by University's Representative.

D. Brass Pipe and Fittings

1. Where indicated on the Drawings, use red brass threaded pipe.
2. Fittings shall be red brass conforming to Federal Specification #WW-P-460.

2.2 VALVES

A. Gate Valves

1. Gate valves 3 inches and larger shall be 125 lb. Static Water Pressure (SWP) bronze gate valve with screw-in bonnet, non-rising stem, solid wedge disc, threaded ends and a bronze or malleable iron handwheel. With a 2" operating nut.
2. Gate valves 2-1/2 inches and smaller shall be manufactured by Nibco, Aqua, Matco, or equal, 200 psi Water Oil Gas (WOG), 125 SWP, Screw-in bonnet, solid wedge.

B. Quick Coupling Valves

1. Quick coupling valves shall have a brass two-piece body designed for working pressure of 125 PSI operable with quick coupler.
2. Key size and type shall be as shown on Drawings.
3. Quick coupling valves shall be manufactured by Hunter (HQ44 – AW), Rainbird (44-LRC), Buckner (QB44) or equal.
4. All quick coupling valves without integral stabilizers shall be equipped with cast ductile iron anti-rotation devices or anchors that attached to the base of the valve and can be secured by



a single bolt, and shall be manufactured by Leemco (LS-120, LS-150), Harco (82201, 82202) or equal .

C. Electrical Remote Control Valves

1. Electric control valves shall have a manual flow adjustment.
2. Provide one control valve box for each electric control valve.
3. Electric Remote Control Valves shall be manufactured by Hunter (ICV Series), Irritrol (Century Series), or equal.
4. Pressure regulating modules as required for pressure reduction on new or existing valves manufactured by, Hunter (Accu-Sync), Irritrol (Omni Reg), or equal, as noted on Drawings.
5. For pipe connections to valve bodies use Teflon tape material. Pipe dope shall not be used.

D. Associated Valves

1. Y-Strainer brass 80 mesh with brass gate valve to blow-out screen.
2. Above ground Y-strainers shall be metal.
3. Y-strainer shall be same size as water supply.
4. Gate valves 3 inches and smaller shall be brass.

E. Flow Sensor and Master Valve

1. Flow sensor and master valve assemblies shall be by Rain Master, or equal and must operate with controller. Install both units after brass gate valve and Y-strainer at point of water connection. The master valve shall be main line-sized for project and have the capacity to have additional systems added on in the future. The flow sensor may be line-sized or smaller, as shown on Drawings. This maximizes flow management capabilities to reduce water window times and improve efficiency

2.3 BACKFLOW PREVENTION UNITS

- A. Backflow prevention units shall be of size and type indicated on the Irrigation Drawings. Install backflow prevention units in accordance with irrigation details.
- B. Backflow prevention devices shall only be used on University domestic water lines. These devices shall not be installed on utility water lines.

2.4 WIRING

- A. Irrigation Control Wiring: Copper direct burial sprinkler wire, sized according to length of the run, minimum 14 gauge (white common, red primary lead, blue for spares). Run extra wires for future valves at the ends of all main line runs (see Drawings – 4 wires minimum).
- B. Electrical Dry Connection. Spears DS -400, pre-filled dri-splice connector with crimp sleeves; DRYCONN #10222 waterproof connectors by King Innovations (#22 to #12 AWG), or equal. Waterproof under-ground wire connections.
- C. Communication Cable: All communication wire for controllers and sensors shall be installed in electrical conduit not less than 1 inch.

2.5 AUTOMATIC CONTROLLERS

- A. Automatic controllers shall be RainMaster Evolution DX-SA6-RM4-8-48, Radio-kit/Ev-ant-FD-kit/DX-flow/PMR-kit with radio and flow sensor boards, separate ground rod kit, surge arrestor (per manufacturers specifications), and stainless steel pedestal cabinet, or equal, no known equal. Controller shall fully communicate and integrate with University's existing system;

Design Professional to select from the following for project

1. [Dome antenna (within one mile of Grounds Division's central computer)]
2. [High gain antenna (for controllers installed greater than one mile)]
3. Provide one hand held Pro Max remote per controller.
4. All controllers shall be installed with a radio set to the UC Davis frequency of 485.075 MHz.
5. If there are more than 48 stations on a site, the controllers may be hard wired together with communication wire and do not need separate radios or antennas.
6. Controllers shall not be placed within 15 feet of buildings that could cause radio interference.

## 2.6 MAIN LINE SHUT OFF BOX

- A. Install main line shut off valve at point of connection in a Christy concrete G5 traffic box for Main Line Shut Off Valves with "water" labeled lid, or equal.

## 2.7 CONTROL VALVE BOXES

- A. Use 10 by 10-1/4 inch round box for all gate valves, Carson Industries #910-12B with green bolt down cover, or equal. Extension sleeve shall be PVC- 6 inch minimum size.
- B. Use 9 1/2 by 16 by 11 inch rectangular box for all electrical control valves, Carson Industries 1419-13B with green bolt down cover, or equal.

## 2.8 SPRINKLER HEADS

- A. All sprinkler heads on any one system (zone) shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the Drawings and specified.
- B. Large rotors shall be pop-ups with stainless steel risers and check valves, have a screw adjustment and shall be manufactured by Hunter (I40-06-SS), Rainbird (8005-SS), or equal.
- C. Medium rotors shall be pop-ups with stainless steel risers and internal check valves, have a screw adjustment and shall be manufactured by Hunter (I-20-06-SS, I-20-12), or equal. Size per Drawings.
- D. Spray heads shall be manufactured by Rainbird (1812/1806/1804-PRS-SAM with standard MPR nozzles unless otherwise noted), Hunter (PROS--06/12-CV-PRS30with standard MPR nozzles unless otherwise noted), or equal. Variable arc nozzles are to be used only when specifically approved by the University's Representative.
- E. Low precipitation rate, multi-stream nozzles shall be Hunter MP Rotator series, or equal, and shall be used with 40 psi pressure regulating heads (PROS-06/12-PRS40-CV-MP1000/2000/3000) or equal.
- F. Double Swing Joint Assembly: These shall be fabricated in accordance with the detail. Use Schedule 80 threaded nipples and risers and Schedule 40 fittings.
- G. Bubbler heads shall be Rainbird 1300A-F with screens, or Hunter AFB, or equal.

- H. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.

## 2.9 LINE SOURCE SUB SURFACE DRIP IRRIGATION SYSTEMS

- A. Drip tubing, type noted on Drawings.
  - 1. Sub-surface drip tubing with in-line, pressure compensating emitters. Emitter and row spacing per Drawings.
  - 2. Sub-surface drip tubing with in-line, pressure compensating emitters, factory wrapped with polypropylene fleece. Emitter and row spacing per Drawings.
- B. Drip Zone Valve Assembly: Valve kit including filter (minimum 120 mesh screen) and pressure regulator, Hunter ICZ-101 or equal.
- C. Automatic flush valve with identification tag, compression tee, min. 24" coil of blank tubing, and flush cap. Install in 8" valve box at furthest point from remote control valve.
- D. Air/Vacuum relief valve installed at highest point of each station with compression tee, and flush cap, in an 8" valve box - Rainbird AR valve kit, or equal.

## 2.10 DEEP ROOT WATERING TUBES

- A. Deep Watering Tube: 3" or 4" diameter semi-rigid polyethylene mesh tube (10 inch, 18 inch, 24 inch or 36 inch) with adjustable bubbler. Construct assembly as shown in details or use Hunter RZWS or equal, size per Drawings.

## 2.11 REMOTE CONTROL VALVE IDENTIFICATION TAGS

- A. 2-1/4 by 2-3/4 inch yellow polyurethane with valve number embossed on tag, as manufactured by Christy's Irrigation I.D. Tags, (714) 771-4142, or equal.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing Utilities Drawings for existing utility locations.
- B. Refer to 1.4 Coordination and Scheduling for additional inspection requirements.

### 3.2 PREPARATION

- A. Physical Layout
  - 1. Prior to installation, Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, and layout of drip tubing.
  - 2. All piping and tubing layout shall be approved by University's Representative prior to installation.
- B. Water Supply
  - 1. Point of Connection (POC): Install flow sensor and master valve assemblies after brass gate valve. The sizes of master valve and flow sensors to be main line-sized or larger for project and have the capacity to have additional systems added on in the future.
  - 2. Electrical Supply
    - a. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the Drawings.

### 3.3 INSTALLATION

#### A. Trenching

1. Provide a minimum cover of 18 inches for all pressure supply lines.
2. Provide a minimum cover of 12 inches for all non-pressure pvc lines.
3. Provide a minimum cover of 4" for all drip tubing.
4. Provide a minimum cover of 18 inches for all control wiring.

#### B. Backfilling

1. No backfilling shall occur until University's Representative visually inspects and approves piping layout in trenches.
2. A fine granular material backfill shall be initially placed on all lines. No foreign matter larger than 1/2 inch in size will be permitted in the initial backfill. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from 4 inch or greater clods of earth or 1/2 inch or greater stones, gravel or other debris. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
3. Flooding of trenches will be permitted only with approval of the University's Representative.
4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments at no additional cost to the University.

#### C. Trenching and Backfill Under Paving

1. Trenches located under areas where paving (asphaltic concrete or concrete), will be installed shall be backfilled with sand (a layer 6 inches below the pipe and 3 inches above the pipe) and compacted in layers to 95 percent compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm condition, not prone to settling. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, as part of the sprinkler Work, cap and pressure test all piping under paving prior to the paving Work.
2. Piping under existing walks shall be done by jacking, boring or hydraulic driving where possible. Where any cutting or breaking of sidewalks or concrete is necessary permission shall be obtained from the University's Representative. No hydraulic driving will be permitted under concrete paving. Concrete paving shall be replaced back to nearest control joint. See Section 01 73 20 Cutting and Patching.
3. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

#### D. Pipe Assemblies

1. PVC pipe, drip tube, and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
2. On PVC to metal connections, Contractor shall work the metal connections first. Pipe tape shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters or machined PVC schedule 80 pipe nipples into which the pipe may be welded.
3. Do not install multiple assemblies in plastic sleeves.
4. Use fittings to change pipe directions. Do not deflect pipe beyond manufacturer's recommendations.
5. Do not install joints in sleeves or under pavement if length is less than 20 feet. Where pipe length exceeds 20 feet, use minimum number of joints.

6. Install PVC piping and fittings without tension on the fittings. Pipes should be inserted squarely and fully into socket of the fittings.
  - E. Pipe Clearance: All pipes shall have a minimum clearance of 6 inches from each other and from lines of other Work. Parallel pipes shall not be installed directly over one another. No more than two pipes may be installed in a single trench.
  - F. High Voltage Wiring for Automatic Controller
    1. Provide 120 volt power connection to the automatic controller.
  - G. Remote Control Valves
    1. Install where shown on Drawings and details. When grouped together, allow at least 12 inches between valve box edges. Install each remote control valve in a separate valve box.
    2. Each controller and station number shall be labeled at the valve with a 2-1/4 by 2- 3/4 inch yellow polyurethane I.D. tag attached to the control wire of the valve.
    3. Set valve boxes perpendicular to adjacent walls and parallel to one another.
    4. Thoroughly flush mainline before installing valves.
    5. Install valve and box to maintain a minimum of 1 inch clear space between the top of the valve and the lid of the box.
    6. Install valve box at the same level as soil grade, not above.
  - H. Control Wiring
    1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
    2. Where more than 1 wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.
    3. An expansion curl shall be provided within 3 feet of each wire connection. Expansion curl at electric control valves shall be of sufficient length so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
    4. All splices shall be made with electric dry connections. Use one splice per connector.
    5. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of University's Representative.
  - I. Flushing of System
    1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the control valves shall be opened and a full head of water used to flush out the system.
    2. Sprinkler head nozzles shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the University's Representative.
- 3.4 EXISTING TREES
- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall first discuss with the University Representative and get written permission for proposed trench route. Contractor shall use all possible care to avoid injury to trees and tree roots. Refer to Section 01 56 39 Tree & Plant Protection.
- 3.5 FIELD QUALITY CONTROL
- A. Testing of Irrigation System
    1. Contractor shall request the presence of the University's Representative in writing at least 48 hours in advance of testing. Testing of pressure mainlines shall occur prior to installation of electric control valves.

2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight.
3. Sustain pressure in lines for not less than 2 hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.
4. All hydrostatic tests shall be made in the presence of University's Representative. No pipe shall be backfilled until it has been inspected, tested and approved in writing, including laterals.
5. Furnish necessary force pump and all other test equipment.
6. When the sprinkler or drip irrigation system is completed, perform a coverage test in the presence of the University's Representative, to determine if the water coverage for planting areas is complete and adequate. This test shall be accomplished before any plants are planted.

B. Adjustment of the System

1. Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. All sprinkler heads shall be set perpendicular to finished grades unless otherwise shown on the Drawings.

- C. The entire sprinkler irrigation system shall be under full automatic operation for a period of 2 days prior to any planting. The University's Representative reserves the right to waive or shorten the operation period.

3.6 CLEAN-UP

- A. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down.

3.7 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. Contractor shall operate each system in its entirety for the University's Representative at time of final observation. Any items deemed not acceptable by the University's Representative shall be reworked to the complete satisfaction of the University's Representative.
- B. The controller must be set up and under full automatic operation before final inspection can occur and maintenance period can begin.
- C. Controller charts and final as-built record drawings shall be submitted in both electronic form and as 1 full-size hard copy. Both must be provided to the University's Representative and approved before final inspection can occur and maintenance period can begin. Refer to 1.2. B. and C.
- D. Contractor shall show evidence to the University's Representative that the University has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

END OF SECTION 32 84 00

The following standard specification is intended to be edited according to the specifics of the project. Brackets [ ] and areas shaded in gray [e.g. format] indicate requirements that are optional depending upon the type of system being provided or per instructions associated with the [ ] and project requirements. Consult with University's Representative and campus stakeholders.

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Design Professional to check for coordination with LEED requirements, University's Sustainability Initiative and Model Water Efficient Landscape Ordinance for applicable requirements.

## SECTION 32 90 00

### PLANTING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Scope of Work: Provide landscape planting, complete in place, as shown and specified including; removal of rock, gravel and other construction related material, sub-grade treatment, soil replacement, rough grading, soil amendment and preparation, finish grading, planting, seeding, staking, header installation, decomposed granite installation, clean-up, and maintenance.
- B. Related Sections:
  - 1. Section 32 84 00 Planting Irrigation

##### 1.2 SUBMITTALS

- A. Submit documentation to University's Representative at least [30] [60] [xxx] days before planting certifying that all plant material is available, listing sources of materials.
- B. Submittals shall include but not be limited to the following:
  - 1. Fertilizer: Chemical and percentage composition.
  - 2. Mulch: Size, type of material.
  - 3. Soil testing report (after rough grading)
  - 4. Amendments: Type, size and composition.
  - 5. Seed: Botanical and common name, percentage by weight, percentages of purity, germination and weed seed for each grass seed species.
  - 6. Planting schedule indicating anticipated dates for planting.
  - 7. Proposed maintenance work schedule.
- C. Quality Assurance Submittals:
  - 1. Plants shall be subject to inspection and approval by University's Representative at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. The health and vigor of the plant material is the sole responsibility of Contractor. Submit written request for inspection of plant material at place of growth to University's Representative stating location and quantity of plants to be inspected.
- D. Plant substitutions requests shall be accompanied by a list of nurseries contacted in the search for the required plant. Requests shall also include sources of plants found that may be of smaller or larger size than specified or different cultivars. No substitutions may be made without approval of the University's Representative.

##### 1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery
  - 1. Deliver fertilizer to site in unopened containers bearing manufacturer's guaranteed chemical analysis.

2. Furnish University's Representative with copies of receipts for all amendments.
3. Deliver all plants with legible identification labels.
  - a. Label trees, shrubs, bundles of plants, or groundcover plants.
  - b. State correct plant name and size indicated on plant list.
  - c. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 days.
4. Protect plant material during delivery to prevent damage to root ball or desiccation of leaves.
5. Notify University's Representative 7 days in advance of delivery of all plant materials and submit an itemized list of the plants in each delivery.
6. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
7. Ship and store seed, mulch and fertilizer with protection from weather or other conditions that would damage or impair the effectiveness of the product.

B. Storage

1. Store plant material in shade and protect from weather.
2. Maintain and protect plant material not to be planted within 4 hours in a healthy, vigorous condition.

C. Handling

1. Contractor is cautioned to exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and shall be replaced with undamaged materials at the Contractor's expense.

1.4 COORDINATION AND SCHEDULING

- A. Perform planting only when weather and soil conditions are suitable in accordance with standards of industry.
- B. Scheduling: Install trees, shrubs, and liner stock plant material before wood mulch is spread.
- C. Observation Schedule. Contractor shall notify University's Representative in advance for the following site visits, according to the time indicated:
  1. Plant material review at growing site - notify University's Representative at least [30][60] [120] [xxx] days before planting.
  2. Pre-job conference - 7 days.
  3. Final grade review - 48 hours.
  4. Soil preparation.
  5. Plant material review - 48 hours.
  6. Planting operation and plant layout review - 48 hours. One tree with each type of specified staking shall be approved prior to planting of trees - 48 hours.
  7. Pre-maintenance - 7 days.
  8. Final acceptance - 7 days.

1.5 SAMPLES AND TESTS

- A. University's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.
- B. Contractor shall have soil tested for soil amendments by a certified soil testing laboratory after rough grading operations are complete.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The following organic, soil amendments and fertilizer are based on typical campus soil composition and establish minimum requirements. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil samples are tested by the



Contractor and approved by the University's Representative. The amounts listed in the Preparation section are considered minimum amounts for the project unless directed otherwise by the University Representative.

- B. All materials shall be of, approved and first-grade quality when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. Contractor shall supply University's Representative with a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance or bearing the manufacturer's guaranteed analysis.

## 2.2 HERBICIDES

- A. Non-selective, systemic contact herbicide install per manufacturer's specifications, Roundup, or equal.
- B. Pre-emergent herbicide (liquid or pelletized) install per manufacturer's specifications, Dimension or equal.

## 2.3 ORGANIC AMENDMENTS

- A. Organic amendment shall be nitrogen stabilized wood residual containing 0.56 to 0.84 percent N based on dry weight.
- B. Particle Size:
  - 1. 95 - 100 percent passing 6.35 mm standard sieve
  - 2. 80 - 100 percent passing 2.33 mm standard sieve
- C. Iron Content: Minimum 0.08 percent dilute acid soluble Fe on dry weight basis.
- D. Ash: 0-6.0 percent (dry weight).

## 2.4 COMPOST

- A. Blended and ground leaf, wood and other plant based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material.
- B. Compost shall be commercially prepared and meet US Compost Council STA/TMECC criteria.
- C. Shall comply with the following parameters:
  - 1. pH: 5.5 - 8.0
  - 2. Soil Salt (electrical conductivity): maximum 3 dS/m (mmhos/cm).
  - 3. Moisture content%, wet weight basis: 30-60.
  - 4. Particle size, dry weight basis: 98percent pass through 3/4 inch screen or smear.
  - 5. Stability carbon dioxide evolution rate: mg CO<sub>2</sub> -C/g OM/day<2.
  - 6. Solvita maturity test:> 6
  - 7. Physical contaminants, percent dry weight: <1percent.
  - 8. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40 CFR & 503.13, Tables 1 and 3 levels.
  - 9. Biological contaminants meet or exceed US EPA Class A standard 40 CFR & 503.32 (a) level requirements.

## 2.5 SOIL AMENDMENTS

- A. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99 percent sulfur (expressed as elemental).

- B. Iron Sulfate: 20 percent Iron (expressed as metallic iron), derived from ferric and ferrous sulphate, 10 percent sulfur (expressed as elemental).
- C. Calcium Carbonate: 95 percent lime as derived from oyster shells.
- D. Gypsum: Agricultural grade product containing 98 percent minimum calcium sulphate.

2.6 FERTILIZER

- A. Planting Fertilizer: Pelleted or granular form shall consist of the following percents by weight and shall be mixed by commercial fertilizer supplier:
  - 1. 16 percent nitrogen
  - 2. 6 percent phosphoric acid
  - 3. 8 percent potash
- B. Planting Tablets
  - 1. Shall be slow-released type with potential acidity of not more than 5 percent by weight containing the following percentages of nutrients by weight:
    - a. 20 percent nitrogen
    - b. 10 percent phosphoric acid
    - c. 5 percent potash
    - d. 2.6 percent combined calcium
    - e. 1.6 percent combined sulfur
    - f. 0.35 percent iron (elemental) from ferrous sulfate
  - 2. Shall be 21 gram tablets as manufactured by Agriform, Best Tabs, or equal, applied per manufacturer's instructions.
- C. Sulphate of Potash: 0-0-50.
- D. Single Super-phosphate: Commercial product containing 18-20 percent available phosphoric pentoxide
- E. Urea Formaldehyde: 38-0-0.

2.7 IMPORT TOP SOIL

- A. Particle Size:

CLASS	PARTICLE SIZE RANGE	MAXIMUM, percent WT.	MINIMUM, percent WT.
Coarse Sand	0.5-2.0 mm	15	0
Silt Plus Clay	< 0.05 mm	50	25
Silt	0.002 - 0.05 mm	30	10
Clay	0 - 0.002 mm	25	10
OTHER CLASSES			
Gravel	2 - 13 mm	15	
Rock	> ½1/2 inch	10% by volume None > 1 inch	0
Organic Matter		15	0

- B. The pH of saturated paste shall be between 5.5 and 7 without high qualitative lime content. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 milliohms per centimeter at 25 degrees centigrade. The boron content shall be no greater than one part per million as measured on the saturation extract. In order to ensure conformance, samples of the import soil shall be submitted to the laboratory for analysis prior to backfilling.

2.8 PLANT MATERIAL

- A. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, weeds, plant diseases, sun scalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well "hardened" systems and vigorous and fibrous root systems that are not root or pot-bound. Root conditions of the plants provided by Contractor in containers will be determined by removal of earth from the roots of not less than two plants or more than 2 percent of the total number of plants of each species or variety. Where container-grown plants are from several sources, the roots of not less than 2 plants of each species or variety from each source, will be inspected. In case the sample plants inspected are found to be defective, the University's Representative reserves the right to reject the entire lot or lots of plants represented by the defective samples.
- B. Trees shall have one central leader. If the leader was headed, a new leader (with a live terminal bud at least one-half the diameter of the pruning cut) shall be present. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Temporary branches on the lower trunk of trees should be maintained unless greater than 3/8 inch diameter. Clear trunk should be no more than 50percent of the total height of the tree. The attachment of major/scaffold branches shall be free of included bark. Each tree must include a minimum of three structural roots, reasonably distributed around the trunk (not clustered to one side). The root collar shall be within the upper two inches of the soil. The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
- C. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as shown on the Drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall conform with the measurements, if any, shown on the Drawings. Plants larger in size than specified may be used with the approval of the University's Representative. If the use of larger plants is approved, the ball of earth or spread of roots for each plant shall be increased proportionately.
- D. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the Work and replaced with new plants at the Contractor's expense.
- E. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the University's Representative.
- F. Plant material shall be true to botanical and common name and variety as specified in "Annotated Checklist of Woody Ornamental Plants in California, Oregon and Washington," published by the University of California School of Agriculture (1979).
- G. Nursery Grown Stock:
  1. Grown under climatic conditions similar to those in locality of project.
  2. Container-grown stock in vigorous, healthy condition, not root-bound or with root system hardened off.
  3. Use only liner stock plant material which is well established in removable containers or formed homogenous soil sections.
- H. See Appendix A of the University Standards for native and non-native plants.

## 2.9 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated.
  1. Seed Mix (at 10 lbs. per 1000 square feet) shall consist of 100 percent dwarf tall fescue varieties.

- C. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, non-toxic, free of plant growth or germination inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- D. Non-asphaltic Tackifier; Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, non-toxic and free of plant growth or germination inhibitors.
- E. See Appendix A of the University Standards for grass seed mixtures and application rates.

#### 2.10 SOD

- A. Sod shall consist of 100 percent dwarf tall fescue varieties.

#### 2.11 STAKING MATERIALS

##### A. Lodge pole tree stakes

1. Provide 2 at each new planted tree as per detail.
2. Round and uniform with chamfered top and conical point.
3. 8 or 10 foot by 2 inches as required for height of tree
4. Pressure Treated Douglas Fir
5. Secure tree with tree ties.

##### B. Tree Tie:

1. Arthur Enterprises: Super Tree Tie, or equal. Vinyl impregnated 1 inch Nylon, waterproof, tensile strength 300 pounds, bursting strength 300 psi.

#### 2.12 WATER

- A. Provide or use only from University approved utility water source.

#### 2.13 MULCH

- A. Shall be 100 percent shredded fir with an average particle size of 2 inches such as Walk On Bark, Redi Gro, Sacramento, or equal.
- B. In large or hard to access landscape areas pallet mulch may be used if approved by University's Representative - Nor Cal Blend, as supplied by Applied Landscape Materials, Rocklin, CA, or equal.

#### 2.14 WOOD HEADERBOARDS

- A. Headerboards shall be 2 by 4 inch Redwood construction heart grade. Splices shall be made with 1 by 4 inch and shall not be less than 12 inches in length. Stakes shall be placed at intervals of not more than 4 feet and shall be 1 by 3 by 16 inches "construction heart redwood." All stakes shall be cut with level cut and set below top of headerboard.
- B. On sharp turns and curves, four 1/2 by 4 inch laminated boards or two 1 by 4 laminated boards may be permitted.
- C. Stakes and splices shall be nailed with galvanized common nails. Nail as required for solid installation.
- D. Provide headerboards as shown on the Drawings and herein specified laid true to line and grade, in a workmanlike manner. Care shall be exercised in laying wood headers to protect adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on the back side of headerboard (away from turf or pavement).

#### 2.13 METAL HEADERS

- A. Metal Headers shall be 3/16 by 4 inch powder-coated black or dark green, with 14 inch steel stakes.
- B. Provide headers as shown on the Drawings and herein specified. They shall be laid true to line and

grade, and in a workmanlike manner. Care shall be exercised in laying metal headers to protect adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on groundcover side of header.

#### 2.14 DECOMPOSED GRANITE PAVING

- A. Size: 1/4 inch minus. Fines shall be evenly mixed throughout the aggregate.

<u>Sieve Designation</u>	<u>Percent Passing</u>
3/8"	100
No. 4	95-100
No. 8	75-80
No. 16	55-65
No. 30	40-50
No. 50	25-35
No. 100	15-25
No. 200	5-15

- B. Color: Gold or Brown. Color to be approved by University's Representative. Submit sample for approval prior to having material delivered.
- C. Sources: CL Smith Trucking, Woodland - Gold; Cascade Rock, Sacramento –Tan/ Rust from Nevada; Hastie's Capital Sand and Gravel, Sacramento – Gold and Tan; or equal.
- D. Stabilizer: Non-toxic binder that is a colorless concentrated powder soil solidifier that binds decomposed granite or crushed 3/8 inch or 1/4 inch minus aggregate.

#### 2.15 SAND

- A. Washed Silica Sand.

#### 2.16 PLANTER DRAINAGE ROCK

- A. Drainage rock shall be 1/4 inch pea gravel and shall be clean, hard, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Obtain University Representative's written acceptance that planting soils have been cleaned of all construction debris, including gravel, concrete, concrete washout, paints, asphalt, etc. Refer to preparation and planting installation paragraphs of this section.
- B. Obtain University Representative's written acceptance that final grades have been established to within 1/10 foot prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. Contractor shall be responsible for shaping all planting areas as indicated on Drawings.
- C. Prior to planting, inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.
- D. Do not begin planting of trees until deficiencies are corrected or trees are replaced.
- E. All finish grading, soil preparation and irrigation work must be complete and accepted (included irrigation coverage test) prior to the installation of any plants.

#### 3.2 SOIL CLEANUP AND PREPARATION

- A. Clean Up: Contractor shall review site conditions and previously completed rough grading to verify that all imported stones, stumps, gravel, concrete, asphalt, and other construction debris have been

cleared from the site to a depth of 24 inches, prior to continuing project work. Contractor shall remove any and all germinated weeds.

B. Soil Cleanup, Replacement and Preparation:

1. The top 12 inches of clean (as approved by the University's Representative) native soil shall be lifted and removed from the site prior to general construction. Clean topsoil shall be stockpiled on site, kept clear and free of debris and rock, and then used as needed for landscaping. Place a minimum of 12 inches of clean topsoil back into all planting areas. The next lower 12 inches of soil shall be cleared of all stones, stumps, debris, etc., larger than 1/2 inch in diameter, that are brought to the surface as a result of cultivations. Cultivation shall be by an excavator or other ripping equipment. Call Underground Service Alert (USA) before beginning cultivation operations.
2. In areas where site soil has been compacted by construction activity, or building foundations have been over-excavated and re-compacted, additional mitigation measures will be required to improve soil and drainage conditions for planting. These may include, but are not limited to: the installation of subsurface drainage systems for shrub and groundcover areas and individual tree pits; removal of additional soil from the planting areas beyond what is specified above until acceptable drainage and compaction levels are achieved; aeration tubes installed; radial soil trenches dug out around each tree; or other measures as determined and approved by the University's Representative. Mitigation measures shall be completed by the contractor as required at no additional cost to the University. See Planting Installation paragraph for more information and additional related requirements.
3. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Amendments shall be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top 6 inches of soil.
4. Application Rates: (Per 1,000 square feet): The following organic, soil amendments and fertilizer establish minimum requirements. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil samples are tested by the Contractor and approved by the University's Representative. The amounts listed below are considered minimum amounts for the project unless directed otherwise by the University Representative.
  - a. Nitrogen stabilized organic amendment or compost – 6 cubic yards for groundcover and shrub beds, 3 cubic yards for lawn areas. University's Representative may request delivery tags.
  - b. Planting fertilizer - 15 lbs.
  - c. Gypsum - 200 lbs.
  - d. Soil sulphur - 20 lbs.
  - e. Iron – 2 lbs.
  - f. Calcium carbonate – 2 lbs.

C. Final Grades:

1. All areas shall be graded so that the final grades will be 1 inch below adjacent paved areas, sidewalks, valve boxes, headers, clean-outs, drains, manholes, etc. or as indicated on Drawings.
2. Surface drainage shall be away from all building foundations.
3. Eliminate all erosion scars prior to commencing maintenance period.

D. Disposal of Excess Soil: Dispose of any unacceptable or excess soil legally at an offsite location.

3.3 PLANTING INSTALLATION

A. General

1. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.
2. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein

specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-plant Weed Control

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days to allow systemic kill. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4 inch below the surface of the soil over the entire area to be planted.
2. After irrigation system is operational, apply water for 5 to 10 days as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by University's Representative.
3. Maintain site weed free until final acceptance by the University's Representative.

C. Layout of Major Plantings: Locations for plants and outlines of areas to be planted shall be marked on the ground by Contractor before any plant pits are dug. All such locations shall be approved by the University's Representative. If underground construction or a utility line is encountered in the excavation of planting areas, other locations for planting may be selected by the University's Representative. Layout shall be accomplished with flagged grade stakes indicating plant names and specified container size on each stake.

D. Planting of Trees and Shrubs:

1. Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.
2. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.
3. Protect all areas from excessive compaction when trucking plants or other material to the planting site.
4. All excavated holes shall have vertical sides and shall be of a size that is three times the diameter and 1 and 1/2 times the depth of the root ball for all trees and shrubs. After pits are dug, roughen the sides of the pit and loosen soil in the bottom of the pit to a depth of 3 inches. Construct foot-tamped mound in the bottom of the pit to support the plant at the proper level.
5. All prepared tree pits must be reviewed and approved by the University's Representative prior to the planting of any trees.
6. Percolation tests are required for 1 out of every 5 trees planted, for and every bioswale or stormwater collection feature on a given site. Tree pits from each planting area of the project shall be tested for percolation. However, in areas where over-excavation of a building foundation has occurred, or any other construction practice typically resulting in extremely compacted subsoil conditions, all tree pits must be tested for percolation. Tree pits and bioswales shall be filled with water and the drainage rate observed. Percolation rate shall be a minimum of the depth of the tree pit or bioswale within 24 hours. If percolation/drainage rate is less than that - mitigation measures shall be implemented (see Soil Cleanup, Replacement and Preparation paragraph above).
7. Do not handle container plants by the tops, stems or trunks at any time. Lift all plants so that the root ball is supported from the underside.
8. Plants that do not have a satisfactory root system may be rejected at the discretion of the University's representative. The outer surfaces of plants and trees shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other equipment that is capable of making clean cuts on the roots. University's Representative must be contacted prior to root pruning all trees in order to coordinate observation of root pruning practices with the Campus Arborist. Modifications required to make the root system of plants and trees conform to plant quality standards shall not be considered as grounds to modify or void the plant warranty.
9. Center plant in pit or trench. Crown of trees shall be 1 inch minimum above finish grade. Crown of shrubs shall be 1 inch above finish grade.

10. Face plants with fullest growth into prevailing wind.
11. Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball or roots.
12. Backfill for trees and shrubs shall consist of amended native soil. If native soil is unsuitable or contaminated, use imported topsoil as specified above.
13. All plants which settle deeper than the surrounding grade shall be raised to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately 1/2 of the height of the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil.
14. Container Removal:
  - a. Cut containers on 2 sides with a can cutter designed for the job.
  - b. Do not injure root ball.
  - c. Do not cut containers with spade or ax.
  - d. After removing plant, superficially cut edge roots with knife on 3 sides.
15. Box Removal:
  - a. Remove bottom of plant boxes before planting.
  - b. Remove sides of box without damage to root ball after positioning plant and partially backfilling.
16. Plant Tablets:
  - a. After the water has completely drained, planting tablets shall be placed as indicated below.
    - 1) Two tablets per 1-gallon container.
    - 2) Four tablets per 5-gallon container.
    - 3) Six tablets per 15-gallon container.
    - 4) Ten tablets per 24 inch box.
    - 5) Fourteen tablets per 36 inch box.
    - 6) Eighteen tablets per 48 inch and those box sizes which are larger.
  - b. Planting tablets shall be set with each plant on top of the root ball while the plants are still in their containers so the required number of tablets to be used in each hole can be easily verified by the University's Representative.
17. Backfill
  - a. The remainder of the hole shall then be backfilled with 2/3 native soil and 1/3 organic amendment thoroughly blended and tamped firm.
  - b. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least 2 inches of water. The basins shall be constructed of amended backfill materials. Remove basin in all turf areas after initial watering.
18. Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to shape the plant material as directed by the University's Representative. Pruning shall not be done prior to delivery of plants.
19. Staking: Staking of all trees shall be completed immediately after planting. All stakes shall be installed plumb and as indicated in Drawing details.

E. Planting of Groundcovers:

1. Groundcover plants shall be grown in flats or gallon containers as indicated on the Drawings. Flat grown plants shall remain in those flats until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.
2. Groundcover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the Drawings. Triangular spacing shall be used unless otherwise noted on the Drawings.
3. Each rooted plant shall be planted with its proportionate amount of flat or container soil. Plantings shall be immediately sprinkled with water after planting until the entire area is soaked to the full depth of each hole.
4. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations shall be repaired immediately.



F. Mulch

1. All groundcover, perennial, and shrub beds shall be dressed with a 3 inch layer of mulch, where slopes are not steeper than 2:1.
2. Pre-emergent weed control product shall be applied to all planting areas after completion of planting and prior to mulch application. Use Dimension, or equal and apply per manufacturer's recommendations.

G. Hardpan Conditions:

1. Where hardpan exists, whether it is in the form of caliche or other impervious clay, and it is within the top 2 and 1/2 feet of soil, use powered equipment to break through completely at each tree location to allow drainage and root growth. Remove hardpan at least 1 - 1/2 feet greater than the root ball diameter of tree. Backfill with soil mix as specified.
2. Where hardpan is within the first 12 inches of soil, it shall be completely penetrated for all shrubs.

H. Lawn

1. Seeded Lawn (see pre-plant weed control)
  - a. Install soil amendments and finish grading as specified. Allow for settlement.
  - b. Broadcast seed evenly at the rate of 12 pounds per 1000 square feet.
  - c. Rake seed bed lightly to cover seed with soil.
  - d. Cover seed with 1/8 inch to 1/4 inch layer of amended soil. Seed cover shall not exceed 1/4 inch.
  - e. Roll seedbed with 200 pound roller. Finished surface shall meet finish grades shown.
  - f. Water thoroughly.
  - g. At end of maintenance period, lawn shall be dense, uniform, healthy and free of weeds, diseases or bare spots.
  - h. At Contractor's option, lawn may be hydroseeded.
2. Hydroseeding
  - a. Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.
  - b. Mix slurry with non-asphaltic tackifier.
  - c. Apply slurry uniformly to all areas to be seeded in a one step process. Apply mulch at the minimum rate of 1500 pound per acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
  - d. Acceptance of all seeded areas will be based on growth of a uniform color and dense stand of grass, without bare spots of over 4 inches square. If grass is not established prior to the end of the maintenance period Contractor shall provide an additional hydroseed application and shall continue maintenance until seeded areas are accepted by the University's Representative.
3. Sod
  - a. Lay sod immediately upon delivery.
  - b. Finish grade sodbed to remove ridges and depressions. Roll with 200 pound roller.
  - c. University's Representative will review and approve sodbed before installation.
  - d. Butt strips tightly together. Stagger joints.
  - e. Roll sod after installation with 200 pound roller.
  - f. Water thoroughly.
  - g. At end of maintenance period, lawn shall be dense, uniform, healthy, and free of weeds, diseases or bare spots.

3.4 HEADERBOARD INSTALLATION

A. Wood and Metal Headers:

1. Headers: Install header true to line and grade as shown on the Drawings. Align header edges and set flush with adjacent paving.

2. Stakes: Stakes shall be a minimum of 12 inches long for wood and 14 inches for metal, and longer as required for solid anchorage.
3. Header is not required where perimeter of decomposed granite is bounded by a concrete curb or slab.
4. Landscape edging is to remain in place, securely staked to hold firmly to approved line and grade.
5. After finished compacted path surface has been achieved, finish adjacent shoulder by backfilling back of header with stockpiled topsoil, compacting to match existing undisturbed ground and slope to required grade and cross section.

### 3.5 DECOMPOSED GRANITE PAVING

#### A. Decomposed Granite Paving:

1. Install decomposed granite on the prepared sub base in two lifts of equal depth, or one 2 inch lift over 2-3 inches of compacted aggregate base per the Drawing details.
2. Thoroughly compact each lift to a minimum 90 percent. Compact each area with at least 4 passes of the compacting equipment. Hand tamp edges around benches, signposts etc. After compacting, screed smooth.
3. Level and water so that moisture permeates the full depth to further compact the decomposed granite and determine correct finish grades. Watering is best accomplished using a garden hose with spray nozzle set to a coarse spray; pressure shall not disturb leveled path surface. Add sufficient water to thoroughly wet decomposed granite without excess "free" water.
4. Correct any deficiencies or low spots by adding additional decomposed granite material and re-compacting the area(s) with both equipment and water application. The previously rolled or compacted area shall be raked to provide a bond with the added material.

#### B. Stabilized Decomposed Granite Paving:

1. Thoroughly and uniformly blend 16 pounds of stabilizer per 1-ton of decomposed granite. Bucket blending or rake blending is not acceptable. Blend material dry.
2. Install decomposed granite per above specifications.
3. Grade, contour and compact the decomposed granite to final elevations.
4. Water heavily after each lift is installed for full-depth moisture penetration. 25-45 gallons of water per 1 ton shall be applied.
5. Upon moisture penetration compact each decomposed granite lift to 85 percent relative compaction with a steel drum roller.
6. In the event of damage or defective installation the contractor shall repair and replace in accordance with these Specifications at no additional cost to the University.

### 3.6 CLEAN UP

- A. During the progress of the Work, the Contractor shall keep the Project site in a neat and clean condition that is free of debris to the satisfaction of the University's Representative. All materials and debris accumulated in conjunction with completing this Work shall be legally recycled or disposed of by Contractor off campus. Refer to Section 017400 Cleaning and Waste Management. Remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.
- B. The Contractor shall leave the site area broom-clean and shall wash down all walkways and other paved areas, leaving the premises in a clean and safe condition.

- C. Promptly remove soil and debris created by hydroseed work from paved areas and building walls. Clean wheels of vehicles before leaving site to avoid tracking soils onto surfaces of roads, walks, or other paved areas.

### 3.7 MAINTENANCE & PLANT ESTABLISHMENT

- A. General: Maintain all plants and planting areas from time of delivery, through installation and maintenance period, until final acceptance.
- B. Schedule: Submit proposed maintenance work schedule to University's Representative in writing for review at least 30 days prior to commencement of maintenance work. Maintenance work shall be done at times accepted by University. Contractor's maintenance crew must be present at the project site at least once a week and as often as necessary to perform specified maintenance.
- C. Maintenance Procedures
  - 1. General: Maintenance of new planting includes but is not limited to watering, cultivating, fertilizing, weeding, mulching, re-staking, resetting plants to proper grades or upright positions, restoring watering basins, maintaining lawns, removal of dead flowers and broken twigs, pest, disease and weed control, erosion control, restoring finish grades with accepted and tested imported topsoil, and taking precautions as necessary to prevent sunscald damage. Remove nursery tags and repair mulch 10 days before final acceptance.
  - 2. Lawn maintenance: Lawns shall be mowed to a height of 2 inches when reaches a height of 3 inches. Lawns must be mowed a minimum of two times during maintenance period. Edges must be trimmed at least twice a month and all grass clippings removed and disposed of.
  - 3. Young tree pruning shall be conducted during the maintenance period by the Contractor as approved by the University's Representative after review by the Campus Arborist and in accordance with the University's standard tree pruning practices. Refer to Section 01 56 39 Tree and Plant Protection. Trees shall be pruned to encourage the growth of strong central leaders where applicable. Contractor shall notify University's Representative 48 hours in advance of any pruning operations.
  - 4. Protection: Protect planting areas and plants against damage until final acceptance. Maintenance also includes temporary fences, barriers, and signs as required for protection. Treat or replace damaged plants as directed by University's Representative at no additional cost to University.
  - 5. Fertilization: Apply potassium sulfate and 16-6-8 fertilizer at the rate of 6 pounds each per 1000 square feet, 30 days after installation.
  - 6. Weed control:
    - a. Keep site free of weeds during maintenance period.
    - b. Identify weeds and apply accepted control methods.
    - c. Herbicides, if used, shall be applied by licensed Pest Control Operator according to manufacturer's recommendations.
- D. Observation for Maintenance Period Commencement: Request after work of this section and Section 32 84 00 Planting Irrigation is substantially complete. Maintenance Period shall begin upon written notice of acceptance by University's Representative and shall continue for a minimum of [60] [90] days until final acceptance by University's Representative.

END OF SECTION 32 90 00