ADDENDUM NO. 1A

PROJECT: Community Planetarium

RFP NO: **2085**

NOTICE TO PROPOSERS ON THE ABOVE PROJECT:

This addendum forms a part of the contract documents and modifies the original bidding documents as noted below. Please acknowledge the receipt of this addendum in the space provided on the bid proposal. Failure to do so may subject the bidder to disqualification.

This addendum consists of:

BID CLARIFICATIONS

1. The projection equipment shall be Owner Furnished Owner Installed (O.F.O.I.) which consists of the following specification sections:
   - 115211 Planetarium Audio Visual Systems – Inset Projector
   - 115212 Planetarium Audio Visual Systems – ATM-4 Stand-Alone Automation System
   - 115214 Planetarium Audio Visual Systems – Surround Sound System
   - 115216 Planetarium Visual System, 2 UHD Projectors
   - 115217 Planetarium Visual System, 5 UHD Projectors

2. The fixed audience seating, specification section 126100 Fixed Audience Seating, shall be Owner Furnished Contractor Installed (O.F.C.I.).

3. In future, the College plans to install a kiosk sign at grass area located adjacent south from southwest corner of existing Library building. There are existing communications and power conduits that the College intends to use for the kiosk sign. The existing conduits route under and existing sidewalk from grass area towards existing Lewis Center for Applied Sciences building at east. As demolition of this existing sidewalk is part of the Community Planetarium work, the existing conduits will be damaged, and therefore new conduits are to be provided with new sidewalk work for the future kiosk sign.

4. An arborist report has been included for preservation recommendations of existing trees to remain on the site as well as other information related to existing trees. The College's Maintenance and Operations department shall have the final say on all matters concerning existing trees.

5. An existing utilities survey, sheet 3 of 4, has been included for reference for information on existing utilities within the planetarium site and adjacent site areas.

6. Refer to the attached DSA approved sheet C7.0 Demolition Plan that shows work related to existing building and site demolition and abatement located within shaded area as not included in the scope of work.

CHANGES TO SPECIFICATIONS

TABLE OF CONTENTS

1. **Table of Contents**
   - The attached Table of Contents has been revised based on changes to the specifications noted here below.

DIVISION 6 – WOOD AND PLASTICS

2. **Section 061600 - Sheathing**
   - This section has been revised and to be replaced in entirety with the attached section 061600 Sheathing.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

3. **Section 072100 – Building Insulation**
   - This section has been revised and to be replaced in entirety with the attached section 072100 Building Insulation.

4. **Section 075419 – Polyvinyl-Chloride (PVC) Roofing**
   - This section has been revised and to be replaced in entirety with the attached section 075419 Polyvinyl-Chloride (PVC) Roofing.

5. **Section 076200 – Sheet Metal Flashing and Trim**
   - This section has been revised and to be replaced in entirety with the attached section 076200 Sheet Metal Flashing and Trim.

6. **Section 076500 – Flexible Sheet Flashing**
   - This section has been revised and to be replaced in entirety with the attached section 076500 Flexible Sheet Flashing.

DIVISION 8 – DOORS AND WIDOWS

7. **Section 088000 – Glazing**
   - This section has been revised and to be replaced in entirety with the attached section 088000 Glazing.

DIVISION 9 – FINISHES

8. **Section 093000 – Tiling**
   - This section has been revised and to be replaced in entirety with the attached section 093000 Tiling.

9. **Section 095113 – Acoustical Panel Ceilings**
   - This section has been revised and to be replaced in entirety with the attached section 095113 Tiling.

DIVISION 11 – EQUIPMENT

10. **Section 115200 – Audio Visual Systems**
    - This section has been revised and to be replaced in entirety with the attached section 115200 Audio Visual Systems.

11. **Section 115216 – Planetarium Visual System, 2 UHD Projectors**

- This section has been revised and to be replaced in entirety with the attached section 115216 Planetarium Visual System, 2 UHD Projectors.

12. Section 115217 – Planetarium Visual System, 5 UHD Projectors

- This section has been revised and to be replaced in entirety with the attached section 115217 Planetarium Visual System, 5 UHD Projectors.

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

13. Section 230500 – Common Work Results for HVAC

- This section has been revised and to be replaced in entirety with the attached section 230500 Common Work Results for HVAC.

14. Section 230923 – Direct-Digital Control System for HVAC

- This section has been revised and to be replaced in entirety with the attached section 230923 Direct-Digital Control System for HVAC.

15. Section 238106 – Packaged Rooftop Air Conditioning Units – Medium Capacity

- This section has been revised and to be replaced in entirety with the attached section 238106 Packaged Rooftop Air Conditioning Units – Medium Capacity.

16. Section 238109 – Custom Package Outdoor Multizone Air Conditioning Unit

- This section has been revised and to be replaced in entirety with the attached section 238109 Custom Package Outdoor Multizone Air Conditioning Unit.

DIVISION 26 – ELECTRICAL

17. Section 260513 – Medium-Voltage Cables

- This section has been revised and to be replaced in entirety with the attached section 260513 Medium-Voltage Cables.

18. Section 260519 – Low-Voltage Electrical Power Conductions and Cables

- This section has been revised and to be replaced in entirety with the attached section 260519 Low-Voltage Electrical Power Conductions and Cables.

19. Section 260543 – Underground Duct Banks

- This section 260543 Underground Duct Banks is new and attached to be added to specification book.

20. Section 260900 – Instrumentation and Control for Dynamic Glazing

- This section 260900 Instrumentation and Control for Dynamic Glazing is new and attached to be added to specification book.

21. Section 260943 – Network Lighting Controls

- This section has been revised and to be replaced in entirety with the attached section 260943 Network Lighting Controls.

CHANGES TO DRAWINGS

CIVIL

Drawings 42” x 30”:

1. **C3.0 Precise Grading Plan**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.
   - Revisions to east portion of hammerhead turnaround.

2. **C3.1 Precise Grading Plan**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.

3. **C4.0 Utility Plan**
   - At southeast area of site, storm drain line segment running north-south under sidewalk area was corrected to 6” size with keynote 23, so as to match 6’ size storm drain line segment at north side.

4. **C5.0 Details**
   - Details 10 and 22 revised on sheet.

5. **C6.0 Horizontal Control Plan**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.

6. **C6.1 Horizontal Control Plan Parking Lot**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.

7. **C7.0 Demolition Plan**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.
   - A greater amount of existing trees now shown to be protected.
   - Trees that do not exist were removed from plan.

8. **C7.1 Demolition Plan**
   - Revisions to loading zone and assembly area.
   - Revisions to curbs at planters northeast end area of parking.
   - Trees that do not exist were removed from plan.

9. **C8.0 Erosion Control Plan**
   - Newly added drawing sheet and shows revisions to loading zone and assembly area.

10. **FH1.0 Fire Hydrant & Access Approval**
    - The east portion of hammerhead turnaround was reduced in length to retain existing trees and plan approved by local fire authority.

LANDSCAPE

Drawings 42” x 30”:

11. **L1.1 Demolition Plan**
    - Completed sheet reference for Demo Legend note #1.

- Added Demo Legend note #10 to schedule.
- Indicated existing trees to be protected in place.
- Added addition demo to paved area outside service yard.
- Added additional demo to area affected by proposed drop off area.

12. L2.1 Hardscape Plan

- Revised description of Construction Keynotes 10 and 11.
- Revised Lighting Schedule.
- Added existing trees to remain.
- Miscellaneous changes including: provided clear indication of Expansion and Contraction joints, revised site light layout and adjusted bike parking area at SW corner of sheet.

13. L2.2 Hardscape Plan

- Revised description of Construction Keynotes 10 and 11.
- Revised Lighting Schedule.
- Added existing trees to remain.
- Revised walk and wall layout for drop off area.
- Added seat wall for drop off area.
- Miscellaneous changes including: provided clear indication of Expansion and Contraction joints and revised site light layout.

14. L3.1 Hardscape Plan Enlargement

- Revised description of Construction Keynotes 10 and 11.
- Revised Lighting Schedule.
- Added existing trees to remain.
- Added planter to main circular walk for existing trees.
- Added concrete paving adjacent to service yard.
- Reduced seat wall thickness along main circular walk. Miscellaneous changes including: provided clear indication of Expansion and Contraction joints and revised site light layout.

15. L4.1 Hardscape Details

- Added sawcut contraction joint reference to detail “I”.

16. L4.2 Hardscape Details

- Added plan view enlargements for light fixtures locations adjacent to paving and in landscape. See detail ‘K’.

17. L5.1 Irrigation Plan

- Revised irrigation due to protection for existing trees.
- Revised Irrigation due to planting and hardscape changes.

18. L5.2 Irrigation Plan

- Revised irrigation due to protection for existing trees.
- Revised Irrigation due to planting and hardscape changes.

19. L7.1 Planting Plan

- Revised tree and plant quantities due to site changes.
- Indicated existing trees to be protected in place.
- Added Red Iron Bark tree to legend.

20. L7.2 Planting Plan

- Revised tree and plant quantities due to site changes.
- Indicated existing trees to be protected in place.
- Added Red Iron Bark tree to legend.

ARCHITECTURAL

Written Clarifications:

21. A2.1 Ground Floor Plan, A2.4 Roof Plan, A4.1 & A4.2 Exterior Elevations, A5.1 & A5.2 Sections, A5.3 Enlarged Building Section, A5.14 & A5.15 Wall Sections, A6.1, A6.2 & A7.1 Enlarged Plans

- Keynote 074213.04 Revised to read: ‘ Metal Panel System @ Exterior Concrete Dome - Aluminum Plate Rainscreen Per Specifications, Powder Coated Factory Finish, Basis of Design: Overly ‘.

22. A2.4 Roof Plan, A4.1 & A4.2 Exterior Elevations, A5.1 & A5.2 Building Sections, A5.3 Enlarged Building Section, A5.14 & A5.16 Wall Sections, A6.2 Enlarged Plans

- Keynote 086300.01 Revised to read: ‘ Custom Framed Aluminum Skylight at Pendulum Tower - Glazing to be electrochromic per Specifications consisting of two layers (1) layer laminated glazing on interior side and (1) layer laminated glazing on exterior side - Basis of Design: "Wasco - Pinnacle System” ‘.
- Keynote 086300.02 Revised to read: ‘ Custom Framed Aluminum Skylight – Glazing to be electrochromic per Specifications consisting of two layers – (1) layer laminated glazing on interior side and (1) layer laminated glazing on exterior side – Basis of Design: “Wasco – Pinnacle System” ‘.

23. A5.3 Enlarged Building Section

- Keynote 033000.02 revised to be Keynote 033000.03 ‘ Concrete Wall per Structural Drawings ‘.

24. A9.4 Details 10 & 15, A9.15 Details 5 & 9, A9.21 Details 10 & 19, A9.22 Details 5 & 25

- All exposed concrete indicated to be sack rubbed finish.

25. A2.1, A2.4, A3.1, A4.1, A4.2, A5.1, A5.2, A5.3, A5.12, A5.15

- Exterior Architecturally Exposed Structural Steel Finish description in Keynotes 051213.01, 051213.02, 051213.05, & 051213.06 revised to read: ‘ Steel to be protected by 3 coat high performance paint system per specifications - Basis of Design: Carboline ‘.

26. A2.1, A3.1, A5.1, A5.11, A5.14, A6.2, A6.3, A9.2

- Interior Architecturally Exposed Structural Steel Finish description in Keynotes 051213.03, 051213.04, 051213.07, & 051213.08 revised to read: ‘ Steel to be protected by 2 coat high performance paint system per specifications - Basis of Design: Carboline ‘.

27. A6.2, A6.3

- General Interior Elevation Note added: ‘ Wall base not shown on interior elevations. Provide and install wall base per Materials and Color Schedule and Room Finish Schedule Sheet A8.1 ’.

28. A9.1

- Detail 18 Note revised to read: ‘ Retrofittable to currently available 33/35A AND 98/99 exit devices. ‘PA’ option called out as ‘Pushpad Filler’ in specification 087100. Provide exit device with pushpad filler per specifications ‘.

29. A9.24

- Detail 5 Note revised from ‘Sarnafil’ to ‘Single ply felt back fully adhered roofing membrane’.
- Detail 5 Note revised from ‘Sarnafastener and SarnaDisc’ to ‘Fasteners per roofing manufacturer and specifications’.

30. TH1.3

- Detail 5 TH- Series drawings are for theater equipment scope only. All other scope shown for reference only. Refer to Architectural drawings for architectural scope of work. Refer to Mechanical drawings for mechanical scope of work. Refer to DI drawings for interior dome screen scope of work.

31. TH1.5

- Sheet T1.5 removed from set. Seating scope included in Architectural Drawings.

32. CW201, CW202, CW203, CW204, CW205

- Glazing description shown in Glazing Schedule to be revised to read ‘Glazing per Specifications’.

Drawings 42” x 30”:

33. A1.2 Site Plan

- Revisions to loading zone and assembly area and existing tree shown to remain at east end of hammerhead turnaround.

34. A6.1 Enlarged Plans – Planetarium Theater & Exhibit

- Revisions related to Planetarium seating.

35. A9.3 Aluminum Window Details

- Revisions to notes on various details.

36. A9.4 Curtainwall Details

- Revisions to notes on various details.

37. A9.21 Exterior Details

- Revisions to notes on various details.

38. A9.22 Stone Veneer Rainscreen and Dome Cladding Dtls

- Revisions to notes on various details.

Sketches 8 ½” x 11”:

39. SKA-1 Roof Plan

- Elevation of +25’-7” is now updated to correctly indicate B.O. exterior dome cladding.

40. SKA-2 Reflected Ceiling Plan

- Keynote 051213.04 has been shown on plan as typical and keynote 051213.08 has been added and shown on plan as typical.

41. SKA-3 Wall Section
- Keynote 054100.01 has been added and shown on section replacing keynote 051213.06 callout.

Sketch 11” x 17”:

42. SKA-4 Tile Flooring Details
- Revisions to details 15 and 20 on sheet A9.9.

Sketches 8 ½” x 11”:

43. SKA-5 Door Schedule
- The head detail reference for doors 101A, 101B and 101C has been updated to 2/A9.2.

44. SKA-6.1 Floor Diffuser Detail
- New detail 25/A9.9 for floor diffuser now referenced on enlarged building section 1/A5.3.

45. SKA-6.2 Floor Diffuser Detail
- New detail 25 for floor diffuser added to sheet A9.9.

Sketches 11” x 17”:

46. SKA-7 Detail 12/A9.24
- Revisions to detail 12 on sheet A9.24.

47. SKA-8 Detail 17/A9.24
- Revisions to detail 17 on sheet A9.24.

Sketches 8 ½” x 11”:

48. SKA-9 Detail 13/A9.24
- Revisions to detail 13 on sheet A9.24.

49. SKA-10 Detail 3/A9.24
- Added note and note revision to detail 3 on sheet A9.24.

50. SKA-11 Detail 24/A9.24
- Added note and curb dimension revision on detail 24 on sheet A9.24.

Sketches 11” x 17”:

51. SKA-12 Detail 5/A9.27
- Revisions to detail 5 on sheet A9.27.

52. SKA-13 Detail 12/A9.27
- Note additions and note revisions to detail 12 on sheet A9.27.

53. SKA-14 Detail 15/A9.27
- Revisions to detail 15 on sheet A9.27.

Sketch 8 ½" x 11":

54. SKA-15 Detail 27/A9.27
- Revisions to detail 27 on sheet A9.27.

55. SKA-16 Ground Floor Plan
- Corrected keynote to be 074213.04 for metal panel system at exterior concrete dome.

56. SKA-17 Slab Plan
- Corrected dimensions to correspond with dimensions shown on the ground floor plan.

STRUCTURAL

Sketches 11" x 17":

57. SKS-1 Partial Foundation Plan
- The note for top of footing along grid line R11 that reads ' TOS EL = -4 - 6" ' has been revised to correctly read: ' TOF '.

58. SKS-2 Partial Roof Framing Plan
- The detail callout 13/S5.3 along grid line R11 near grid line S4 has been correctly revised to 13/S5.1.

59. SKS-3 Partial Framing Plan
- Adjacent to grid line C1.5 and between grid lines R11 and R12, condensing unit CU-6 is has been added.

60. SKS-4 Grid C1 Wall Elevation
- Footing thickness change corresponding to sheet S2.1 Foundation Plan is now correctly shown on wall elevation.

61. SKS-5 Foundation Details
- On detail 13/S4.1, Section A-A, the 1'-0" dimension from edge of footing was removed. This is due to the construction joint being noted as being 4" minimum and 8" maximum from the corner of the column on the Plan View and 1'-0" from the edge of the footing on Section A-A. For large and small, plan dimension, footings, these constraints would conflict.
- Detail 14/S4.1 has been revised to describe spacing requirements when there are multiple pipe penetrations.

62. SKS-6 Foundation Details
- On detail 1/S4.2 added arrow pointing to top rebar to clarify that rebar is running each way.

63. SKS-7 Foundation Details
- On detail 2/S4.2 the thickened slab edge reference to 9/S4.1 was removed as it is for over excavation and compacted fill requirements. Also thickened slab edge dimensions, rebar information with clear dimensions and reference to detail 15/S5.1 for rebar lap have been added to detail.

64. SKS-8 Foundation Details
- On detail 14/S4.2 reference to curb detail 6/S4.1 has been added.

65. SKS-9 Foundation Details

- On detail 8/S4.3 at 8” slab a note specifying rebar requirements has been added.

66. SKS-10 Foundation Details

- On detail 5/S4.4 at the slab on grade and concrete walls a note has been added for optional construction joints.

67. SKS-11 Framing Details

- On details 9&10/S5.2 the shear plates are now shown and noted as extended to allow for bolt installation.

68. SKS-12 Framing Details

- On detail 3/S5.2 the reference to detail 14/S5.2 for diagonal brace and HSS hanger has been clarified.

69. SKS-13 Framing Details

- On detail 11/S5.4, for connection of the stiffener plates centered on the angles, note has been added specifying weld.

70. SKS-14 Framing Details

- On detail 4/S5.5 the shim plate size and welds have been revised due to the space constraints of an all around weld.

71. SKS-15 Framing Details

- On detail 7/S5.5 Section A-A the welding of shear plate to embed plate has been clarified and on Section B-B the welding of bar to plate at top and bottom shear plates has been clarified.

72. SKS-16 Framing Details

- On detail 8/S5.7, references to detail 13/S5.2 have been corrected to 14/S5.2.

73. SKS-17 Interior Steel Stud Sections and Details

- On detail A/S6.1 references to header and sill details have been updated at duct opening and sill detail has been updated at window opening.

74. SKS-18 Interior Steel Stud Sections and Details

- On detail 4/S6.1 the configuration of multiple steel studs to track connection has been revised and on detail 12/S6.1 a clip angle connection has been added.

75. SKS-19 Interior Steel Stud Sections and Details

- Details 11&13/S6.1 have been revised using a clip angle connection.

76. SKS-20 Interior Steel Stud Sections and Details

- Detail 14/S6.1 has been revised using a clip angle connection.

77. SKS-21 Exterior Steel Stud Sections and Details

- Details 2&4/S6.2 have been revised using a clip angle connection.

78. SKS-22 Exterior Steel Stud Sections and Details

- On detail 7/S6.2 the reference for clip angle has been corrected to14/S5.2.

79. SKS-23 Equipment Anchorage Support Details

- The Equipment Anchorage Schedule A/S7.1 has been updated. The title of detail 9/S7.1 have been corrected and notes have been updated within the detail.

MECHANICAL

Drawings 42” x 30”:

80. M0.01 Mechanical Cover Sheet
- Within ‘Design Criteria’ notes the word ‘Structural’ was added.

81. M0.02 Mechanical Schedules
- Various updates have been made to sheet.

82. M2.01 Ground Floor Mechanical Plan
- FC-2 was relocated, FC-6 is now shown, added thermostats for zone averaging, model number noted for RA curve linear bars, exhaust grille deleted that was graphic error and keynote M24 has been revised.

83. M2.02 Roof Mechanical Plan
- CU-6 has been added. Added OA hood at RTU-1. At RTU-2 the following have been added: control panel, OA louver, EA damper, service access and coil pull access. Keynotes M19 and M20 now shown at EF-3 and note added at roof hatch to see architectural drawings for detail.

84. M5.01 Roof Mechanical Plan
- Symbol corrections to detail 6 on this sheet.

85. M6.01 Mechanical Controls
- Revised detail 2 Network Riser, revised detail 3 RTU Control Diagram and added Multi-Zone Unit Sequence of Operation notes.

86. M6.02 Mechanical Controls
- Newly added drawing sheet.

PLUMBING

Drawings 42” x 30”:

87. P0.01 Plumbing Cover Sheet
- Within Pipe Material notes, for natural gas, revised note for above grade and added condensate drain. Within Plumbing Legend added point of disconnection.

88. PD.01 Plumbing Demolition Site Plan
- Revisions to utilities work at northwest and southeast areas of site.

89. P1.01 Plumbing Site Plan
- New gas line has been added at southeast area of site between the building and existing gas line at east area of site. Additional clean outs in yard boxes shown at south, west and east sides of building.

90. P2.01 Ground Floor Plumbing Plan
- Various updates to plan and keynotes.

91. P2.02 Roof Plumbing Plan
- Various updates to plan and keynotes.

92. P3.01 Enlarged Plumbing Plans
- On enlarged plan 1, clean outs with yard boxes have been added and domestic water flow meter has been added.

93. P5.01 Plumbing Details
- Revisions to details 5 and 7 on sheet.

ELECTRICAL

Drawings 42" x 30":

94. E0.01 Cover Sheet
- Added type E2.
- Revised types X2 and X6 to campus standard.
- Deleted types X4, X5, X7 and X10.

95. E0.02 Single Line Diagram
- Revised single line diagram.
- Revised key notes.
- Deleted ground fault protection on 800A circuit breaker.
- Revised meter to shark #200.
- Added primary fuse size at UPC.

96. E0.03 Panel Schedules
- Revised sheet name.
- Revised MSH feeder schedule.

97. E1.00 Electrical Site Plan
- Added power receptacles at site walls.

98. E1.01 Lighting Site Plan
- Revised site lighting plan and circuitry.

99. E2.01 Ground Floor Lighting Plan
- Identified type "C" lighting fixtures on plan.

100. E2.02 Roof Lighting Plan
- Clarified light fixture symbol.
- Re-routed lighting circuitry.

101. E3.01 Ground Floor Power Plan
- Added power and data floor boxes for future show control at center of theatre.
- Added future security camera locations, conduit and circuitry.

102. E3.02 Roof Power Plan
- Revised circuit feeding RTU-1.
- Revised key notes.

103. E4.01 Enlarged Plans and Electrical Details
- Revisions to detail 5 on this sheet.

TELECOMMUNICATIONS

Drawings 42” x 30”:

104. TE0.01 Telecommunications General Notes
- Revised general notes 12, 20 and 31 and description for wall-mounted wireless access point has been revised for CAT6A cables within the symbol legend.

105. TE0.02 Telecommunications Approved Components
- New added drawing sheet.

106. TE0.10 Telecommunications Risers
- Revised copper/fiber diagram detail 1, revised internal conduit riser diagram detail 2 and added keynotes 1 and 2.

107. TE1.1 Telecommunications Ground Floor Plan
- Revisions related to wireless access and data.

108. TE3.1 Telecommunications Enlarged Plans
- Revisions to details 1, 3 and 4, update to general note 17 and added keynote 14.

All other terms and conditions remain the same.

John Eriksen, Director of Purchasing May 4, 2016

Consulting Arborist's Report
March 14, 2016

Construction Impact Evaluation

For Orange Coast College, Planetarium

Prepared for: Ammar Sarsam
Principal Operations
HPI Architecture
115 22nd Street
Newport Beach CA 92663

Prepared by: Arborgate Consulting, Inc.
Greg Applegate, ASCA, ASLA
1131 Lucinda Way
Tustin, CA 92780
714/ 731-6240

Table of Contents

Introduction

Background

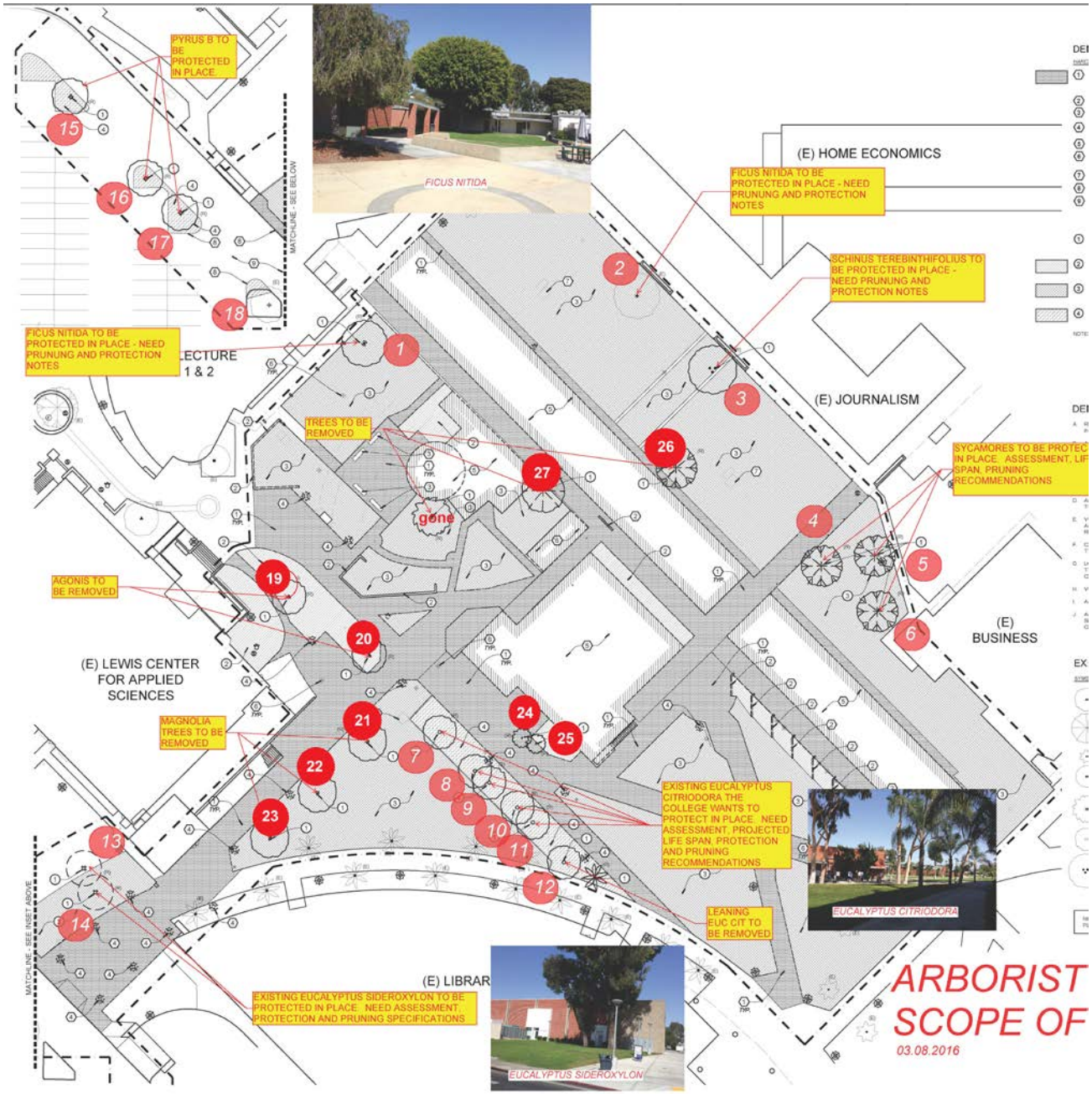
Orange Coast College is planning a new planetarium with new walkways, new fire access, and landscaping for the surrounding area. The site has an old, smaller planetarium, an old, one-story classroom building, and is currently covered with trees and turf. These will be removed and replaced, except for suitable trees. The construction will impact about: 20 mature and young trees. The site is nearly flat. The college and designers would like to save as many existing trees as is safe and reasonable.

This consultant inspected and measured the trees and took photographs on March 10, 2016.

Assignment

Mr. Jim Ridge of Ridge Landscape Architecture, Mr. Woodward Dike of Woodward Dike Associates, and Mr Ammar Sarsam of HPI Architecture, contacted this consultant and asked that I provide an arboricultural evaluation of 18 trees' health and condition, professional opinions and report as appropriate. There are 18 existing trees on site that OCC would like to protect in place. Arborgate Consulting will review the designated existing trees; provide an assessment of their health, an estimate of their remaining life span, recommendations for protection, and pruning recommendations.

Tree Map


PYRUS B TO BE PROTECTED IN PLACE
FICUS NITIDA
(E) HOME ECONOMICS
FICUS NITIDA TO BE PROTECTED IN PLACE - NEED PRUNUNG AND PROTECTION NOTES
SCHINUS TEREBINTHIFOLIUS TO BE PROTECTED IN PLACE - NEED PRUNUNG AND PROTECTION NOTES
FICUS NITIDA TO BE PROTECTED IN PLACE - NEED PRUNUNG AND PROTECTION NOTES
(E) JOURNALISM
TREES TO BE REMOVED
gone
SYCAMORES TO BE PROTEC IN PLACE. ASSESSMENT, LIF SPAN, PRUNING RECOMMENDATIONS
AGONIS TO BE REMOVED
(E) BUSINESS
(E) LEWIS CENTER FOR APPLIED SCIENCES
MAGNOLIA TREES TO BE REMOVED
EXISTING EUCALYPTUS CITRIODORA THE COLLEGE WANTS TO PROTECT IN PLACE. NEED ASSESSMENT, PROJECTED LIFE SPAN, PROTECTION AND PRUNING RECOMMENDATIONS
EUCALYPTUS CITRIODORA
LEANING EUC CIT TO BE REMOVED
(E) LIBRAR
EXISTING EUCALYPTUS SIDEROXYLON TO BE PROTECTED IN PLACE. NEED ASSESSMENT, PROTECTION AND PRUNING SPECIFICATIONS
EUCALYPTUS SIDEROXYLON
ARBORIST SCOPE OF
03.08.2016

Summary

When buildings are built, trenches are dug, and sidewalks are constructed near existing mature trees, some trees may deserve to be saved and some may not, but all will suffer some health impacts – visible or not. Roots spread much further than the dripline or what lay people believe. With early planning, monitoring and observing certain precautions, valuable large trees may be preserved. Trees as large as the ones found on this site are irreplaceable and are valuable campus landmarks, establishing a sense of continuity in the history of the campus. They can provide an instant benefit after the new building, hardscape and landscape is installed. Sound and healthy large trees in favorable locations will justify more expense to preserve, since they can easily be worth tens of thousands of dollars and still have a good remaining lifespan. Trees like the large Ficus can have value beyond what any appraisal formula would yield.

There are limits to how close roots can be cut without sacrificing health or stability. Although I am a tree appraiser and tree advocate, I know that the lives of people are more important than trees and I will recommend the removal of any tree that cannot be made reasonably safe. I will offer separate clearances for health and safety, so that campus administrators can opt to risk killing the tree, but not go so far as to put people at risk due to loss of stability. Regardless, reports do not save trees unless they are implemented.

Prior to my site visit and inspection, the trees on this site already had a number of injuries and stress factors. I was called in to consult on these trees *after* removal of several trees that I was asked to evaluate and include in this report. The tree map above shows the locations of the trees I was to inspect, including the ones that already have been removed. The campus community and administration considered these important trees and desired a professional opinion, I assume before they were cut down.

Protecting trees during construction requires *good* fencing, more than orange plastic fencing, to protect their root zones from compaction, trenching and pollution. Soil under turf grass grows more and more compact over the years. Moist soil compacts more easily and lawns are kept moist. The combined effect of students' foot traffic, lawn mowers and other maintenance vehicles

running over the moist soil day-by-day compacts the soil so much that tree roots can only grow near the surface. To mitigate the effects of existing compaction and construction compaction, vertical mulching and a reduction of turf area will be needed. The needs of trees and turf are not compatible when considered on a long term basis. If the surface roots can be protected, replacing large areas of turf around trees with good organic mulch will reduce water use and increase tree health and stability.

If, after construction, the remaining trees had too many roots cut, they will decline and die over the following years. This can take years and they trees may look terrible over that time. If even more roots were cut, they may topple suddenly during a storm or Santa Ana wind. However this report will provide recommendations to maximize tree protection and the chances of their survival. Good root *and* soil protection will be needed from here on, especially during landscaping when trenching for irrigation may cut additional roots. All trenches for the irrigation should be marked out and approved by this consultant prior to trenching. All soil disturbances within the critical root zone must be prevented or very carefully controlled.

Observations

General Findings

The planetarium site is located in Costa Mesa, near the south edge of the Orange Coast College campus, and northwest of the library. The site is nearly flat. Most of the site soil is heavily compacted, due to years of turf grass irrigation and foot or vehicle traffic. The heavy soil compaction and frequent irrigation of the turf causes most trees to be shallow rooted.

The most abundant tree species around this site is the lemon gum, *Corymbia citriodora*. Six lemon gums are in a row west of the library and south of the existing planetarium. Other than the end trees, the others are planted in pairs about a foot or two apart. This crowding has caused unnatural one-sided growth as they reach for sunlight around their neighbor. The root zone of all six is covered in compacted decomposed granite (DG). The DG appears to be a more recent design feature, and the health of the trees has declined due to reduced gaseous exchange and reduced return of organic matter to the soil. It may also be limiting soil moisture by increasing water runoff. Lion-tail pruning has left large gaps in the branching with foliage concentrated at the branch ends. Three of these lemon gums will need to be removed, two for construction and one due to leaning, with basal damage opposite the lean.

The more significant specimen trees include an Indian laurel, *Ficus microcarpa Nitida*; a cultivar of rusty leaf fig, *Ficus rubiginosa Microphylla*; and a Brazil pepper, *Schinus terebinthifolius*. Past pruning of the Indian laurel headed back most of the limbs, especially upper limbs. This pruning reduced the overall size of the tree, probably after a large limb broke near the top of its current canopy. Sprouts (epicormic shoots) grew out behind these heading cuts. This tree has included bark in several narrow main crotches. If this tree were allowed to grow out much these weak crotches could fail. As a result of these factors, this tree has lost some aesthetic value, but is still worthwhile to retain.

The rusty leaf fig cultivar, *Ficus rubiginosa Microphylla*, is a large and attractive specimen. It has been lion-tailed, leaving the weight of the limbs more concentrated near the ends. Many sprouts are filling in on the denuded inner limbs. Lion-tailing also

eliminates trees' "old age insurance", meaning that because trees often develop longer and longer limbs as they age and the weight becomes cantilevered more and more end heavy, it becomes necessary to "drop-crotch" or reduce such long limbs by cutting them back to a good sized interior limb. If most of the interior limbs have been stripped out, there may be no good place to cut them back to. Like the ficus above there are several crotches with included bark. Without the ability to reduce much end weight, those limbs with included bark may need to be entirely removed. This tree should be able to remain in place with appropriate protection measures, but it will need more professional pruning to correct the overly-long, poorly-attached, end-heavy limbs. This is a large and attractive specimen worth good care and more effort.

There is a large healthy bottle tree, *Brachychiton populneus*, south of the above rusty leaf fig. It is against the building and the building will be removed and it will probably need to be removed. There are multiple codominant leaders crowding each other. As a result, it does not have sufficient value to justify transplanting.

The Brazil pepper, *Schinus terebinthifolius*, has been moderately lion-tailed. The amount of lion-tailing is more visible from below the canopy. Some arborists like this look and call it "thin pruning" or "lacing". However, all current pruning standards say it is destructive. Although air may pass through more easily, the limbs lose their damping ability and more storm damage occurs, not less. This tree does not have epicormic sprout growth on the interior of the limbs, like the Ficus. This may be due to reduce health or that it was very recently pruned. If Brazil peppers are over-pruned, they normally sprout either from the branching, trunk, limbs, or roots. The trunk has an interesting appearance due to large galls, a common feature of both Brazil and California peppers, but not of much concern.

The two red ironbarks, *Eucalyptus sideroxylon*, are out near the parking lot, separated from the main site, but possibly impacted by upgrading the access for fire trunk entry. Both are attractive and in good to excellent health. However, they have been headed back which produced large amounts of epicormic shoots. Both are also codominant. Much earlier in their lives they should have had one side subordinated or removed. Red ironbarks are more prone to splitting apart than most other eucalypts. Their canopies are so dense from the shoot growth it is hard to see if there are any cracks or defects in their branching.

The one spotted gum, *Corymbia maculata*, is in good structural condition, but poor health, and has no serious defects. It is in a group with two white alders, both of which are also declining in health. The spotted gum has died back about three feet on the upper limbs and the foliage is somewhat pale in color. Upper dieback is usually a sign of dry conditions or root problems.

The alders, *Alnus rhombifolia*, are riparian (water loving) trees. Their decline is most likely due to lack of water. One is nearly dead and the other is in weak health. Both are poorly structured, but the healthier one has very weak branching that appears to be resulting from past topping, done years ago. The branching is so poor, it is unlikely pruning can correct it.

Three of the four parking lot trees (#15, 16, 17 & 18) are missing without even stumps remaining. The one remaining tree, #16, is a Catalina cherry, *Prunus lyonii*. This is not a long lived species. The top is getting sparse and the limbs are too long. There are a number of inner sprouts, some of which are dead. The roots are cracking and lifting the adjoining curbs.

Both of the Agonis shown on the original map had been removed. A small stump was found for #20, but no trace of #19 was found.

The three southern magnolias, *Magnolia grandiflora*, are young and have not been trained yet. The scaffold limbs are clustered close together and would eventually pinch each other out. The north one is in poor health. Magnolias are shallow rooted and appreciate a 2-3" deep layer of mulch.

The two Hollywood junipers, *Juniperus chinensis Torulosa*, are attractive and in good health with no significant structural defects. Neither is in need of pruning or other care, except to remove the fallen lemon gum branches stuck in their foliage.

Few of the trees have adequate amounts or adequate coverage of mulch. Lawn mowers are wounding surface roots of these trees.

Common abbreviations in the following matrix include:

1s=one-sided
2long = too long
Brk = broken limb
Cod=codominant
Cr=crowding or crowded
Db=dieback
DBH – Diameter at breast height, i.e. 4.5'
DG = decomposed granite
Dk = decay, DkT = decayed trunk
DL=Dog-leg
EH=end heavy
epi = epicormic shoots
FC=flush cut
Hd = headed
Inc=included bark
Inj=injury
Lt=lion-tailed
MB = mower blight, root injury
OP=over pruned
OL = over-lifted
RF = root flare, mRF = small root flare
Sp=sparse
TD = tear down
TO – tear out

"m" preceding an abbreviation indicates a minor problem.

Matrix of Findings

Tree #	Species	DBH	Health	Structr	Pruning style + objective	max % foliage removal	Comments
1	Ficus m. Nitida	40	C	C-	DC to contain size	10%	Move planned walkway. Topped cod inc MB Hd TO
2	Ficus r. Microphylla	38.5	A	C-	DC, space epicormics	25%	Cod inc epi EH Lt MB stubs TD
3	Schinus terebinthifolius	36	B	C	None now	0%	Cod inc galls EH Lt
4	Alnus rhombifolia	13	D-	D	Remove	100%	Nearly dead, shot hole borers
5	Corymbia maculata	16.8	D	C	Dead wood only	0%	Cod Db

Tree #	Species	DBH	Health	Structr	Pruning style + objective	max % foliage removal	Comments
6	Alnus rhombifolia	19.5	C	D	Subordinate + DC	20%	Cod inc topped DkT
7	Corymbia citriodora	22.8	C	C	Cut lower S. limb DC	<10%	Close to planned paving. mRF in DG
8	Corymbia citriodora	18.2	C	C	Remove	100%	girdling, Cr#8 1s in DG
9	Corymbia citriodora	14.1	B	C	Remove	100%	Cod DL mRF in DG
10	Corymbia citriodora	19.1	C-	C	DC loner limbs	<10%	mDb cod DL m RF 2long in DG
11	Corymbia citriodora	18.9	C-	C-	None now	0%	1s DL Cr#10 mRF in DG
12	Corymbia citriodora	18.2	C	C	Remove	100%	Old brk, TO Lt mRF Basal damage opposite lean
13	Eucalyptus sideroxylon	23	A	C	Space & DC epicormics	20%	Hd DL cod epi
14	Eucalyptus sideroxylon	34.3	B	C	Space & DC epicormics + sub	20%	Hd DL cod inc epi
15	Pyrus c.	gone					
16	Prunus lyonii	16.2	B	B	space epicormics DC lower	20%	Inner Db epi curb broken and lifted.
17	Pyrus c.	gone					
18	Pyrus c.	gone					
19	Agonis flexuosa	gone					
20	Agonis flexuosa	gone					
21	Magnolia grandiflora cv	2	C-	C	None now	0%	Db Sp
22	Magnolia grandiflora cv	4	B	C-	Structural pruning to train	15%	Crowded scaffold limbs
23	Magnolia grandiflora cv	3	C	C-	Structural pruning to train	15%	Crowded scaffold limbs
24	Juniperus c. 'Torulosa'	8	B	B	None now	0%	Okay
25	Juniperus c. 'Torulosa'	8.5	B	C	None now	0%	mLean
26	Brachychiton populneum	17	B	C-	Remove	100%	Cod inch against bldg. CrS
27	Bauhinia purpurea	18	C	C	Remove	100%	Cod inside construction.

DBH = diameter at breast height, i.e. 4.5 feet above grade.

Photographic Documentation

#1 Indian laurel – note crowded limbs and included bark.

Note included bark in the main crotch.

#2 Ficus rubiginosa ‘Microphylla’
The limbs in front are growing too long and end heavy.

Note included bark at the right ➔

#3 Brazil pepper – note lion-tail pruning leaves few inner branches or foliage.

#4 White alder – the left half is dead. The right half has some green. The tan spots with a small hole are shot ho0le borers tunnels.

#5 Spotted gum – note dieback at the branch ends.
Deep water this tree immediately.

#6 White alder – note multiple leaders.

Lemon gums, #7 to 12 from right to left.

Red ironbarks #13 & 14 from right to left.

#21 Southern magnolia – note dieback of lower limbs on the right.

#22 &23 Magnolilas, from foreground to background.

#24 & 25 Hollywood junipers, from left to right.

#27 Bottle tree – note multiple leaders.

Testing & Evaluation

Visual Analysis of Tree Condition

All the subject trees were evaluated for condition of the trunk, its lean, scaffold limbs, secondary branching, foliage density, and root crown condition. The root crown was examined, as far as it was visible, without excavation. Surface roots were noted as MB, i.e. mower blight, i.e. the lawn mowers were damaging the upper surface of the shallow roots.

The health was evaluated on a visual basis. If there were no nutrient deficiency symptoms, the foliage was full and dense, there were few dead twigs or limbs, and there were no pest or disease symptoms, it was assumed that they were healthy. To the degree that symptoms or problems existed, the trees were rated on a five point scale (A to F). The best condition is termed “A“ or excellent. If there were only a couple minor problems the condition is called “B“or good. If the health was such that the tree was not in jeopardy, but it was not good, the condition is called “C “or fair. If the tree was in decline, but might be recuperated, the condition is called “D“or poor. “F” is dead or as good as dead. The condition of the structure, i.e. trunk, scaffold limbs and branches were evaluated on a similar five point scale.

The trunk diameter was measured with a diameter tape. The measurements were taken at 4.5 feet (DBH) to be in conformity with industry standards. If a tree branched low and the narrowest point of the trunk was below 4.5 feet, the diameter was measured there, i.e. at the narrowest point.

No internal testing was done, but if decay testing is desired, Shigometer, Resistograph and Picus sonic tomography are available.

Discussion

The preservation of trees should be based not only on the soundness, health and value of the trees, but how well they fit the new design and use of the site. The preservation decision must be based on an accurate forecast of the extra stresses imposed on trees during the construction period and landscaping, and the probable end condition of the trees.

The main stresses and risks of construction are:

- Ignoring arborist reports and instructions
- Soil compaction
- Lack of water
- Change of grade in the root zone
- Physical damage to the roots and upper structure
- Spilling or dumping of potentially toxic construction wastes
- Lack of pest control and other care
- Dust

In the consideration of the recommendations included in this report, it was assumed that no matter what level of protection is given the trees from here on, there will be considerable stress imposed on the trees related to construction. It was also considered that the new site use will allow students and staff to hold activities or pass beneath the weakened trees.

Trunk decay, e.g. in #6, that may have been held in check can advance when the trees' reserve carbohydrates are reduced or depleted by construction impacts, or just by aging. Large roots cut for irrigation, underground utilities and footings can immediately render trees less stable during storms and strong winds. Large roots cut inside the root plate are also more likely to decay back into the base of the trunk.

Pruning

Topping, heading and over pruning result in sprout growth. These epicormic sprouts form from dormant buds and ray traces in the area of the cambium and have a weak attachment just in the outer growth ring. Normal branches are laminated on year after year with alternating branch and trunk tissue and have a very strong attachment. The shoots can be kept small to minimize the risk of their breaking out, but this will reduce the amount of green foliage and therefore the amount of food (carbohydrates from photosynthesis) that the trees get. This sort of "starvation" will prevent the tree from forming good new growth rings, healthy roots and strong compartmentalization.

Lion-tail pruning can only be corrected by keeping more internal shoots and grooming them to become permanent branches. This will take several years of annual pruning and more thought and better supervision than is usually applied to maintenance pruning. Older trees of low vigor will take even longer. Without the ability to significantly reduce end weight, those limbs with included bark may need to be entirely removed. When such limbs begin to show signs of sagging and there is no good place to cut back to, they must be removed back to the branch collar.

Careful pruning *can* reduce the risk of limb failure in such cases, but careless or unprofessional pruning will probably make matters worse. A balance needs to be struck, based on the health of the tree and how many shoots need to be removed and how soon they need to be removed. To achieve such a balance will usually require good supervision by at least a certified arborist, but more likely by a board certified master arborist or registered consulting arborist.

Soil Compaction

One of the major impacts of construction is soil compaction, both deliberate and circumstantial. Soil compaction is already at a near critical level due to the lawn. The compaction of the soil at a developed site is beneficial for the construction of footings, structures, and paving, but almost fatal to the roots of trees. This soil compaction often goes well beyond the limits of the footings. Evidence linking compaction to the poor health and death of trees is graphic. Root systems are very demanding and simply will not grow in compacted soil. Natural forest soils are a living ecosystem, dependant upon a critical amount of air and water filled pores spaces. A number of the necessary symbiotic partners of tree roots will not survive in less than ten percent pore space.

Converting the areas with surface roots to mulch beds will eliminate the need to mow, increase root depth, and reduce root injuries. Using good green-waste mulch would improve the health of the soil and roots. The campus' own green waste could be composted and processed to save money, improve the soil, and minimize land fill problems.

Lack of Water

This spring may be wetter than usual. This has benefits and drawbacks. Wet or moist soil compacts more easily, but the trees need water to survive. During construction trees may receive at best light watering from water trucks, which is far less than most mature trees need. The ficus will probably tolerate lack of supplemental irrigation for a year or more. However, the lemon gums are already drought stressed because of the decomposed granite cap over the roots. The magnolias and alders are not drought tolerant.

Areas with foot or equipment traffic should be kept dry as dry as possible when the equipment traffic level is high and watered when it is low. Equipment run over wet soil will be excessively compacted. Once compacted, the usual methods of compaction reduction cannot be used without damaging the roots in the soil. Its too late. Prevention is the only realistic way to reduce soil compaction.

All trees to remain should be deep watered before construction begins and kept well irrigated inside the fenced protection zone during construction.

Change of Grade in the Root Zone

At least one area appears to have a layer of fill soil over the original grade – the DG over the lemon gums' roots. Proposed grading plans are unknown to this consultant; however without controls the grade level near some trees probably would be changed. The soil level within the protection zone must remain unchanged. Changing the grade around trees is risky.

Having the proper proportion of air and water in the soil is related to proper watering and avoiding soil compaction. As you go deeper in the soil, the amount of available oxygen naturally drops off rapidly. When roots are deprived of adequate oxygen they quickly die. For the fine feeder roots of a tree this can happen in a matter of minutes. When soil is piled on top of the root system, available oxygen is excluded and the soil compacted. The soil is permanently compressed below, so the effect can last after a pile of soil is removed.

Piles of soil or spoils from trenches and footings can severely compact the soil below, and the equipment used to remove the piles can further compact the soil. Since much of the damage is already done, the best we can do is make sure the original grade is restored and that only track mounted small equipment is used to remove soil piles. This work must also be done when the soil in the haul route is dry.

Physical Damage to the Roots and Structure

Damage to the upper structure of trees seems to always happen on job sites unless secure fencing is in place out to the dripline. Not everyone on a construction site knows about or is concerned about trees. Only physical barriers work, and they need to be supplemented by the cooperation and help of the construction superintendent or inspectors.

Without real fencing, versus orange plastic snow fence, physical injuries to the trunk and branches are likely. Well secured chain link fence is about the only thing that seems to work. Shallow roots are more likely to be damaged during construction. Without controls, trenching for utilities or sprinkler lines is likely to damage roots. Beyond reducing the trees' health, such impacts could also destabilize the trees. Utilities need to be planned to avoid the root zones of trees. Tunneling may be needed to avoid ruining a valuable specimen. Although many people believe mature trees depend on strong, deep tap roots, it is a myth.

Many times trees that people have gone to great measures to preserve through development are severely injured when landscaping is installed under them. Digging holes for shrubs and ground covers can injure main lateral roots, causing extensive damage. Nicking the roots can also open up roots to infection. Roto-tilling can also destroy a large percentage of the feeder roots.

Spilling of Potentially Toxic Construction Wastes

Oil and hydraulic fluid from construction equipment, cement, form oil, acid washes, paint and solvents are toxic to tree roots. Soil pollution also includes concrete debris, asphalt, form oil, and hydraulic fluid. Again, without fencing and active controls, such dumping is likely. Many times debris is just buried on job sites. Concrete debris, some base materials and sand can also be harmful to soils. Concrete debris increases the alkalinity of the soil as do base materials that contain concrete or lime. Sand and gravel disrupt the capillary spread of water in the soil and can create a "perched water table" if enough material is buried. Even the Port-a Johns can pollute the soil by the detergents used to clean them.

Lack of Pest Control and Other Care

Construction can last for more than a year on projects such as this. During this time the pest seasons come and go, especially in spring. Dust accumulates on leaf surfaces and in leaf pores. Most often pest control is put on hold or blocked by fencing until construction is finished. However this is a stressful and demanding time for the trees. Pests can further deplete the reserves of trees and allow decay to advance. Drought stressed trees are more vulnerable to borers and certain other pests.

The polyphagous shot-hole borer is spreading quickly and has already killed tens of thousands of trees. It spreads a Fusarium disease and there is no effective treatment approved so far. The Huntington Botanic Garden said that almost a third of their 900 species are vulnerable. UCI is losing all their sycamores, about 1,400 trees. No preventative treatment is known to be effective, so the best that can be done is to recommend that only trees known to be resistant be planted.

Dust

Construction creates copious amounts of dust. The trees, on the other hand, do not benefit from dust. Dust can block the pores the leaves breathe through (stomata) and dust blocks sunlight, reducing photosynthesis. The trees will need to be kept clean. Strict dust control measures may help, but dust is inevitable.

Remaining Life Span

Keep in mind that estimated life spans for trees are not any better than for humans. Any trees with construction in their root zone, and especially in the health clearance radius, cannot be given an accurate life span estimate.

Ficus m. Nitida	20-30 years
Ficus r. Microphylla	40-50
Schinus terebinthifolius	20-30
Alnus rhombifolia	1 & 10 (#4 & #6)
Corymbia maculata	?
Corymbia citriodora	20-30
Eucalyptus sideroxylon	20-30
Prunus lyonii	5-10
Agonis flexuosa	N/A
Magnolia grandiflora	40-50
Juniperus c. Torulosa	40-50
Brachychiton populneum	N/A

Recommendations

Removals

The following matrix shows the radius of protection needed around each tree going forward. One column is for maintaining the health of the trees, which should be provided unless College administrators are willing to risk killing certain trees for a chance of possibly preserving them. Removing trees after the site is in use will be more expensive and disruptive. Consider though that it is impossible to predict where all the roots are, and many times trees with work inside the health clearance radius do survive. However, testing by Bartlett Tree Research has shown that there are predictable limits beyond which stability is reduced. The column called “stability clearance” is a column that must not be tested here.

Desirable trees that the college wants to save should have more extensive study done to determine as precisely as possible the extent and depth of their root systems. In addition, an accurate survey, versus GPS, needs to be done to verify or know there will be sufficient room to preserve these trees before construction begins. Deep water trees to be remain before construction begins.

The health clearances given are based on formulas presented in *Trees and Development: a Technical Guide to Preservation of Trees during Construction*, by Matheny and Clark and published by the International Society of Arboriculture. The species, health, size and age of the trees are all considered, as well as site conditions.

Bartlett Tree Research did pull test studies of younger trees growing in a field back east. They found that if roots were cut no closer than three times trunk diameter, no significant loss of stability occurred. This was not followed up after a soaking rain, and mature shallow rooted trees growing in lawns were not tested. Based on questions to the author of the study, Dr. Tom Smiley, many arborists have added a factor to these findings to feel safe when working with such shallow rooted or larger trees.

Factors of four or five times the trunk diameter are commonly applied as safety margins. The stability clearance column is based on a factor of five times trunk diameter. The only alternative to using such factors is to do pull testing here.

Prior to demolition, meet on site with the contractor and clearly mark all trees to be removed. Impress on the demolition contractor that if there are adjoining trees to remain, the roots of the tree to be removed must be cut by a trencher prior to being grubbed out. Otherwise the roots of the adjoining tree may be damaged or ripped up with the roots of the removed tree.

Future Landscaping

Move the sidewalk planned next to Ficus #1 seventeen feet away to allow it to remain.

Prior to construction, remove the decomposed granite below the lemon gums and replace it with a 2-3" deep layer of well-composted, coarse-textured, green-waste type mulch, e.g. Aguinaga Forest Floor ½ to 1 ½ inch particle size. While removing the DG, be careful not to damage shallow roots.

The new landscape plan should be designed and installed to protect and improve the health and habitat of the valuable preserved trees. The trees closer to construction will essentially be in critical care for a decade or more. Once they are clearly recovered, more liberties can be taken with the surrounding landscape.

Irrigation in particular must be designed for the needs of the trees first. Spot bubblers will not serve the needs of mature trees. Deep watering devices sound helpful, but they require water to be drawn up through capillary action and the salts are deposited near the surface rather than being leached below the roots. Low precipitation systems will allow deep irrigation to leach salts and improve root health. Fewer heads will allow less trenching and less trenching causes less root damage. Trenches that approach trees directly toward the trunk will cut fewer roots than trenches passing their canopy as a tangent. Irrigation design around existing trees needs to be more specific and less schematic.

As much as possible, turf must be eliminated under these trees. Any shrubs must be planted outside the driplines of these trees or have the planting holes dug using AirSpades. Mulch beds will be the best way to improve root health and depth. Apply a 2-3" deep layer of well composted, coarse-textured green waste mulch, e.g Aguinaga Forest Floor ½ to 1½", below all the trees after removing construction debris, including sand, base material, gravel, asphalt and concrete debris. Do not use mulch containing manure or bark. Cover all the soil at least under the driplines and between surrounding paving areas, but do not apply against the trunks.

Pest Control

Retain a licensed pest control advisor to prepare a monitoring and prevention program for polyphagous shot-hole borers on the susceptible trees. The plan should include monthly visits and inspections. New trees selected for this site should be checked against the list of shot-hole borer susceptible species. During construction the increase dust levels often lead to mite infestations. The monitoring program needs to check specifically for these pests, as well as many other possible ones.

Pruning

All pruning must be done by properly licensed and insured tree service that provides a certified arborist to supervise his crew. The project consulting arborist should oversee the pruning of sample trees of each species. The tree service must demonstrate ability to carry out an understanding of the instructions before allowing them to proceed. Do not allow the general contractor to cut on any trees for any reason. Clearance pruning should be done only by the properly licensed and insured tree service, with the general contractor's information of clearance needs.

Beyond clearance pruning, do not prune the more impacted trees for at least 3 years or until they resume normal growth. Focus on balance, subordination of codominant leaders, reducing the length of overly long limbs and control of epicormic shoots. Do not remove more than the recommended limit in the matrix. All pruning must be done in winter for the alders and junipers. All the eucalypts, ficus and magnolias can be pruned in spring, or the ficus can be pruned in early summer.

Follow the recommendations in the matrix to follow and ANSI A300, part 1 pruning standards and the ISA supporting publication "Best Management Practices, Pruning".

Recommendations Matrix

Tree #	Species	DBH	Health	Structr	Pruning style, objective, recommendations	*Max % foliage removal	*Health clearance	*Safety clearance
1	Ficus m. Nitida	40	C	C-	Contain size using many small reduction cuts	10%	30	17
2	Ficus r. Microphylla	38.5	A	C-	DC long limbs, space epicormics	25%	29	16
3	Schinus terebinthifolius	36	B	C	No pruning now or next year	0%	27	15
4	Alnus rhombifolia	13	D-	D	Remove – poor health	100%	13	5
5	Corymbia maculata	16.8	D	C	Too close or in construction - remove	0%	17	7
6	Alnus rhombifolia	19.5	C	D	Too close or in construction - remove	20%	15	8
7	Corymbia citriodora	22.8	C	C	Too close or in construction - remove	<10%	22.8	10
8	Corymbia citriodora	18.2	C	C	Too close or in construction - remove	100%	18.2	8
9	Corymbia citriodora	14.1	B	C	Too close or in construction - remove	100%	11	6
10	Corymbia citriodora	19.1	C-	C	DC lower limbs - protect in place	<10%	19.1	8
11	Corymbia citriodora	18.9	C-	C-	No pruning - now protect in place	0%	18.9	8
12	Corymbia citriodora	18.2	C	C	Remove – due to lean + root damage	100%	18.2	8
13	Eucalyptus sideroxylon	23	A	C	Space & DC epicormics & DC doglegs	20%	17	10
14	Eucalyptus sideroxylon	34.3	B	C	Too close or in construction - remove	20%	26	14
15	Pyrus c.	gone						
16	Prunus lyonii	16.2	C	B	Too close or in construction - remove	20%	12	7
17	Pyrus c.	gone						
18	Pyrus c.	gone						
19	Agonis flexuosa	gone						
20	Agonis flexuosa	gone						
21	Magnolia grandiflora	2	C-	C	Too close or in construction - remove	0%	2	1

Tree #	Species	DBH	Health	Structr	Pruning style, objective, recommendations	*Max % foliage removal	*Health clearance	*Safety clearance
22	Magnolia grandiflora	4	B	C-	Too close or in construction - remove	15%	3	2
23	Magnolia grandiflora	3	C	C-	Too close or in construction - remove	15%	3	1
24	Juniperus c. 'Torulosa'	8	B	B	None now – maybe too close	0%	8	3
25	Juniperus c. 'Torulosa'	8.5	B	C	None now – maybe too close	0%	8.5	4
26	Brachychiton populneum	17	B	C-	Too close or in construction - remove	100%	13	7
27	Bauhinia purpurea	18	C	C	Too close or in construction - remove	100%	14	8

*Clearances and maximum foliage removal are shown for the purpose of possible relocation of paving.

General Tree Preservation Recommendations

1. Protection Barrier: A protection barrier shall be installed around the tree or trees to be preserved. The barrier shall be constructed of 6' high chain-link fencing. The barrier shall be placed as far from the base of the tree(s) as possible, preferably at or beyond the dripline and the health clearance radius. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the arborist involved.
2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection zone. Concrete and cement materials, block, stone, sand and soil shall not be placed within the protection zone of the tree.
3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees. Equipment that leaks hydraulic fluid shall be removed from the site immediately.
4. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within the protection zone. Wash down of concrete or cement handling equipment, in particular, shall NOT be permitted within 150 feet of protected trees.
5. Grade Changes: Grade changes can be particularly damaging to trees. Even as little as two inches of fill can cause the death of a tree. Lowering the grade can destroy major portions of a root system. Any grade changes proposed should be

approved by a Registered Consulting Arborist before construction begins, and precautions taken to mitigate potential injuries.

6. Damages: Any damages or injuries should be reported to the project arborist as soon as possible. Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches or limbs shall be pruned according to International Society of Arboriculture "Best Management Practices – Pruning", and ANSI A-300, part 1 Pruning Standards.
7. Preventive Measures: Pruning of the tree canopies and branches should be done at the direction of the project arborist to remove any dead or broken branches, and to provide the necessary clearances for the construction equipment.

Appendix

A. Resume

B. Glossary

A. Resume GREGORY W. APPLEGATE, ASCA, ASLA

PROFESSIONAL REGISTRATIONS:

American Society of Consulting Arborists - Registered Consulting Arborist #365
International Society of Arboriculture - Certified Tree Risk Assessor #PNC-444
International Society of Arboriculture - Certified Arborist # WE-180a

EXPERIENCE:

Mr. Applegate is an independent consulting arborist. He has been in the horticulture field since 1963, providing professional arboricultural consulting since 1984 within both private and public sectors. His expertise includes appraisal, tree preservation, diagnosis of tree growth problems, construction impact mitigation, environmental assessment, expert witness testimony, hazard evaluation, pruning programs, species selection and tree health monitoring.

Mr. Applegate has consulted for insurance companies, major developers, theme parks, homeowners, homeowners' associations, landscape architects, landscape contractors, property managers, attorneys and governmental bodies.

Notable projects on which he has consulted are: Disneyland, Disneyland Hotel, DisneySeas-Tokyo, Disney's Wild Animal Kingdom, the New Tomorrowland, Disney's California Adventure, Disney Hong Kong project, Knott's Berry Farm, J. Paul Getty Museum, Tustin Ranch, Newport Coast, Crystal Court, Newport Fashion Island Palms, Bixby Ranch Country Club, Playa Vista, Laguna Canyon Road and Myford Road for The Irvine Company, MTA Expo Line, MWD-California Lakes, Paseo Westpark Palms, Loyola-Marymount campus, Cal Tech, Cal State Long Beach, Pierce College, The Irvine Concourse, UCI, USC, UCLA, LA City College, LA Trade Tech, Riverside City College, Crafton Hills College, MTA projects, and the State of California review of the Landscape Architecture License exam (re: plant materials)

EDUCATION:

Bachelor of Science in Landscape Architecture,
California State Polytechnic University, Pomona 1973
Arboricultural Consulting Academy (by ASCA)
Arbor-Day Farm, Kansas City 1995
Continuing Education Courses in Arboriculture
required to maintain Certified Arborist status and for ASCA membership

PROFESSIONAL AFFILIATIONS:

American Society of Landscape Architects (ASLA), Full member
American Society of Consulting Arborists (ASCA), Full member
International Society of Arboriculture (ISA), Regular member
California Tree Failure Report Program, UC Davis, Participant
Street Tree Seminar (STS), Member

COMMUNITY AFFILIATIONS:

Horticulture Advisory Committee, Saddleback College (1988 until present)
Landscape Architecture License Exam, Reviewer, Cal Poly Pomona (1986-90)
American Institute of Landscape Architects (L.A.) Board of Directors (1980-82)
California Landscape Architect Student Scholarship Fund - Chairman (1985)
International Society of Arboriculture - Examiner-tree worker certification (1990)
Guest lecturer at UCLA, Cal Poly, Saddleback College, & Palomar Junior College

B. Glossary

Arboriculture	The cultivation and care of trees and shrubs.
Caliper	Diameter of a tree trunk. Larger trees are usually measured at 4½ feet (see DBH) Trees with calipers 4 inches and below are measured at 6 inches above grade. Trees above 4 inches, but still transplantable are measured at 12 inches above grade.
Cambium	A thin layer of actively growing and dividing cells, located between the xylem (sapwood) and bark of a plant; the part responsible for lateral growth of a tree stem or branch.
Codominant	stems: two or more vigorous and upright branches of relatively equal size that originate from a common point, usually where the leader has been lost or removed.
Compaction	(Soil Compaction) The compression of soil, causing a reduction of pore space and an increase in the density of the soil. Tree roots cannot grow in compacted soil.
Crotch	The union of two or more branches; the axillary zone between branches.
Crown	The upper portions of a tree or shrub, including the main limbs, branches, and twigs.
DBH	Diameter of the trunk, measured at breast height or 54 inches above the average grade. Syn. = caliper.
Decay	Progressive deterioration of organic tissues, usually caused by fungal or bacterial organisms, resulting in loss of cell structure, strength, and function. In wood, the loss of structural strength.
Decline	Progressive reduction of health or vigor of a plant.
Decurrent	Referring to crowns which are made up of a system of codominant scaffold branches. Lacking a central leader.
Dieback	Progressive death of buds, twigs and branch tissues, on individual limbs, or throughout the canopy.
Drop-crotch	Reduction cuts meant to shorten a limb or branch by cutting back to an inner branch that can serve as the new end of the limb.
Epicormic	Epi - upon; cormic – stem. Branches that are upon the stem, i.e. sprouting from either dormant buds in the cambial zone, or from buds sprung anew from ray traces. Epicormic shoots are a sign that energy reserves have been lowered.

Grading	Also Regrading. Intentional altering of topography and soil levels, using machinery.
Hazardous condition	The combination of a likely failure of a tree or tree part with the presence of a likely target.
Heading	Pruning techniques where the cut is made to a bud, weak lateral branch or stub.
Included bark	Bark or cortex tissue that is included or trapped between close-growing branches. Usually found in narrow or tight crotches.
Leader	A dominant upright stem, usually the main trunk. There can be several leaders in one tree.
Limb	A large lateral branch growing from the main trunk.
Reduction cut	A pruning cut meant to shorten a limb or branch by cutting it back to an inner branch that will serve as the new end of the limb or branch.
Root crown	Area at the base of a tree where the roots and stem merge (synonym - root collar)
Root plate	The stiff primary roots close to the trunk and able to provide compressive support.
Root system	The portion of the tree containing the root organs, including buttress roots, transport roots, and fine absorbing roots; all underground parts of the tree.
Root zone	The area and volume of soil around the tree in which roots are normally found. May extend to three or more times the branch spread of the tree, or several times the height of the tree.
Scaffold	large, main branches that form the main structure of the crown.
Sprout	Also water sprout. A shoot or stem that grows from the bark of a tree; adventitious or secondary growth.
Stress	"Stress is a potentially injurious, reversible condition, caused by energy drain, disruption, or blockage, or by life processes operating near the limits for which they were genetically programmed." Alex Shigo
Subordination	Pruning to reduce the size and growth rate of a branch or leader in relation to other branches or leaders.
Target	People or property potentially affected by tree or limb failure.
Value	Value is the present worth of future benefits. Value is not necessarily cost.
Wound	Any injury which induces a compartmentalization response.

Disclaimer

Good current information on tree preservation has been applied. However, even when every limb and root is inspected, inspection involves sampling, therefore some areas of decay or weakness may be missed. Weather, winds and the magnitude and direction of storms are not predictable and some failures may still occur despite the best application of high professional standards. Future tree maintenance will also affect the trees health and stability and is not under the supervision or scrutiny of this consultant. Continuing construction activity such as trenching will also affect the health and safety, but are unknown and unsupervised by this consultant. Trees are living, dynamic organisms and their future status cannot be predicted with complete certainty by any expert. This consultant does not assume liability for any tree failures involved with this property.

Certification

I, Gregory W. Applegate, certify to the best of my knowledge and belief:

That the statements of fact contained in this report are true and correct. That the report analysis, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal unbiased professional analysis, opinions and conclusions.

That I have no present or prospective interest in the vegetation that is the subject of this report, and I have no personal interest or bias with respect to the parties involved.

That my compensation is not contingent upon the reporting or a predetermined reporting that favors the cause of the client, the attainment of stipulated result, or the occurrence of a subsequent event.

That my analysis, opinions, and conclusions were developed, and this report has been prepared, in conformity with the standards of arboricultural practice.

That I have made a personal inspection of the plants that are the subject of this report. No one provided significant professional assistance to the person signing this report.

Arborgate Consulting, Inc.
Gregory W. Applegate  Date 3-14-16
Registered Consulting Arborist #365

UNDERGROUND UTILITIES & STRUCTURES

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES OR CONDUITS SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF AND THE REPAIR OF ANY DAMAGE TO THESE LINES OR STRUCTURES. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNERS OF THE UTILITIES OR STRUCTURES CONCERNED BEFORE STARTING WORK. CONTRACTOR FURTHER ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UNDERGROUND UTILITY PIPES, CONDUITS OR STRUCTURES SHOWN OR NOT SHOWN ON THESE PLANS.

"CAUTION: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS."

LEGEND:

ELECTRICAL (HIGH VOLTAGE)	HV
GAS	G
WATER	W
TELEPHONE	TEL
SEWER	SS
STORM DRAIN	SD
SIGNAL	SG
ELECTRICAL	E
STREET LIGHT	SL
WATER (IRRIGATION)	IW
UNKNOWN	UN?

CONSUMER SCIENCE AND DESIGN
FF=68.95

LEWIS CENTER FOR APPLIED SCIENCES
FF=68.99

SCIENCE HALL
FF=67.27

LOT E
MERRIMAC LOT

PLANETARIUM
FF=67.55

MATH BUILDING
FF=67.55

JOURNALISM BUILDING
FF=67.33

REPROGRAPHICS BUILDING
FF=67.40

LIBRARY BUILDING
FF=69.33

SEE SHEET 4

scale 1"= 20' (20 0 20 40 feet)

NO.	DESCRIPTION	DATE	BY
	REVISONS		

LICENSED LAND SURVEYOR MATTHEW H. OKUBO Exp. 12/31/13 No. 8686 STATE OF CALIFORNIA

Hall & Foreman, Inc.
Engineering · Planning · Surveying
14297 CAJON ST, SUITE 101 · VICTORVILLE, CA 92392 · 760-524-9100
PREPARED UNDER THE SUPERVISION OF:
MATTHEW H. OKUBO P.L.S. 8686 DATE:

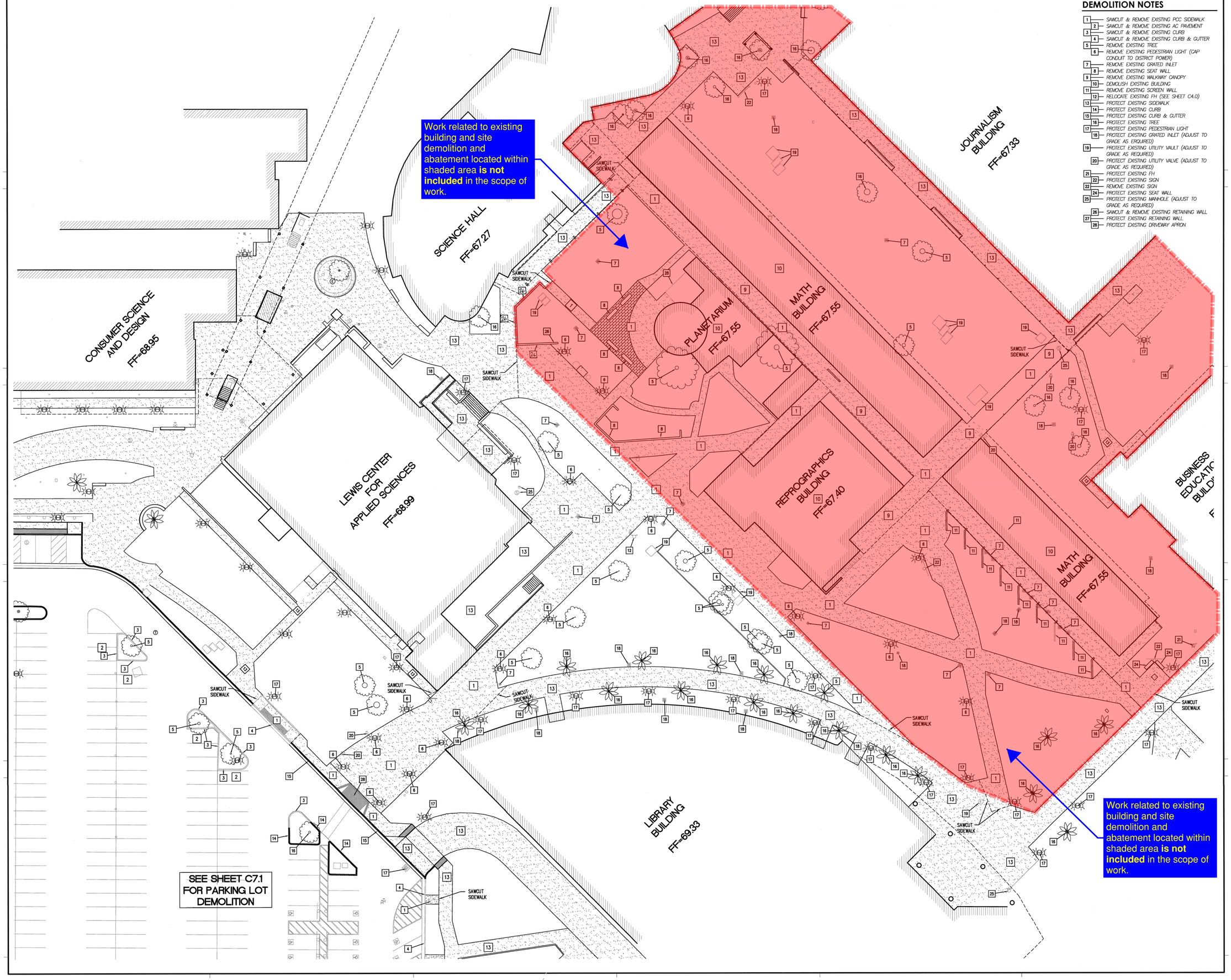
ORANGE COAST COLLEGE
NEW PLANETARIUM BUILDING

DRAWN BY: JMH
DESIGNED BY: JMH
CHECKED BY: MHO

EXISTING UTILITIES
FOR REFERENCE

SCALE: 1"=20'
DATE: 01/15/2013
SHT NO.: 3 OF 4

Drawing Name: F:\OCC Community Planetarium\Survey\03-120251s1.dwg
Last Opened: Apr 27, 2016 - 3:14pm by: jwilson



DEMOLITION NOTES

1. SAWCUT & REMOVE EXISTING PCC SIDEWALK
2. SAWCUT & REMOVE EXISTING AC PAVEMENT
3. SAWCUT & REMOVE EXISTING CURB
4. SAWCUT & REMOVE EXISTING CURB & GUTTER
5. REMOVE EXISTING TREE
6. REMOVE EXISTING PEDESTRIAN LIGHT (CAP CONDUIT TO DISTRICT POWER)
7. REMOVE EXISTING GRATED INLET
8. REMOVE EXISTING SEAT WALL
9. REMOVE EXISTING WALKWAY CANOPY
10. DEMOLISH EXISTING BUILDING
11. REMOVE EXISTING SCREEN WALL
12. RELOCATE EXISTING FH (SEE SHEET C4.0)
13. PROTECT EXISTING SIDEWALK
14. PROTECT EXISTING CURB
15. PROTECT EXISTING CURB & GUTTER
16. PROTECT EXISTING TREE
17. PROTECT EXISTING PEDESTRIAN LIGHT
18. PROTECT EXISTING GRATED INLET (ADJUST TO GRADE AS ERQUIRED)
19. PROTECT EXISTING UTILITY VAULT (ADJUST TO GRADE AS REQUIRED)
20. PROTECT EXISTING UTILITY VALVE (ADJUST TO GRADE AS REQUIRED)
21. PROTECT EXISTING FH
22. PROTECT EXISTING SIGN
23. REMOVE EXISTING SIGN
24. PROTECT EXISTING SEAT WALL
25. PROTECT EXISTING MANHOLE (ADJUST TO GRADE AS REQUIRED)
26. SAWCUT & REMOVE EXISTING RETAINING WALL
27. PROTECT EXISTING RETAINING WALL
28. PROTECT EXISTING DRIVEWAY APRON

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REGISTERED PROFESSIONAL ENGINEER MARK S OSBORNE No. C-58109 CIVIL STATE OF CALIFORNIA

SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC ___ FLS ___ SS ___
DATE JAN 15 2015

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
	-	-

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY MO
CHECKED BY MSO

SHEET TITLE
DEMOLITION PLAN

SHEET NUMBER
C7.0

CONSTRUCTION DOCUMENTS 12/15/2014

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VOLUME 1

VOLUME 2

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SECTION 061600 - SHEATHING

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. Wall sheathing.
   2. Vapor permeable membrane air barrier.
   3. Sheathing joint-and-penetration treatment.

B. Related Sections include the following:
   1. Division 7 Section “Polyvinyl-Chloride (PVC) Roofing” for roof boards.
   2. Division 7 Section “Sphere Metal Wall Panels” for vapor permeable membrane air barrier specified in this section used in conjunction with sphere metal wall panels.
   3. Division 7 Section “Composite Wall Panels” for vapor permeable membrane air barrier specified in this section used in conjunction with composite wall panels.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

1.4 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
   1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
   2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
   3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
   4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
   5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
   6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.

7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.
14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for “Visual Devices”).
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheathing that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
   2. Warranty Period: 5 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass-Mat Gypsum Sheathing:
   1. Dens-Glass by G-P Gypsum Corporation.
   2. Gold Bond Brand e2XP by National Gypsum.
   3. Or equal.

B. Fluid-Applied, Vapor Permeable Membrane Air Barrier: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. R-Guard Cat 5 by Prosoco. (Basis of Design)
   2. Air-Bloc 33 by Henry Company.
   3. Or equal.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177.
   1. Product: Dens-Glass by G-P Gypsum Corporation or equal.
      a. Type X.
      b. Thickness: As indicated on Drawings.

2.3 FLUID-APPLIED, VAPOR PERMEABLE MEMBRANE AIR BARRIER

A. Product: PROSOCO R-Guard Cat 5by Prosoco or equal.
   1. Fluid applied, waterproofing, and air and water barrier membrane that combines the best of silicone and polyurethane properties.
   2. Single component, Silyl-Terminated-Poly-Ether (STPE) is roller applied to produce a highly durable, seamless, elastomeric weatherproofing membrane on exterior sheathing, CMU back-up walls, and pre-cast concrete.
   3. Prevent water and air penetration of the building envelope in conditions ranging from everyday weather to the drenching rains and 155 mph winds of a Category 5 hurricane.
   4. Can be applied in unfavorable weather conditions to dry or damp substrates.
   5. Primer: R-Guard PorousPrep, a sprayable primer for the porous substrates, Green Gypsum Sheathing, Plywood, OSB, Block to fill up the pores before application of Cat 5.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Power-Driven Fasteners: NES NER-272.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.5 WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES

A. Product: R-GUARD PorousPrep by Prosoco or equal.
   1. Primer to seal the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of liquid applied fiber-reinforced fill coat and seam treatment for through-wall components.

2.6 LIQUID APPLIED FILL COAT AND SEAM FILLER

A. Product: R-GUARD Joint & Seam Filler by Prosoco or equal.
   1. High modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. The single-component, Silyl-Terminated-Poly-Ether (STPE) prepares open joints, seams and cracks before installing primary water and air barrier system to prevent the movement of water and air through building envelopes.

2.7 LIQUID-APPLIED FLASHING AND DETAILING MEMBRANE

A. Product: R-GUARD FastFlash by Prosoco or equal.
   1. Gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. The single component, Silyl-Terminated-Poly-Ether (STPE) produces a highly durable, seamless, elastomeric should treat joints, seams, cracks and provide the flashing membrane in rough openings of structural walls and to counter-flash waterproofing and air barrier components.

2.8 PREFORMED SILICONE SEALANT EXTRUSION

A. Product: SureSpan EX by Prosoco or equal.
   1. Manufacturer’s standard system consisting of pre-cured low modulus elastomeric extrusion that provides a continuous transition and bridges to air barrier materials. Provide continuous Preformed Silicone Sealant Extrusion System that is flexible, durable, designed for high dynamic and thermal movement which is resistant to ultraviolet exposure and weathering.

2.9 MISCELLANEOUS MATERIALS

A. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in CBC's "California Building Code."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with screws.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent

boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.3 FLUID-APPLIED, VAPOR PERMEABLE MEMBRANE AIR BARRIER

A. General: Comply with fluid-applied, vapor permeable membrane air barrier manufacturer's written instructions.

B. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation.

C. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Cover membrane within 14 days.

D. Apply double thickness or install extra layer of self-adhered membrane at fastener locations.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 072100 - BUILDING INSULATION

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. Concealed thermal and sound insulation.

B. Related Sections include the following:
   1. Division 7 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
   2. Division 9 Section “Non-Load-Bearing Steel Framing” for framing requirements.
   3. Division 9 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.5 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
   1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
   2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
   3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
   4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).

5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.
14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for "Visual Devices").
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of building insulation that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass-Fiber Batt/Blanket Thermal and Sound Insulation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Johns Manville (JM). (Basis of Design)
   2. CertainTeed Corporation.
   3. Guardian Fiberglass, Inc.
   4. EcoBatt with ECOSE technology by Knauf Fiber Glass.
   5. Owens Corning.
   6. Lamtec.
   7. Or equal.

B. Extruded Polystyrene Foam: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Styrofoam Z-Mate by Dow. (Basis of Design)
   2. DiversiFoam Products.
   3. Owens Corning.
   4. Pactiv Building Products Division.
   5. Or equal.

C. Slag-Wool-Fiber/Rock-Wool-Fiber Blanket (Fire-Safing) Insulation: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Thermafiber Safing Insulation by Thermafiber.
   2. Fibrex Insulations Inc.
   3. Owens Corning.
   4. Or equal.

D. Acoustical Boards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. SelectSound Acoustic Board insulation by Owens Corning. (Basis of Design)
   2. Insul-Shield, Black Mat Boards, by Johns Manville.
   3. Or equal.

2.2 GLASS-FIBER BATT/BLANKET INSULATION

A. Unfaced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Glass-fiber bonded with acrylic thermosetting binder.
   1. For walls and partitions: Unfaced Batts.
   2. Formaldehyde-free, Unfaced Batts by JM or equal.

B. Faced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft vapor-retarder membrane on 1 face.
   1. For ceilings under decks: FSK-25 Faced Batts with 2 inch tabs or Panel Deck FSK-25 Faced Batts with 5 inch tabs.
   2. Formaldehyde-free, FSK-25 Faced Batts by JM or equal.

C. Thermal Rating: R values as indicated on Drawings.

D. Sound Attenuation Ratings: Minimum R-11 on interior walls and partitions, unless otherwise indicated on Drawings.

2.3 EXTRUDED POLYSTYRENE FOAM (RIGID INSULATION)

A. Extruded Polystyrene Foam: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
   1. Board Sizes: 23-7/8” x 8’, 2” with R-10.
   2. R-rating: Built-up board to comply with R-rating indicated on Drawing.

B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, thickness as indicated but not less than bare-metal thickness of 0.0179 inch (25 gage), and depth required to fit insulation thickness indicated.
   1. Size: As indicated on Drawings.

2.4 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER BLANKET (FIRE-SAFING) INSULATION

A. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.5 ACOUSTICAL (BLACK DUCT LINER) BOARD

A. Product: SelectSound Black Acoustic Board by Owens Corning or equal.
   1. Sizes: 24” x 48” and 48” x 96” standard sizes.
   2. Dimensionally stable with no capability for shrinking or warping.

3. Resilient composition with good resistance to damage from job-site impact.
4. Composed of inorganic glass fibers.
5. Mat face shall be able to be cleaned by vacuuming.
6. Not be susceptible to rot or mildew contamination.
7. Not cause corrosion greater than caused by sterile cotton to steel and aluminum, when tested in accordance with ASTM C665.
8. Acoustical Performance (Tested to ASTM C423, Type A mounting):
   a. 1 inch thick: 0,70 NRC.
   b. 2 inch thick: 1.00 NRC.
9. Surface Burning of Core Material (tested to UL 723, or CAN/ULC-S102-M):
   a. Flame spread 25.
   b. Smoke developed 50.
10. Water vapor sorption – by weight (Tested to ASTM C1104): 1. <3% at 120oF (49oC) at 95% relative humidity.
11. Minimum Compressive Strength (Tested to ASTM C165): 3 lb. Density
    a. At 10% deformation: 25 lb/ft2 (1197 Pa).
    b. At 25% deformation: 90 lb/ft2 (4309 Pa).
12. Fungi resistance: Meets all requirements of ASTM C1338.

2.6 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

B. Nails or Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install insulation in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
   4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 075419 – POLYVINYL-CHLORIDE (PVC) ROOFING

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. Section Includes: Adhered PVC Thermoplastic roofing membrane with flashings and other components to comprise a roofing system.
   1. Substrate Preparation.
   2. Wood Blocking.
   3. Rigid insulation for thermal and slope.
   4. Separation Board.
   5. Roof Membrane.
   6. Fasteners.
   7. Adhesive for Flashings.
   8. Roof Membrane Flashings.
   9. Walkways.
   10. Metal Flashings.
   11. Sealants.
   12. Vapor barrier.

1.3 SUBMITTALS

A. Copies of Specification including physical properties.

B. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.

C. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.

D. Sample copy of Manufacturer's warranty including no exclusion for ponding water and no time limit shall be assigned to any such ponding water.

E. Installer's warranty.

F. Dimensioned shop drawings which shall include:
   1. Outline of roof with roof size and elevations shown.
   2. Profile details of flashing methods for penetrations.

G. Technical acceptance from Manufacturer.

H. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and industry standards or practices and requirements of this specification.

I. Certification from the Installer that the system specified meets all identified code, FM approvals, and insurance requirements as required by the Specification.

1.4 PERFORMANCE REQUIREMENTS

A. Submit evidence that the proposed roof system meets the requirements of the California Building Code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

B. Factory Mutual Research Corporation (FM) - Norwood, MA
   1. Class I-75.

C. Underwriters Laboratories, Inc. - Northbrook, IL
   1. Class A assembly.

1.5 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2011)
   1. Title 19 CCR, Public Safety, State Fire Marshal (SFM) Regulations.
   2. Title 24 CCR, Part 1 – 2010 Building Standards Administrative Code.
   3. Title 24 CCR, Part 2 – 2010 California Building Code, Vol. 1 & 2 (CBC) (2009 IBC, as amended by CA)
   4. Title 24 CCR, Part 3 – 2010 California Electrical Code (CEC) (2008 National Electrical Code, as amended by CA).
   5. Title 24 CCR, Part 4 - 2010 California Mechanical Code (CMC) (1009 IAPMO UMC, as amended by CA).
   6. Title 24 CCR, Part 5 - 2010 California Plumbing Code (CPC), (2009 IAPMO UMP, as amended by CA).
   7. Title 24 CCR, Part 6 - 2010 California Energy Code.
   8. Title 24 CCR, Part 9 - 2010 California Fire Code (CFC) (2009 International Fire Code as amended by CA).
   9. Title 24 CCR, Part 11 - 2010 California Green Building Standards Code.
   10. Title 24 CCR, Part 12 - 2010 California Referenced Standards.
   11. 2010 NFPA 13, Installation of Sprinkler Systems (CA amended).
   12. 2007 NFPA 14, Installation of Standpipe and Hose Systems
   13. 2002 NFPA 17, Dry Chemical Extinguishing Systems.
   14. 2002 NFPA 17A3, Wet Chemical Extinguishing Systems.
   15. 2007 NFPA 20, Installation of Stationary Pumps for Fire Protection.
   16. 2003 NFPA 22, Water Tanks for Private Fire Protection.
   17. 2010 NFPA 24, Installation of Sprinkler Systems (CA amended).
   18. 2010 NFPA 72, national Fire Alarm Code (CA amended); See UL Standards 1971 for “Visual Devices”.
   19. 2007 NFPA 80, Fire Door and Other Opening Protectives.

20. 2008 NFPA 2001, Clean Agent Fire Extinguishing Systems.
21. 2005 UL 300, Class 1 Hood Fire Suppression Systems.
22. 2003 UL 464, Audible Signal Appliances.
23. 1999 UL 521, Heat Detectors for Protective Signaling Systems.
24. 2002 ICC 300, Bleachers, Folding and Telescopic Seating, and Grandstands (ICC/ANSI 300-2002).
25. Americans with Disabilities Act (ADA), Title II or Title III.

B. This roofing system shall be applied only by a Roofing Contractor authorized by the Manufacturer. The Roofing Contractor shall have at least five (5) years of experience as an Installer with the submitted manufacturer as certified by the manufacturer.

C. Upon completion of the installation and the delivery to the Manufacturer by the Installer of a certification that all work has been done in strict accordance with the contract specifications and the Manufacturer's requirements. The Manufacturer must provide interim and final roof inspection from a directly employed dedicated team of experienced inspectors. Sales personnel may not be used for on-site inspection of installations

D. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and the Manufacturer.

E. Use only manufacturers systems certified Platinum by NSF/ANSI 347 Sustainability Assessment for Single Ply Roofing Membranes.

F. No "Private Label" or third party membrane manufacturers are approved alternates.

G. Use only manufacturers systems certified Platinum by NSF/ANSI 347 Sustainability Assessment for Single Ply Roofing Membranes

1.6 PRELIMINARY ROOFING CONFERENCE

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Store membrane rolls lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

D. Store all adhesives at temperatures between 40º F and 80º F.

E. Store all flammable materials in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

1.8 JOB CONDITIONS

A. Membrane materials may be installed under certain adverse weather conditions but only after consultation with the manufacturer, as installation time and system integrity may be affected.

B. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.

C. Schedule and executed all work without exposing the interior building areas to the effects of inclement weather. Protect the existing building and its contents against all risks.

D. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, provide the necessary equipment to dry the surface prior to application.

E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

G. Certain membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with the membrane. Consult manufacturer regarding compatibility, precautions and recommendations.

H. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Felt or plywood over

insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

K. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site and properly transported to a legal dumping area authorized to receive such material.

L. Take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.

M. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

N. All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.

O. Verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Report any such blockages in writing (letter copy to the manufacturer) to the Owner's Representative for corrective action prior to installation of the roof system.

P. Immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Architect of such condition in writing for correction.

Q. Site cleanup, including both interior and exterior building areas that have been affected by construction.

R. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

S. Conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.

T. The adhered membrane shall not be installed under the following conditions without consulting manufacturer Technical for precautionary steps:
   1. The roof assembly permits interior air to pressurize the membrane underside.
   2. Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.
   3. The wall/deck intersection permits air entry into the wall flashing area.

U. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

1.9 WARRANTY

A. Manufacturer System Warranty:
   1. Provide twenty (20) year System Warranty. The System Warranty shall provide for the roof membrane, all accessories that comprise a roof system, and contractor labor. The Warranty shall be Non-Prorated provide for No Dollar Limit (NDL), and shall not exclude ponding water and no time limited shall be assigned for any such ponding water during the warranty period.

B. Installer Warranty:
   1. Provide separate five (5) year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Installer warranty term, defective or otherwise not in accordance with the Contract Documents, the Installer shall repair that defect at no cost to the Owner. The Installer's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. PVC Thermoplastic Membrane Roofing: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. G410 Feltback by Sarnafil (Basis of Design).
   2. Duro-Last Roofing.
   3. Fiber-Tite

2.2 GENERAL

A. The components of the adhered roof system are to be products of the manufacturer as indicated on the Detail Drawings and specified in the Contract Documents.

B. Components to be used that are other than those supplied or manufactured by the membrane manufacturer may be submitted for review and acceptance by the manufacturer. The manufacturer acceptance of any other product is only for a determination of compatibility with membrane products and not for inclusion in the warranty. The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with membrane products.

C. Membrane shall be certified by the manufacturer to be within two (2) mils of the specified membrane thickness as stated in this section.

D. Membrane shall have a minimum of twenty-two (22) mils of waterproofing polymers above the reinforcements as documented by a third party source.

2.3 ROOF ASSEMBLY

A. Class A roofing: Assembly from bottom up.
   1. Metal deck.
   2. Structural Concrete Slab

3. Vapor barrier.
4. Rigid thermal insulation.
5. Separation Board.
6. Membrane.

2.4 MEMBRANE

A. Sarnafil G410 Feltback fiberglass reinforced membrane with an integral factory-applied lacquer coating to repel dirt and sustain reflectivity.

B. Membrane shall conform to ASTM D4434-96 (or latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I.
1. Sarnafil G410-18 feltback, thermoplastic membrane with fiberglass reinforcement and a factory applied 9 oz. geotextile felt backing.
2. 72 mil, Minimum (72 mils of PVC exclusive of the fleece). ASTM +/- tolerance for membrane thickness is not accepted.

C. Color of Membrane
1. Energy Smart Reflective Light Gray, initial reflectivity of 0.73, initial emissivity 0.89, solar reflective index (SRI) of >90.

D. Typical Physical Properties

Parameters	ASTM Test Method	Minimum ASTM Requirement	Sarnafil Typical Physical Properties
Reinforcing Material	-		Fiberglass
Overall Thickness, min., inches (mm)	D638	0.072 inches	0.072 inches
Tensile Strength, min., psi (MPa)	D638	1500 (10.4)	1600 (11.1)
Elongation at Break, min. (machine x tranverse)	D638	250% / 230%	270% / 250%
Seam strength*, min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D638	90	90
Tearing Resistance, min., lbf (N)	D1004	10 (45.0)	14 (63.0)
Low Temperature Bend, -40º F (-40º C)	D2136	Pass	Pass
Accelerated Weathering Test (Xenon Arc)	D2565	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7 x magnification)	-	None	None
Linear Dimensional Change	D1204	0.10 %	0.02%
Weight Change After Immersion in Water	D570	± 3.0%	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass	Pass

*Failure occurs through membrane rupture not seam failure.

2.5 FLASHING MATERIALS

A. Wall/Curb Flashing
1. G410 Membrane: 60 mil, fiberglass reinforced membrane adhered to approved substrate using adhesive. Any wall flashing exceeding 30 inches in height, install incremental securement every 24 inches (refer to supplied drawing). The color is to be selected by the Architect.

2. Clad: PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad is a 25 gauge, G90 galvanized metal sheet with a 20 mil unsupported membrane laminated on one side. The dimensions of Clad are 4 ft x 8 ft and color to match main field sheet.

B. Perimeter Edge Flashing
1. Clad: PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad is a 25 gauge, G90 galvanized metal sheet with a 20 mil unsupported membrane laminated on one side. The color is to be selected by the Architect.
2. Non-Typical Edge: Project-specific perimeter edge detail reviewed and accepted for one-time use by the Technical Department. Consult Regional Technical Manager prior to job start for review and consideration for acceptance.

C. Miscellaneous Flashing
1. Reglet: A heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Reglet is produced from 6063-T5, 0.10 inch - 0.12 inch thick extruded aluminum. Reglet has a 2-1.4 inch deep profile, and is provided in 10 foot lengths. Use prefabricated Reglet mitered inside and outside corners where walls intersect.
2. Stack: Prefabricated vent pipe flashing made from 0.048 inch thick G410 membrane.
3. Circle-"G": Circular 0.048 inch thick G410 membrane patch welded over T-joints formed by overlapping thick membranes.
4. Corner: Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil) thick membrane that are heat-welded to membrane or Clad base flashings.
5. Multi-Purpose Sealant: A sealant used at flashing terminations.
6. StaBond Adhesive: A solvent-based reactivating-type adhesive used to attach membrane to flashing substrate.
7. Felt: Non-woven polyester or polypropylene mat cushion layer that is necessary behind G410 or G459 Flashing Membrane when the flashing substrates are rough-surfaced or incompatible with the flashing membrane.

2.6 DECK PRIMERS

A. Self-Adhered WB Primer:
1. A water-based primer designed for use with Sarnavap Self-Adhered vapor barrier to promote adhesion to most substrates.
2. Particularly recommended when use of solvent-based primer is not advised or permitted.

2.7 RIGID INSULATION FOR THERMAL AND FOR SLOPE

A. Polyisocyanurate Insulation Board: ASTM C1289, Type 2, Class 1, Grade 2.
1. Compressive Strength: 20 psi per ASTM D1621.
2. Moisture Vapor Transmission: Less than 1.5 perm per ASTM E96.
3. Foam Core Density: 2.0 pcf nominal ASTM D1622.
4. Flame Spread: 25-50 per ASTM E84.
5. Smoke Development: 50-170 per ASTM E84.
6. R value per inch: Approximately 5.6.
7. R value: As indicated on Drawings.

2.8 SEPARATION BOARD

A. Dens-Deck Prime: Siliconized gypsum, fire-tested hardboard with glass-mat facers. 4 ft x 8 ft board in thicknesses of 1/4 inch.

2.9 ATTACHMENT COMPONENTS

A. Membrane Adhesive:
   1. 2121 Adhesive: Water-based adhesive used to attach the membrane to horizontal or near-horizontal substrates. VOC content 240 g/l.
      a. There is a significant increase in drying time due to an increase in humidity and/or a decrease in temperature. Do not install when outdoor or substrate temperatures during drying period are expected to fall below 40º F.
      b. Do not allow 2121 adhesive to skin-over or surface-dry prior to installation of membrane.
      c. Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.

B. Sarnacol 2163 Adhesive: A low odor, VOC compliant, one step, low-rise urethane foam used to attach protection board to approved compatible substrates. Adhesive is applied with a gravity fed applicator or by hand with a dual component caulk gun. Additional adhesive may be required for rougher surfaces.

C. Fastener CD10: A nail-in, corrosion-resistant fastener used with Sarnaplate-HD/CD, Sarnastop or Sarnabar to attach membrane to normal weight concrete roof deck. Sarnafastener-CD10 has a shank diameter of 0.215 inch, a split diameter of 0.265/0.275 inch and a flat head with a 0.435 inch diameter.

D. Fastener-XP: A #15, heavy-duty, corrosion-resistant fastener used with Plate to attach insulation or Stop and Bar to attach G410 roof membrane to steel or wood roof decks. Fastener-XP has a shank diameter of approximately 0.21 inch and the thread diameter is approximately 0.26 inch. The driving head has a diameter of approximately 0.435 inch with a #3 Phillips recess for positive engagement.

E. Peel Stop: An extruded aluminum, low profile bar used with certain Fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Stop is a 1 inch wide, flat aluminum bar 1/8 inch thick that has predrilled holes every 6 inches on center.

2.10 WALKWAY PROTECTION

A. Crossgrip Walkway:
   1. Rolled-out walkway protection mat used to protect Sarnafil roofing membrane from mechanical abuse.
   2. Crossgrip Walkway is 9/16 inch thick flexible PVC with a heavily textured surface.
   3. Crossgrip Walkway is secured with loops of Sarnafil membrane welded to the field sheet.

2.11 VAPOR BARRIER

A. Sarnavap Self-Adhered:

1. A 32 mil self-adhesive vapor barrier that can also serve as temporary roof protection.
2. Sarnavap Self-Adhered is available in rolls 44.9 inches x 133.8 feet.

2.12 MISCELLANEOUS ACCESSORIES

A. Aluminum Tape: A 2 inch wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Clad joints.

B. Sealing Tape Strip: Compressible foam with pressure-sensitive adhesive on one side. Used with metal flashings as a preventive measure against air and wind blown moisture entry.

C. Multi-Purpose Tape: A high performance sealant tape with used with metal flashings as a preventive measure against air and wind blown moisture entry.

D. Welder 641mc: 220 volt, self-propelled, hot-air welding machine used to seal long lengths of membrane seams.

E. Solvent: A high quality solvent cleaner used for the general cleaning of residual asphalt, scuff marks, etc., from the membrane surface. Solvent is also used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if the membrane is not welded the same day it is unrolled. VOC content 0 g/l with exemption; 790 g/l without Acetone exemption. Consult Product Data Sheet for additional information.

F. Membrane Storm Collar: 60 mil Sarnafil sheet including stainless steel cinch bound and sealant. Collar shall be field fabricated.

2.13 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.

PART 3 - EXECUTION

3.1 SUBSTRATE CONDITION

A. Be responsible for acceptance or provision of proper substrate to receive new roofing materials.

B. Verify that the work done under related sections meets the following conditions:
1. Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.
2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
3. All surfaces are smooth and free of dirt, debris and incompatible materials.

4. All roof surfaces shall be free of water, ice and snow.

3.2 SUBSTRATE PREPARATION

A. The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. Load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight.

3.3 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the adhered roof system.

B. Inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

E. Membrane shall be applied over compatible and accepted substrates only.

3.4 VAPOR BARRIER INSTALLATION

A. Primer Application:
   1. The substrate must be clean, dry and free of dust, grease or other contaminants. Shake well before using.
   2. Apply to clean and dry surfaces with a paint brush, roller or sprayer. Application rates will vary depending on substrate.
   3. Sarnavap Self-Adhered vapor barrier must be installed on the same day as the primer application.
   4. Acceptable substrates for primer application include wood, concrete, lightweight concrete, gypsum boards and decks.
   5. Drying time is typically 30 minutes to 3 hours.

B. Spraying equipment recommendations:
   1. Spray tip size: between 20 and 25 mils.
   2. Pressure: 1300 psi continuous.

C. Installation:
   1. Apply primer to prepared substrate.
   2. Allow primer to dry completely.
   3. Install Sarnavap Self-Adhered vapor barrier.
   4. Do not install when it is raining, snowing, or on wet/humid surfaces.
   5. Install Sarnavap Self-Adhered Primer at temperatures 32 degree F and above. Average coverage rate is 0.25 to 1.22 gallons per square.
   6. Install Sarnavap Self-Adhered Primer WB at temperatures 41 degree F and above. Average coverage rate is 0.25 to 0.75 gallon per square. KEEP FROM FREEZING.
   7. Do not use Sarnavap Self-Adhered Primer WB to seal Sarnavap Self-Adhered vapor barrier membrane joints.
   8. Sarnavap Self-Adhered Primer WB is not suitable for plastic surfaces.

D. Membrane Application Over New Concrete Deck:
   1. Install Sarnavap Self-Adhered over a clean and dry substrate. In concrete applications allow concrete to cure for at least 7 days. Do not install when it is raining, snowing, or on wet/humid surfaces. Install in temperatures 32 degree F and above. The use of a primer is required on the following substrates: wood, concrete, lightweight concrete, gypsum boards and decks.
   2. Begin application at the bottom of the slope. Unroll Sarnavap Self-Adhered onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 inches lengthwise following the reference line and by 6 inches at each end. Stagger end laps by at least 12 inches. Do not immediately remove the silicone release sheet.
   3. Once aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold Sarnavap Self-Adhered tight and peel back the release sheet by pulling diagonally.
   4. Use a 100 lb. linoleum roller to press Sarnavap Self-Adhered down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.5 TAPERED INSULATION AND SEPARATION BOARD INSTALLATION

A. Insulation and separation board shall be installed according to insulation manufacturer's instructions.

B. Insulation and separation board shall be neatly cut to fit around penetrations and projections.

C. Install tapered insulation in accordance with insulation manufacturer's shop drawings.

D. Install tapered insulation around drains creating a drain sump.

E. Do not install more insulation board than can be covered with membrane by the end of the day or the onset of inclement weather.

F. Use at least 2 layers of insulation when the total insulation thickness exceeds 2.7 inches. Stagger joints at least 12 inches between layers.

G. Sarnacol 2163: Two Part Urethane Adhesive:
   1. With a utility knife, cut away the plastic plugs from the adhesive mixing head. Attach a mixing tip to the threaded mixing head. Place the cartridge into the applicator. At the beginning of the tube, some of the material should be pumped out initially to make sure of a proper mix. Apply using a battery powered applicator or by hand with a dual component caulk gun over properly installed and prepared substrates in bands 12 in. o.c. Bands are 1/4-1/2 in. wide before foaming. Adhesive will quickly, within 30-45 seconds at 60-80°F, transform from a liquid into a low rise foam. Immediately set insulation/protection boards into wet adhesive. Do not allow the adhesive to skin over. Walk insulation/protection boards into place to ensure full embedment. Within 5-15 minutes the boards are securely attached to the substrate. In warmer weather this process is a little quicker. In colder weather the process is a little slower. CAUTION: Walking insulation/protection boards in immediately after placement into adhesive may cause slippage/movement until adhesive starts to set up. On roof slopes greater than 1/2 inch in 12 inches, begin adhering insulation/protection boards at low point and work upward to

avoid slippage. One person should be designated to walk in, trim/slit and apply weight to all insulation/protection boards to ensure adequate securement. Only areas that can be made completely watertight in the same day's operations shall be coated. Un-used adhesive can be applied at a later date by simply replacing the mixing tip.

2. For multiple layers of insulation apply adhesive over the base layer once fully secured and follow procedures above for attachment of each insulation layer.

3.6 INSTALLATION OF MEMBRANE

A. The surface of the insulation or substrate shall be inspected prior to installation of the roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

B. 2121 Adhesive:
   1. Over the properly installed and prepared substrate, 2121 adhesive shall be poured out of the pail and spread using a nap roller. The 2121 adhesive shall be applied at a rate according to the manufacturer's requirements. No adhesive is applied to the back of the G410 feltback membrane. Do not allow adhesive to skin-over or surface-dry prior to installation of G410 feltback membrane.
   2. The G410 feltback roof membrane is unrolled immediately into the wet 2121 adhesive. Adjacent rolls overlap previous rolls by 3 inches. This process is repeated throughout the roof area. Immediately after application into adhesive, each roll shall be pressed firmly into place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. Do not allow adhesive to skin-over or surface-dry prior to installation of G410 feltback membrane.
   3. Weld G410 coverstrips at all G410 feltback seams that do not have a factory selvage edge.
      a. 2121 shall not be used if temperatures below 40º F are expected during application or subsequent drying time.
      b. No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.7 HOT-AIR WELDING OF SEAM OVERLAPS

A. General:
   1. All seams shall be hot-air welded. Seam overlaps should be 3 inches wide when automatic machine-welding and 4 inches wide when hand-welding, except for certain details.
   2. Welding equipment shall be provided by or approved by the manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Technical Representative prior to welding.
   3. All membrane to be welded shall be clean and dry.

B. Hand-Welding:
   1. Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.

2. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
3. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1-1/2 inch wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch wide nozzle shall be used.

C. Machine Welding:
1. Machine welded seams are achieved by the use of the automatic welding equipment. When using this equipment, instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.
2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Quality Control of Welded Seams:
1. Check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Installer to locations as directed by the Owner's Representative or a manufacturer’s representative. One inch wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched at no extra cost to the Owner.

3.8 MEMBRANE FLASHINGS

A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at Contractor's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

B. Adhesive for Membrane Flashings:
1. Over the properly installed and prepared flashing substrate, adhesive shall be applied according to instructions found on the Product Data Sheet. The adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.
2. No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.

C. Install Peel Stop according to the Detail Drawings with approved fasteners into the structural deck at the base of parapets, walls and curbs. Stop is required by at the base of all tapered edge strips and at transitions, peaks, and valleys according to the details.

D. Manufacturer's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by the manufacturer prior to installation.

E. All flashings shall extend a minimum of 8 inches above roofing level unless otherwise accepted in writing by the Owner's Representative and the Technical Department.

F. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the membrane.

G. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Stop at 6-8 inches on center.

H. Membrane flashings shall be terminated according to recommended details.

I. All flashings that exceed 30 inches in height shall receive additional incremental securement. Consult Technical Department for securement methods.

3.9 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
   1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
   2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.
   3. Coping Metal shall comply with ANSI/SPRI ES-1.

B. Metal, other than that provided by the manufacturer, is not covered under the warranty.

C. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

D. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

E. Metal joints shall be watertight.

F. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch.

G. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches on center into the wood nailer or masonry wall.

H. Counter flashings shall overlap base flashings at least 4 inches.

I. Hook strips shall extend past wood nailers over wall surfaces by 1-1/2 inch minimum and shall be securely sealed from air entry.

J. Items projecting through or mounted on roofing:
   1. Flash and seal weather tight with plastic cement.
   2. Field paint: Comply with requirements of Division 9 Section "Painting".
      a. Color: As selected by Architect to match roofing.

3.10 CLAD METAL BASE FLASHINGS/EDGE METAL

A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced.

B. Clad metal flashings shall be formed and installed per the Detail Drawings.
   1. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch.
   2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

C. Adjacent sheets of Clad shall be spaced 1/4 inch apart. The joint shall be covered with 2 inch wide aluminum tape. A 4 inch minimum wide strip of flashing membrane shall be hot-air welded over the joint.

3.11 WALKWAY INSTALLATION

A. Cross-Grip Walkway

Install Crossgrip Walkway loose laid on completed Sarnafil roof assembly. Secure the walkway with loops of Sarnafil membrane welded to the field sheet. Unroll and position Crossgrip Walkway within specified areas and cut to desired length. Do not install Crossgrip Walkway directly over Sarnabars. Connecting clips are available for butting two ends together. Important: Check all existing deck membrane seams that are to be covered and re-weld any inconsistencies before installation.

3.12 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as specified. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

B. If inclement weather occurs while a temporary waterstop is in place, provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced.

3.13 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Installer. All defects noted and non-compliances with the Specifications or the recommendations of the manufacturer's Technical Inspector shall be itemized in a punch list, during the final inspection. These items shall be corrected immediately by the Installer to the satisfaction of the Owner's Representative and the manufacturer prior to demobilization.

B. All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Section Includes:
   1. Sheet metal flashing and trim not specifically specified in other sections.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
   6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   7. Details of special conditions.
   8. Details of connections to adjoining work.

1.5 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.
14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for “Visual Devices”).
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheet metal flashing and trim that fails in materials or workmanship within specified warranty period.
   1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Galvanized Sheet Metal Flashing and Trim:
   1. Fry Reglet Corporation.
   2. Hickman, W. P. Company.
   3. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
   4. Or equal.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
   2. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finishes:
   a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
2. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
3. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

G. Flashing corners shall be shop fabricated and fully soldered such that corner assemblies are single monolithic units for 18" in all directions from corners.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
   2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant interlocking folded seam or blind rivets and sealant anchor and washer at 36-inch centers.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 076500 - FLEXIBLE SHEET FLASHING

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. Flexible sheet flashing for windows, doors, parapets, and other openings and where indicated on Drawings.
   2. Flexible sheet membrane over the Concrete dome.

1.3 SUBMITTALS

A. Concurrent Review Requirements: Submit submittals of this section with doors and windows sections.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of flexible sheet flashing.

C. Shop Drawings: Show locations and extent of flexible sheet flashing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For the following products:
   1. 12-by-12-inch square of flexible sheet flashing.

E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for flexible sheet flashing.

1.4 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
   1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.

2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.
14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for “Visual Devices”).
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Installer Qualifications: A firm that is acceptable to flexible sheet flashing manufacturer for installation of flexible sheet flashing required for this Project.

C. Source Limitations: Obtain flexible sheet flashing materials through one source from a single manufacturer.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup with doors and windows.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to flexible sheet flashing including, but not limited to, the following:
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review and discuss the flashing to be coordinated with the finishing of doors and windows.

3. Review, discuss, and coordinate the interrelationship of flexible flashing with other exterior wall components. Include provisions for sealants and fasteners.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by flexible sheet flashing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of flexible sheet flashing that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flexible Sheet Flashing: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. WR Grace (Basis of Design).
2. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
3. Henry Company; Blueskin PE200 HT.
4. Metal-Fab Manufacturing, LLC; MetShield.
5. Owens Corning; WeatherLock Metal High Temperature Underlayment.
6. Or equal.

2.2 FLEXIBLE SHEET FLASHING

A. Product: Ultra by WR Grace or equal.
   1. Self-Adhering, High-Temperature Sheet: Consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
      a. Thickness:
         1) 40 mils: Windows, doors, parapets, and other openings.
         2) 60 mils: Over concrete dome.
   2. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
   3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
   4. Location: At eaves, rakes, valleys, penetrations, slope and direction changes, horizontal and soffit areas, in addition to where indicated on Drawings
   5. Method: Overlap with felt after putting down Self-Adhering sheet.

2.3 AUXILIARY MATERIALS

A. Mastic, Joint Sealant, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by flexible sheet flashing manufacturer.
   1. Caulking, sealants, and adhesives applied on the interior of the building envelope shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that concrete has cured and aged for minimum time period recommended by flexible sheet flashing manufacturer.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install flexible sheet flashing in accordance with the manufacturer’s written instructions, AAMA Publication 2400, and the applicable code.

END OF SECTION 076500

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Glazed curtain walls.
   4. Glazed entrances.
   5. Storefront framing.
   6. Skylights.
   7. Electrochromic insulating glass units.

B. Related Sections:
   1. Division 26 Section “Instrumentation and Control for Electrochromic Insulating Glass Units” – if using glass from Sage Glass.
   2. Division 26 Section “Instrumentation and Control for Dynamic Glazing” - if using glass from View Inc.

1.3 DEFINITIONS

A. Sealed Insulating Glass Unit Surfaces & Coating Orientation:
   1. Surface 1 – Exterior surface of outer pane (surface facing outdoors of outboard lite).
   2. Surface 2 – Interior surface of outer pane (surface facing indoors of outboard lite).
   3. Surface 3 – Exterior surface of inner pane (surface facing outdoors of inboard lite).
   4. Surface 4 – Room side surface of inner pane (surfacing facing indoors of inboard lite).
   5. For the electrochromic glass which is laminated insulating glass, there are 6 surfaces (two for each surface of 3 lites of glass) numbered sequentially from one starting from the exterior surface of the outer ply.

B. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For each glazing products, in the form of 12to 14-inch- square Samples for glass and of 12 to 14-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
   1. Insulating glass for each designation indicated.
   2. Fire-rated glazing.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
   1. List by windows and door types scheduled on Drawings.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each types of glazing products specified.

1.6 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
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14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for “Visual Devices”).
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain glazing products through one source from a single manufacturer for each glass type as practical.

D. Electrochromic Glass supplier qualifications: An experienced electrochromic manufacturer that has had EC products successfully installed and operating in at least 5 different buildings for at least three years.

E. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

F. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

G. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

H. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

I. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

J. Safety Glazing Products: Comply with testing requirements in 2013 CBC, Section 2406 and CPSC 16 CFR 1201.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

K. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications:
      a. GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

L. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.
   3. For electrochromic glass, the manufacturer must also provide documentation that the IG weathering testing to E2190 was carried out on insulating glass units containing all the constituents of the standard EC product including, but not limited to EC coatings and EC device components such as wires and bus bars.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years.
   2. For EC coatings, warranty period: 5 years

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 5 years.

C. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Fire-Rated Glass Manufacturers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. PPG (Basis of Design).
   2. Oldcastle BuildingEnvelope.
   3. Guardian.
   4. Pilkington.
   5. Visteon.
   6. Or equal.

B. Non-Fire-Rated Glazing Fabricators: Subject to compliance with requirements, provide either the named fabricator or an equal fabricator by one of the other fabricators specified.
   1. Oldcastle Building Envelope. (Basis of Design)
   2. Viracon.
   3. Guardian.
   4. Or equal.

C. Fire-Rated Glazing Fabricators: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. FireLite NT by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products (Basis of Design)
      a. Premium grade, lamination on one side, 3/16 inch thick.
   2. Interedge Technologies.
   3. Oldcastle BuildingEnvelope.
   4. Pilkington.
   5. Pyran Star F by Schott.
   6. Safti.
   7. Vetrotech Saint-Gobain NA
   8. Or equal.

D. Electrochromic insulating glass units: Provide glazing from one of the manufacturer listed below.
   1. Sage Glass , or
   2. View, Inc.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass (Safety Glass): ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. For uncoated glass, comply with requirements for Condition A.
   2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
    a. Class II tempered safety glazing per CBC 2406.3 and Table 2406.1.

C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

2.3 FIRE-RATED GLAZING PRODUCTS

A. Monolithic Ceramic Glazing Material: Proprietary product in the form of clear flat sheets of 3/16-inch nominal thickness weighing 2.5 lb/sq. ft., and as follows:
1. Fire-Protection Rating: As indicated for the fire window in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Listing:
    a. Listed and labeled by Underwriters Laboratories, Inc.® and Underwriters' Laboratories of Canada.
    b. Test report number for labeled fire-rated assemblies is UL File No. R13377. All above tests performed in accordance with UL 9, UL 10C, ASTM E2010, CSFM 43.7, and NFPA 257.
3. FireLite shall be glazed into the appropriate fire-rated framing with an approved glazing compound (Dow 795, GE Siliglaze II 2800, or Tremco Spectrum II silicone; closed cell PVC tape; or DAP 33 putty) as supplied by the installer.
4. For 90 min. ratings that exceed 1,393 sq. in., FireLite shall be glazed with fire-rated glazing tape as supplied by TGC.
5. Check for clearance around the edges, and adjust setting blocks as needed.
6. All edges must be captured for a valid fire rating.
7. Surface Finish: Polished.

B. Wire glass is not acceptable.

2.4 ELECTROCHROMIC INSULATING GLASS UNITS

A. One of:
1. Electrochromic Laminated Sealed Insulating Glass Units (IGUs), Argon Filled:
    a. Laminated Outboard Lite meeting safety glass requirements for ANZI Z97.1 and CPSC 16 CFR Part 1201:
        1) Outer Ply (Surface 1 & 2):
            a) Glass Type: Coated float glass.
            b) Glass Tint: Clear with SR2.0 coating
            c) Nominal Thickness: 0.16 inch (3.9 mm).
            d) Heat Treatment: heat strengthened
            e) Coating orientation: Surface No. 2.
            f) Obscuration: <21mm from IGU edge black ink obscuration band on surface # 2 around the perimeter.
        2) Interlayer (between surface 2 & 3):

a) Interlayer Type: Ionoplast interlayer.
b) Interlayer Tint: Clear.
c) Nominal Thickness: 0.0.38 inch (0.90mm).

3) Inner Ply (Surface 3 & 4):
a) Glass Type: Electrochromic coated clear float glass.
b) Glass Tint: Electronically variable tintable.
c) Nominal Thickness: 0.087 inch (2.2 mm).
d) Heat treatment: Annealed
e) Coating Orientation: Surface No. 4

b. Cavity:
1) Spacer Material: Austenitic standard stainless steel, mill finish/black finish.
2) Nominal Thickness: 0.45" +/- 0.02 inch.
3) Cavity: 0.5".
4) Wall Thickness: >/= 0.007 inch.
5) Gas Fill: 90% Argon/10% Air
6) Desiccant: Four legs filled with blend of 3A molecular sieve and silica gel desiccant.

c. Inboard Lite:
d. Glass Type: Float glass.
e. Glass Tint: Clear.
f. Nominal Thickness: 0.250 inch (6 mm)
g. Heat Treatment: Tempered.
h. Pigtail:
1) Multi-conductor sheathed cable.
2) 2, 3 or 4 pin weather tight connector.

i. Clear Performance Characteristics (Center of Glass):
1) Visible Transmittance: 60 percent.
2) Exterior Reflectance: no greater than16 percent.
3) Interior Reflectance: no greater than 15 percent.
4) Summer U-factor (U-value): 0.28 with 90% argon fill.
5) Winter U-factor (U-value): 0.28 with 90% argon fill.
6) Solar Heat Gain Coefficient (SHGC): 0.412.
7) Shading Coefficient: 0. 47.
8) Exterior reflected color using the l*a*b* color system shall have a negative value of b* (blue). The b* coordinate of the reflected exterior color shall not be positive (yellow).

j. Tinted state characteristics (center of glass)
1) Visible transmittance: 1.0 percent
2) Exterior Reflectance: 11 percent
3) Interior Reflectance: no greater than 10 percent
4) Summer U-factor: 0.28 with 90% argon fill
5) Winter U-factor: 0.28 with 90% argon fill
6) Solar heat gain coefficient: 0.09
7) Exterior reflected color in the blue-green (-a*, -b*) quadrant of the a*b* color space.

k. In-pane zoning
1) Provide up to 3 separate, independently controllable, sections (zones) within each electrochromic insulating glass unit to provide optimum daylight

control, glare control and indoor light color quality (see architectural drawings for specific location and number of in-pane zones).

2) For a three zone EC insulating glass unit, the individual pane is segmented so that zones/sections are vertically above the other to create a bottom, middle and top zone in the unit. Provide three zone electrochromic insulating glass units in the north, southwest and east facing curtainwalls and the office areas as indicated on the architectural drawings.

3) For a two zone EC insulating glass unit, the individual pane is segmented so that zones/sections are vertically above the other to create a bottom and top zone in the unit. Provide electrochromic insulating glass that is segmented into two independently controlled zones for the skylight glazing.

4) For a one zone electrochromic insulating glass unit, the entire area of the pane is controlled as one segment. Provide one zone electrochromic insulating glass units for the tower vertical glazing and glass in the lower section of the north facing curtainwall (see architectural drawings).

l. Frame Cable (one per IGU):
   1) Multi-conductor plenum rated sheathed cable type CMP/CL2P.
   2) 2, 3 or 4 pin weathertight connector.
   3) Connector shall be thin at <0.2" in height and installed in the glazing pocket or other easy to access space in the framing system for ease of maintenance.

m. Off state: Clear.

n. Operating Voltage: 5 volts DC or less applied to the EC insulating glass. Class 2 (low voltage, low current) electrical system.

o. Safety Tempered Float Glass: Comply with ANSI Z97.1 and CPSC 16 CFR 1201.

p. Laminated Glass: Comply with ASTM C1172 and other requirements as specified.

q. Fabricate laminated glass products in autoclave with heat, plus pressure, free of foreign substances and air pockets.

r. Provide hermetically sealed IGU with dehydrated airspace, primary seal of polyisobutylene (PIB);color black and secondary seal of two part silicone; color-black, and >/=0.007 inch (.15mm) wall thickness stainless steel spacer as specified.

2. Electrochromic Laminated Sealed Insulating Glass Units (IGUs), Argon Filled:

a. Acceptable model: View Dynamic Glass Insulating Glass Units (IGUs) - Laminated Construction.

b. Outboard Lite:
   1) Glass Type: Clear float glass
   2) Glass Tint: Variable electrically
   3) Nominal Thickness: 0.25 in (6 mm) per industry standards
   4) Heat Treatment: Tempered
   5) Coating Orientation: Surface No. 2
   6) Busbar Location: Along the edge of the glass

c. Air Space:
   1) Spacer Material: a triple seal design suitable for Structural Glazing, consisting of a thermoset foam spacer incorporating integral 3A desiccant, pre-applied adhesive for glass bonding, a captive polyisobutylene primary seal, and a structural seal. Edgetech Super Spacer TriSeal™ or approved equivalent.
   2) Nominal Thickness: 0.50 plus/minus 0.02 inch (12.5 mm plus/minus 0.5mm)

3) Gas Fill: 90 percent argon

d. Inboard Lite:
   1) Glass Type: laminated heat treated glass
   2) Glass Tint: Clear
   3) Nominal Thickness: 0.250 inch (6 mm)
   4) Heat Treatment: Tempered

e. Pigtail: Manufacturer's custom cable as follows:
   1) Length: 12 inches (300mm)
   2) Termination: IP67 rated, environmentally sealed, 5/16" (8mm) circular connector.
   3) Minimum diameter hole through framing: 7/16" (11mm).

f. Standard insulating glass configuration performance:
   1) Tint 1 Performance Characteristics (Center of Glass):
      a) Visible Transmittance: 58 percent
      b) Interior Visible Reflectance: 16 percent
      c) Exterior Visible Reflectance: 13 percent
      d) U-factor (U-value): 0.30
      e) Solar Heat Gain Coefficient (SHGC): 0.40
   2) Tint 2 Performance Characteristics (Center of Glass):
      a) Visible Transmittance: 30 percent
      b) Interior Visible Reflectance: 15 percent
      c) Exterior Visible Reflectance: 9 percent
      d) U-factor (U-value): 0.30
      e) Solar Heat Gain Coefficient (SHGC): 0.23
   3) Tint 3 Performance Characteristics (Center of Glass):
      a) Visible Transmittance: 10 percent
      b) Interior Visible Reflectance: 15 percent
      c) Exterior Visible Reflectance: 7 percent
      d) U-factor (U-value): 0.30
      e) Solar Heat Gain Coefficient (SHGC): 0.13
   4) Tint 4 Performance Characteristics (Center of Glass):
      a) Visible Transmittance: 1 percent
      b) Interior Visible Reflectance: 15 percent
      c) Exterior Visible Reflectance: 7 percent
      d) U-factor (U-value): 0.30
      e) Solar Heat Gain Coefficient (SHGC): 0.09

g. Fabrication:
   1) Laminated glass: Fabricate in autoclave with heat and pressure, free of foreign substances and air pockets.
   2) IGU units: Hermetically sealed IGU with dehydrated airspace sealed as follows:
      a) Primary seal of Polyisobutylene (PIB), color: gray
      b) Secondary seal of Silicone, color: gray

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Silicone complying with ASTM C 1115.

2.6 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
   1. Silicone complying with ASTM C 1115.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   1. Silicone complying with ASTM C 1115.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
   1. Silicone complying with ASTM C 1115.

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
   1. Silicone complying with ASTM C 1115.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 INSTALLATION OF ELECTROCHROMIC INSULATING GLASS UNITS

A. Install products using recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in the "GANA Glazing Manual".

B. Verify that the glazing sealants are compatible with the IGU sealant materials.

C. Install glass in prepared glazing channels and other framing members.

D. Install glass per framing manufacturer’s wiring diagram showing IGU orientation and wire exit point into building. Comply with glass manufacturer’s labels and instructions for glass orientation.

E. Protect IGU pigtail and Frame Cable from any damage during installation. Use grommets during installation to protect wire when routing through frame. If Frame Cable or the connector is damaged during installation the Frame Cable must be replaced. If the IGU pigtail connector is damaged during installation electrochromic glass manufacturer must be notified and the connector must be repaired with the manufacturer’s approved method.

F. PVC jacketed plenum cables (Bus cable, trunk cable, IGU Pigtails, 12 Conductor Cable, Frame Cables, Sensor Cables, etc.) should be conditioned for 24 hours at room temperature prior to installation and never installed below 0°C (32° F) ambient temperature. Once installed these wires must not be exposed to sunlight even through glass. If they are installed in an exposed location they must be covered or painted (latex / water based paint only).

G. Verify glazing pocket where IGU Pigtail and Frame Cable connection is made is a dry location.

H. Install silicone setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual and IGMA Glazing Guidelines and manufacturer’s Glazing Guidelines.

I. Use silicone edge blocks for all installed panes to prevent glass from walking post installation.

J. Provide bite on glass, minimum edge and face clearances, and glazing material tolerances recommended by GANA Glazing Manual and as approved by glass manufacturer.

K. Provide weep system as recommended by GANA Glazing Manual.

L. Distribute weight of glass unit along edge rather than at corners.

M. Comply with framing manufacturer's and referenced industry recommendations on expansion joints and anchors, accommodating thermal movement, glass openings, use of setting and edge blocks, use of glass spacers, edge blocks, and installation of weep systems. Setting and edge blocks must be made from silicone. Electrochromic glass manufacturer does not recommend the use of setting blocks made from other materials, as they been known to alter the chemical makeup of plastics and rubbers they come in contact with, resulting in seal failure.

N. Protect glass from edge damage during handling and installation.

O. Install per IGMA North American Glazing Guidelines for Sealed Insulated Glass Units, for Commercial and Residential Use TM-3000-90(04) states “For dry glazed systems, an adequate seal should consist of a minimum of 0.70 N/mm (4 lb/in) and not exceeding 1.75 N/mm (10 lb/in) applied to the edges of the insulated glass unit by gaskets or other fastening systems.”

P. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing, or plaster.

Q. Once electronically tintable IGUs have been removed from manufacturer’s packaging, remove labels within 30 days of exposure to sunlight or other UV light sources.

3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.6 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.8 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.9 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 093000 - TILING

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. Porcelain tile.
   2. Stone tile.
   3. Stone thresholds installed as part of tile installations.
   4. Waterproof membrane for tile installations.
   5. Tile backer units installed as part of tile installations.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

1.4 SYSTEM DESCRIPTION

A. Accessibility Requirements for Tile Flooring:
   1. Ceramic and Quarry Tile Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.5 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.

2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
1. Propose locations of expansion, contraction, control, and isolation joints if not indicated on Drawings.

C. Installation Method: Show TCA installation method number for each tiled area in tabulated form.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Qualification Data: For Installer.

G. Material Test Reports: For each tile-setting and -grouting product.

1.7 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.

14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.
16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for "Visual Devices").
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

E. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of floor and wall tile installation.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of ceramic tile and accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Porcelain Tiles: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Daltile; Div. of Dal-Tile International Inc. (Basis of Design)
   2. Arizona Tile. (Basis of Design)
   3. Crossville Ceramics Company, L.P.
   4. American Olean; Div. of Dal-Tile International Corp.
   5. Interceramic.
   6. Unicorn.
   7. Or equal.

B. Stone Tiles: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Arizona Tile. (Basis of Design)
   2. Daltile; Div. of Dal-Tile International Inc.
   3. Crossville Ceramics Company, L.P.
   4. American Olean; Div. of Dal-Tile International Corp.
   5. Interceramic.
   6. Unicorn.
   7. Or equal.

C. Setting and Grouting Materials: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Custom Building Products.
   2. LATICRETE International Inc.
   3. MAPEI Corporation.
   4. Omega.

5. Or equal.

D. Fluid Applied Waterproofing and Crack Suppression for Tile Installation: Subject to compliance with requirements, provide products by one of the following manufacturers.
1. Mapelastic 315 by Mapei.
2. RedGard by Custom Building Products.
3. Laticrete 9235 Waterproof Membrane by LATICRETE International Inc.
4. Or equal.

E. Coated Glass Mat Gypsum Backer Board:
1. Gold Bond eXP Tile Backer by National Gypsum.
2. Durock Brand Glass-Mat Tile Backerboard by USG.
3. DensShield Tile Backer by Georgia Pacific (GP).
4. Or equal.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Porcelain and Stone Tiles: As indicated on Drawings.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
1. Description: Match Architect's sample.

2.5 FLUID-APPLIED WATERPROOFING AND CRACK SUPPRESION FOR TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.

2.6 SETTING AND GROUTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:
   1. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
   2. Latex Additive: Manufacturer's standard water emulsion.
   3. Products:
      a. MAPEI, Mapecem 102, Powder, MAPEI, Planicrete AC (Liquid).
      b. 3701 (liquid) Additive with 226 (powder) by Laticrete.
      c. Custom Building Products: Acrylic Mortar Admix
      d. Or equal.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
   1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
      a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
   2. Products:
      a. MAPEI: Ultraflex 2, Walls: MAPEI Ultralite.
      b. 254 Platinum by Laticrete.
      c. Custom Building Products: MegaFlex.
      d. Or equal.

C. Chemical-Resistant, Water-Cleanable, Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.
   2. Products:
      a. MAPEI: Kerapoxy IEG.
      b. SpectraLock Pro by Laticrete.
      c. Custom Building Products: 100% Solids Epoxy Grout.
      d. Or equal.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
   1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.8 TILE BACKER BOARDS

A. Coated Glass Mat Gypsum Backer Boards:
   1. Product: Gold Bond eXP Tile Backer by National Gypsum or equal.
      a. Meets ASTM C 1178 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
      b. An acrylic coated moisture and mold resistant gypsum panel specially designed for use as a substrate for tile applications in high moisture areas.
      c. Acrylic coated fiberglass facer provides an integral water barrier, eliminating the need for a separate water barrier.
      d. Manufactured with an enhanced moisture and mold resistant core and facer. The facer is composed of an acrylic coated fiberglass mat which provides superior moisture resistant capabilities.
      e. Recommended as a substrate for tile and other finishes in both wet and non-wet areas, areas of high humidity and fire-rated assemblies. It is ideally suited for interior walls and ceilings.
      f. GREENGUARD Certified for microbial resistance per ASTM D 6329.
      g. Resists the growth of mold per ASTM D 3273 with a score of 10, the best possible rating.
      h. Achieves a flame spread of 0 and smoke developed of 0 per ASTM E 84.
      i. 5/8" eXP Tile Backer contains a Fire-Shield Type X gypsum core and is approved for inclusion in specific UL fire-rated designs.

B. Joint Tape: Mesh type as recommended by backer unit manufacturer.

C. Joint Compound: As recommended by backer unit manufacturer.

2.9 MOISTURE AND MOLD-RESISTANT GYPSUM BOARD

A. Comply with requirements of Division 9 Section “Gypsum Board”.

B. Substrates for painted surfaces in toilet rooms. Do not use as substrate for tile application.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: ADA compliant, angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, in aluminum finishes selected by Architect.
   1. Outside Corners: ECK-E by Schluter or equal.

2. Exposed Edges: JOLLY by Schluter or equal.

C. Transitions: ADA compliant, various shapes, height to match tile and setting-bed thickness, metallic designed specifically for flooring applications, in aluminum finishes selected by Architect.
1. Reno, Reno-T, Reno-U, Reno-TK, and Reno-Ramp by Schluter or equal.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
a. Sub-floor and Vertical Surfaces: 1/4 inch in 10 feet.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.

H. Grout tile to comply with requirements of the following tile installation standards:
1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 BACKER BOARD INSTALLATION

A. Install backer boards and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has been tested to determine that it is watertight.

3.6 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: 1/16 inch unless specified otherwise.

C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
   1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.7 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

3.8 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.9 FLOOR TILE INSTALLATION, TCNA ASSEMBLY

A. Tile Installation: Interior floor installation on waterproof membrane over concrete; cement mortar bed (thickset); TCNA F121 with epoxy grout.
1. Mortar: Latex-portland cement mortar.
2. Grout: Chemical-resistant, water-cleanable, tile-grouting epoxy.
3. Tile Pattern: Grid pattern.

3.10 WALL TILE INSTALLATION, TCNA ASSEMBLY

A. Tile Installation: Interior wall installation on waterproof membrane over coated glass-mat, water-resistant backer board (ASTM C1658); thin-set mortar; TCNA W245 and ANSI A108.
1. Mortar: Latex-portland cement mortar.
2. Grout: Chemical-resistant, water-cleanable, tile-grouting epoxy.
3. Tile Pattern: 1/3 running bond pattern.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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:
   1. Acoustical panels and suspension systems for ceilings.
   2. Acoustical metal panels for walls.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SYSTEM DESCRIPTION

A. DSA Interpretation of Regulations (IR) Document Metal Suspension Systems for Lay In Panel Ceilings (IR25-2.13) references 2013 CBC, Section 1616A.1.20.
   1. Applies to ceiling systems whose total weight, including air conditioning grilles and light fixtures, does not exceed four (4) psf. Heavier systems and those supporting lateral loads from partitions will require special design details.
   2. 12 ga. minimum hanger wires may be used for up to and including 4'-0" x 4'-0" grid spacing and shall be attached to main runners.
   3. Provide 12 ga. hanger wires at the ends of all main and cross runners within eight inches of the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area. End connections for runners which are designed and detailed to resist the applied vertical and horizontal forces may be used in lieu of the 12 ga. Hanger wires, subject to Division of the State Architect (DSA) review and approval.
   4. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have countersloping wires.

5. Ceiling grid members may be attached to not more than 2 adjacent walls. Ceiling grid members shall be at least 3/4 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.
6. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a 16 ga. wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12 inch or less, this interlock is not required.
7. Provide bracing assemblies consisting of a compression strut and four 12 ga. Splayed bracing wires oriented 90 degrees from each other (see Figure 1) at the following spacing:
    a. Design compression strut per AISC EQ. 2.2.
    b. For school buildings, place bracing assemblies at a spacing not more than 12 by 12 feet on center.
    c. For Essential Services Buildings, place bracing assemblies not more than 8 by 12 feet on center.
    d. Provide bracing assemblies at locations not more than 1/2 the spacings given above, from each perimeter wall and at the edge of vertical ceiling offsets. The slope of these wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted without special DSA approval.
    e. Suspended acoustical ceiling systems with a ceiling area of 144 square feet or less, and fire rated suspended acoustical ceiling systems with a ceiling area of 96 square feet or less, surrounded by walls which connect directly to the structure above, do not require bracing assemblies when attached to two adjacent walls.
8. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
    a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns should be maintained, and be as tight as possible.
9. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4 inch nominal diameter, to hanger wires using connectors acceptable to DSA.
10. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 lbs. in tension. Shot-in anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, see CBC, Section 1913A.7.
    a. Drilled-in or shot-in anchors require special DSA approval when used in prestressed concrete.
11. Attach all light fixtures and ceiling mounted air terminals or services, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Screws or approved fasteners are required.
12. Flush or recessed light fixtures weighing less than 56 lbs., and air terminals or services, weighing less than 20 lbs may be supported directly on the runners of a heavy duty grid

system but, in addition, they must have a minimum of two 12 ga. slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 x 4 feet light fixtures must have slack safety wires at each corner.

a. All flush or recessed light fixtures weighing 56 lbs. and air terminals or services, weighing 20 lbs or more must be independently supported by not less than four (4) taut 12 ga. wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.
b. The 4 taut 12 ga. Wires including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

13. All fixtures and air terminals or services supported on intermediate duty grid systems must be independently supported by not less than 4 taut 12 ga. wires each attached to the fixture or terminal, and to the structure above.
14. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by a 12 ga. wire. Spring clips or clamps that connect only to the runner are not acceptable.
    a. Provide additional supports when light fixtures are 8’-0" or longer.
15. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 4 times the weight of the fixture. A bracing assembly per Figure 1, is required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit horizontal forces.
16. Required notes on construction documents:
    a. Classification of ceiling grid is heavy duty.
    b. Manufacturer’s catalog number - main runner.
        1) DX-26 (USG), ICC-ES. ESR-1222.
        2) 7301 (Armstrong), ICC-ES, ESR-1308.
    c. Manufacturer’s catalog number - cross runner.
        1) DX424 or DX216 (USG), ICC-ES, ESR-1222.
        2) XL7341 4 ft cross tee and XL7328 2 ft cross tee (Armstrong), ICC-ES, ESR-1308.
    d. Manufacturer’s catalog number of detail for runner splice.
        1) Integral system (USG) ICC-ES, ESR-1222.
        2) Same as main runner, 7301. Mains connect together for compression/tension strength (Armstrong), ICC-ES, ESR-1308.

B. Structural Performance:
1. CBC Seismic Categories D, E, F.
2. Heavy Duty Grid.
3. Minimum 3/4 inch clearance from grid end to wall.
4. Minimum 2 inch perimeter molding or tested 7/8 inch perimeter molding with BERC2 clip by Armstrong.
5. Grid must be attached on 2 adjacent walls, no attachment on other 2 walls.
6. Perimeter T ends tied together at perimeters on tees that are not attached to perimeter molding.
7. Partition attachment bracing is required to be independent from ceiling splay bracing.
8. Seismic separation joint required for areas greater than 2,500 sq. ft. (or full height partitions).
9. Rigid bracing required for ceiling elevation changes.

10. Interior suspended ceilings, soffits, and bulkheads: Maintain deflection of not more than L/360 of distance between supports.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of full-size Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Reference Standards: (Effective January 1, 2014)
   1. Part 1 - 2013 California Building Standards Administrative Code, Title 24 C.C.R.
   2. Part 2 - 2013 California Building Code, Title 24 C.C.R. (2012 International Building Code of the International Code Council, with California Amendments).
   3. Part 3 - 2013 California Electrical Code, Title 24 C.C.R. (2011 National Electrical Code of the National Fire Protection Association, NFPA).
   4. Part 4 - 2013 California Mechanical Code, Title 24 C.C.R. (2012 Uniform Mechanical Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
   5. Part 5 - 2013 California Plumbing Code, Title 24 C.C.R. (2012 Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials, IAPMO).
   6. Part 6 - 2013 California Energy Code, Title 24 C.C.R.
   7. Part 8 - 2013 California Historical Building Code, Title 24 C.C.R.
   8. Part 9 - 2013 California Fire Code, Title 24 C.C.R. (2012 International Fire Code of the International Code Council).
   9. Part 10 - 2013 California Existing Building Code, Title 24 C.C.R. (2012 International Existing Building Code of the International Code Council, with amendments).
   10. Part 11 - 2013 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
   11. Part 12 - 2013 California Referenced Standards Code, Title 24 C.C.R.
   12. NFPA 13 - Automatic Sprinkler Systems (California Amended), 2013 Edition.
   13. NFPA 14 - Standpipe Systems (California Amended), 2013 Edition.
   14. NFPA 17 - Dry Chemical Extinguishing Systems, 2013 Edition.
   15. NFPA 17A - Wet Chemical Extinguishing Systems, 2013 Edition.

16. NFPA 20 - Stationary Pumps, 2013 Edition.
17. NFPA 24 - Private Fire Service Mains (California Amended), 2013 Edition.
18. NFPA 72 - National Fire Alarm and Signaling Code (California Amended) 2013 Edition (Note: See UL Standard 1971 for “Visual Devices”).
19. NFPA 80 - Fire Door and Other Opening Protectives, 2013 Edition.
20. NFPA 253 - Critical Radiant Flux of Floor Covering Systems, 2006 Edition.
21. NFPA 2001 - Clean Agent Fire Extinguishing Systems (California Amended), 2012 Edition.
22. Americans with Disabilities Act (ADA), Title II or Title III.

B. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.
      b. Flame-Spread Classification: CBC 803 and Table 803.9.
         1) Flame-Spread Rating: Class 1 (0-25).

E. Seismic Loads: Design and size components to withstand seismic loads in accordance with the California Building Code, Section 1616A.1.20 for Category D, E, and F.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical panel ceilings that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Panels and Acoustical Metal Panels: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Armstrong World Industries, Inc. (Basis of Design)
   2. USG Interiors, Inc.
   3. Hunter Douglas Architectural Products.

4. BPB- Celotex.
5. Tectum Inc.
6. Or equal.

B. Suspension Systems: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. Armstrong World Industries, Inc. (Basis of Design)
2. USG Interiors, Inc.
3. Hunter Douglas Architectural Products.
4. BPB Celotex.
5. Chicago Metallic Corporation.
6. Or equal.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Products: As indicated on Drawings.

2.4 ACOUSTICAL METAL PANELS FOR WALLS

A. Products: As indicated on Drawings.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: In accordance with the California Building Code, Section 1616A.1.20 for Category D, E, and F.

D. Wire for Hangers and Ties: In accordance with the California Building Code, Section 1616A.1.20.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

L. Wall Moldings: In accordance with the California Building Code, Section 1616A.1.20 for Category D, E. and F.

2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; heavy-duty.

B. Products: As indicated on Drawings.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2.8 ACOUSTICAL SEALANT

A. Comply with requirement of Division 7 “Joint Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Install suspension system and panels in accordance with the California Building Code, Section 1616A.1.20.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 115200 – AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The Invitation for Bids, Instruction to Bidders, and General Conditions of the Contract including any Supplementary Conditions apply to all Work under this section.

B. The Contractor acknowledges and warrants that he has closely examined all the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in the time allotted for the Contract Sum as accepted by the Owner and Consultant, and that they include all Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable codes, laws, ordinances, rules, and regulations.

C. Execution of the Contract by the Contractor is a representation and warranty that the Contractor has carefully examined the Contract Documents, and represents and warrants that the Contractor is thoroughly familiar with the nature and location of the Work, the Site, the specific conditions under which the Work is to be performed, and all matters which may in any way affect the Work or its performance. The Contractor further represents that as a result of such examinations and investigations, the Contractor has thoroughly reviewed and understands the Contract Documents and their intent and purpose, and is familiar with all applicable codes, ordinances, laws, regulations and rules as they apply to the Work, and that the Contractor will abide by same.

D. Claims for additional time or additional compensation as a result of the Contractor's failure to follow the foregoing procedure and to familiarize itself with all local conditions and the Contract Documents will not be permitted.

E. Related Work Specified Elsewhere:

1. All Division 1 Specification Sections apply to this Section.

2. Power, signal conduits and back-boxes provided and installed under Division 26; except loudspeaker back-boxes and specialty back-boxes provided under this work for installation under Division 26.

1.2 SUMMARY OF WORK

A. SCOPE:

1. Supply and install sound and video systems including all apparatus and equipment, wiring, termination, labor, and services required to provide systems as specified and shown on drawings.

2. Supply and install any incidental equipment needed in order to meet the functional requirements stated herein and on drawings. This shall include all support and restraint for the fixed loudspeakers and projection equipment.

3. Set up and adjustment of specified hardware and software.

4. Furnish all test equipment and the services of the project engineer and the project manager to assist the Owner's representative in the acceptance testing.

5. Make any adjustments to any part of the system, including the re-aiming of loudspeakers, which may be found necessary during the acceptance testing.

6. Provide training in the operation of the systems to the person or persons selected by the Owner. Refer to in Part 3 paragraph below entitled “Training”.

B. Coordination:

1. Schedule installation operations in sequence required in order to obtain best completion results.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. All specialty sub-Contracting including installation of all telecommunications lines and equipment as shown on the Contract Documents to be coordinated by the Contractor.

1.3 EQUIPMENT AND MATERIALS

A. The AV Contractor shall verify characteristics of elements of interrelated equipment specified under this section are compatible; coordinate work having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

B. By making requests for substitutions, the Contractor:

1. Represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified.
2. Represents that he will provide the same warranty for the substitution that the Contractor would for that specified.
3. Certifies that the cost data presented is complete and includes all related costs under this Contract, and waives all claims for additional costs related to the substitution which may later become apparent.
4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, including, but not limited to, in full compliance with all applicable codes, laws, ordinances, rules, and regulations and completion in the time allotted for the Contract Sum as accepted by the Owner and Consultant.

1.4 SUBMITTALS

A. All submittals shall be in accordance with the general provisions of the Contract, including General and Supplementary conditions and other Division 1 Specification Sections.

1. Audio-Visual Consultant will not review partial submittals.
2. Audio-Visual Consultant will review up to two (2) submittals of any one submittal topic.
3. The cost Audio-Visual Consultants time for additional submittal reviews due to non-conformance with the requirements listed herein will be borne completely by the Audio-Visual Contractor.

B. Pre-Award Submittal: The submittal must justify in the judgment of the Consultant, the Architect, and the Owner that the Audio Visual Bidder meets the requirements, that he has the capability to perform the specified work for a project of this size and scope, and that he is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service. The Owner reserves the right to evaluate and, if desired, waive certain of the below criteria and requirements if it is deemed to be in the best interest of the project. In all cases, the Contractor should submit all applicable criteria regarding their qualifications for evaluation. Submit the following as applicable:

1. A detailed brochure describing its capabilities in terms of facilities, personnel, experience background, examples of similar installations, distribution arrangements with manufacturers and financial capability (including satisfaction of the project bonding requirements).
2. Proof that contracting firm has at least five (5) years' experience in the fabrication, assembly, and installation of audio-visual systems of similar magnitude and quality as specified herein.
3. Information identifying any and all local agents and/or subcontractors assisting in the work.
4. Identification of all sources of labor for all fabrication and installation throughout the duration of the project.
5. Evidence of all necessary licenses and approvals to perform the specified work.
6. Information on how, and by whom, it will fulfill the requirements of the warranty period.
7. Information about three (3) representative projects, similar in scope to this project, completed within the past five (5) years. Include the Project Name, Project Location, Owner's Name, Owner's Address, Owner's Phone, and a contact person employed by the Owner familiar with the Audio Visual system.
8. With regard to equipment to be furnished, per Part 2, "Products" below:
    1) Submit a statement of subcontractors, franchises, distributorship, dealerships, arrangements and agreements with manufacturers of equipment to be used for this work.
    2) Submit a complete bill of quantities, including all material, components, devices and equipment required for this work. The bill of quantities shall be tabulated respective of each and every system as specified, in the order of the specification section 2 below, and shall contain the following information for each item listed:
        a) Quantity.
        b) Description.
        c) Manufacturer's name.
        d) Manufacturer's model number.
    3) Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the manufacturer's replacement model. The Audio-Visual Consultant shall be the final judge of the acceptability of substitutions
9. Credentials of its project engineer for review and approval. This person shall:
    1) Either be a university graduate engineer in electrical or electronic engineering of physics and have at least five years' experience with similar electronic and optical specialty systems, or have other experience and educational background appropriate for the Work as approved by the Consultant and the Owner
    2) Observe at all times a good working relation with the Architect's and Owner's representatives, and cooperate with engineers and technicians assigned by the Owner, who are charged with the operation and maintenance of the system.

3) Provide all technical liaisons between the Audio-Visual Contractor, the Architect, the Owner and the Consultant(s). This shall include participation in meetings and conferences. He will be required to be present at the project site for final inspection, approve the operating and maintenance manuals, and provide the specified instruction to designated members of the Owner's staff.

4) Be responsible for supervision of all technical work that is part of the contract. This supervision includes the following:

a) Preparation of all construction Drawings from information within the specifications and the Drawings, including approval and signing of all shop Drawings.

b) Supervision of shop fabrication and field installation work to assure conformance with the contract Drawings, the specifications, and the approved shop Drawings to assure workmanship of the highest quality. He shall oversee the testing of all assemblies and sub-assemblies prior to delivery to the project site.

5) Take a leading role in the specified testing of the completed installation to assure himself for the Audio-Visual Contractor that all specifications are met. Work with and assist the Consultant in his final testing for approval and acceptance of the system for the Owner.

10. Proof of the firm's current membership in (or at least two (2) supporting staff memberships in) two (2) or more of the following professional Audio Visual organizations for two (2) or more years:

1) NSCA: National Systems Contracting Association

2) ICIA: International Communications Industries Association

3) AES: Audio Engineering Society

4) USITT: United States Institute for Theatre Technology

11. Credentials of supporting staff who have received current factory certifications from any/all equipment manufacturers whose franchise agreements require it and who meet the following qualifications:

1) The supervisor of the work of this section shall have at least five (5) years direct professional experience with devices, equipment, and system installation of the type and scope specified herein.

2) All personnel engaged in the installation of this Section shall have at least three (3) years direct experience with devices, equipment, and system installations of the type and scope specified herein.

3) In addition, submit proof of at least two (2) current staff member certifications in two (2) or more of the following:

a) NICET-II (Certification by National Systems Contractor's Association)

b) NICET-III (Certification by National Systems Contractor's Association)

c) C-EST (Certification by National Systems Contractor's Association)

d) R-ESI (Certification by National Systems Contractor's Association)

e) CTS-D (Certification by International Communications Industries Association)

f) CTS-I (Certification by International Communications Industries Association)

12. Credentials of Control System Programmer:

    1) The Contractor shall employ a Level 3 or Level Ace control system certified programmer to provide the control system programming for this project. Submit proof of certification.

C. Post Award Submittals: submit within 30 days of award.

1. Submit four (4) copies and one (1) reproducible (CD-ROM [drawings as .dwg; documents as .pdf; software as per manufacturer's directions]) of the following:

    1) A statement of subcontractors, franchises, distributorship, dealerships, arrangements and agreements with manufacturers of equipment to be used for this work.

    2) Complete bill of quantities, including all material, components, devices and equipment required for this work. The bill of quantities shall be tabulated respective of each and every system as specified, in the order of the specification section 2 below, and shall contain the following information for each item listed:

        a) Quantity

        b) Description

        c) Manufacturer's name and model number

        d) Manufacturer's specification sheet

2. Schedule: Within fourteen (14) calendar days of the receipt of the notice to proceed the Audio-Visual Contractor shall prepare and submit for approval, in accordance with the General Conditions, a schedule which shall include, but is not limited to, the following:

    1) Submission of shop drawings, samples and layouts for all items described herein.

    2) Start and Completion date(s) for field installation work.

        a) Installation date(s) of all wires and cables in conduits and required cable trays.

        b) Date when fully-operational equipment racks will be fully tested and ready for Audio-Visual Consultant's observation.

        c) Delivery date(s) of all systems and subsystems to the project site.

    3) Start and Completion date(s) for shop fabrication work.

    4) Date of submission of samples for approval by the Architect of all finishes/materials which will be visible to the public.

    5) Programming of all remote control and Digital Signal Processing driven devices.

    6) Completion dates(s) for the following tests:

        a) Performance tests on all individual A/V components as they are received from the manufacturer in the Audio-Visual Contractor's shop.

        b) Performance tests on completed assemblies and subassemblies assemblies, including all racks in the Audio-Visual Contractor's shop.

        c) Performance tests on the completed systems as a whole prior to shipment to the project site.

        d) General performance testing of systems at the project site.

7) Completion dates for the following Shop and Field Observations.

a) Shop fabricated assembly and subassembly observation.

b) Substantial Completion Observation at the project site.

c) Final acceptance observation at the project site.

8) Submission date for operating, maintenance manuals, as-built drawings, documentation and closeout materials.

9) In the event the Audio-Visual Contractor wishes to deviate from the schedule once it is established and approved, he may do so only receiving written approval from the General Contractor.

D. Field and Shop Drawing Submittal:

1. Submit four (4) half-size copies and one (1) CD-ROM copy of the following:

1) Corrected items from previous submittals. All resubmitted drawings shall be identified with clouded changes. Label each cloud with delta number and date of resubmittal.

2) Control panel Layouts: Developed drawings of all control system panel layouts.

3) Functional Diagram: single-line block diagram showing interconnection of all components, receptacles, terminal blocks, controls, transformers and loudspeakers in addition to the active elements. Include terminal and cable numbers, all system and component labels. Show detailed system component information including but not limited to manufacturer's name, model number, any specialized part number option and all input and output connection information, for each piece of equipment. No drawing codes shall be permitted. Mount one (1) full-scale original or photograph (not blueprint) copy behind acrylic in the control booth for each system.

4) Floor plans, at scale of Contract Documents, showing the locations throughout the project of all receptacles, conduits, wireways, trays, pullboxes, junction boxes, equipment racks equipment and other devices with appropriate designations and fill.

5) Riser diagrams, showing all elevations, room numbers, conduit sizes, types and fills, box sizes and types, devices, equipment and rack designations.

6) Equipment rack elevation drawings scaled (1-1/2" = 1'-0" or larger):

a) Front Elevations: include equipment designation, manufacturer's name, model number, rack location and rack designation.

b) Rear Elevations: include AC power wireways and route of wiring harnesses.

c) Sections: include depth of all equipment components.

7) Patch bay elevations, showing all patch bay appearances and designations.

8) Samples for approval by the Architect of all finishes/materials that will be visible to the public including at least receptacles and controls with associated trim plate and each type of loudspeaker baffle and/or grille.

9) Cable schedules and run sheets, associates with each equipment rack and/or any isolated piece of equipment or device, including cable designation, type, manufacturer and manufacturer's type number, wire color, device and

terminal designation and device location, keyed to both the system block diagram and equipment rack elevation drawings.

10) Contractor fabricated items, detailed drawings showing all components, devices and equipment, including dimensions, component values, terminal designations, types, locations, manufacturer's name and model number.

11) Loudspeaker cluster and monitor loudspeaker supports stamped and signed by an engineer licensed in the project state. Include all loads, location of attachment to building structure, complete layout of all components, devices and equipment, including dimensions, methods of assembly, and connections to supporting construction, details of hardware, locations, manufacturer's name and model number. All design calculations, loads, etc. shall be shown.

12) All drawings shall be clear and legible. The minimum text size for all drawings shall be 1/8" high. Permissible scales shall be: 1/8"=1', 1/4"=1', 3/8"=1', 1/2"=1', 1"=1', 1-1/2"=1', 3"=1', 6"=1', and full scale

13) A bound volume or volumes of comprehensive specifications for all material, devices, components and equipment selected for use in this section, whether modified or not, provided as required under "Post Award Submittals" above.

E. Digital Signal Processor (DSP) System Submittal for Owner Review:

1. Prior to programming the Digital Signal Processing (DSP) system, the Contractor shall submit shop drawings per the project standards showing all screen layouts and control descriptions of all system functions to the Owner for review and comment prior to actual programming of the system. Shop drawings shall include screen layouts of the DSP software "Control Pages" for all "configuration presets" and "parameter presets". Submit all information in native file format and hard copy form to the Consultant for review and approval. The contractor shall incorporate all Consultant and Owner comments into the programming of the system.

2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the DSP system programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub-Assemblies (Refer to Part 3 paragraph entitled "System Performance Tests"). The Owner will review and comment upon the remote control programming, and the Contractor shall incorporate all Owner comments into the programming of the systems.

3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of thirty (30) days to observe the operation of the DSP system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the operation pages or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.

F. Control System Submittal for Owner Review:

1. Prior to programming the remote control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts, graphical user interfaces (GUI) and control descriptions of all remote control system functions to the Owner for review and comment prior to actual programming of the system. Submit in native file format and hard copy form. Shop drawings shall include control screen layouts of the touch panel pages for each venue, web page layouts (as required in Part 2 below). Submit electronic versions for Owner review. The Contractor shall incorporate all Owner comments into the programming of the systems.

2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote control

programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub- Assemblies (Refer to Part 3 paragraph entitled "System Performance Tests"). The Owner will review and comment on the remote control programming submittal, and the Contractor shall incorporate all Owner comments into the programming of the systems.

3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of thirty days to observe the operation of the remote control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote control panels or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.

G. Shop Test Statement Submittals:

1. Submit four hard copies and one electronic of the following prior to shipping fabricated equipment racks to the Project site:

1) A bound volume, or volumes, of results of performance tests and adjustment data, including all test procedures specified in Part 3 paragraph entitled "System Performance Tests". Example Shop Test Statement submittal templates are available from the Consultant upon request.

2) Submit a written request for equipment rack observation certifying that equipment racks are completely assembled, tested and ready for inspection.

3) Detailed interior and exterior photos of assembly supporting claim for readiness for inspection.

H. Final Submittals: Submit the following Record Drawings developed from the final "as built" systems:

1. Four (4) half-size (15"x21") copies and one (1) reproducible of each of the block diagrams, plans, risers, patch bay drawings, rack elevations, cable schedules and detail drawings. All reproducible drawings shall be submitted on CD-ROM.

1) One (1) complete set of Functional diagrams dry mounted to matte board and set under clear acrylic cover.

2) One (1) additional set of rack elevation drawings, each drawing mounted in the associated equipment rack with a protective plastic cover

2. No more than thirty (30) days after Acceptance Testing, submit three (3) copies of each of the following manuals prior to, and as a requirement of, Owner Acceptance of the work of this section:

1) Equipment operating instructions; complete, comprehensive instructions for the operations of all contractor-fabricated devices and equipment items provided as part of the work of this section.

2) Manufacturer's installation, operating and service information including schematic diagrams for each item of equipment furnished. Order the equipment manuals in the order of the specifications. Provide tabs between each equipment manual. Provide a detailed index at the front of each manual indicating specification reference number, manufacturer's trade name, model number and part description. Provide three (3) copies to the Owner after they have been reviewed and approved by the Audio-Visual Consultant.

3) Printed material within contractor-fabricated equipment and systems operating manuals shall be bond paper copies, offset or letterpress printed. Drawings, charts and graphs shall be bond paper offset printed. The systems

contractor-fabricated equipment instruction manuals shall be composed using a single, consistent visual format and writing style; text shall be derived from component equipment manufacturer's instruction manuals and may include reproductions of artwork and other materials.

3. Submit four (4) copies of each of the following schedules, lists, and data prior to, and as a requirement of, Owner Acceptance of the work of this section:
    1) All source code for any contractor provided or programmed equipment on CD-ROM.
    2) Final bill of quantities; complete bill of quantities all material as delivered, including a separate schedule of portable equipment.
    3) Equipment schedule; complete, final schedules of equipment and devices provided in each room, by room number and name.
    4) Performance, test and adjustment data; comprehensive documentation of all performance verification and correction procedures and measurements, including raw and equalized house curves and equalizer settings.
    5) Maintenance and spare parts schedules; a comprehensive tabulation of equipment, devices, miscellaneous parts and maintenance items, including manufacturer's name, address, model number, systems use and miscellaneous information.
4. No more than thirty (30) days after Acceptance Testing, provide one (1) copy of the following:
    1) Certificates; any and all licenses, certificates of operation and/or compliance as required.
    2) The system will not be accepted until these documents are reviewed and approved by the Owner's Representative.

1.5 QUALITY ASSURANCE

A. Unless otherwise stated, all electrical, electronic and optical equipment shall be a product of firms regularly engaged in the manufacture of electrical, electronic or optical equipment. The equipment shall be the latest model or type offered which meets the applicable specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review. It shall be the Contractor’s responsibility to provide the Audio-Visual Consultant with information regarding discontinued products listed as alternatives in the specification. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the manufacturer’s replacement model.

B. Quality of workmanship and fabrication of all equipment and components, which are custom fabricated shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and shall be verified by observation. Only firms having 5 years experience in all aspects of the fabrication and installation of similar systems shall be allowed to perform the work.

C. All materials and products shall be new and of professional quality. Unless specifically stated in the drawings or specifications, no existing or pre-owned materials shall be installed.

D. The work specified herein, and in each of the allied sections, shall be accomplished by a single Audio-Visual Contractor experienced in the design, fabrication, installation, checkout and warranty contract management of systems such as those described in each section. This Audio-Visual Contractor shall have complete responsibility for the systems described herein and shall

be the single contract point for the Architect, the Consultant and/or the Owner with respect to all work specified herein.

E. Contractor Qualifications:

1. The Contractor shall have a minimum of five (5) years' experience in the fabrication, assembly, and installation of audio-visual systems of similar magnitude and quality to that indicated for this project.
2. The Contractor shall possess a current Contractors license in the appropriate category(ies) in the project state at the time of bid.
3. The Contractor shall employ a qualified project engineer on its staff assigned to this project. (Refer to Part 1 paragraph 1.5.E "Post-Award Submittal" subparagraph 12 "credentials of project engineer…").
4. The Contractor shall have current membership in (or employ at least two (2) staff with individual memberships in) one (1) or more professional Audio Visual organizations for two (2) or more years. (Refer to Part 1 paragraph 1.5.E "Post-Award Submittal" subparagraph 11 "Proof of firm's current membership in…").
5. The Contractor shall employ qualified staff assigned to this project. (Refer to Part 1 paragraph 1.5.E "Post-Award Submittal" subparagraph 13 "credentials of supporting staff…").
6. The Contractor shall employ a Crestron Certified Programmer to provide the control system programming for this project.
7. The Contractor shall employ a Crestron DMC-E Certified Systems Engineer to provide the digital media signal distribution design, oversee installation and perform commissioning for this project. Furnish proof of current certification.

1.6 WARRANTY AND SERVICE

A. The AV Contractor shall warrant the installation to be free of faulty workmanship.

B. All components, including solid-state devices, warranted free of defects for a period of one (1) year from date of final acceptance. This minimum warranty provision shall not diminish the terms of individual equipment manufacturers' warranties.

C. Paint and exterior finishes, fuses and lamps excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.

D. Provide maintenance service for a period of one (1) year after acceptance of installation. Service shall consist of at least two (2) semiannual visits to the site for checking and adjustment of equipment.

E. Response: Provide four (4) hour telephone warranty service, with 48-hour on-site technical response time. Provide a technician on call from 7 a.m. to 9 p.m. seven (7) days a week.

PART 2 - PRODUCTS

2.1 GENERAL

A. OWNER FURNISHED, CONTRACTOR INSTALLED EQUIPMENT

1. The owner intends to furnish the following pieces of equipment. The contractor shall provide all necessary cable, connectors, miscellaneous hardware, engineering and

installation labor, and depot level support for all owner furnished, contractor installed equipment for the duration of the project warranty as described above.

2. AV Contractor shall develop a schedule indicating delivery dates necessary for the receipt of all Owner Furnished equipment to ensure an on-time completion of the Work of this section. This schedule shall be coordinated with the Owner, GC and Consultant.
    1) ~~NONE~~Science On a Sphere Globe and Software Package
    2) Ancillary Interactive Kiosk Software Package (Kiosks are part of this scope)

B. ALTERNATES

1. Provide adjusted alternative pricing for replacing/upgrading the digital signage solution indicated on drawings. Include all necessary equipment, hardware, software, licenses, cable and labor (installation and programming) for a fully functional installation.
    1) NONE

C. MASTER QUOTES

1. Manufacturer Master Quotes have been prepared for the following items:
    1) NONE

D. ALLOWANCES

1. The AudioVisual Subcontractor shall carry the following allowances for work not yet fully defined:
    1) NONE

2.2 AUDIO AMPLIFIERS AND SIGNAL PROCESSORS

A. (AMP1) AMPLIFIER, 4 channel 150 Watt

1. Acceptable
    1) Ashly TRA-4150
    2) Consultant approved equal.

B. (DSP1) DIGITAL SIGNAL PROCESSOR TYPE-1

1. Acceptable
    1) Tesira Forte AVB AI with all required hardware, software and configuration
    2) Consultant approved equal.
2. Quantity
    1) Furnish frames as necessary to fulfill i/o count indicated.

C. (DSP2) DIGITAL SIGNAL PROCESSOR TYPE-2

1. Acceptable
    1) Tesira EX-MOD with
        a) Two (2) EOC-4 Cards
        b) all required hardware, software and configuration
    2) Consultant approved equal.
2. Quantity

1) Furnish frames/ cards as necessary to fulfill i/o count indicated.

2.3 AUDIO TRANSDUCERS

A. (S1) CEILING LOUDSPEAKER TYPE 1
   1. Acceptable
      1) Tannoy CMS801DC PI with CMS801PI Back Can
         a) All required Hardware
         b) Coordinate color with architect.
      2) Consultant approved equal.

B. (S2) CEILING LOUDSPEAKER TYPE 2
   1. Acceptable
      1) Tannoy CMS801DC PI with CMS801PI Back Can
         a) All required hardware
         b) Coordinate color with architect
      2) Consultant approved equal.

C. (S3) CEILING LOUDSPEAKER TYPE 3
   1. Acceptable
      1) Tannoy CMS501PI with CMS 501 Back Can
         a) All required hardware
         b) Coordinate color with architect
      2) Consultant approved equal.

D. (S4) SCIENCE ON SPHERE SPEAKER
   1. Acceptable
      1) Tannoy D15DCt
         a) Transformer version with supplied yoke bracket
         b) Coordinate color with Architect

E. FM Hearing Assistance System:
   1. Features
      1) Front panel audio input level.
      2) Multiple available channels (17).
      3) Balanced line input.
      4) Adjustable RF power Output.
      5) Multi-function LED Battery Level indication on receiver.
      6) LCD Display of system status on receiver and transmitter.
   2. Electrical Characteristics

1) 72 MHz frequency band, ensure frequency compatibility with local RF environment and other equipment.
2) Signal to noise ratio 60dB (wide band channels).
3) Output power (full) 100mW.

3. Acceptable:
   1) (ALS-HAS) Transmitter: Listen Technologies LT-800-072 or approved equal. (furnish quantity indicated on drawings)
   2) (ALS COMB) Antenna Combiner: Listen Technologies LA-82 or approved equal. (furnish quantity indicated on drawings).
   3) (ANT2) Universal Antenna Kit: Listen Technologies LA-122 or approved equal. (furnish 1 per transmitter)
   4) Rack Mount Kit: Listen Technologies LA-326 or approved equal. (furnish 1 per transmitter pair)
   5) Receiver, programmable: Listen Technologies LR-5200-072 or approved equal. (furnish 16 units)
   6) Ear Speakers: LA-401 or approved equal. (furnish 1 per receiver)
   7) Neck loop lanyard: LA-430 or approved equal. (furnish 1 per 4 receivers)
   8) Receiver storage/charging case, 12-unit: LA-380 or approved equal (furnish number of units required to simultaneously charge all receivers)
   9) ADA Compliance Kit: LA-304 or approved equal
   10) Remote Antenna Kit: LA-130 or approved equal

F. (WLS) MICROPHONE, WIRELESS, DUAL CHANNEL COMBO SYSTEM

1. Features:
   1) Dual channel diversity receiver with mic/line level output
   2) Operation in UHF band; 2400 selectable preset frequencies
   3) Dante audio outputs
   4) USB and Ethernet network control and monitoring
   5) Include all necessary connectors, coax cable, mounts, etc. required for antennas and receivers.
   6) Wireless microphone system shall consist of a dual channel receiver with a belt pack transmitter, lavaliere microphone and handheld microphone for each channel.
2. Electrical Characteristics:
   1) Audio Frequency Response: 50Hz to 15kHz
   2) Total Harmonic Distortion: <0.3% @1kHz
   3) Signal to Noise Ratio: >100dB (A)
   4) Selectable RF power 10/50mW
3. Acceptable: (Quantities are per system; furnish systems as shown on contract documents.)
   1) Shure ULXD Series consisting of:

a) Receiver: Shure ULXD Dual Channel Receiver (QTY:1)

b) Lavaliere Microphone and Belt pack Transmitter (LAPEL)r: Shure ULXD1 body pack transmitter & Shure 184 Clip on Microphone or approved equal. (QTY:2)

c) Handheld Microphone Transmitter: Shure ULXD2 handheld transmitter (black) with Beta 87A supercardioid, condenser microphone element (QTY:2)

2) Consultant approved equal

G. (TCD) AM/FM TUNER - CD PLAYER

1. Features/ Requirements

1) Plays music files from CDs, USB & SD cards

2) RS-232 Control

3) Furnish AM & FM antenna

2. Acceptable

1) Australian Monitor model MYMTCD

2) Consultant approved equal.

2.4 NOT USED

2.5 VIDEO

A. (HDTX) HD Base T Transmitter

1. Acceptable

1) Atlona AT-HDTX-RSNET

a) Furnish all necessary hardware and accessories and configuration.

2) Consultant approved equal

B. (HDRX) HD Base T Receiver

1. Acceptable

1) Atlona AT-HDRX-RSNET

2) Consultant approved equal.

C. (VP1) VIDEO PROJECTOR ~~—~~ Laser Phosphor ~~TYPE 1~~

1. Acceptable

1) ~~Epson G6900WUNL~~Panasonic PT-RZ570B/W

a) ~~Furnish 1 spare lamp & filter per unit~~Confirm throw distance.

b) Coordinate color with architect

c) Furnish mount and mounting hardware as required

2) Consultant approved equal.

D. (FPD1) FLAT PANEL DISPLAY-55", 4K~~-TYPE 1~~

1. Acceptable
    1) NEC ~~X552S~~X551UHD
        a) All required hardware and accessories
    2) Consultant approved equal

2.6 REMOTE CONTROL SYSTEM

A. General: The Control Systems consist of three (3) parts: Remote Control and Monitoring, DSP Control and Monitoring, and Crestron communications and interfacing.

1. The contractor shall provide programming for the remote control systems as described below and shown on the Category AV drawings. The Contractor shall submit shop drawings of all control screen layouts and control descriptions to the Architect for review and comment prior to actual final programming and installation.
2. Provide bi-directional feedback on all screens for all devices.
3. Labels and Text: Avoid abbreviations and acronyms. Device selection and control buttons will be labeled with clear text descriptions. Transport control buttons will use graphical icons. Lettering is 1/8" minimum sans serif font, maintaining background to text contrast. Use contrasting color to highlight function or feedback status.
4. Use positive logic. Avoid conditions that may cause command synchronization conflicts. Provide power sensors or other devices to ensure that positive logic conditions are maintained. Use RS-232 or RS-422 devices that provide feedback of equipment status to the control system.
5. Feedback shall be indicated in a logical manner on the touch screen at all times. The status of each controllable device shall be polled to reflect the most accurate state of the overall system condition at all times.
6. Link functions to require the fewest number of use actions to control the audiovisual equipment.
7. Each media selection clears the previous audio and visual selection (i.e. "CD SELECT" clears the audio as well as video selection of "DVD SELECT").
8. Default conditions shall be established for the system at power-up including device, warm-up routine, power conditions, switcher status and other default conditions.
9. Buttons (hard and soft) shall incorporate pilot lights or inverted illumination capabilities.
10. The programming shall be "foolproof" to the extent that each operation or sequence of operations does not cause the control system to become inoperable to interfere with further procession, correct operations or execution of commands.
11. Provide the following modules for control as required:
    1) Relays.
    2) Serial and Infrared (IR).
    3) RS 232 and RS 422 with adjustable baud rate.
    4) Logic Input Control.
12. Provide the following control system accessories as required:
    1) Control Bus Terminal Block (CTRLHUB): Crestron CNTBLOCK or approved equal.

2) Power Supply (PS): CNPWS-75 or approved equal.

3) Supply Com ports, IR ports and/or modules as necessary.

4) Provide additional accessories, including sync and power sensors, as required to provide a fully operational system.

5) Provide minimum 30-minute UPS backup for the RC units.

13. The Contractor shall be responsible for developing and implementing, with the assistance and oversight of the Consultant and Information Services personnel, an expansion of the existing facility-wide Web-based Asset Management solution. This solution must include at least the following features:

1) [DELETED]

2) Remote monitoring and control of all applicable AV devices furnished under this scope. Furnish interfaces as necessary.

3) Multiple customizable layers or levels of organization.

4) Equipment scheduling capabilities such as turn on / turn off at specific times.

5) Provide Web client interfaces.

6) Email Notification.

7) Database integration.

8) Ability to generate customized reports.

9) iPad integration

B. Remote Control Submittals and Owner Review:

1. Prior to programming the remote control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts and control descriptions of all remote control system functions to the Owner's Representative and AV Consultant for review and comment prior to actual programming of the system. Shop drawings shall include control screen layouts of the touch panel pages for each panel, layouts (accessible by any AV PC computer on the AV network), DSP software "Control pages" for all preset configurations. Submit electronic versions of the software and to the Consultant for review and approval. The Contractor shall incorporate all Owner comments into the programming of the systems.

2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote control programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub-Assemblies (Refer to Section 3.2). The Owner will review and comment upon the remote control programming, and the Contractor shall incorporate all Owner comments into the programming of the systems.

3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of forty-five days to observe the operation of the remote control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote control panels or the functionality of commands. The Contractor shall make these changes prior to final acceptance of the systems.

C. Control System Help Menu:

1. Provide a detailed context sensitive help section to aid the operation and use of the media system. The help section shall provide a "novice" user with enough information to use every aspect of the programmed, controllable devices.

2. Provide a help button on every “page”.

3. The help button on each “page” shall open the section of the help menu specific to that “page”. Every button on that “page” shall be detailed in such section of the help menu.

D. Touch Screen Layout Description:

1. Programming: System Screens shall be ordered, mapped, and the buttons defined as deemed necessary by the Consultant. The goal of the remote control system programming is to provide a simple, user-friendly interface to the audio-visual system. With this in mind, each button on the remote control panels may initiate control of multiple devices to streamline operation of the system.

2. Template: Layouts shall be clear, uncluttered, professional, and up to date.

3. Title Screen: Contractor shall obtain bitmap file of the Owner’s logo for this screen. Touching the screen in any location will bring user to the Main Menu screen. This is the default start up screen for power up and sleep mode.

E. Remote Control Submittals and Owner Review:

1. Prior to programming the remote control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts and control descriptions of all remote control system functions to the Consultant and Owner for review and comment prior to actual programming of the system. The Contractor shall incorporate all Consultant and Owner comments into the programming of the systems.

2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor’s facilities that include the remote control programming. This demonstration shall coincide with the Owner’s Representatives observation of Completed Sub-Assemblies (Refer to Paragraph 3.2). The Consultant and Owner will review and comment upon the remote control programming and the Contractor shall incorporate all Consultant and Owner comments into the programming of the systems.

3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of 90 days to observe the operation of the remote control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote control panels and/or the functionality of commands. The Contractor shall make these changes, at no cost to the Owner, prior to final acceptance of the systems.

F. (RC1) REMOTE CONTROL SYSTEM - TYPE 1

1. Acceptable:

1) Crestron PRO3

2) expansion modules as required

2. Consultant Approved Equal

2.7 A/V DATA NETWORK DISTRIBUTION SYSTEM

A. (DSWCH1) 24 PORT MANAGED POE+ SWITCH WITH UPLINK

1. Features

1) All ports POE+

2. Acceptable

1) Cisco Catalyst WS C2960S-24PD-L

a) Furnish uplink modules as necessary/ shown

B. (AVPC) CONTROL & MONITORING COMPUTER:

1. Features:

1) Desktop form factor chassis (DT) with low-profile: (1) PCI, (1) PCIe x1, (2) PCIe x16 expansion slots.

2) ATX motherboard with minimum 3.40 GHz i7-3770 quad-core processor, 4GB DDR3-1600MHz RAM,

3) AMD Radeon HD 7570 1GB graphics card, dual output

4) SATA DVD +/- RW Writer

5) Dual, 160GB(min.), Solid-State hard drives, RAID 1

6) Dual 10/100/1000 Base Ethernet NICs

7) 104 key PS2 keyboard

8) Three button laser wheel mouse.

9) Windows 7 Pro, 64 bit

10) Provide Middle Atlantic custom CPU rack kit.

11) Optional 3-year next business day onsite service plan

12) Install and fully configure all relevant control and monitoring software packages.

2. Acceptable:

1) HP 6300 Pro Workstation and ancillary components/options.

C. (SOS-PC) SCIENCE ON SPHERE COMPUTER:

1. Features:

1) Desktop form factor chassis (DT) with low-profile: (1) PCI, (1) PCIe x1, (2) PCIe x16 expansion slots.

2) ATX motherboard with minimum 3.40 GHz i7-3770 quad-core processor, 4GB DDR3-1600MHz RAM,

3) ~~AMD Radeon HD 7570 1GB~~NVidia GTX-970 graphics card, ~~dual~~ quad output

4) SATA DVD +/- RW Writer

5) Dual, 160GB(min.), Solid-State hard drives, RAID 1

6) Dual 10/100/1000 Base Ethernet NICs

7) 104 key PS2 keyboard

8) Three button laser wheel mouse.

9) Windows 7 Pro, 64 bit

10) Provide Middle Atlantic custom CPU rack kit.

11) Optional 3-year next business day onsite service plan

12) Install and fully configure all relevant control and monitoring software packages.

13) Confirm system compatibility with NOAA – SoS personnel prior to ordering.

2. Acceptable:
    1) HP 6300 Pro Workstation and ancillary components/options.

D. (IDS-PC) INTERACTIVE DISPLAY COMPUTER:

1. Features:
    1) Desktop form factor chassis (DT) with low-profile: (1) PCI, (1) PCIe x1, (2) PCIe x16 expansion slots.
    2) ATX motherboard with minimum 3.40 GHz i7-3770 quad-core processor, 4GB DDR3-1600MHz RAM,
    3) AMD Radeon HD 7570 1GB graphics card, dual output
    4) SATA DVD +/- RW Writer
    5) Dual, 160GB(min.), Solid-State hard drives, RAID 1
    6) Dual 10/100/1000 Base Ethernet NICs
    7) 104 key PS2 keyboard
    8) Three button laser wheel mouse.
    9) Windows 7 Pro, 64 bit
    10) Provide Middle Atlantic custom CPU rack kit.
    11) Optional 3-year next business day onsite service plan
    12) Install and fully configure all relevant control and monitoring software packages.
    13) Confirm system compatibility with NOAA – SoS personnel prior to ordering.
2. Acceptable:
    1) HP 6300 Pro Workstation and ancillary components/options.

E. (MON) PC DISPLAY

1. Acceptable
    1) Acnodes RP1195 W/ HDMI and Speaker
    2) Consultant approved equal.

F. (KBD) PC KEYBOARD

1. Acceptable
    1) Acnodes RK1500U
    2) Consultant approved equal.

G. (KVM) KEYBOARD/VIDEO/MOUSE SWITCH

1. Acceptable
    1) Adder ADDERView 8 PRO DVI
    2) Consultant approved equal.

2.8 RACKS, WIRE, CONNECTORS AND MISCELLANEOUS HARDWARE

A. (RACK) AV Equipment Rack
   1. Features:
      1) 45 X 1-3/4" rack space elevation.
      2) Accepts EIA standard 19 panel width, 27” overall rack depth, 24.2” usable depth.
      3) Gangable with 4” cable chase in between
   2. Acceptable: Middle Atlantic BGR-4527 with
      1) Furnish Solid Front Door
      2) Furnish Thermostatically controlled Fan Kit(s): Provide in rack, and coordinate room, ventilation sufficient to maintain all equipment within manufacturer recommended temperature parameters.
      3) Provide top panel coordinated with fan and cable entry requirements
      4) Furnish Rear Rack Rails
      5) Furnish 1 pair of side panels per stand alone rack, or 1 pair of side panels per ganged set of racks.
      6) Furnish BGR-ISO-Z4 Seismic Isolation Brackets

B. (FPD) Flat Panel Display Backbox
   1. Acceptable
      1) Chief Mfg. PAC501B and PWIR Series mount with all required hardware and configuration.
      2) Consultant Approved Equal

C. Rack Panels:
   1. Blank Panels:
      1) Features:
         a) 1/8" anodized brushed aluminum finish.
         b) 19" standard EIA width.
      2) Acceptable: Lowell, Middle Atlantic or approved equal.
      3) Quantity: As shown on drawings.
   2. Vent Panels:
      1) Features:
         a) 16 Ga. perforated steel with black power coat finish.
         b) 60% minimum open area.
         c) 19" standard EIA width.
      2) Acceptable: Lowell, Middle Atlantic or approved equal.
      3) Quantity: As shown on drawings.

D. Rack Kit(s):

1. Features:
    1) 1/6" anodized brushed aluminum finish.
    2) Custom manufactured for each piece of equipment.
    3) 19" standard EIA width.
2. Acceptable: Middle Atlantic or manufactures optional rack kit.
3. Quantity: 1 for each non-standard 19" EIA piece of equipment.

E. (BAL/UBAL) Line Input Transformer +4dB output to -10dB input:
1. Features:
    1) Unbalances "Pro" to "Consumer IHF" Outputs.
    2) Transformer isolation.
    3) Passive device.
2. Electrical Characteristics:
    1) Bandwidth: -3dB at 0.25 Hz and 100 kHz.
    2) Input impedance: 13 kohm.
    3) Common Mode Rejection: greater than 60dB.
    4) Insertion loss: 14dB
3. Acceptable: Jensen ISO-MAX PC-2XR or approved equal.
4. Quantity: 1 per unbalanced stereo input pair.

F. (ISO-A) Stereo unbalanced to mono balanced audio with isolation transformer
1. Acceptable:
    1) Radio Design Labs (RDL) TX-J2
    2) Consultant approved equal

G. (ISO-A2) 1:1 Line Transformer:
1. Features:
    1) 1:1 turn ratio.
    2) Transformer isolation.
    3) Passive device.
2. Electrical Characteristics:
    1) Bandwidth: -3dB at 0.25 Hz and 100 kHz.
    2) Distortion: > 0.001% THD
    3) Common Mode Rejection: greater than 60dB.
    4) Insertion loss: less than 1.5 dB
    5) Hum Rejection: greater than 60 dB.
3. Acceptable: Jensen ISO-MAX DM2-2XX or approved equal.
4. Quantity: Use as required.

H. Line Level Amplifier Interface:

1. Features:
    1) Balances unbalanced "Consumer" line level signals.
    2) Unbalances balanced "Pro" line level signals.
    3) Servo Balanced inputs and outputs.
    4) 600-ohm termination switch.
2. Electrical Characteristics:
    1) Frequency response: -0dB +0.5 dB from 5 Hz to 100 kHz.
    2) Distortion: 0.005 THD
    3) Common Mode Rejection: greater than 45dB.
    4) Insertion loss:
        a) - 14dB +-6dB ("Pro" to "Consumer")
        b) + 14dB, +- 6dB ("Consumer" to "Pro")
3. Acceptable: Aphex Model 124 or approved equal.
4. Quantity: 1 per "consumer" -10 dB unbalanced stereo pair.

I. Rack Power Conditioner:

1. Features:
    1) Power line filters for spite and RFI control.
    2) 20 amp power conditioning capacity.
2. Acceptable: SurgeX SX1120-RT or approved equal.
3. Quantity: Provide 1 per equipment rack provided.

J. (A-#) AUDIO PATCH PANEL:

1. Features:
    1) 48x2 mini-weco jacks
    2) Programmable configuration
2. Acceptable:
    1) Bittree B96DC-FNSST/E3 M2OU12B series (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)
    2) Furnish (1) 36" patchcord per jack pair
    3) Consultant approved equal

K. (DM-#) DIGITAL MEDIA PATCH BAY

1. Features
    1) 24-port Category 6 rated STP patch field
    2) Fully populate all jack locations
    3) Furnish (1) 36" patchcord per jack pair
2. Acceptable
    1) Bittree DSKP124-C6FTS

2) Consultant approved equal.

L. Audio Terminal Blocks:

1. Features:

1) All mic, line level and DC control cables interconnecting with an equipment rack shall connect to an audio terminal block, prior to exiting the rack or landing on a piece of equipment.

2) Rated for stranded 20 GA - 24 GA wire.

2. Acceptable: WAGO Style modular terminal blocks (must be used in conjunction with cable end ferrules and mfg. recommended tooling).

M. High-Level Audio Terminal Blocks:

1. All loudspeaker lines leaving an equipment rack shall be connected via barrier-type screw terminal blocks.

N. Installed Wiring: (NOTE: Non-plenum versions listed, furnish plenum equivalents as required by Code.)

1. Loudspeaker lines in conduit: standard electrical wire, stranded copper, color-coded, THHN/THWN type.

1) CONDUIT HAS BEEN SIZED FOR THHN

2) Low Z: AWG #10 unless otherwise noted

3) High Z: AWG #14 unless otherwise noted

2. Loudspeaker lines not in conduit:

1) Low Z: AWG #10 equal to WestPenn/CDT HA210 or consultant approved equal.

2) High Z: AWG #14 equal to WestPenn/CDT 226 or consultant approved equal.

3. Mic and Line, twisted, shielded pair #22: equal to Belden 8761 or WestPenn/CDT (x)454 or consultant approved equal.

4. Production communication: Two shielded pairs #20 equal to Belden 8762 or consultant approved equal by WestPenn/CDT.

5. Video 75 ohm COAX, field/inter-rack runs greater than 150’ feet, conduit sized for .300" OD cables:

1) RG-6/U Type in conduit: Belden 1694A, WestPenn/CDT 6350 or Canare L-5CFB or consultant approved equal.

6. Video 75 ohm COAX, field/inter-rack runs greater than 25 feet / less than150’, conduit sized for .250" OD cables:

1) RG-59/U Type in conduit: Belden 1505A, WestPenn/CDT 819 or Canare L-4CFB or consultant approved equal.

7. Video 75 ohm COAX, inter/intra-rack runs less than 25 feet

1) RG-59/U Type: Belden 1865A, WestPenn/CDT HD825 or Canare L-3CFB or consultant approved equal.

8. DC Control Lines:

1) low current loads (mute, VCA, LED): AWG #20.

2) medium current loads (relays, switch lamps): AWG #18.

9. RF: 50 ohm.
    1) (runs <25') Acceptable: Belden 8240 or approved equal.
    2) (runs >25'<75') Acceptable: General C1176A or approved equal.
    3) (runs >75') Acceptable: Belden 8214 or approved equal.
10. RF: 75 ohm.
    1) RG-6/U Acceptable: Comm/Scope F690BV or approved equal.
    2) RG-11/U Acceptable: Comm/Scope 5912 or approved equal.
11. Digital Remote Control Lines:
    1) Acceptable: Carol 1130, West Penn 271, or approved equal.
12. Unshielded, Twisted Pair:
    1) Category 5e
        a) Acceptable: Berk-Tek LanMark-350, or approved equal.
    2) Category 6
        a) Acceptable: Berk-Tek LanMark-1000, or approved equal.
13. Digital Media Cable
    1) HDMI – Only pre-made factory terminated and V1.4 certified cable assemblies shall be permitted.
        a) (runs <15') Category 2-HighSpeed w/Ethernet: Blue Jeans Cable (Belden Series-FE).
        b) (runs >15'<30') Category 2-HighSpeed w/Ethernet: Blue Jeans Cable)Belden Series-1).
    2) Copper (DM over one-wire cable requirements)
        a) Category 5e Shielded Twisted Pair (STP) equal to Crestron DM-CBL-8G-NP cable or manufacturers approved equal
    3) Fiber
        a) Crestron CresFiber8G or approved equal

O. Portable Cables:
1. Reusable Portable Cable Tie
    1) Acceptable: Rip-Tie CableWrap no known equal.
    2) Quantity: 1 per portable cable provided.

P. Connectors and Receptacles:
1. Only metal connector shells and bodies are permitted.
2. Mic and Line:
    1) Solder only. No IDC, 1-piece compression or screw terminal versions permitted.
    2) Input: 3-pin female XLR-type and 1/4" TRS jacks where shown on drawings. Insulate 1/4" jacks from plate, do not ground pin 1 on XLRs.
    3) Output: 3-pin male XLR-type and 1/4" TRS as above.

4) RCA: Only solder style, metal connector shells and bodies are permitted., no "molded assemblies" shall be permitted

3. Loudspeaker:
    1) Only Neutrik Speakon devices are acceptable.
    2) Wire all terminals unless otherwise noted.
    3) Panel: Neutrik NL4MP or NL2MP as required.
    4) Cords: NL4FC.
    5) Cable couplers: Neutrik NL4MM.
    6) Wooden box mounting: Neutrik NL4MPR.
    7) All NL4 devices shall be cabled for two channel operation unless otherwise noted.
4. Video: 75 ohm Coax
    1) Only 3-piece BNC devices are acceptable.
    2) No IDC, compression or screw terminal versions permitted.
    3) Extron BNC's shall not be permitted
    4) Panel-mount recessed BNC: Neutrik D-Series
    5) Cable:
        a) Canare BCP-C3B for Vx-3C series cables.
        b) Canare BCP-C4B for use with RG-59 cables.
        c) Canare BCP-C77A for use with LV-77S cables.
    6) Cable couplers: BNC male/male barrel
    7) HDMI: Cables shall be Cat-2 certified for 10.2 Gb/s and shall carry the HDMI logo.
5. Control: submit cut sheets.
6. Production Communications: 3-pin and 6-pin male XLR-type as shown on drawings

Q. Receptacle Panels, aluminum:
1. Field-verify panel sizes required for backboxes.
    1) Oversize flush panels sufficient to trim wall openings but not less than ½”
    2) Size surface mount panels exactly to backbox yielding no sharp corners and chamfering edges
2. Aluminum panels 0.125” thick, with labels engraved and back-filled in black
3. Anodized, horizontal brushed finish
4. Submit engraved sample for approval by architects.

R. DC Power Supplies:
1. Voltage and capacity as required with 100% headroom, UL (or other) listed: Acopian linear or approved equal, submit cut sheets.
2. Provide and install in shielded metal chassis with fused LED status indicators.

S. UPS Uninterruptible Power Supply

1. Acceptable: SurgeX SU-2000-Li
    1) Rack mounted, furnish one unit per each rack populated with the following devices:
        a) AVPC's
        b) RC's
        c) DSP's
        d) Data Switches
    2) Furnish expansion batteries as required to power AVPC's, RC's, DSP's and Data Switches for 30 minutes minimum.
2. Consultant Approved Equal

T. (V-#) HD/SDI DIGITAL VIDEO PATCH PANEL:

1. Features:
    1) 2x24 mini-weco jacks
    2) Full-Normal configuration
    3) Furnish (1) 36" patchcord per jack pair
2. Acceptable:
    1) Bittree B48S-2WHD
    2) Consultant approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. The following installation requirements shall govern the design, fabrication and installation of the system(s) specified herein. In case of a discrepancy between these overall system standards and the individual equipment item specifications, the latter shall govern:
    1) The equipment specified shall be installed according to standards of good human engineering practice and the conditions specified herein.
    2) Workmanship on the installed systems shall be of professional quality, best commercial practice and accomplished by persons experienced in the techniques and standards of the particular industries involved.
    3) The specifications describe required performance. The specifications with the contract drawings indicate a general design; it is the intention of the specifications that the Audio-Visual Contractor will supply from his background of experience and knowledge the necessary supporting details; for example, the implementation of specific components into functioning sub-systems.
    4) In general, the drawings show dimensions, positions, and kind of construction. The specifications describe materials, qualities and methods. Any work called for on the drawings and not mentioned in the specifications, or vice versa, shall be performed as though fully set forth in both. In case of differences

between the drawings and the specifications, the decision of the Owner's Representative shall govern. Work not particularly detailed, marked or specified, shall be construed to be the same as similar parts or areas that are detailed, marked, or specified.

2. Equipment markings shall present only needed information and be readable from the operator's normal work position. These markings shall be designed to minimize ambiguous interpretation.

3. Control panels shall be designed to reduce chances of human error and controls shall be natural and consonant with normal operator expectations.

4. All control consoles and their panel mountings shall be provided with the necessary controls, indicators and switches, etc., as outlined in the pertinent sections of this specification. The grouping of these facilities shall be in accordance with the associated drawings and shall, in all cases, be arranged to present an orderly, functional appearance. The layout of controls shall be such that priority of accessibility shall be given to those facilities which frequently require attention.

5. The total design of the system shall simplify the operator's task and insure maximum performance and reliability while minimizing possibilities for human error and providing a comfortable environment for the operator during operation.

6. At the operational level (i.e., patch panels, Audio-Visual equipment receptacle boxes, etc.) all receptacles shall be clearly marked by function and number. When there are multiples of the same function for example, a given microphone line may appear at several locations, the same label shall be shown at each location.

B. The Conduit System:

1. The category AV drawings indicate the number, type and location of the receptacle, wire and cable requirements and Equipment Room layouts, which are the responsibility of the Audio-Visual Contractor. The conduit diagrams indicate schematically the functions served by the conduit system. Also, the conduit diagrams may indicate the locations at which functions are served at several locations in the facility. See the general installation notes for additional information and requirements as shown on the category AV drawings.

2. The Electrical Contractor shall provide the conduit system shown on the category AV drawings. If the conduit installation is concurrent with the present contract, the Audio-Visual Contractor shall inspect the work at appropriate times during construction and report any discrepancies to the Architect and General Contractor in writing. The Audio-Visual Contractor shall coordinate the exact location of intermediate collector boxes behind the equipment rack(s) with the electrical contractor.

3. The Electrical Contractor shall verify continuity of all conduit as described in the category AV drawings with a yellow pull string.

4. The Audio-Visual Contractor shall be responsible for supplying any additional conduit that may be required to complete the system installation in accordance with the drawings.

5. It shall be the responsibility of the Audio-Visual Contractor to obtain the exact location of any pull boxes, "LBs" or other intermediate locations from the Electrical Contractor.

6. The Audio-Visual Contractor shall also verify that conduits are adequate for the wiring and functions specified. If the Audio-Visual System Contractor substitutes the specified wiring the Audio-Video Contractors hall bear the sole responsibility for reengineering the conduit system.

7. The Audio-Visual Contractor shall field verify all back box installation conditions on site and shall size connection panels as described below. Notify the Audio-Visual Consultant of any discrepancies between AV drawings and installation conditions.

1) Surface Mounted Back Boxes: Connection panels shall be sized to match the outer edges of the installed back box and shall have smooth edges.

2) Recessed Mounted Back Boxes: Connection panels shall be sized to overlap the outer edges of the installed back box by 1” in both horizontal and vertical directions and shall be installed tightly against the wall surface finish.

8. Each conduit shall contain wires or cable of the same signal level or the same type of circuitry only. Each separate service level designation shown on the AV conduit riser shall be run in their respective, separate conduits and all conduit landings in backboxes or equipment racks shall be grouped by service level.

9. Ground power conduits to the power system ground. Do not connect power system conduits to the racks or to the audio system ground.

C. Equipment Room(s) Arrangement:

1. The general layout for these rooms is indicated in the drawings. The Audio-Visual Contractor shall prepare and submit a detailed layout for approval by the Owner's Representative. This drawing shall include, but not be limited to, the equipment racks, the operator's console and monitoring station, the lighting system and the fire suppression/extinguishing system.

2. Maintain accessibility to the rear of the equipment racks. In the event that the equipment room is not large enough to maintain minimum rear access clearance as mandated by National Electric Code, local code requirements and herein, the equipment racks shall be mounted on 3" casters or use an extension system. If casters are used the Audio-Visual Contractor shall engineer a locking mechanism and submit it for approval by the Owner's Representative. See specification section 3.01D5 for minimum clearance information.

D. Equipment Rack Assemblies:

1. General:

1) Equipment rack(s) shall be completely assembled, tested and programmed in the Audio-Visual Contractor's shop. No rack assembly shall be performed at the project site. After the equipment racks are tested the Audio-Visual Contractor shall notify the Owner's Representative in writing that the equipment rack assemblies are ready for observation and approval. Allow adequate time for any modifications necessary to satisfy the contract drawings and specifications.

2) Use rear and mid rails for intermediate terminations. Maintain accessibility to the rear of the equipment.

3) Mid rails must be used to support equipment weighing more than 50 pounds.

2. Wiring Harnesses:

1) Equipment rack wiring shall be "Harness" style. "Point to Point" rack wiring is not acceptable. The individual wiring harnesses shall be located at the front of the equipment rack and individual pairs of cable shall be broken out around the side of the equipment to the rear where the connectors are located.

2) Electrical service levels shall not be mixed in an individual harness. It is the intent that there will be a separate harness for each electrical service level.

3) Great care shall be exercised to keep low level signal harnesses separated from the AC power lines and high level signal harnesses.

4) When 3 or more equipment racks are used, interconnection between equipment racks shall be performed with multi channel cable and multi-pin

connector assemblies. It is the intent that each rack shall be a complete stand-alone assembly allowing the system to be completely tested in the Audio-Visual Contractor's shop.

3. Equipment Labels:
    1) Rack-mounted equipment shall be labeled on front and back, as to function using engraved black/white laminated plastic blocks. For example: LEFT HI-FREQ AMPLIFIER or CENTER EQUALIZER
    2) Use permanent professional quality labels such as "Lamacoid" or approved equal. Stick-on strip labels such as those from Dyno, Brother or Kroy are not acceptable.
    3) The labels shall directly relate to the device names indicated on the as-built drawings.
4. Internal A/C Receptacles:
    1) Maintain grounding as shown on contract drawings and described in the herein.
    2) In general, locate all internal AC receptacles on the left side of the rack and all harnesses on the right side of the rack. In the event that there are 2 equipment racks side by side locate the A/C receptacles in the middle of the equipment racks and the wiring harnesses to the outer sides.
    3) Furnish each equipment rack with a full height AC plug strip with receptacles sufficient for powering all equipment contained with plus 20% for future expansion.
    4) The use of “Waber” strip style plug strips, commercial or consumer grade is strictly prohibited.
    5) All “wall-wart” style power supplies shall be firmly secured to the plug strip using 3M Dual-Lock™ recloseable fastener strips or single Ty-wraps, joined or linked ty-wraps are not permitted.
    6) Provide one high-intensity LED lamp with magnetic mount for each equipment rack.
5. Installation:
    1) No equipment may be installed prior to the following:
        a) The Consultant has performed the A/V Equipment Rack Observation in the A/V Contractor’s Shop.
        b) Any and all punch list items described as ‘minimum to enable rack delivery to site’ have been addressed, proof has been submitted to Consultant, and Consultant has approved rack delivery to site.
        c) Notice has been filed with the General Contractor, the Architect, and the Consultant that a ‘dust-free’ environment has been achieved in the project in all areas where audiovisual system equipment is to be installed. Dust-free shall be defined as follows: all floor, wall, ceiling construction, millwork, finishes (including paint), carpet, hardware, electrical, and HVAC is absolutely complete (and tested and fully operational in the case of electrical and HVAC systems) before A/V equipment racks may be delivered to the site.
    2) The equipment rack(s) shall be installed in the Equipment Room(s) in the configuration shown in the drawings. The plan shall allow for an absolute

minimum of 36 inches, preferably 42 inches, of clear space measured from the front of the rack(s) and from the rear of the equipment rack(s) to any installed equipment or walls.

3) All stationary equipment rack(s) shall be secured to the building structure to meet seismic and code requirements.

4) Interconnecting multi-channel cabling shall be led laterally from equipment rack to the vertical rack member, opposite from the AC power and then run vertically, remaining as exposed and accessible as possible. Wherever corners in multi-channel cabling occur strain relief spiral covering shall be used. All cable clamps shall be non-conducting or have soft insulating covers.

5) Great care shall be exercised to keep low level signal lines separated from the AC power lines and high-level signal lines.

6) All audio field lines entering the Equipment Racks must be connected with an intermediate terminal block. Video field lines may be connected directly to the switcher or patch bays. In the event that a patch bay with an E3 or E90 connectors is used, the patch bay may serve as the terminal block. This will also facilitate the testing of the systems in the Audio-Visual Contractor's shop.

7) All connections of lines at terminal blocks, as well as at signal receptacles, shall be mechanically secured and then soldered. No unsoldered connections shall be permitted. Where lines approach the racks and terminal blocks they shall also be mechanically anchored at the rack, and provided with sufficient slack length to avoid strain, abrasion or wear.

E. Wiring and Cabling:

1. General:

1) Extreme care must be taken to physically segregate and separate all high level lines from lower level lines.

2) Control cables and power distribution wiring shall not be installed adjacent to signal cables. Power distribution cabling shall be on the opposite side from signal wiring in equipment enclosures and shall be uniformly located throughout an installation.

3) A wall location near the racks shall be chosen and suitable suspension "fingers" provided so that all patch cords of a given type can be grouped and suspended.

4) All wire and cable utilized in systems interconnection shall be of the flame-retardant type (FR-1 flame test).

5) All cabling or system interconnection which passes through or into acoustically isolated areas, such as sound locks and studios, shall be suitably sealed after cable has been installed.

2. Wire Labels:

1) During installation both ends of all wires or cables shall be clearly labeled with approved wire labels.

2) The wire labels shall be numbered consecutively with respect to the patch bay with a leading service level designation. If there are no patch bays utilized in the system the wire labels shall be numbered consecutively with a leading service level designation.

3) The wire labels shall not be more than 8 inches or less than 4 inches from the connector or termination at each end of the cable.

4) Wire labels shall utilize plastic shrink-wrap, protecting the text and ensuring they remain affixed to the wiring. Approved: Thomas and Betts or approved equal, submit sample to the Owner's Representative.

3. Documentation:

1) Maintain a careful running log of route and terminations for each cable.

2) A detailed wiring diagram shall be furnished with wire numbers shown as part of the as-built documentation. All spare cable shall be shown on the as-built documentation.

4. Cable Management:

1) Cabling and wiring within the Equipment Room(s), that are semi-permanent (i.e., those leading from rack to rack, rack to conduit terminus or rack to equipment locations) shall be carried not within conduit, but rather within ducts, troughs or cable trays mounted along walls or below the ceiling.

2) Appropriate hooks along the wall or on the ceiling will aid in running occasional or frequently changed extension cables to use position.

3) Cables shall be grouped and bundled by type and routed from source to termination in a uniform manner throughout all equipment housings. Care shall be taken not to break the insulation or deform the cable by harness supports. Cables shall not change relative position in a cable group throughout a cable route.

4) Cable support bars shall be installed to support cables in areas of dense harness breakouts such as behind patch panels, distribution amplifiers and other multiple input/output devices.

5) Edge protection material ("cat track") or grommets shall be installed on the edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edges.

5. Terminations:

1) The Audio-Visual Contractor shall employ the latest industry-standard termination practices and materials.

2) Signal and control cable ends shall be neatly formed, and shrinkable tubing shall be applied where necessary to secure the insulation against fraying or raveling.

3) Internal rack terminations and field terminations shall be made with Wago style modular terminal blocks. All wires shall be fitted with ferrules prior to insertion.

4) Punch block terminations are not acceptable and shall not be allowed except in the case of Category style data terminations.

5) Coaxial connectors shall be three-piece crimp-on style. Audio and control wires shall be terminated with crimp-on Thomas and Betts® style lugs.

6) All bare wire shall be tinned prior to termination unless the connector manufacturer recommends otherwise.

7) Unused line level shields shall be individually insulated using shrinkable tubing and attached to the cable using an additional piece of shrinkable tubing.

8) Pre-made, molded cable assemblies, the sorts of which are typically supplied with consumer grade electronics are not permitted for use on this project. Only custom made and commercial grade, factory certified assemblies shall be accepted. The Consultant shall be the final judge on the acceptability of any given cable assembly.

9) All cable pin out and connector conversions shall be performed utilizing factory terminated, certified cable assemblies. Adapters, gender changers, format converters shall not be permitted unless indicated on the contract documents or otherwise specifically authorized by the AV consultant.

10) All panel mount connectors shall be secured with Kep® style lock nuts having integral external tooth lock washers and treated with LocTite® 242-Blue thread locking compound.

F. System Grounding:

1. The "spider" concept, as indicated in the grounding diagram, is designed to avoid ground loops and inductive coupling.

2. The systems shall be hum free, stable and free of oscillation with the earth ground temporarily disconnected.

3. The earth ground shall be made at only one point in the system as indicated and shall be in accordance with National Electric Code 2002 paragraphs 250.146(D), 406.2(D) and 480.20 Exception.

4. The grounding method shall insure that the system is free of the following problems under any mode of operation:

1) RF oscillation, pickup and interference.

2) Distortion.

3) Crosstalk.

4) Signal Leakage.

5) Very high frequency feedback.

6) Audio Hum.

5. Major wiring ducts or trays in the Equipment Room(s) shall be grounded to the conduit system.

6. The equipment racks shall be isolated from, and not electrically bonded to, the building conduit system. This means that the conduit system shall not be electrically connected to the equipment racks and that the equipment racks shall be installed so that they are electrically isolated from the building structural steel. The racks shall be electrically bonded at only one point to the isolated grounding system as shown on the category AV drawings.

G. Seismic Restraints:

1. All hanging or free-standing equipment and cabinets furnished including but not limited to racks, loudspeakers, projection screens, and TV monitors shall be secured to substantial building structures. The equipment described shall resist seismic acceleration in any direction up to a limit of the greater of 1.0 G or the limit prescribed by the local governing codes.

2. Maintain electrical isolation between the equipment racks and building steel.

3. Loudspeaker hanging details, rack bracing, and other seismic restraints are not shown on the contract drawings; it shall be the Audio-Visual Contractor responsibility to develop these drawings to a level suitable for structural review.

4. Submit mounting (rigging) drawings for all suspended equipment to the AV Consultant for review after they have been stamped and signed by a licensed structural engineer engaged in regular practice in the Project's State.

H. Audio System Processing Adjustments:

1. The AV Contractor shall program the DSP system to include filters adjusted such that the loudspeaker zone(s) effected by same are measured to exhibit uniform (flat) frequency response (less than +/- 3 dB) at the listening location for the frequencies the transducer is designed/intended to address. Measurements utilized for determining filter adjustments shall be made on axis with respect to a single transducer (representative of the zone) in its intended field of coverage. Loudspeaker cross-over filters shall be provided first for all actively crossed transducers per loudspeaker manufacturer's instructions. Additional filters will still be required to achieve uniform frequency response measured at the various listening locations. For loudspeaker zones of small transducers, utilize high-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response. For loudspeaker zones of large transducers, where other transducers in the system will address higher frequencies, utilize low-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response.

2. The AV Contractor shall program the DSP system to include delay settings adjusted so that the direct sound from the main loudspeaker clusters and the delay zone transducers in question arrives simultaneously at the listening plane served by the delay zone transducers. The Audio-Visual Consultant may add additional delay to address 'imaging / Haas effect preferences' as appropriate.

3. Available DSP system components shall include (but not limited to) various forms of mixers, equalizers, filters, crossovers, dynamics/gain controls, routers, delays, remote controls, meters, generators and diagnostics.

4. The Audio-Visual Consultant may add additional filters and delay (as required) to address 'tuning preferences', but such 'tuning preferences' shall not be considered as part of the base line requirements for determining substantial completion of the audio system. Flat frequency response and time alignment of the direct sound from the loudspeakers will be considered a base line requirement for determining substantial completion of the audio system.

I. Loudspeaker Installation:

1. Verify all loudspeaker aiming and positioning with Owner's Representative.

2. Submit loudspeaker mounting (rigging) drawings to the Architect for review after they have been approved and signed by a certified structural engineer engaged in regular practice in the Project's State.

3. All loudspeaker backcans must be secured to the building structure by qualified personnel in accordance with safe installations practices. Use suspension materials, connection fixturing and methods that are appropriate for the building structure and installation conditions. Employ a minimum 5:1 safety factor for each suspension point or greater as may be required by local code.

J. Video Projector Installation:

1. The video projector shall be converged, registered and color balanced. Obtain from the owner all scan rates and resolutions that are to be used and properly converge the projector

for all possible inputs. In addition, the Audio-Visual Contractor shall optimize the projector for the following standard scan rates and resolutions:

1) NTSC
2) HDTV, 720i, 720p, 1080i, 1080p
3) 640x480, 60Hz.
4) 800 x 600, 60Hz and 72Hz.
5) 1024 x 768, 60Hz, 70Hz, 72Hz and 75Hz.
6) 1152 x 870, 75Hz.
7) 1280 x 1024, 60Hz, 70Hz, 72Hz and 75Hz.
8) 1400 x 1050, 60Hz, 70Hz, 72Hz and 75Hz.
9) 1600 x 1200, 60Hz, 70Hz, 72Hz and 75Hz.

K. Satellite Receiving Equipment Installation (as appropriate):

1. Installers must hold current Level 2 certification through the (SBCA) Satellite Broadcasting & Communications Association.
2. Follow all local & national codes governing dish installation and grounding.

3.2 SYSTEM PERFORMANCE TESTS:

A. General:

1. The Audio-Visual Contractor shall pre-assemble and test all systems and sub-systems in his own facility before completed assemblies are delivery to the project site.
2. Tests shall include but are not limited to those listed below in order to verify that the system meets all design requirements.
3. The Audio-Visual Contractor shall perform the initial system testing and adjustment prior to scheduling the final system acceptance tests.
4. The Consultant shall provide forms in electronic form for the documentation of all test results. All tests shall be fully documented and a neat copy presented for review by the Owner's Representative and inclusion in the system manual.

B. Performance Tests on Individual Components:

1. Perform in Audio-Visual Contractor's facility.
2. Verify that the manufacturer's specifications are met.
3. Measure and record the impedance on each driver, and verify the acoustical output and freedom from rattles and distortion of all loudspeakers.

C. Performance Tests on Completed Component Sub-assemblies:

1. Perform in Audio-Visual Contractor's facilities.
2. Before delivery of the equipment to the project site, the specialty Audio-Visual Contractor shall demonstrate to Owner's Representatives at the Audio-Visual Contractor's facilities that all sub-assemblies are operating as specified.
3. Verify the achievement of the specifications for each electronic component in situ, i.e., as assembled in its console, rack or other enclosure, powered by the system power supply and with all other components also activated, i.e., powered and interconnected. The

magnitude and character of the threshold noise shall be observed for appearance of hum in excess of that present with individual activation, or the appearance of high frequency oscillation.

4. Projection equipment shall be tested to verify that the manufacturer's specifications are met after it has been incorporated into a complete subassembly.

5. Video equipment shall be tested to verify that its operation meets the manufacturer's specifications and EIA RS-170A after assembly into complete subsystems.

D. Performance Tests on the Complete System:

1. Verify that all wiring is correctly and completely installed. Verify that there are no short circuits between conductors within any cable, or from cable to cable. Verify the integrity of each conductor, i.e., that the conductor is not open circuited. In addition, the correct polarity of each connector, including those in patch panels, shall be verified and the color-coding scheme shall be recorded and included in the documentation provided to the Owner's Representative.

2. Verify that the entire system performance is in accordance with the design requirements. Specific attention is directed to the following for each system:

    1) Projection Equipment.

    2) Video Transports.

    3) Video Matrix Switchers.

    4) Remote Control Components.

    5) Video Distribution Amplifiers.

    6) Audio Amplifiers.

3. The threshold noise output of the system, measured at the output of the power amplifier, must equal the input when its gain control is full on, and of the line or booster amplifier input when all channel controls are off. No hum shall be audible in the system within the noise signal, or with the inputs terminated in microphone impedance and all controls full on. No high frequency oscillation shall be observed at the system output. No audible radio signal shall be detectable in the system at any control setting. Depending upon the proximity of a local radio station, or upon the cable configuration of the system, RF oscillation or leakage may be a problem and the Audio-Visual Contractor shall be prepared to install a RF low pass filter appropriately in the system as a final remedy.

4. Cross talk between channels shall be measured with signal equivalent to 1.0 Volts output into one channel with its gain off and the gain of each other channel varied over their full range. Maximum signal leakage at the system output must be equivalent to -70 dB re 1.0 Volt at the pre-amp output at 1 kHz, increasing to -52 dB at 8 kHz.

5. The general performance of each loudspeaker unit in situ shall be verified by applying pink noise signal at 10.0 Volt level and verifying the specified output SPL at a distance of 1 foot. Normal undistorted sound quality shall be verified by headphone listening at the output of the calibrated system. Each loudspeaker shall also be fed with an oscillator signal at 10.0 Volt level within its intended frequency range, verifying absence or abnormal distortion of rattles due to installation.

6. The audio system shall be adjusted as specified above in paragraph entitled “Audio System Processing Adjustments” where minimum requirements for establishing readiness for the substantial completion observation of an audio system are specified.

7. The complete video system shall be tested in the following manner: All video outputs of the system shall conform to EIA RS-170A when typical inputs to the system are fed with a "known good signal" from a video signal generator.

E. All optical projection system performance shall be in accordance with the following:

1. Projected images shall properly fill their respective screens to full size without "cropping" or overshoot.
2. Projection lenses shall provide distortion free images without color fringing or aberration.
3. Screen brightness and screen brightness ratio shall reasonably approach the theoretical value based on the projector's specified light output value with the necessary light loss corrections.

F. Test procedures for the optical projection systems shall conform with the following basic guidelines:

1. All equipment items shall be 100% tested for correct functional operation.

G. Test procedures for video systems shall conform to the following basic guidelines:

1. All equipment and video signal chains shall operate according to manufacturer's specifications and/or to the EIA RS-170A standard.
2. All video monitors shall be setup and adjusted following the manufacturer's guidelines including the following (with or without blue gun only):
    1) Black level (using the brightness control).
    2) White level (using the contrast control).
    3) Correct Hue.
3. All video cameras shall be setup and adjusted for the following:
    1) Black balance.
    2) White balance.
    3) Range of zoom and iris function.

H. The contractor shall conduct performance testing and conduct commissioning on the digital video transport systems as recommended by the manufacturer. All such testing and commissioning shall be performed by an individual, factory certified to perform such work. In addition to built-in system testing, the following tests shall be performed on all digital video connections utilizing a Quantum Data 780 or equal (as approved by the Consultant) HDMI test system.

1. Conduct cable performance tests on all critical path copper.
2. Conduct Sink (downstream) Tests on projector including:
    1) Verify hot plug detect
    2) Verify HDMI +5V
    3) Verify EDID compliance
        a) Header
        b) Checksum
        c) Test EDID video at 1080p, 1080i, 720p
    4) Perform HDCP test
    5) Perform video test at optimum EDID timing and HDCP enabled

6) Perform deep color parameters test
7) Perform port switching test with HDCP re-authentication

3. Conduct Source (upstream) Tests on BD players, Tuner including:
   1) Perform max. HDCP keys test
   2) Verify incoming video at multiple timings
   3) Verify video timing parameters

4. Conduct Repeater Tests on Switchers, Scaler, DAs and Audio Proc. including:
   1) Verify hot plug detect
   2) Verify HDMI +5V
   3) Verify EDID compliance
      a) Header
      b) Checksum
      c) Test EDID video at 1080p, 1080i, 720p
   4) Verify video timing pass-through
   5) Verify HDCP authentication
   6) Perform port switching test with HDCP re-authentication

5. Conduct Link Tests at critical signal chain locations including:
   1) Verify hot plug detect
   2) Verify HDMI +5V
   3) Verify EDID compliance
      a) Header
      b) Checksum
      c) Test EDID video at 1080p, 1080i, 720p
   4) Verify HDCP authentication from both source and sink
   5) Perform video test at optimum EDID timing and HDCP enabled
   6) Perform port switching test with HDCP re-authentication
   7) Perform max. HDCP keys test
   8) Verify incoming video at multiple timings
   9) Verify video timing parameters

I. All these tests, and any others that the Audio-Visual Contractor may wish for his own satisfaction, shall have been performed and successfully achieved before observation requested. Submit a report of the results of these tests and commissioning exercises to the consultant for review a minimum of one (1) week prior to requesting substantial completion observation visit. The Owner's Representative may request repetition and demonstration during observation of certain of these tests or other critical tests if problems become apparent. If specifications are not met, further observations will be at the Audio-Visual Contractor's expense.

3.3 DEMONSTRATION AND ACCEPTANCE TESTING

A. Substantial Completion Observation:

1. The Audio-Visual Contractor shall file a written notice with the General Contractor when all of the aids to use described in paragraph above entitled “Submittals”, above, have been submitted for approval, all tests described in paragraph above entitled “System Performance Tests”, are complete and the test reports have been submitted for review and approval and the systems and sub-systems are ready for the Substantial Completion Observation.

2. The Consultant shall provide a checklist in electronic form for the AVC to fill out, certifying that they have completed all requisite tests and checks and have performed remedial corrections. These forms must be completed and submitted for review along with the written notice of readiness indicated above.

3. The Audio-Visual Contractor shall be prepared to demonstrate the overall system performance including but not limited to functionality, control system programming, operation, optics performance and DSP software control (where applicable). The Audio-Visual Contractor shall be prepared to demonstrate proper gain structure and that base line EQ (uniform frequency response) settings and delay filters (time alignment) have been set. In addition the Substantial Completion Observation of the systems may include repetition or demonstration of any or all of the tests described in paragraph above entitled “System Performance Tests” above or other critical tests if problems become apparent and the specifications are not met. After the Substantial Completion Observation, written notice noting whether the systems meet the criteria set forth in the General Conditions for Substantial Completion, along with a list of items for the Audio-Visual Contractor to correct shall be provided to the Audio-Visual Contractor.

4. In the event that the systems are found not to be Substantially Complete, all of the costs including fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Audio-Visual Contractor. This includes new problems that arise during the course of the subsequent observations.

B. Acceptance Observation:

1. After the systems have been certified as Substantially Complete, and the Audio-Visual Contractor has filed written notice with the General Contractor that the corrections ordered, have been completed, a Final Acceptance Observation shall be scheduled.

2. During the Final Acceptance Observation of the systems repetition or demonstration of any of the tests described in paragraph above entitled “System Performance Tests”, above, or other critical tests if problems become apparent and the specifications are not met, may be requested.

3. Assist in performing final system adjustments and acceptance tests. Provide all labor, materials and tools necessary for these tests and adjustments. Provide all necessary test equipment to complete the tests.

4. Budget 24 working hours for the performance of these tests and adjustments. If final acceptance is delayed beyond this period because the installation is not in proper working order or is incomplete, the Audio-Visual Contractor shall pay for all additional time and expenses for any resultant extension or re-scheduling of the acceptance testing period.

5. Any measurements of frequency response, distortion, noise or other characteristics and any adjustments deemed necessary may be performed on any item or group of items, including re-orientation of loudspeakers, to insure optimum performance of the system.

6. In the event that the corrections have not been completed to the satisfaction of the Owner's Representative, or new problems arise at the time of the Acceptance Observation, all costs

including consulting fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Audio-Visual System Contractor.

C. Acceptance:

1. After observations and tests indicate that the entire Audio-Visual system and sub systems as specified herein and indicated on the drawings are in total compliance with the drawings and specifications, a letter indicating said compliance shall be issued.

2. Acceptance of the system shall be accomplished as described in the General Conditions.

3. Final acceptance of the installation will be granted when it is clear to the Owner's Representative and the Architect that the following conditions have been met:

    1) All fixed equipment has been furnished and installed according to the drawings and specifications.

    2) All portable equipment has been turned over to the Owner.

    3) All equipment and installation have been tested and shown to perform as specified.

    4) All instruction manuals, software source code and as-built documentation have been completed and delivered to the Owner's Representative.

    5) All wall-mounted diagrams are installed to the satisfaction of the Owner's representative.

4. The Warrantee period will begin only when all of the above listed items have been performed to the satisfaction of the Architect, Owner and Owner's Representative.

3.4 TRAINING

A. Submit all training materials to the owner's representative for approval prior to scheduling training sessions.

B. Provide 12 hours of hands on training in no less than three sessions practical operation of the system to the Owner's Representative. Address in the training, the general configuration of the system, basic functionality, correct operation procedures, routine maintenance and upkeep.

C. Provide 4 hours of follow-up training within 3 months of the initial training to review aspects of the original training and provide instruction on specific troubleshooting issues the Owner's Representative raises during the training.

D. Video tape all training sessions and provide 3 copies to the Owner on DVD-R format.

END OF SECTION 115200

SECTION 115216 – PLANETARIUM VISUAL SYSTEM, 2 UHD PROJECTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufacture, delivery, and installation of a Digistar®5 two-UHD-projector 4K digital planetarium projection system with its associated computer graphics system and software.

1.2 RELATED SECTIONS

A. Section 115215 – Projection Dome

1.3 REFERENCES

A. The publications listed below form a part of this Section. All specifications and requirements given in these references form a part of this specification.

B. Referenced Documents:

1. Digistar Site Prep Guide, Evans & Sutherland Computer Corp.

2. JVC DLA-SH7NLG or Christie Boxer (2 projectors, cove-mounted) Appendix, Evans & Sutherland Computer Corp.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A qualified manufacturer of Digistar 5 digital planetarium systems with products indicated for this project.

B. Standards of Manufacture: Manufacturer and product listed in this Section indicate quality of materials to be used on this project.

C. Installer Qualifications: All field work shall be executed by a qualified firm with experience in installing Digistar 5 systems. A qualified firm shall have installed a minimum of five Digistar systems within the last year.

D. Specifications for the Digistar 5 system outlined in this Section are minimum requirements. It shall be the Digistar 5 contractor's responsibility to comply with the complete requirements of the material manufacturer.

E. Manufacturer shall provide the following to insure the quality of the product:

1. Attend site visits and coordination meetings in accordance with contract requirements.

2. Support from a Project Engineer in coordinating all technical issues with the contractor.

3. Run an acceptance test with the end customer upon completion of the installation which demonstrates the functionality and features of the system and its compliance with these specifications.

1.5 SUBMITTALS

A. Within 30 days of contract the manufacturer shall provide a specific Site Preparation Guide written for the specific circumstances of this planetarium and contract which provides the details of exactly how the site must be prepared to accommodate the planetarium system. Note: The referenced documents in paragraph 115216.1.3.2 are general purpose documents that must be customized for the specifics of this contract. The referenced documents serve as a guideline in the preliminary stages of bidding and planning the construction of the planetarium.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Material shall be stored indoors in a dry, secure environment to prevent damage.

B. Handle material in strict compliance with manufacturer's instructions to prevent damage.

1.7 CHAMBER CONDITIONS

A. The contractor must provide the planetarium system installation personnel with clear and safe access to all necessary work areas during the various phases of installation. Adequate lights, heat, air conditioning, electrical power, and restrooms must be available for the period of the installation. During the installation, installation engineers must have full access to the theater and computer room.

B. During the installation, the theater must be clean! All construction debris must be removed and all areas thoroughly vacuumed (this includes hidden areas such as under computer floors and in closets). Special attention should be paid to areas under the control console, in and around equipment racks, under any computer-type flooring, around the projectors, and anywhere that cabling might be routed. All exposed concrete surfaces, including those under the computer room raised floor, must be sealed before material or equipment is moved into the theater space. This cleaning should be done prior to the dome installation and then again just prior to the installation of the Digistar system. The HVAC system must also be purged for at least one week prior to installation. The manufacturer reserves the right to request additional cleaning or sealing as required during the installation.

C. Equipment is shipped on pallets and in crates and arrives by truck before the installation crew arrives. The contractor is responsible for off-loading the trucks and must store the equipment in a secure area until the start of the installation. The contractor is responsible for delivery of the equipment to the installation area, i.e. from the shipping or storage area to the theater. A few items to consider: hallways and doorways must be wide enough for the largest crate to pass through, a pallet jack which is provided by the contractor must be available to move the pallets and the path to the dome or computer room should be stair-free. The contractor is responsible to store or remove shipping crates, pallets, and cartons.

D. Prior to planetarium system installation, the theater must be light tight—absolutely no light can be leaking into the theater from anywhere. Even the minimal light that leaks under a door might affect a show. To check for light leaks, turn off all lights, close doors, and have someone sit in the theater to dark-adapt. This can take as long as 15 minutes. After the

individual has dark-adapted, have them carefully examine the theater for all places where light might be leaking from adjacent areas or lights inside the theater. This should be done on a sunlit day.

E. During the installation of the planetarium system, the technicians will often need to have uninterrupted total darkness. No other activities should be scheduled in the theater during the Digistar installation.

1.8 WARRANTY

A. *Limited System Warranty*. The hardware portion of the planetarium system, i.e. the computer system and projectors, shall be warranted for a period of 12 months (Warranty Period) from the date of final acceptance, as defined by the contract, of the System by the Buyer, or eighteen (18) months after shipment of the System if the Buyer delays the installation, the equipment comprising the System will conform in all material respects to the functional specifications contained in the contract and will be free from “material” defects in workmanship and materials.

B. *Limited Software Warranty*. The system software shall be warranted for a period of 12 months from the date of final acceptance, as defined in the contract, of the System by the Buyer, or eighteen (18) months if the Buyer delays the installation, the Software will conform in all material respects to specifications contained in the contract, and will be free from “material” defects.

PART 2 PRODUCTS

2.1 MANUFACTURERES

A. Acceptable Manufacturers:

1. Evans & Sutherland Computer Corporation, 770 Komas Drive, Salt Lake City, Utah 84108, www.es.com, (801) 588-1000.

2. Basis-of-Design Product: Digistar 5 4K 2-projector UHD cove-mounted system with Auto Alignment and HD Video Input.

3. Substitutions: No substitutions permitted.

B. Projection System

1. The projection system shall consist of two UHD (ultra-high definition) projectors with the following specifications:

a. Projectors must be new and designed for heavy-duty use. Projectors labeled for home or office use will not be considered.

b. Minimum resolution of each projector – 4096 x 2160 pixels.

c. Approximate total pixels on the dome – 10.6 MP.

d. Minimum brightness of each projector – 10,000 lumens

e. Minimum sequential contrast ratio of each projector – 2000:1

f. Minimum refresh rate – 60 Hz

g. The lens of each projector shall be designed so that between the two projectors the entire hemisphere of the dome is covered in imagery with minimal excess.

h. The images from the two projectors shall be blended together so that in any scene from total black to full white the images appear uniformly blended and appear as a single image.

i. All video channel delivering the projected full-dome image must present frame synchronized content (rather than simply gen-locking video signals from asynchronous content).

2. The projection system shall be mounted in the cove of the dome, i.e. behind and below the baseline of the dome in such a manner that the projectors are not readily visible to the audience. The projectors shall also be bolted down to their stands so that they remain fixed in their locations.

C. Computer System

1. The computers rendering and providing the video for the projectors shall be mounted in a racks which is installed in a computer room designed for this purpose.

2. The computer system shall provide a dedicated computer for the master of the system and to run the user interface and then one dedicated computer for each video feed going to the projectors.

3. The computer system shall also provide the audio stream for the planetarium shows to be fed to the theater's audio system as either 5.1 or 7.1 channels. The audio system is not part of the planetarium visual system but is specified in another section.

D. Software Features
The planetarium visual system software shall have the following features:

1. The pre-rendered video and real-time generated graphics must be playable simultaneously and not mutually exclusive. Real-time astronomy features and video playback must be accessed from a single, integrated User Interface.

2. System must be capable of using the mouse to drag an image, 3D model, video or audio file from Windows Explorer into the user interface, and specifically into Dome View for immediate display on the dome. No other steps should be required. In addition,

a. Folders of images also must be supported by using the mouse to drag and drop into the Dome View.

b. Panorama, all-sky and spherical imagery should also be accessible by this same method.

c. Support for automatic display of AVM tagged images is also required.

3. Ability to create real-time shows within user interface without the need for scripts, screen recordings or text based solutions. Feature must allow for the user to capture a current scene, create a new scene and then have the feature to automatically create a transition between the two. This should be a repeatable process for creating an entire real-time show.

4. User interface must include a live real-time view of the dome on the computer monitor.

   a. Dome view must be interactive. For example, by using a mouse a user can drag real-time objects around the dome, move astronomical diurnal motion forward and zoom in and out of real-time objects. This is to be integrated into the user interface and not a stand-alone non-interactive dome view. In addition, user should be able to drag objects onto the dome view directly.

5. The system must allow the user to place user-created models of objects of any desired size (from nanometers and smaller to astronomical scales) at any desired position in 3D space or relative to any object.

6. The system must allow the user to create, edit, resize, and style user-programmable buttons to automate commonly used sequences and commands.

7. The system must allow the user to view the sky at any date/time from the surface of any solar system body, with correct local diurnal motion, where data is available.

8. A Full API must be available to allow the system and user to connect to other devices, data sources. In addition, the system should allow the user to create plug-ins to load and render custom data.

9. The system should allow full Python and JavaScript integration for advanced real-time capabilities.

10. Ability to create real time shows within user interface without the need for scripts, screen recordings, or text based solutions. Feature must allow for the user to capture a current scene, create a new scene and then have the feature to automatically create a transition between the two. This should be a repeatable process for creating an entire real-time show.

11. Keyhold Markup Language (KLM) files can be downloaded from the Internet and used to demonstrate a wide range of scientific concepts.

12. Starfield Requirements –

    a. Perform culling: the ability to select a range of absolute magnitudes or visual magnitudes for display.

b. Include the Tycho-2 catalog, Gliese catalog and be HR-complete.

c. Provide accurate simulation of aberration and stellar position during near-speed-of-light travel (of course faster-than-light travel is also available).

d. Have each individual star in a starfield be cross-referenced and searchable by Bayer-Flamsteed designation, as well as designations in a variety of catalogs, including but not limited to: Yale Bright Star Catalog (HR), Bonner/Cordoba/Cape Photographic Durchmusterung (BD/CD/CP), Henry Draper Catalogue (HD), Gliese Catalogue of Nearby Stars (GJ), Smithsonian Astrophysical Observatory Star Catalog (SAO), Hipparcos (HIP).

e. Allow flights to systems of multiple stars. Multiple stars should move correctly in their relative gravitational orbits with the passage of time.

f. Include all Messier objects.

13. Planets and Moons Requirements –

a. Provide proper simulation of atmospheric refraction, reddening, extinction and scintillation.

b. Show Rayleigh scattering (where appropriate, seamless transition between surface and space view.

c. Show proper simulation of eclipses, shadows and ring shadows.

d. Show proper crater/relief shading for rocky bodies.

e. Include high-resolution terrain for Earth that implements the following features and requirements:

1) Smooth transition from outer space to any place on Earth.

2) High-resolution details for cities should be to street level.

3) With an Internet connection provided by the facility, include point-and-click downloads (with a view of up to 1 m per pixel imagery) without the need for writing a script or preparing these files manually. Further, the system must manage all data files and distribute as needed to all the graphics processors without user intervention.

4) Prevent accidental fly-through of the terrain mesh.

5) Navigate smoothly across a terrain without a loss in frame rate, or severe frame jumps or channel tearing.

6) Must include detailed surface “terrains” for the Moon and Mars.

7) Vendor must describe how the high-resolution terrain imagery is licensed.

8) At Earth: the system must have the ability to visualize sub-surface earthquake locations.

9) The system must also accept unaltered Comet and Asteroid elements data from the IAU Minor Planet Center.

14. Artificial Satellites and Spacecraft Requirements –

    a. Allow the user to create and add date-synchronized trajectories to the system. By default, the system must include models and trajectories for the following spacecraft: Voyager I and 2, Pioneer 10 and 11, Cassini, New Horizons, Dawn, Ulysses, Spitzer, Galileo, Rosetta, Mars Science Laboratory, and Stardust.

    b. Accept unaltered TLE (Two-Line Elements) data for real-time spacecraft and satellite positions.

15. Comets Requirements –

    a. Automatically and realistically visualize both ion and dust tails

    b. Dust and ion tails automatically face away from the sun

    c. Provide a high degree of customizability to include adjusting the size, color, brightness, glow size, and texture of a comet's:

        1) Coma

        2) Dust Tail

        3) Ion Tail

    d. Provide the ability to fly up to the comet's nucleus and free fly around it.

    e. The size of the coma, dust tail, and ion tails increase in size according to how close you are to the sun, and when you get far enough away, the coma and tails disappear completely, leaving only the nucleus.

16. Asteroids Requirements –

    a. Models of common asteroids must be provided, and available to activate automatically.

    b. Must be able to fly smoothly up to any individual asteroid model in its correct location in space and time.

    c. Must include all known asteroids published in the MPC (Minor Planet Center) database.

17. Exoplanets Requirements –

    a. Exoplanetary systems associated with stars in the starfield must be included. For these stars the planets and their orbits must be shown correctly with orientations and motions based on the latest available data.

    b. Provide models, or automatic visualizations, of all known exoplanets based on existing scientific theories of what those planets look like.

    c. Ability to smoothly fly from anywhere, directly up to the exoplanet and land on any exoplanet.

    d. All features available for solar system planets must be possible for any exoplanet. (rings, atmosphere, orbits, labels, textures etc.)

    e. Gravitation motions should be accurately simulated. The parent star should “wobble” appropriately when orbited by large planets.

18. Navigation and Flight Requirements –

    a. The system must allow the user to fly a camera to within any specified distance of any model in the system, including user-created models and system-created celestial objects. Motion of the camera, and the resulting real-time graphics imagery from the camera’s point of view, must be smooth throughout the flight, regardless of the destination object’s size or distance from Earth. The images of objects within the flying camera’s view must not appear to jump about, or scintillate, on the dome.

    b. The system must allow the user to land the camera at any location on any solar system body or exoplanet. Once landed, the system must allow the user to fly the camera to other locations on that body or exoplanet and to take off from that body or exoplanet. All motion must be smooth.

    c. Navigation and flight actions must work correctly while the system’s scene date is changing and with bodies and exoplanets rotating and in relative motion.

19. User Interface Requirements –

    a. The User Interface must be easily translatable to other local languages without the need for recreating it. The translation includes all system errors, warnings, messages, etc. Changing languages is done from within the user interface.

    b. Independent of the chosen language, labels for system objects (guides, planetary bodies, named stars, deep space objects, etc.) can be localized to the chosen language or to a different language.

    c. Languages should be available on a per-show basis via the ability to load custom preferences files. i.e., the 1 p.m. show can be in English and the 2 p.m. in Spanish.

d. The user interface must support a dark or red mode to preserve a presenter's night vision during live astronomy presentations.

e. The system must allow the user to move manually to any point within a playback show and have the show start and run from that point forward fully synchronized with all video and audio.

f. The user interface must include a customizable, searchable library of content available for use on the dome.

g. The user interface must include a panel or window that displays information about the selected item on the dome to aid in live astronomy presentations.

h. The user interface must allow the user to create custom pages that contain buttons, sliders and other controls to interact with the system.

i. The user interface must supply the ability to control the system from an iPad or other wireless mobile device.

j. System must include a controller-free experience that uses an infrared camera to interpret body movements for control of the system.

k. The user interface must allow for drag-and-drop installation of new videos, audio, models, images, etc. which also includes automatically copying that content to all computers in the system.

l. The user interface must include a script editor that automatically colors commands, suggests commands as the user types and helps the user find errors when a script plays.

m. The user interface must provide a single button to save the state of the current scene on the dome for one-click restoration to the dome at a later time.

n. The user interface must provide one-click access to a searchable library of models, images, videos, audio, etc. hosted on the web and the ability to easily download this content to the system and use it in the dome without requiring any external software.

20. The user interface must provide the ability to share content to an Internet library that is available to other sites using only a few clicks and does not require any external software to do so. Other Requirements -

    a. System must contain database of all known active and inactive satellites in Earth orbit, along with objects tagged as space debris.

    b. The system must be able to show the Sun's motion relative to the solar system barycenter.

    c. System must include the American Museum of Natural History *Digital Universe*.

d. All celestial objects displayed by the system must be represented at their known sizes and at their known positions in 3D space.

e. System must be able to display a volumetric Milky Way Galaxy in real-time.

f. The system must support generic real-time volume rendering and include astronomical and non-astronomical volume sample data.

g. System must include *Science on a Sphere* data sets. Video datasets should wrap correctly around Earth and other bodies as appropriate.

h. *Astronomy Picture of the Day* by NASA must be fully integrated into the system and available as a one click download (with internet connection provided by facility)

i. KML files can be downloaded from the Internet and used to demonstrate a wide rand of scientific concepts.

j. System must include the ability for remote system diagnosis.

E. Additional System Features

1. The planetarium visual system shall also have the following features:

a. Auto Alignment –

1) Integrated into the main planetarium visual system software so that there is no need to run a separate program

2) One button operation for the system operator

3) Alignment time typically less than 5 minutes

4) Aligns the imagery between the two projectors to within ±1/2 pixel

5) Uses permanently installed cameras and other hardware so that no equipment setup is required for the user to run the alignment.

b. High Definition Video Input –

1) Accepts video input from a variety of sources, e.g.
Note: These sources are not part of this specification. The system must simply be able to accept input from these types of sources. Provision of the source video feeds is the responsibility of others.

a) Blu-ray player

b) Over-the-air broadcast, cable, or close-circuit TV (HD and standard resolution)

c) PCs and laptop computers

d) Cameras (HD and standard resolution)

2) These sources can then be displayed on the dome in real time “video windows” in a number of common predefined sizes that can be scaled to virtually any size and can be warped to any shape. There can be multiple video windows displayed simultaneously with the HD video input playing on those windows.

3) Also includes a real time chroma key filter so that objects on video shot in front of a blue screen or green screen will be able to be cut out from their backgrounds and composited in real time onto the imagery being presented on the dome.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the planetarium system in accordance with manufacturer’s instructions.

1. Install the projectors within ±1 inch of their designed positions.
2. Install the projectors within ±0.5° of their designed attitudes.
3. Install the computer system in its designed location.
4. Install the operator console equipment in it designed location.
5. Run all interconnect wires, cables, network connections, cameras, etc. necessary to provide the functionality of the system.
6. Properly align, balance the projector’s image.
7. Create and edit all software setup files as needed to provide the designed functionality and to be readily usable by the end user.
8. Run an acceptance test which demonstrates the features and functions of the system to the end users.
9. Train the end user’s maintenance personnel on the proper use and maintenance of the system.

END OF SECTION

SECTION 115217 – PLANETARIUM VISUAL SYSTEM ALTERNATE - 5 or 6 UHD PROJECTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufacture, delivery, and installation of a Digistar®5 five- or six-UHD-projector 8K digital planetarium projection system with its associated computer graphics system and software.

1.2 RELATED SECTIONS

A. Section 115215 – Projection Dome

1.3 REFERENCES

A. The publications listed below form a part of this Section. All specifications and requirements given in these references form a part of this specification.

B. Referenced Documents:

1. Digistar Site Prep Guide, Evans & Sutherland Computer Corp.

2. JVC DLA-SH7NLG or Sony GTZ270 (5 or 6 projectors, cove-mounted) Appendix, Evans & Sutherland Computer Corp.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A qualified manufacturer of Digistar 5 digital planetarium systems with products indicated for this project.

B. Standards of Manufacture: Manufacturer and product listed in this Section indicate quality of materials to be used on this project.

C. Installer Qualifications: All field work shall be executed by a qualified firm with experience in installing Digistar 5 systems. A qualified firm shall have installed a minimum of five Digistar systems within the last year.

D. Specifications for the Digistar 5 system outlined in this Section are minimum requirements. It shall be the Digistar 5 contractor's responsibility to comply with the complete requirements of the material manufacturer.

E. Manufacturer shall provide the following to insure the quality of the product:

1. Attend site visits and coordination meetings in accordance with contract requirements.

2. Support from a Project Engineer in coordinating all technical issues with the contractor.

3. Run an acceptance test with the end customer upon completion of the installation which demonstrates the functionality and features of the system and its compliance with these specifications.

1.5 SUBMITTALS

A. Within 30 days of contract the manufacturer shall provide a specific Site Preparation Guide written for the specific circumstances of this planetarium and contract which provides the details of exactly how the site must be prepared to accommodate the planetarium system. Note: The referenced documents in paragraph 115217.1.3.2 are general purpose documents that must be customized for the specifics of this contract. The referenced documents serve as a guideline in the preliminary stages of bidding and planning the construction of the planetarium.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Material shall be stored indoors in a dry, secure environment to prevent damage.

B. Handle material in strict compliance with manufacturer's instructions to prevent damage.

1.7 CHAMBER CONDITIONS

A. The contractor must provide the planetarium system installation personnel with clear and safe access to all necessary work areas during the various phases of installation. Adequate lights, heat, air conditioning, electrical power, and restrooms must be available for the period of the installation. During the installation, installation engineers must have full access to the theater and computer room.

B. During the installation, the theater must be clean! All construction debris must be removed and all areas thoroughly vacuumed (this includes hidden areas such as under computer floors and in closets). Special attention should be paid to areas under the control console, in and around equipment racks, under any computer-type flooring, around the projectors, and anywhere that cabling might be routed. All exposed concrete surfaces, including those under the computer room raised floor, must be sealed before material or equipment is moved into the theater space. This cleaning should be done prior to the dome installation and then again just prior to the installation of the Digistar system. The HVAC system must also be purged for at least one week prior to installation. The manufacturer reserves the right to request additional cleaning or sealing as required during the installation.

C. Equipment is shipped on pallets and in crates and arrives by truck before the installation crew arrives. The contractor is responsible for off-loading the trucks and must store the equipment in a secure area until the start of the installation. The contractor is responsible for delivery of the equipment to the installation area, i.e. from the shipping or storage area to the theater. A few items to consider: hallways and doorways must be wide enough for the largest crate to pass through, a pallet jack which is provided by the contractor must be available to move the pallets and the path to the dome or computer room should be stair-free. The contractor is responsible to store or remove shipping crates, pallets, and cartons.

D. Prior to planetarium system installation, the theater must be light tight—absolutely no light can be leaking into the theater from anywhere. Even the minimal light that leaks under a door might affect a show. To check for light leaks, turn off all lights, close doors, and have someone sit in the theater to dark-adapt. This can take as long as 15 minutes. After the individual has dark-adapted, have them carefully examine the theater for all places where light might be leaking from adjacent areas or lights inside the theater. This should be done on a sunlit day.

E. During the installation of the planetarium system, the technicians will often need to have uninterrupted total darkness. No other activities should be scheduled in the theater during the Digistar installation.

1.8 WARRANTY

A. *Limited System Warranty*. The hardware portion of the planetarium system, i.e. the computer system and projectors, shall be warranted for a period of 12 months (Warranty Period) from the date of final acceptance, as defined by the contract, of the System by the Buyer, or eighteen (18) months after shipment of the System if the Buyer delays the installation, the equipment comprising the System will conform in all material respects to the functional specifications contained in the contract and will be free from “material” defects in workmanship and materials.

B. *Limited Software Warranty*. The system software shall be warranted for a period of 12 months from the date of final acceptance, as defined in the contract, of the System by the Buyer, or eighteen (18) months if the Buyer delays the installation, the Software will conform in all material respects to specifications contained in the contract, and will be free from “material” defects.

PART 2 PRODUCTS

2.1 MANUFACTURERES

A. Acceptable Manufacturers:

1. Evans & Sutherland Computer Corporation, 770 Komas Drive, Salt Lake City, Utah 84108, www.es.com, (801) 588-1000.

2. Basis-of-Design Product: Digistar 5, UHD 5- or 6-projector, cove-mounted system with Auto Alignment, Auto Blending, and HD Video Input.

3. Substitutions: No substitutions permitted.

B. Projection System

1. The projection system shall consist of five or six UHD (ultra-high definition) projectors with the following specifications:

a. Projectors must be new and designed for heavy-duty use. Projectors labeled for home or office use will not be considered.

b. Minimum resolution of each projector – 4096 x 2160 pixels.

c. Approximate total pixels on the dome – 28.5 MP

d. Minimum brightness of each projector – 5,000 lumens

e. Minimum sequential contrast ratio of each projector – 10,000:1

f. Minimum refresh rate – 60 Hz

g. The lens of each projector shall be designed so that between the five projectors the entire hemisphere of the dome is covered in imagery with minimal excess.

h. The images from the five projectors shall be blended together so that in any scene from total black to full white the images appear uniformly blended and appear as a single image.

i. All video channel delivering the projected full-dome image must present frame synchronized content (rather than simply gen-locking video signals from asynchronous content).

2. The projection system shall be mounted in the cove of the dome, i.e. behind and below the baseline of the dome in such a manner that the projectors are not readily visible to the audience. The projectors shall also be bolted down to their stands so that they remain fixed in their locations.

C. Computer System

1. The computers rendering and providing the video for the projectors shall be mounted in a racks which is installed in a computer room designed for this purpose.

2. The computer system shall provide a dedicated computer for the master of the system and to run the user interface and then one dedicated computer for each video feed going to the projectors.

3. The computer system shall also provide the audio stream for the planetarium shows to be fed to the theater's audio system as either 5.1 or 7.1 channels. The audio system is not part of the planetarium visual system but is specified in another section.

D. Software Features
The planetarium visual system software shall have the following features:

1. The pre-rendered video and real-time generated graphics must be playable simultaneously and not mutually exclusive. Real-time astronomy features and video playback must be accessed from a single, integrated User Interface.

2. System must be capable of using the mouse to drag an image, 3D model, video or audio file from Windows Explorer into the user interface, and specifically into Dome View for immediate display on the dome. No other steps should be required. In addition,

    a. Folders of images also must be supported by using the mouse to drag and drop into the Dome View.

    b. Panorama, all-sky and spherical imagery should also be accessible by this same method.

    c. Support for automatic display of AVM tagged images is also required.

3. Ability to create real-time shows within user interface without the need for scripts, screen recordings or text based solutions. Feature must allow for the user to capture a current scene, create a new scene and then have the feature to automatically create a transition between the two. This should be a repeatable process for creating an entire real-time show.

4. User interface must include a live real-time view of the dome on the computer monitor.

    a. Dome view must be interactive. For example, by using a mouse a user can drag real-time objects around the dome, move astronomical diurnal motion forward and zoom in and out of real-time objects. This is to be integrated into the user interface and not a stand-alone non-interactive dome view. In addition, user should be able to drag objects onto the dome view directly.

5. The system must allow the user to place user-created models of objects of any desired size (from nanometers and smaller to astronomical scales) at any desired position in 3D space or relative to any object.

6. The system must allow the user to create, edit, resize, and style user-programmable buttons to automate commonly used sequences and commands.

7. The system must allow the user to view the sky at any date/time from the surface of any solar system body, with correct local diurnal motion, where data is available.

8. A Full API must be available to allow the system and user to connect to other devices, data sources. In addition, the system should allow the user to create plug-ins to load and render custom data.

9. The system should allow full Python and JavaScript integration for advanced real-time capabilities.

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11. Keyhold Markup Language (KLM) files can be downloaded from the Internet and used to demonstrate a wide range of scientific concepts.

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    a. Perform culling: the ability to select a range of absolute magnitudes or visual magnitudes for display.

    b. Include the Tycho-2 catalog, Gliese catalog and be HR-complete.

    c. Provide accurate simulation of aberration and stellar position during near-speed-of-light travel (of course faster-than-light travel is also available).

    d. Have each individual star in a starfield be cross-referenced and searchable by Bayer-Flamsteed designation, as well as designations in a variety of catalogs, including but not limited to: Yale Bright Star Catalog (HR), Bonner/Cordoba/Cape Photographic Durchmusterung (BD/CD/CP), Henry Draper Catalogue (HD), Gliese Catalogue of Nearby Stars (GJ), Smithsonian Astrophysical Observatory Star Catalog (SAO), Hipparcos (HIP).

    e. Allow flights to systems of multiple stars. Multiple stars should move correctly in their relative gravitational orbits with the passage of time.

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    a. Provide proper simulation of atmospheric refraction, reddening, extinction and scintillation.

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    e. Include high-resolution terrain for Earth that implements the following features and requirements:

        1) Smooth transition from outer space to any place on Earth.

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        3) With an Internet connection provided by the facility, include point-and-click downloads (with a view of up to 1 m per pixel imagery) without the need for writing a script or preparing these files manually. Further, the system must

manage all data files and distribute as needed to all the graphics processors without user intervention.

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6) Must include detailed surface “terrains” for the Moon and Mars.

7) Vendor must describe how the high-resolution terrain imagery is licensed.

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9) The system must also accept unaltered Comet and Asteroid elements data from the IAU Minor Planet Center.

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a. Allow the user to create and add date-synchronized trajectories to the system. By default, the system must include models and trajectories for the following spacecraft: Voyager I and 2, Pioneer 10 and 11, Cassini, New Horizons, Dawn, Ulysses, Spitzer, Galileo, Rosetta, Mars Science Laboratory, and Stardust.

b. Accept unaltered TLE (Two-Line Elements) data for real-time spacecraft and satellite positions.

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c. Provide a high degree of customizability to include adjusting the size, color, brightness, glow size, and texture of a comet’s:

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        1) Integrated into the main planetarium visual system software so that there is no need to run a separate program

        2) One button operation for the system operator

        3) Alignment time typically less than 5 minutes

        4) Aligns the imagery between the five projectors to within ±1/2 pixel

5) Uses permanently installed cameras and other hardware so that no equipment setup is required for the user to run the alignment.

b. Auto Blending –

1) Integrated into the main planetarium visual system software so that there is no need to run a separate program

2) One button operation for the system operator

3) Blending/calibration time typically less than 10 minutes

4) Use optical and digital video masking techniques to create the optimal edge blend.

5) Functionality includes –

a) Brightness uniformity between the projectors

b) Gamma matching between projectors

c) Edge blending

c. High Definition Video Input –

1) Accepts video input from a variety of sources, e.g.
Note: These sources are not part of this specification. The system must simply be able to accept input from these types of sources. Provision of the source video feeds is the responsibility of others.

a) Blu-ray player

b) Over-the-air broadcast, cable, or close-circuit TV (HD and standard resolution)

c) PCs and laptop computers

d) Cameras (HD and standard resolution)

2) These sources can then be displayed on the dome in real time “video windows” in a number of common predefined sizes that can be scaled to virtually any size and can be warped to any shape. There can be multiple video windows displayed simultaneously with the HD video input playing on those windows.

3) Also includes a real time chroma key filter so that objects on video shot in front of a blue screen or green screen will be able to be cut out from their backgrounds and composited in real time onto the imagery being presented on the dome.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the planetarium system in accordance with manufacturer's instructions.

1. Install the projectors within ±1 inch of their designed positions.
2. Install the projectors within ±0.5° of their designed attitudes.
3. Install the computer system in its designed location.
4. Install the operator console equipment in it designed location.
5. Run all interconnect wires, cables, network connections, cameras, etc. necessary to provide the functionality of the system.
6. Properly align, balance the projector's image.
7. Create and edit all software setup files as needed to provide the designed functionality and to be readily usable by the end user.
8. Run an acceptance test which demonstrates the features and functions of the system to the end users.
9. Train the end user's maintenance personnel on the proper use and maintenance of the system.

END OF SECTION

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section supplements all Sections of this Division and shall apply to all phases of Work specified, shown on the Drawings, or required to provide for complete installation of mechanical systems for this Project. The Work required under this Division is not limited to the "mechanical" Drawings. Refer to site, architectural, structural, and electrical Drawings which may also designate Work to be accomplished. The intent of this Specification is to provide a complete and operating mechanical system which includes all documents which are a part of the Contract.

B. Related Work Specified Elsewhere:
   1. Refer to all Sections in Division 00, REFERENCE, and Division 01, GENERAL REQUIREMENTS.

C. Work Installed but Furnished by Others:
   1. Where the Drawings indicate points of connections to piping which are to be furnished and installed by others, the final connection are deem as part of this contract. Locations shall be determined from the drawings and/or from the site conditions.

1.2 QUALITY ASSURANCE

A. General Requirements.
   1. All electrical Work performed under this Division shall be installed by competent craftsmen, skilled in the trade involved, and shall be installed in conformance with the National Electrical Code and applicable local codes.
   2. Installation of all items shall be performed in strict accordance with all codes and regulations set forth by State, Local, and Federal authorities.

B. Requirements of Regulatory Agencies:
   1. Codes and Ordinances.
      a. All Work shall meet the requirements of local codes, ordinances, and utility companies except adhere to the Contract Documents when more strict requirements are specified.
      b. Codes which govern mechanical Work in this Project are as follows:
         1) American National Standard Institute (ANSI)
         2) American Society of Mechanical Engineers (ASME)
         3) American Water Works Association (AWWA)
         4) National Fire Protection Association (NFPA)
         5) National Electrical Manufacturers Association (NEMA)
         6) Underwriters Laboratories (U.L.)
         7) Cast Iron Soil Pipe Institute (CISPI)

8) Compressed Gas Association (CGA)
9) American Gas Association (AGA)
10) California Building Code (CBC), 2013
11) California State Fire Marshal Regulations
12) California Mechanical Code (CMC), 2013
13) California Plumbing Code (CPC), 2013
14) California Electrical Code (CEC), 2013
15) California Energy Code, Part 6, Title 24 C.C.R. 2013

C. Source Quality Control:
1. Manufacturer's Tests. All materials shall, so far as possible, be subjected to standard tests by the manufacturer before shipment.

1.3 SUBMITTALS

A. Division 01 - Shop Drawings and Product Data:
1. Requirements for all shop drawings are specified in Division 01 GENERAL, REQUIREMENTS and Division 01, PRODUCT AND SUBSTITUTIONS.

B. Operation and Maintenance Data:
1. Maintenance Manuals.
a. Furnish two sets of maintenance manuals, each containing items specified below. Furnish manuals to the Architect for review prior to giving them to the Owner during the time of the Contract and before final acceptance of the mechanical Work.
b. Definitions Applicable to the Maintenance Manuals.
1) Literature. Any page (either whole or in part), sheet, drawing, or booklet describing the maintenance, operation, and parts of mechanical equipment, which is furnished either in the shipping carton, attached to the equipment, or otherwise prepared and distributed by the manufacturer for the user, not limited to papers submitted as shop drawings.
2) Mechanical Equipment. All major items shown in the Mechanical Division Drawings and Work for which shop drawings are requested except the following: thermometers, expansion tanks, air separating tanks, insulation materials, vibration isolation equipment, plumbing drains and fixture carriers, boiler stack, and Work in Section 23 31 00, HVAC DUCTS AND CASINGS.
3) Instructions. An outline written by the Contractor with information necessary to help the Owner apply the maintenance manual and simplify verbal instructions.
c. Collection of "Literature." Collect "literature" in like new condition, of all pieces of "mechanical equipment" until two copies of each are obtained. Copies soiled during construction will not be accepted.
d. Assembly of "Literature."
1) Assemble "literature" in separate, multiples of two, 3-ring loose leaf binders, 2 inches (50 mm) size, with chrome-plated piano hinges and black hard coated covers.

2) Small or large "literature" not easily inserted in binders shall each be put in heavy manila envelopes.
3) Furnish each binder with plastic enclosed tabs on reinforced paper neatly arranged. Type each of the following on a separate tab.
   a) Instructions
   b) Valve Charts
   c) Accessories
   d) Lubrication
   e) Testing and Balancing Reports
   f) Each Specification and Title in the Project Specification for which "Literature" has been collected.
4) File "instructions" envelopes and "literature" under correct tabs. Clearly identify each piece of "literature" and envelope with equipment name and numbers.

e. Valve Charts.
1) Format. Arrange format of valve charts by rooms and sequence all valve numbers starting with mechanical equipment rooms and finishing with "occupied spaces."
2) Information. Furnish the following information typed on valve charts for each valve furnished throughout the Project in the Mechanical Division, except check valves and automatic valves.
   a) Room numbers and name where valve is located, i.e. "ZG boiler room."
   b) Valve number assigned by Contractor and stamped on brass plate, i.e. "l47."
   c) Service medium using designation assigned to Drawings on mechanical symbols, i.e. "heating hot water supply" or "plumbing cold water."
   d) Valve types as specified in Section 23 05 23, GENERAL-DUTY VALVES FOR HVAC PIPING, i.e. ECCENTRIC PLUG VALVE or GATE VALVE.
   e) Function valve serves, i.e. "strainer shut-off" or "balancing valve."
   f) Zone identification, i.e. "AHU-2" or "auxiliary heating."
3) Insert Charts in Manuals.

f. Lubrication Charts. Furnish a chart listing each lubricated piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication. Insert charts in manuals.

g. Accessories.
1) Furnish the Owner with a complete equipment accessory schedule listing each piece of equipment and the related size, type, number required, and manufacturer of the following items.
   a) Filters
   b) Fan Belts
   c) Refrigerant Dryers
2) Insert Schedules in Manuals.

h. Insert 2 copies each of correct testing and balancing reports in manuals.

2. Instructions in Operation.

a. After all tests and adjustments have been made and the maintenance manual has been completed and given to the Owner, furnish one or more full-time qualified personnel as necessary to put the mechanical Work in continuous operation for a period of not less than 4 days, during which time the designated personnel's only purpose shall be to give complete operating and maintenance instructions to the operating personnel selected by the Owner, and furnish all service necessary for the proper operation and protection of the mechanical Work. Fuel, power, and other supplies required during this period will be furnished by the Owner.

1.4 JOB CONDITIONS

A. Existing Conditions:
1. Existing Pipe Lines.
a. If any existing water, gas, or other pipes and appurtenances are encountered which interfere with the proper installation of new Work and which will not be used in connection with new Work, or existing systems, close such pipe in a proper manner, and if necessary, move or remove the pipes as directed by the Architect.
b. Where existing Work is to be modified, it shall be done in conformance with the Specifications. Materials used shall be same as existing unless otherwise specified.

B. Sequencing, Scheduling:
1. Coordination of Work.
a. Plan all Work so that it proceeds with a minimum of interference with other trades. Inform the general Contractor of all openings required in the building construction for the installation of mechanical Work. Provisions shall be made for all special frames, openings, and pipe sleeves as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical.
1. All motors, starters, or any other electrical components furnished or installed under the mechanical Division shall be in complete compliance with Division 26, ELECTRICAL.
2. Unless otherwise specified, all electric motors, provided under this Division shall be 60 hertz. All motors shall be single phase or 3-phase as indicated on the Drawings. Motor starters shall be as scheduled on the Drawings or specified herein. If motors appliances or apparatus are furnished varying in horsepower and/or characteristics from those specified, accommodate the change at no additional cost to the Owner.
a. All fan and pump motors (except smoke exhaust fans and two-speed motors) ( ) HP and larger shall be of the high efficiency type. Provide Reliance Electric "Duty Master," General Electric "Energy Saver," Westinghouse "Tee 11," U.S. Motors "XB," or Baldor "Super-E" motors. Guaranteed minimum full load efficiencies shall be certified in accordance with IEEE Standard 112 Test Method B, NEMA MG-1-12.53a and shall meet or exceed the following minimum criteria:

GUARANTEED MINIMUM FULL LOAD EFFICIENCY

Rated HP	Nominal 1180 RPM	Nominal 1770 RPM
5	86.5	86.5
7.5	86.5	88.5
10	88.5	88.5
15	88.5	90.2
20	89.5	90.2
25	91.7	90.2
30	90.2	91.7
40	91.7	91.7
50	91.7	93.0
60	91.7	93.0
75	93.0	93.0
100	93.0	93.6

3. Wiring Diagrams. Furnish a composite control and interlock wiring diagram of Work not in the mechanical Division but necessary to put equipment shown in the mechanical Division in operation as specified and shown. Submit wiring diagram for review as a shop drawing.

B. Equipment Identification.
1. Provide for each motor driven piece of equipment and all two-speed starters an anodized aluminum identification label, manufactured by the Seton Name Plate Corp. Background color and wording shall be as selected by the Architect.

C. Access to Equipment.
1. All motors, valves, control devices, equipment, specialties, etc. shall be located for easy access for operation, repair and maintenance. If items are concealed, provide access doors of size required for easy access to the items. Provide access doors of the types specified in Division 08, DOORS AND WINDOWS.

D. List of Materials and Equipment
1. All items of material and equipment required by this section shall bear the approval of the Architect prior to the start of any work. The Contractor shall submit all items requiring such approval, allowing ample time for checking and processing, and shall assume all responsibility for delays incurred due to rejected items. Neatly bind together submittal information covering all items into one or several packages; separate submittal of individual items not allowed. The procedure for submitting material shall be as specified

in Divisions 00 and 01. Within thirty (30) days after award of Contract, submit for approval, product information with at least the following minimum data for all materials, appurtenances, and equipment required under this section, including where applicable:

a. Job name.
b. Job location.
c. Governing specification paragraph or subparagraphs, and governing drawing number.
d. Dimensional information.
e. Performance ratings, including at least the following, where applicable:
    1) Capacity in Btu per Hour.
    2) Water quantity.
    3) Entering and leaving water temperatures.
    4) Water pressure drop.
    5) Fouling factor.
f. Pump size, RPM.
g. Design working pressures.
h. Motor horsepower and/or current rating; equipment current rating; voltage characteristics.
i. Wiring diagrams for all equipment and control systems under this section requiring electrical connections.
j. Cuts of all equipment, controls, thermometers, gauges and temperature indicators.

E. Substitutions and equal products
1. For substitution procedures follow the requirements of Division 00 and Division 01.
2. Named Manufacturers
    a. All design has been done with the first named equipment in each specification section of this Division.
    b. The first named manufacturer is the standard of quality, performance, space requirements, and coordination with other Divisions on the project.
    c. Any names beyond the first named is an acceptable manufacturer. However, being listed as an acceptable manufacturer does not imply that the manufacturer has a product that meets or exceeds the project requirements. Contractor shall verify if these manufacturers provide items that meet or exceed the specifications.
    d. All submittals of any manufacturer beyond the first named manufacturer shall be considered substitutions, shall be made in the form of substitutions, and will be reviewed as substitutions.
    e. If an item is provided from a manufacturer that is not the first named, or a model number that is different from the Contract Documents, it is the Contractor=s responsibility to determine that the item can be installed in the available location.
        1) Any redesign and change in installation methodology, and connections involved shall be the Contractor=s responsibility, including coordination with all other trades.
        2) All costs for the changes of all trades involved shall be borne by the Contractor.
        3) Contractor shall pay for any redesign required.
        4) Contractor shall pay for and obtain any additional plan checks as a result of the substitution.

5) Contractor shall provide dimensioned drawings of the revised installation with the submittal of the item.

PART 3 - EXECUTION

3.1 INSTALLATION/APPLICATION/PERFORMANCE/ERECTION

A. Installation:
1. General.
a. Cooperate with all other Contractors in furnishing material and information for correct location, in proper sequence, of all sleeves, bucks, inserts, foundations, wiring, etc.
b. All piping connections to equipment shall be made with unions or flanges to permit dismantling. Flanges and unions shall also be installed in the piping systems to permit disassembly consistent with good installation practice and as required for removal of connected equipment from place of installation.
2. All belt drives, flexible couplings, and other exposed rotating or reciprocating parts shall be covered with OSHA approved safety covers. Covers shall be permanent type and easily removable.
3. All motors and bearings shall be covered with watertight and dust-proof covers during construction period.
4. Sleeves, frames, and wall pipes shall be furnished and installed for all pipes and ducts, passing through concrete floors and walls and shall be coordinated with other trades. Special sleeves through floors and walls shall be installed in accordance with manufacturers printed instructions and as detailed.
a. All sleeves and frames through exterior floors and walls above ground and all interior floors and walls shall be black iron pipe unless otherwise noted. Sleeves and frames shall be of a size to accommodate the pipe or duct and insulation. Sleeves and frames shall be grouted in place with installation left smooth and finished to match surrounding surfaces.
b. Pipes passing through exterior floors and walls below ground, 3 inch (75 mm) and larger, shall utilize cast iron wall pipes unless noted or detailed otherwise. The wall pipe shall be used to convey the liquid or gas through the floor or wall without the use of sleeves. Wall pipes shall be furnished complete with end connections and adapters required to connect to the piping material. Size of wall pipe shall equal or exceed the maximum pipe size connected thereto. Wall pipes shall be integrally cast into floor or wall construction and provide the best possible seal at the exterior exposure. Wall pipes shall be manufactured by Clow.
c. Pipes passing through exterior floors and walls below ground, 2-1/2 inch (63 mm) and smaller, shall utilize black iron pipe sleeves as specified for aboveground in conjunction with a modular mechanical type seal as hereinafter specified.
1) The modular mechanical type seal shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Tightening of the bolts shall cause the rubber sealing elements to expand providing a watertight seal between the pipe and wall sleeve.

2) The required inside diameter of the sleeve and the installation of the seal shall be coordinated with the seal manufacturer to provide a watertight joint. Seals shall be "Link Seal" manufactured by Thunderline Corporation. A seal consisting of a combination of a sleeve and a pressure clamping system manufactured by O. Z. Manufacturing is acceptable.

d. Cutting of openings and installation of sleeves and frames through exterior floors and walls above grade, and interior floors and walls shall be done in a neat, workmanlike manner. Openings shall be cut only as large as required for the installation.
   1) At fire-rated floor and wall penetrations, provide penetration sealant as specified in Division 07, THERMAL AND MOISTURE PROTECTION.

e. Sleeves and frames at floors and walls in concealed locations and in unfinished spaces such as mechanical rooms, etc. shall extend 1 inch (25 mm) from the finished surface. All other sleeves at floors shall extend 1/4 inch (6 mm) from finished floor surface, but shall allow placement of escutcheons. All other sleeves at walls shall be installed flush with finished surface.

f. Escutcheons for exposed pipe through floors and walls where exposed to view shall be provided and shall be chromium plated except where special escutcheons are required under plumbing fixtures. Escutcheons shall be sized sufficiently to conceal the floor or wall opening and sleeve.

5. Interference.
   a. Wherever piping runs on ceilings, arrange the run of the piping in such a manner that it does not interfere with grilles, light outlets or light fixtures.
6. Valves.
   a. Valves shall be provided on all piping wherever shown or specified using adapters where required. All removable or replaceable equipment shall be valved. All valves shall have a securely fastened stamped brass metal plate each bearing a different number identified in the maintenance manual.
7. Openings in Pipes.
   a. All openings in pipes shall be kept closed during the progress of the Work.
8. Lubrication.
   a. Provide all lubrication for the operation of all equipment until substantial completion of the Project. Run in all bearings, and after they are run in, drain and flush bearings and refill with a new oil change. Refer to maintenance manual specification for lubrication chart.
9. Freeze Protection.
   a. It shall be the responsibility of the Contractor during the warranty period to perform, in cooperation with the Owner's personnel, all operations necessary to protect the cooling system for winter protection, including but not limited to, draining water coils and cooling tower.

3.2 ADJUSTMENT AND CLEANING

A. Safety Devices. Thoroughly check all safety devices to assure proper operation and protection.

B. Service.

1. Perform service on all mechanical Work until the date of substantial completion including oiling and greasing, adjustments, cleaning, packing of seals, and other items as recommended by equipment manufacturer in the maintenance manual hereinbefore specified.
2. Air filters.
   a. Do not operate air moving equipment having air filters unless temporary filters are in place to protect the mechanical Work.
   b. Clean or replace these temporary filters before final test and balance Work is begun as necessary for accurate readings. After completing the testing and balancing Work, replace temporary filters with new filter media as specified.
3. Strainers.
   a. Remove, clean and reinstall each strainer screen as specified below after systems have been flushed as specified in other sections of Division 23.
      1) Clean each strainer after all adjustments have been made and system has operated a minimum of 24 hours, but before final test and balancing operation is started.
      2) Clean each strainer again, after final test and balancing operation and before substantial completion of the Project.
   b. Certain screens may remain out of the strainer body after removal during the final cleaning only as directed by the Architect.
4. Purge all air from water systems after each servicing.
   a. Protect all furnishings and finishes during each servicing operation, and repair or replace to original condition, those damaged as a result of servicing.
5. Replace insulation removed or damaged after each operation. Leave insulation as specified in Section 23 07 00, HVAC INSULATION.
6. Contractor may coordinate servicing operations with Owner's operating personnel so as to coincide with time interval specified for instruction in operation.
7. Put system in full operating condition before substantial completion of the Project.

C. Alarms. Test and adjust alarms for satisfactory operation.

D. Tests and Adjustments. Upon completion of the installation and before substantial completion of the Project, the Contractor shall make all necessary tests and adjustments to place the system in a working condition. Systems shall be balanced as specified in Section 23 05 93, TESTING, ADJUSTING AND BALANCING FOR HVAC. The general operating tests shall cover a period of not less than 12 hours after completion of final testing and balancing, and shall demonstrate that the entire equipment is functioning in accordance with the Specifications. Furnish all instruments, test equipment, and competent personnel that are required for the tests.

END OF SECTION 230500

SECTION 230923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Orange Coast College has standardized on the Alerton building management system & control suite. No exceptions. This Building Management System (BMS) integrates building management controls and energy management, and shall be an Alerton system consistent and seamlessly integrated with the existing campus building control system.

B. The control contractor shall have been an authorized Alerton dealer in Southern California for at least (10) years and have a minimum of (15) factory certified technicians on staff prior to the bid. The contractor must furnish all labor, materials, equipment, and service necessary for a complete and operating system, utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.

C. The BMS shall be capable of total integration of the facility infrastructure systems with user access by a standard Web Browser over the Internet. This shall include HVAC control, electrical, gas and water metering, energy management, alarm monitoring, security and personnel access control, fire-life safety monitoring, and all trending, reporting and maintenance management functions related to normal building operations all as indicated on the drawings or elsewhere in this specification.

D. All central plant & air handler controllers shall be the Alerton BACtalk VLX, and the field level controllers shall be the Alerton BACtalk VLC. Other controller brands that operate with BACnet protocol will not be accepted.

E. Provide the detail design of the system, furnish and install hardware, start-up and commissioning of the system and then warrant the completed system including equipment, appurtenances, and existing campus system modifications.

F. Provide a Building Management System (BMS) incorporating Direct Digital Control (DDC) Energy Management, monitoring and control of HVAC equipment and room control. The BMS shall be fully integrated to provide the end users with full control, monitoring and management functions based on a common computer operating system and operating procedures.

G. The building HVAC control system will be comprised of microprocessor based plant controllers and intelligent room controllers interfacing directly with sensors, actuators, HVAC equipment, chillers, boilers, room climate control, lighting systems, and electrical systems.

H. Furnish a totally native BACnet-based system, based on a distributed control system in accordance with this specification. All building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2001, BACnet. In other words, all controllers, including

unitary controllers, shall be native BACnet devices. The control system shall be Alerton BACtalk to match existing campus standards.

I. The BMS shall be listed by the Underwriters Laboratories Inc. (ULI) for use in energy management, (PAZX), critical process (QVAX), security (APOU), and the primary control and monitoring device for smoke control (UUKL) and fire alarm systems (UOJZ). In addition to the above listings, the BMS shall have the ability to integrate all open communications protocol standards including BACnet, LonMark, ODBC, OPC, AdvanceDDE and Modbus. The BMS shall have the ability to simultaneously allow open integration and control of stand-alone systems, HVAC, fire, security, lighting, asset tracking and monitoring CCTV and digital video systems.

J. Complete temperature control system to be DDC with electronic sensors and electric/electronic actuation of valves and dampers.

K. The system shall include all interconnecting wiring and conduit as required for an operational system under this section of the specification. Wiring and conduit shall be installed as per local codes or Division 26 whichever is more stringent, and a letter indicating method of code compliance which shall be furnished with first shop drawing submittal.
1. Line voltage wiring shall utilize methods and materials complying with the requirements of the Electrical Specifications, local building code, and NEC.
2. Low voltage wiring shall use methods and materials complying with the requirements of the Electrical Specifications, local building code and NEC.

L. Where interface between a device such as a variable frequency drive and the building management system is required and the manufacturer's interface card does not provide the required points or information then the required points shall be hard wired from the device to the required destination. The required points shall be landed, and all control logic for those points shall be implemented at no additional cost to the campus. The intent shown on the construction document for those required points shall be implemented to the satisfaction of the campus.

1.2 QUALITY ASSURANCE DURING CONSTRUCTION

A. The acceptable manufacturer is:
1. Alerton.
2. No known equal.

B. The Building Control System shall be integrated to the existing campus Alerton Building Management System. The controls contractor responsible for the controls interface with the Orange Coast College Alerton Building Management System shall be Climatec or an approved equal. Request for approval must be submitted at least 14 days before bid.

C. Prior to receiving approval to proceed on this project the contractor must provide and demonstrate the following:
1. A copy of Southern California Alerton dealership license.
2. Ten (10) customer references in Los Angeles County with the installed Alerton BACtalk systems as specified for this project.

3. Five (5) projects, larger than this project, completed in the last 2 years, in Southern California with the Alerton BACtalk system installed as specified for this project.
4. Reference Information must include the following:
   a. Customer name
   b. Address
   c. Contact name
   d. Contact phone number
   e. System description
   f. Statement of BACnet compliance

D. The authorized Alerton BACtalk Installer shall coordinate all portions of the project and perform final integration.

E. Contractor performing work as part of this specification shall be fully responsible for all building automation system warranties in all buildings whether existing or in construction at the Orange Coast College.

F. The control contractor must perform all engineering, programming, & project management in house. Subcontracting or brokering of these responsibilities is not allowed of the control contractor.

G. The Installation Contractor shall be responsible for the complete installation, including the initial data input, system debugging, and initial calibration of system components.

H. A full-time Project Manager with a minimum of ten (10) years experience with facilities of this size project and complexity shall be assigned to manage both the engineering/design and system installation/start-up phases of the projects. Close coordination and approval from and with the Design Professional is required.

I. Control system shall be engineered, programmed, and supported completely by representative's local office that must be within 20 miles of project site. The control contractor shall be independent and not part of a Mechanical Contractor's control division.

J. The Building Control System Contractor shall submit a list of projects with contact names as part of his submittal package. The contractor shall possess valid California State Class C-10 and-C20 license.

K. Orange Coast College reserves the right to immediately disqualify contractors and products that do not meet the specific requirements as outlined in this specification.

1.3 SUBMITTALS

A. Submit complete coordination system documentation including, but not limited to:
1. Equipment location and conduit routing drawings.
2. Point-to-point wiring diagrams.
3. Descriptive literature and specification sheets for hardware and equipment.
4. Operating and maintenance instructions on hardware and equipment.
5. I/O (input/output device) point assignments.

6. Complete schedule and legend listing sensors, readers, etc., indicating its location, make and model number, I/O assignment, etc. Room numbers shall be actual, final building room numbers.
7. Database and software modification documentation indicating sequences of operation, listing of control program additions, flow charts of control program additions, and proposed floor maps with symbols to be programmed into the existing campus central EMS database.
8. Procedures and documents to be used for training, check-out, and commissioning.

1.4 FUNCTION

A. Design and install an integrated building control system including necessary hardware and software to perform the functions intended.

B. The system shall be fully integrated to the existing campus Alerton building controllers and the existing hardware and software shall be modified to include the extended system.

C. The system shall provide the following functions:
1. Monitor control and alarm points for alarm and status.
2. Control the Sage glass shading (4 stages of shading) through BACnet interface based on cooling demand. If thermostat calls for cooling and the AC unit does not meet the cooling demand (i.e. 10 minutes (adjustable)) the DDC controls to force Sage Glass to a higher stage of shading until cooling demand is met and vise versa (go a lower stage if cooling demand is excessive based on VFD preset % ramp down (adjustable).
3. Log selected events to the host system database.
4. Upload and download data to the central server database server.
5. Display alarms on the host system terminal including a location plan.
6. Local programming of the system using a portable computer.
7. The building management control decisions shall be made locally by the building controller automatically without the need for any operator intervention. Whenever an alarm or other exceptional situation occurs, the controller shall automatically transmit event data to the central campus BMS server via a dedicated connection while simultaneously alerting any remote alarm monitoring station, executing preprogrammed output commands as established by the system design submittals.
8. The BMS shall perform data acquisition of facility point conditions and shall be capable of uploading transactions and/or events to the existing campus central database system and include the date, time, location, and nature of the event.
    a. The BMS shall utilize distributed control architecture to ensure minimum down time in the event of a single or multiple component failure. The BMS shall be capable of identifying the failed component(s) and bring it to the attention of the existing campus central server operator.
    b. The BMS shall possess a modular architecture that permits 25% expansion of the system through the addition of expansion boards and memory to a building terminal controller and adding more building control panels, sensors, and readers.

1.5 WARRANTY

A. All components, system software, and parts supplied by the building control system contractor shall be guaranteed against defects in materials and workmanship for three (3) years from acceptance date.

B. Labor to repair, reprogram, or replace components shall be furnished by the building control system contractor at no charge during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the Owners request for warranty service within 24 hours during normal business hours.

PART 2 - NETWORKS

2.1 LOCAL AREA NETWORK

A. The Local Area Network (LAN) shall be a 100 Megabits/sec (Minimum) Ethernet network supporting LON, BACnet, and XML for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:
1. Ethernet; IEEE standard 802.3
2. Cable; 100 Base-T, UTP-8 wire, Category 5
3. Minimum throughput; 100 Mbps.

2.2 REMOTE ACCESS

A. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

PART 3 - PRODUCTS

3.1 BUILDING MANAGEMENT SYSTEM AND COMPONENTS DESCRIPTION

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified herein.
1. Building Management System to be provided shall perform the following general functions:
    a. Building management and control

b. Monitoring and control of controllers, remote devices and programmable logic controllers including sensors, actuators, environmental delivery systems (chillers, boilers, room climate control, lighting systems, electrical systems etc.)
c. Operator interface to allow general supervision of room controls
d. Data collection and historization
e. Alarm management
f. Trending
g. Report generation
h. Network integration

2. Data exchange and integration with a diverse range of other computing and facilities systems using industry standard techniques.
3. System shall employ all standard features and functions as described in Section 1 to monitor and control building equipment. At a minimum, the following data shall be accessible:
   a. Space temperature
   b. Space temperature set point
   c. Occupancy status
   d. Operating mode
   e. Window status
   f. Valve positions
   g. Air volume flow
   h. Percent terminal load
   i. Time schedules
   j. Zero energy bands
   k. Room name
   l. Terminal type e.g. fan coil
4. In the event of a power failure or disconnection from the network, the controllers shall continue to be fully operational with full time program capability.

B. Web Browser Clients:
1. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Mozilla FireFox™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMS, shall not be acceptable.
3. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
4. The Web browser client shall support at a minimum, the following functions:
   a. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
c. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
d. Storage of the graphical screens shall be in the Tridium Vykon AX Supervisor without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
e. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
f. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
(1) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
(a) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
(b) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
(2) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
(3) View logs and charts
(4) View and acknowledge alarms
(5) Setup and execute SQL queries on log and archive information
g. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
h. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

C. On-line Help:
1. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

D. Security:
1. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.
2. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data.
3. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object.

4. User log-on and log-off attempts shall be recorded.
5. All system security data shall be stored in an encrypted format.
6. System shall protect itself from unauthorized use by automatically logging off five minutes following the last keystroke or mouse activity.

E. System Diagnostics:
1. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
2. Provide fully licensed software with no recurring fees for programming of controllers.

F. Alarm Console:
1. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

3.2 SERVER FUNCTIONS AND HARDWARE

A. Alerton campus central server is located in the maintenance and operations office. The server supports all Alerton Control Modules (ACM), a Network Area Controller (NAC) connected to the customer's network whether local or remote.

B. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

C. The server shall provide the following functions, at a minimum:
1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

D. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).

E. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.

F. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.

G. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

H. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.

I. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

J. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
1. Routing of alarms to display, printer, email and pagers
2. View and acknowledge alarms
3. Query alarm logs based on user-defined parameters

K. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
1. Viewing and printing log data
2. Exporting log data to other software applications
3. Query log data based on user-defined parameters

L. Connection to the BMS network shall be via an Ethernet network interface card, 100 Mbps.

M. Graphics:
1. Provide custom dynamic graphics for systems and controlled devices installed in this project.
2. Provide standardized intelligent dynamic graphics for application specific controllers that will automatically modify itself based on system components installed.
3. All graphics shall be stored at the Vykon AX Supervisor.

3.3 NETWORK AREA CONTROLLER (NAC)

A. The Alerton Control Module, ACM 1 GB of DDR3 SDRAM and a Quad Core 996 Ghz processor shall be the only acceptable Network Area Controller (NAC).

General Requirements

1. BACnet Conformance

a. Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.

b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly

documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2. Building controller shall be of scalable design such that the number of trunks and protocols may be selected to fit the specific requirements of a given project.

3. The controller shall be capable of panel-mounted on DIN rail and/or mounting screws.

4. The controller shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller.

5. The controller shall be capable of running up to six (6) independent control strategies simultaneously. The modification of one control strategy does not interrupt the function or runtime others.

6. The software program implementing the DDC strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a wide area network (WAN) or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.

7. Programming shall be object-oriented using control function blocks and support DDC functions. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.

8. The programming tool shall provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.

9. Controller shall have 6,000 Analog Values and 6,000 Binary Values.

10. Controller IP configuration can be done via a direct USB connect with an operator's workstation or field computer.

11. Controller shall have at a minimum a Quad Core 996Ghz processor to ensure fast processing speeds.

12. Global control algorithms and automated control functions shall execute using a 64-bit processor.

13. Controller shall have a minimum of 1 GB of DDR3 SDRAM on a 533Mhz bus to ensure high speed data recording, large data storage capacity and reliability.

14. Controller shall support two (2) on-board EIA-485 ports capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.

    a. Ports are capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.

15. Controller shall support two (2) ports—each of gigabit speed—Ethernet (10/100/1000) ports.

    a. Ports are capable of supporting various Ethernet protocols including, but not limited to BACnet IP, FOX, and Modbus.

16. All ports shall be capable of having protocol(s) assigned to utilize the port's physical connection.

17. The controller shall have at a minimum four (4) onboard inputs, two (2) universal inputs and two (2) binary inputs.

18. Schedules

    a. Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.

    b. Each building controller shall support a minimum of 380 BACnet Schedule Objects and 380 BACnet Calendar Objects.

19. Logging Capabilities

    a. Each building controller shall log as minimum 2,000 objects at 15-minute intervals. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.

    b. Logs may be viewed both on-site or off-site using WAN or remote communication.

    c. Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.

    d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

20. Alarm Generation

    a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

    b. Each alarm may be dialed out as noted elsewhere.

    c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.

    d. Controller must be able to handle up to 2,000 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

21. Demand Limiting

    a. Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 1,200 loads using a minimum of two types of shed programs.

    b. Load shedding programs in building controller modules shall operate as defined in section 2.1.J of this specification.

B. BACnet MS/TP

1. BACnet MS/TP LAN must be software-configurable from 9.6 to 115.4Kbps

    a. Each BACnet MS/TP LAN shall support 64 BACnet devices at a minimum.

    b. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with

proprietary information.

C. BACnet IP

1. The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the local area network (LAN).

2. Must support interoperability on WANs and campus area networks (CANs), and function as a BACnet Broadcast Management Device (BBMD).

3. Each controller shall support at a minimum 128 BBMD entries.

4. BBMD management architecture shall support 3,000 subnets at a minimum.

5. Shall support BACnet Network Address Translation.

5. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

D. Expansion Ports

1. Controller shall support two (2) expansion ports.

   a. Combining the two on-board EIA-458 ports with fully loaded expansion ports, the controller shall support six (6) EIA-485 trunks simultaneously.

2. Expansion cards that mate to the expansion ports shall include:

   a. Dual port EIA-485 card.

E. Power Supply

1. Input for power shall accept between 17 and 30VAC, 47 and 63Hz.

2. Rechargeable battery for shutdown of controller including storage of all data in flash memory.

3. On-board capacitor will ensure continuous operation of real-time clocks for minimum of 14 days.

F. Controller shall be in compliance with the following:

1. UL 916 for open energy management

2. FCC Class B

3. ROHS

4. IEC 60703

5. C-Tick Listed

G. Controller shall operate in the following environmental conditions:

1. -4 to 149 °F (-20 to 65 °C) without optional battery, or 32 to 122 °F (0 to 50 °C) with optional battery.

2. 0 to 95% relative humidity (RH), non-condensing.

~~B.~~**H.** The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

~~C.~~**I.** The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

~~D.~~**J.** Event Alarm & Notification Actions:

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
   a. To alarm
   b. Return to normal
   c. To fault
4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. Alarms shall be annunciated in any of the following manners as defined by the user:
   a. Screen message text
   b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
      (1) Day of week
      (2) Time of day
      (3) Recipient
   c. Pagers via paging services that initiate a page on receipt of email message
   d. Graphic with flashing alarm object(s)
   e. Printed message, routed directly to a dedicated alarm printer
9. The following shall be recorded by the NAC for each alarm (at a minimum):
   a. Time and date
   b. Location (building, floor, zone, office number, etc.)
   c. Equipment (air handler #, access way, etc.)
   d. Acknowledge time, date, and user who issued acknowledgement.
   e. Number of occurrences since last acknowledgement.
10. Alarm actions may be initiated by user defined programmable objects created for that purpose.
11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
12. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

13. Provide a "query" feature to allow review of specific alarms by user defined parameters.
14. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

~~E.~~**K.** Data Collection & Storage:

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
   a. Designating the log as interval or deviation.
   b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
   c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
   d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
   e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.
4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the user in the following data formats:
   a. HTML
   b. XML
   c. Plain Text
   d. Comma or tab separated values
6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
7. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
   a. Archive on time of day
   b. Archive on user-defined number of data stores in the log (buffer size)
   c. Archive when log has reached its user-defined capacity of data stores
   d. Provide ability to clear logs once archived

~~F.~~**L.** Audit Log:

1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
   a. Time and date
   b. User ID
   c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

~~G.~~**M.** Database Backup & Storage:

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
2. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

~~H.~~**N.** Graphical User Interface Software

1. Operating System:
   a. The GUI shall run on Microsoft Windows XP Professional.
2. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
3. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
   a. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
   b. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
   c. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
   d. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
      (1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
      (2) Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
   e. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
   f. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
4. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
   a. Create, delete or modify control strategies.
   b. Add/delete objects to the system.

c. Tune control loops through the adjustment of control loop parameters.
d. Enable or disable control strategies.
e. Generate hard copy records or control strategies on a printer.
f. Select points to be alarmed and define the alarm state.
g. Select points to be trended over a period of time and initiate the recording of values automatically.

3.4 SYSTEM PROGRAMMING

A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods:
1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. All programming shall be graphical and utilize a non proprietary tool like Microsoft Visio. Text based programming is not acceptable.
4. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
5. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

6. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

D. Scheduling:
1. Provide the capability to schedule each object or group of objects in the controller system. Controllers shall have a minimum of 20 schedules. Each schedule shall consist of the following:
   a. Daily schedule: Provide daily schedules that are the basic building blocks for any of the following time schedules. Using daily schedules, user shall enter the switching times with the desired set points and switching conditions for the data-points. When preparing a daily schedule and assigning the name, there is initially no specific relationship to a particular day in the week. The modular structure of the time schedule shall make it possible for the user to establish various different daily schedules, keep them in a library, and include them in the weekly schedule. User shall be free to extend the list of daily schedules to meet his/her special requirements. The repeated use of the same daily schedule shall also be possible (for example, the same daily schedule can apply from Monday to Friday in the weekly schedule). Changes in a daily schedule shall be immediately effective in the weekly and annual schedules, as well as in the special day list.
   b. Weekly schedule: Provide a separate weekly schedule that shall be generated for each time schedule. Weekly schedule defines which daily schedule is to be used for which weekday. A daily schedule is assigned to each day of the week (Monday to Sunday). It shall also be possible to assign the same daily schedule to several weekdays. Weekly schedule, as defined, shall automatically be copied for each week in the annual schedule. If a change is made to a weekday in a weekly schedule, this change shall affect the weekday in every week of the year. If a daily schedule is entered directly in the annual schedule, this daily schedule shall have priority over the daily schedule from the weekly schedule. Definition of a weekly schedule forms the basis of the annual schedule.
   c. Annual schedule: Provide an annual schedule that is structured like a calendar and consists of successive weekly schedules. It provides an overview of which daily schedules are valid on which calendar days. If the daily schedule in a weekly schedule does not apply on a particular calendar date, another daily schedule can be entered for it directly in the annual schedule. Annual schedule starts on the current day. Each day, the time frame shifts one day. Days added at the end shall automatically be assigned the daily schedule from the weekly schedule. Entries in the annual schedule shall therefore be made only if a daily schedule differing from the one selected is to be used. An undefined daily schedule to be inserted in the annual schedule can be defined in the daily schedule.
   d. Holiday schedule: Provide one holiday day list that shall exist per time schedule. List shall make a number of holidays and special days available to which a daily schedule can be assigned. This daily schedule will then apply to this holiday or special day every year. The date of floating holidays shall be calculated automatically by the controller. If no daily schedule is entered on certain holidays, the special day list is not taken into account on this day. Provide capability for 24 holidays and special days.

E. Digital alarms: Each digital object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

F. Analog alarms: Provide analog objects with two maximum limits (limit max 1 and limit max 2), and two minimum limits (limit min 1 and limit min 2).

G. Totalizer alarms: Each totalizer object shall be set to alarm based on a pulse input signal interval that, if exceeded, triggers an alarm signal. Alarm signal text shall be permanently programmed and needs no input from the user.

H. Alarms shall be selectable as critical or non-critical. Critical alarms shall be transmitted as high priority.

I. System alarms: Operating errors that occur in a control unit or during communication with other controllers shall be recognized and displayed by the computer module. These alarm signals can relate, for example, to a defective module, the need to change the buffer battery (data protection), or the presence of one digital output module too many (maximum 10). These alarm signal texts are preprogrammed. They are always critical alarms.

J. Demand limiting:
1. Demand-limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter or from a watt transducer or current transformer attached to the building feeder lines.
2. Demand-limiting program shall predict the probable power demand such that action can be taken to prevent exceeding the demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates the demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
3. Demand reduction shall be accomplished by the following means:
    a. Reset air-handling unit supply temperature set point up by 1 degree C (2 degrees F).
    b. Reset space temperature set points up by 1 degree C (2 degrees F).
    c. De-energize equipment based upon priority.
4. Demand-limiting parameters, frequency of calculations, time intervals, and other relevant variables shall be based on the means by which the local power company computes demand charges.
5. Provide demand-limiting prediction and control for any individual meter monitored by the system or for the total of any combination of meters.
6. Provide the means for an operator to make the following changes on-line:
    a. Addition and deletion of loads controlled.
    b. Changes in demand intervals.
    c. Changes in demand limit for meter(s).
    d. Maximum shutoff time for equipment.
    e. Minimum shutoff time for equipment.
    f. Select rotational or sequential shedding and restoring.
    g. Shed and restore priority.
7. Provide the following information and reports, to be available on an hourly, daily, and monthly basis:
    a. Total electric consumption

b. Peak demand
c. Date and time of peak demand
d. Daily peak demand

K. Sequencing: Provide application software based upon the sequences of operation specified to properly sequence chillers, boilers, and pumps.

L. EPID control: An EPID (enhanced proportional-integral-derivative) algorithm with additional features shall be supplied. Algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. Enhanced features shall include a built-in start-up ramp, direct-reverse action selection, integral recalculation to prevent windup below minimum and above maximum, and an auxiliary input for limit applications and integral reset. Controlled variable, set point, and PID gains shall be user-selectable.

M. Staggered start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment or groups of equipment is started, along with the time delay between starts, shall be user-selectable.

N. Energy calculations:
1. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., gpm) to be accumulated and converted to energy usage data.
2. Provide an algorithm that calculates a sliding window average (e.g., rolling average). Algorithm shall be flexible to allow window intervals to be user-specified (e.g., 15 minutes, 30 minutes, and 60 minutes).
3. Provide an algorithm that calculates a fixed window average. A digital input signal will define the start of the window period (e.g., signal from utility meter) to synchronize the fixed window average with that used by the utility.

O. Anti-short cycling: Digital output objects shall be protected from short cycling. This feature shall allow minimum on time and off time to be selected.

P. On and off control with differential: Provide an algorithm that allows a digital output to be cycled based on a controlled variable and set point. Algorithm shall be direct acting or reverse acting and incorporate an adjustable differential.

Q. Duty cycle: Provide software to switch HVAC systems on and off at variable intervals to save energy while maintaining room conditions. Program shall have adjustable internal parameters for room comfort range, maximum off times, minimum off times, and motor cycle times.

R. Economizer: Provide software that determines the most economical system operation for full and partial air conditioning systems. For a full air conditioning plant, it calculates the control signal for energy recovery on the basis of actual outdoor air enthalpy, return air enthalpy, and demand. In partial air conditioning systems, this control icon shall be used for heat recovery with temperature comparison. Economizer program shall make decisions based on the following information: Is the system a full or partial air conditioning system. A full system has temperature and humidity control. A partial system has temperature control only. Is there mixed air damper operation or heat and humidity recovery using a thermal wheel? Which has the higher energy cost: heating or cooling?

S. Night purge: Provide a program that outputs an on and off value to start and stop ventilation and air conditioning systems to precondition rooms when cold outdoor air is available during non-working hours (usually, nighttime). To switch on the air conditioning as late as possible, this function shall permit room temperature to drop below room temperature set point during night cooling. Night purge shall achieve this action by resetting the room temperature set point downward. Minimum outdoor air temperature shall be limited to prevent damage from excessively cold outdoor air.

T. Optimum start and stop: Provide a software program that calculates optimized values for starting and stopping the heating plant. Optimized start-stop function shall consider the residual heat in a building to avoid unnecessary heating operation. Required room conditions are met at all times. Optimum start and stop program calculates required flow temperature with an integrated heating curve. Two techniques shall be available: optimization without room sensor or optimization with room sensor. Optimization without room sensor uses outdoor air temperature to determine optimum start (the preheat point). Optimization with room sensor uses room control and needs a time constant (time program) and dead time to calculate the preheat point.

U. Zero energy band: Provide a software program that determines set points to maintain a predetermined comfort band divided into heating, cooling, and zero energy bands. ZEB subdivides a predetermined comfort band into: Heating band zero energy band cooling band. Zero energy band represents a temperature range in which the room temperature may vary without a need for heating or cooling.

V. Run-time totalization: Provide software to totalize run times for all digital input objects. A high run-time alarm shall be assigned, if required, by the operator.
1. Data references like text descriptors, historical data, alarm buffer, engineering units, engineering characteristics etc. must be resident inside the building controller.
2. Provide at minimum 1000 BACnet ® Objects, of which a minimum 300 physical I/Os must be possible.

~~3.~~3.5 DASHBOARD INTERFACE

~~4.~~A. As part of this project, extend the existing campus Climatec AXCESS Dashboard to include this building. Update the existing dashboard system with the latest security patches and software revision.

~~5.~~B. KW, Gas, BTU, and Water consumption metered in this project shall be integrated into the AXCESS dashboard and extended to aggregate and visualize this data.

~~3.5~~3.6 EXPANDABLE AIR HANDLING UNIT CONTROLLERS

A. General:
1. Alerton VLX Platinum, native BACnet controller shall be used for these applications.
2. Expandable application controller shall be capable of providing control strategies for the system based on information from any or all connected inputs. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site via simple download are not acceptable. Changing global strategies via

firmware changes is also unacceptable. Program execution of controller shall be a minimum of once per second.

3. Programming shall be object-oriented using control program blocks. Controller shall support a minimum of 500 Analog Values and 500 Binary Values. Each and every analog and binary value shall support standard BACnet priority arrays. Programming tool shall be provided with system and shall be the same tool that is used to program the Building Controller. All flowcharts shall be generated and automatically downloaded to controller. No re-entry of database information shall be necessary.
4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's terminal or field computer.
5. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. Unused battery life shall be 10 years.
6. The onboard, battery-backed real time clock must support schedule operations and trend logs.
7. Global control algorithms and automated control functions should execute via 32-bit processor.
8. Controller shall include both on-board 10BASE-T/100BASE-TX Ethernet BACnet communication over twisted pair cable (UTP) and shall include BACnet IP communication. In addition, controller shall include BACnet PTP connection port.
9. The base unit of the controller shall host up to 8 expansion modules with various I/O combinations. These inputs and outputs shall include universal 12-bit inputs, binary triac outputs, and 8-bit switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support 3K and 10K thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.
10. All outputs must have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position.
11. The position of each and every HOA switch shall be available system wide as a BACnet object. Expandable Central Plant Controller shall provide up to 176 discreet inputs/outputs per base unit.

B. BACnet Conformance:

1. Central Plant/AHU Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Building controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Clock Functional Group
   b. Files Functional Group
   c. Reinitialize Functional Group
   d. Device Communications Functional Group
   e. Event Initiation Functional Group
2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the

functional groups listed above. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.
4. The Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Schedules: Each Central Plant/AHU controller shall support a minimum of 50 BACnet Schedule Objects.

D. Logging Capabilities:
1. Each controller shall support a minimum of 200 trend logs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2. Controller shall periodically upload trended data to system server for long term archiving if desired.
3. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs

E. Alarm Generation:
1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications
3. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

~~3.6~~3.7 TERMINAL UNIT APPLICATION CONTROLLERS (HEAT PUMPS, AC UNITS, FAN COILS)

A. Provide one Alerton Visual Logic Controller (VLC) that is a native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance:
1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

a. Files Functional Group
b. Reinitialize Functional Group
c. Device Communications Functional Group

2. Please refer to Section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum–Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

D. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

E. Application controller shall include support for the Microset II intelligent room sensor. Display on the room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

~~3.7~~3.8 INPUT AND OUTPUT INTERFACE

A. Hardwired inputs and outputs may tie into the system through general purpose, custom application, unitary controllers or distributed I/O devices.

B. Input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to controller. Input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to controller. Inputs and outputs shall be arranged on interchangeable modules or circuit boards to allow the replacement of a damaged module or board without replacing the entire controller.

C. Digital inputs shall allow the monitoring of on and off signals from remote devices. Digital inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense dry contact closure without external power other than that provided by the controller being applied.

D. Totalizer input points: This type of point shall conform to all requirements of digital input points, and also accept up to 15 pulses per second for pulse accumulation.

E. Analog inputs for GPCs shall be minimum 12-bit resolution and allow the monitoring of low-voltage (0 to 10 VDC), current (0 to 20 mA), negative temperature coefficient (NTC), and resistance to detector (RTD). Analog inputs shall be compatible with and field-configurable to commonly available sensing devices. To prevent thermal loading, RTDs and thermistors shall be scanned rather than have continuous power applied.

F. Inputs shall be electrically isolated from their associated field points.

G. Digital outputs shall provide for on and off operation, or a pulsed low-voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.

H. Analog outputs shall be minimum 8-bit resolution and provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on general purpose or custom application controllers shall have status lights and a two-position Auto and Manual switch and manually adjustable potentiometer with feedback for manual operation. Analog outputs shall not exhibit a drift of greater than 0.4 percent of range per year.

I. Tri-State outputs: Provide tri-state outputs (two coordinated digital outputs) for control of three-point floating-type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation). Control algorithms shall run the zone actuator to one end of its stroke every 24 hours for verification of operator tracking.

J. System point capacity: System size shall be expandable to at least two times the number of hardware and software input and output points required for this project or 20,000 points, whichever is greater. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. Operator interfaces installed for this project shall not require any hardware additions or software revisions to expand the system.

K. Spare I/O Points: At each controller location, provide spare points equal to 15 percent of total I/O points at that location or 2 AI, 2 AO, 2 DO and 2 DI, whichever is greater.

~~3.8~~3.9 POWER SUPPIES AND LINE FILTERING

A. Control transformers shall be UL and CSA Listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Limit connected loads to 80 percent of rated capacity

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1. 0 percent line and load combined, with 100-microsecond response time for 50 percent load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150 percent current overload for at least three seconds without trip-out or failure.
   a. Unit shall operate between 32 degrees F and +120 degrees F. EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
   b. Line voltage units shall be UL Recognized and CSA approved.

B. Power line filtering:
1. Provide transient voltage and surge suppression for all workstations and controllers, either internally or as an external component. Surge protection shall have the following at a minimum:
   a. Dielectric strength of 1,000 volts minimum
   b. Response time of 10 nanoseconds or less
   c. Transverse mode noise attenuation of 65 dB or greater
   d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz

~~3.9~~3.10 FIELD CONTROL DEVICES

A. Temperature Sensors:
1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application.
2. Wall sensors to be installed as indicated on drawings. Mount 48 inches about finished floor.
3. Duct sensors to be installed such that the sensing element is in the main air stream.
4. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors.
5. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

B. Intelligent Room Sensor with LCD Readout:
1. The intelligent room sensor shall be the Microset 4 by Alerton.
2. Sensor shall contain a backlit touchscreen -LCD digital display along with temperature & humidity sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
3. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, humidity, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

4. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
5. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
6. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to terminal controller, terminal box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

C. Wall Sensor:
1. All thermostats shall be the Microtouch II by Alerton, and shall be a communicating, intelligent thermostat with a microprocessor.
2. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure.
3. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis.
4. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller.
5. All programmable variables shall be available to Field Service Tool through wall sensor port.

D. RELAYS:
1. Control relays shall be UL Listed plug-in type. Contact rating, configuration, and coil voltage suitable for application. Honeywell R4228/8228.
2. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable *200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

E. Voltage Transformers:
1. AC voltage transformers shall be UL and CSA recognized, 600 VAC rated, complete with built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of +40 to +130 degrees F and shall provide *0.5 percent accuracy at 24 VAC and a 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.
4. Transmitters
   a. Transmitter shall operate on 24 VAC. Transmitter shall not require an isolated power source.
   b. Operating temperature range for the transmitter shall be -20° F to 120° F. Protect transmitter from weather and water.
   c. Communication with host controls using one of the following interface options:
      (1) Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
      (2) RS-485: Field selectable BACnet-MS/TP, ModBus-RTU
5. Measuring device shall be UL listed as an entire assembly.

6. Contractor shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the engineer if any measurement locations do not meet the manufacturer's placement requirements.

F. Local Control Panels:
1. Indoor control cabinets shall be fully enclosed NEMA 1 construction with hinged door or key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide on and off power switch with over-current protection for control power sources to each local panel.
4. Build control panels in accordance with UL508A standards and label with separate UL label numbers.

G. Current Sensing Relay
1. Current Sensing Relays: Provide solid-state sensor, which operates when the current level sensed by the internal current transformer, exceeds the adjustable trip point. The internal circuits shall be totally powered by induction from the line being monitored. The relay shall have zero off state leakage in the solid-state output while switching both AC and DC circuits. The monitored AC circuits shall be 1 to 150 amps. Veris, Model H908, or approved equal.

H. Flow Meters
1. Shall be Onicon Model F-3100 Series.
2. No substitutes accepted.

~~3.~~**I.** Electric Meters
~~4.~~**1.** Shall be Electro Industries/ Gauge Tech, Shark 200 to include V3 switch pack, INP100S 10/100 Base T Ethernet slot, and PO1S pulse outputs/4 status input slot.
~~5.~~**2.** No substitutes accepted.

~~6.~~**J.** Gas Meters
~~7.~~**1.** Shall be Sensus, Sonix 600 or 880 gas meters, utilizing single path ultrasonic metering, with Form A pulse output at 50ms, and a 10 year battery life.
~~8.~~**2.** 3/8" LCD index display; 4, 5, or 6 digits with 3 digit alarm/ high resolution index.
~~9.~~**3.** Flash memory: Permanent information retention without power.
~~10.~~**4.** No substitutes accepted.

~~I.~~**K.** Network Connection Tool
1. Network connection tool shall allow technician to connect a laptop to any MS/TP network or at any MS/TP device and view and modify all information throughout the entire BACnet network. Laptop connection to tool shall be through Ethernet or PTP.

2. Provide quick connect to MS/TP LAN at each controller. Tool shall be able to adjust to all MS/TP baud rates specified in the BACnet standard.
3. Provide (1) Network Connection Tool for this project.

~~3.10~~3.11 ACTUATORS

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

B. Manufacturers:
   1. Belimo

C. Valves: Size for torque required for valve close off at maximum pump differential pressure.

D. Coupling: V-bolt and V-shaped, toothed cradle.

E. Overload Protection: Electronic overload or digital rotation-sensing circuitry.

F. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.

G. Power Requirements (non-Spring Return): 24 V ac.

H. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.

I. Proportional Signal: 2- to 10-V dc, and 2- to 10-V dc position feedback signal.

J. Temperature Rating: 40 to 104 deg F

K. Standard spring ranges are 2 to 5 psig, 3 to 10 psig, and 8 to 11 psig.

L. Not pulse actuated.

PART 4 - EXECUTION

4.1 INSTALLATION

A. Provide conduit and wire from dedicated 120 VAC emergency power circuit if available.

B. Power supply wiring (120 VAC) shall be run in dedicated conduit. Power conduit shall be separated from control and signal conduits by a minimum of 3 inches.

C. EMS equipment shall be located such that it is accessible for service while maintaining clearances or walkways required around other equipment or obstacles.

D. Control elements located in outdoor installations shall be weatherproof.

E. Splices in shielded cables shall not be permitted. Terminations of shields and conductors shall be done in accordance with the manufacturer's instructions.

F. Cabling and wiring within panels shall be harnessed with tie wraps and secured in a neat and orderly fashion.

G. Cable runs shall be kept as short as possible, allowing extra length for making connections to termination points.

H. Each cable or individual conductor shall be labeled with a unique tag for quick identification during checkout, testing, and troubleshooting. each component shall be permanently labeled with the device name and at each terminal point per section.

4.2 EXAMINATION

A. Project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect and Engineer for resolution before rough-in work is started.

B. Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

C. Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and contractor’s work, and the plans and the work of others— contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the contractor’s work with the work of others. Changes in the work covered by this Specification made necessary by the failure or neglect of contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

4.3 PROTECTION

A. Contractor shall protect work and material from damage from its work or employees, and be liable for all damages thus caused.

B. Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. Contractor shall protect material that is not immediately installed. Contractor shall close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

4.4 COORDINATION

A. Site:
1. Where mechanical work will be installed in close proximity to, or will interfere with, work of other trades, contractor shall assist in working out space conditions to make a

satisfactory adjustment. If contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, contractor shall make necessary changes in its work to correct the condition without extra charge.

2. Coordinate and schedule work with all other work in same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals: Refer to Submittals Article in Part 1 of this Specification for requirements.

C. Test and balance:
1. Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.
2. Contractor shall provide training in the use of these tools. This training will be planned for a minimum of four hours.
3. In addition, the contractor shall provide a qualified technician to assist in test and balance process, until the first 20 terminal units are balanced.
4. Tools used during the test and balance process will be returned at completion of the testing and balancing.

D. Coordination with controls specified in other sections or divisions: Other sections and divisions of this Specification include controls and control devices that are to be part of or interfaced to control system specified in this section. Controls shall be integrated into the system and coordinated by contractor as follows:
1. Communication media and equipment shall be provided as specified in Part 2: Communication of this Specification.
2. Each supplier of a control product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.
3. Contractor shall coordinate and resolve any incompatibilities that arise between the control products provided under this section and those provided under other sections or divisions of this Specification.
4. Contractor is responsible for providing all controls as referenced in the related sections this work of contract documents.
5. Contractor is responsible for the interface of control products provided by multiple suppliers, as referenced in the related sections this work of contract documents.

4.5 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring raceway parallel to the building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electric Code (NEC).

D. Verify wiring integrity to ensure continuity and freedom from shorts and grounds.

E. Equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility, and be executed in strict adherence to local codes and standard practices.

4.6 WIRING

A. Control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where requirements of this section differ with those in Division 26, the requirements of this section shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 26 requirements.

C. Low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.)

D. Wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage—shall be installed in raceway at levels below 10ft.

E. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two.

F. Do not install wiring in raceway containing tubing.

G. Class 2 wiring to be installed in conduit.

H. Wire-to-device connections shall be made at a terminal block or terminal strip. Wire-to-wire connections shall be made at a terminal block or wire nut at junction box.

I. Wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

J. Maximum allowable voltage for control wiring shall be 120v. If only higher voltages are available, the contractor shall provide step-down transformers.

K. Wiring shall be installed as continuous lengths, with no splices permitted between termination points.

L. Size of raceway and size and type of wire shall be the responsibility of contractor, in keeping with the manufacturer’s recommendation and NEC requirements, except as noted elsewhere.

M. Include one pull string in each raceway 1 inch or larger.

N. Use coded conductors throughout with different colored conductors.

O. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6inch from high-temperature equipment (e.g., steam pipes or flues).

P. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

Q. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

R. Contractor shall terminate control and interlock wiring, and maintain updated wiring diagrams with terminations identified at the job site.

S. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture—including chiller and boiler rooms—liquid-tight, flexible metal raceways shall be used.

T. All conduits on roof or exposed to weather to be rigid.

U. Raceway shall be rigidly installed, adequately supported, properly reamed at both ends and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations shall be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

4.7 COMMUNICATION WIRING

A. Contractor shall adhere to items listed in Wiring Article in Part 3 of Specification.

B. Follow manufacturer’s installation recommendations for communication cabling.

C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during the installation.

E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrestor shall be installed between the lines and ground. Lightning arrestor shall be installed according to the manufacturer’s instructions.

G. Runs of communication wiring shall be unspliced lengths when that length is commercially available.

H. Label communication wiring to indicate origination and destination data.

4.8 FIELD QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Specification.

B. Contractor shall continually monitor the field installation for code compliance and quality workmanship.

C. Contractor shall have work inspected by local or state authorities having jurisdiction over the work.

4.9 IDENTIFICATION OF HARDWARE AND WIRING

A. Wiring, cabling, and tubing within factory-fabricated panels shall be labeled within 2inch of termination with point address or termination number.

B. Label pneumatic tubing at each end within 2inch of termination with descriptive identifier.

C. Identify control panels with minimum 1/2inch letters on laminated plastic nameplates.

D. Manufacturers' name plates and UL or CSA labels are to be visible and legible after equipment is installed.

E. Identifiers shall match record documents.

F. Permanently label or code each point of field terminal strips to show instrument or item served.

G. Identify room sensors relating to air handling units and terminal air units with nameplates.

H. Label wiring and conduit, including wire within panels.

I. Electrical devices such as transformers and power supplies shall be labeled with supply voltage and power circuit number.

J. Terminal blocks shall be labeled to match the connected device.

K. Label panel-mounted devices to match as built drawings.

L. Wire and tubing labels shall be clearly indicated on the control drawings. Method of labeling shall be logical and intuitive.

M. Provide label on ceiling grid near each terminal air unit, and air and water pressure transducers in the ductwork and piping. Follow campus standard for type and appearance of label.

4.10 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25 percent of available memory free for future use.

B. Point naming and point value: System point names and values shall be of sufficient size to allow flexibility in design, allowing easy operator interface without the use of a written point index or cryptic alphanumeric shorthand.
   1. Point ID is used to designate the location of the point within the building, such as mechanical room, wing, or level, or the building itself in a multi-building environment. Point ID shall be a minimum of 40 characters in length.
   2. Point descriptors shall be a minimum of 132 characters.
   3. Point states shall be a minimum of 8 characters in length.
   4. Point engineering units shall be a minimum of 6 characters in length.
   5. Point values shall be a minimum of 15 characters in length with a variable decimal point.

C. Operator interface:
   1. Standard graphics: Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, fan coil unit, terminal equipment and all life safety devices. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
   2. Show terminal equipment information on a graphic summary table. Provide dynamic information for each point shown.
   3. Program graphic screens to show the location of, alarm points, and cameras. Set up these screens to provide automatic camera call up upon alarm.
   4. Contractor shall provide labor necessary to install, initialize, start up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, operator interface database, and any third-party software installation and integration required for successful operation of the operator interface

4.11 BUILDING CONTROL INSTALLATION SPECIFICS

A. Installation of sensors
   1. Install sensors in accordance with the manufacturer's recommendations.
   2. Mount sensors rigidly and adequately for the environment within which sensor operates.
   3. Room temperature sensors shall be installed on concealed junction boxes properly supported. Wiring to the sensor shall not be required to be polarity sensitive. Design of sensor shall be modular, which allows for rough-in of wiring without presence of electronics or esthetic covering.
   4. Wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

B. Flow switch installation
   1. Use correct paddle for pipe diameter.
   2. Adjust flow switch in accordance with manufacturer's instructions.

C. Actuators
   1. Mount and link control damper actuators per manufacturer's instructions.
      a. Check operation of damper and actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
      b. Provide mounting hardware and linkages for actuator installation.
   2. Electric and electronic actuators:

a. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. Actuators shall be mounted following manufacturer's recommendations.
b. Valves: Actuators shall be connected to valves with adapters approved by actuator manufacturer. Actuators and adapters shall be mounted following actuator manufacturer's recommendations.

4.12 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup testing: Testing listed in this Article shall be performed by contractor and make up part of the necessary verification of an operating control system. Testing shall be completed before the Owner's representative is notified of the system demonstration.
1. Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all instruments, controls, and accessory equipment furnished under this Specification.
2. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
3. Enable control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.
4. Verify that digital output devices (relays, solenoid valves, two-position actuators and control valves, and magnetic starters) operate properly and that normal positions are correct.
5. Verify that analog output devices (I/Ps, actuators) are functional, that start and span are correct, and that direction and normal positions are correct. Contractor shall check all control valves and automatic dampers to ensure proper action and closure. Contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify that system operation adheres to the Sequences of Operation. Simulate and observe modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum start and stop routines.
7. Analog intelligent devices shall be tested for current address, sensitivity and user defined message
8. Verify activation of all waterflow switches.
9. Open initiating device circuits and verify that the trouble signal actuates.

4.13 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration:
1. Prior to acceptance, control system shall undergo a series of performance tests to verify operation and compliance with this Specification. Tests shall occur after the contractor has completed the installation, started up the system, and performed its own tests.
2. Tests described in this section are to be performed in addition to tests that contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the Control System Checkout and Testing Article in Part 3 of this Specification. Engineer will be present to observe and review these tests. Notify Engineer at least 10 days in advance of the start of the testing procedures.
3. Demonstration process shall follow that approved in Part 1: Submittals. Approved checklists and forms shall be completed for all systems as part of the demonstration.

4. Contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate field operation of each control and sensing point for modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, alarm, trouble, and power failure modes. Purpose is to demonstrate the calibration, response, and action of every point and system. Test equipment required to prove operation of system shall be provided and operated by contractor.
5. Complete a log showing the date, technician's initials, and any corrective action taken or needed for each control input and output checked.
6. Demonstrate compliance with Part 1: System Performance.
7. Demonstrate compliance with Sequences of Operation through all modes of operation.
8. Demonstrate the following items:
    a. Complete operation of the operator interface
    b. DDC Loop response: Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. Test shall show the loop's response to a change in set point that represents a change of actuator position of at least 25 percent of its full range. Sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. For each sample, the trend data shall show the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by contractor.
    c. Demand limiting (if implemented): Contractor shall supply a trend data output showing the action of demand limiting algorithm. Data shall document action on a minute-by-minute basis over a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
    d. Optimum start and stop (if implemented): Contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include output status of optimally started and stopped equipment, and area temperature sensor inputs.
    e. Interface to the building fire alarm system (if implemented).
    f. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the Architect and Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. Provide logs in both printed and disk formats.
    g. Devices supplied by others connected to the LonWorks™ system shall be checked out and commissioned by supplier, and verification of interface interoperability shall be conducted by contractor.
9. Tests that fail to demonstrate operation of the system shall be repeated at a later date. Contractor shall be responsible for necessary repairs or revisions to hardware or software to successfully complete tests.

B. Acceptance:
1. Tests described in this Specification shall have been performed to the satisfaction of the Engineer and Owner prior to acceptance of the control system as meeting the requirements of completion. Tests that cannot be performed due to circumstances beyond the control of contractor may be exempt from completion requirements if stated in writing by the Engineer. Tests shall then be performed as part of the warranty.

2. System shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: Submittals.

4.14 CLEANING

A. Contractor shall clean up all debris resulting from its activities daily. Contractor shall remove all cartons, containers, and crates under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At completion of work in any area, contractor shall clean all of its work and equipment, keeping it free from dust, dirt, and debris.

C. At the completion of work, equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

4.15 SYSTEM TESTING AND CHECKOUT

A. Prior to the acceptance test, perform the following tasks:
1. Check for electrical continuity, eliminating shorts and open circuits, and verify grounding.
2. Install, calibrate, adjust, debug and set system's initial operating parameters including the existing campus central server.
3. Check out systems to verify the provided engineering documentation and approved submittals have been followed.

B. The EMS must operate continuously for seven (7) days with no operational malfunctions or problems before setting an acceptance test date. Simulate different building control scenarios for worst-case condition and simulate other alarm conditions to test the response and handling of situations.

C. Prepare and submit an Acceptance Test Plan for approval. This test shall include verification of communications, control, and response from the existing campus central server to the building controller and finally to the sensor and controlled device to demonstrate the proper operation of control loops, conditional control and default sequences in accordance with the project documentation.

D. Obtain the approval of the Orange Coast College representative as to when the acceptance test will be performed.

E. Conduct the acceptance test in the presence of the designated representative for Orange Coast College following the approved Acceptance Test Plan.

F. The College’s Representative shall check off and initial each successfully tested item. Demonstrate that the electromechanical systems are operating properly and that the system is providing the required control sequences, alarms, graphic displays, and report generations.

G. An ongoing punch list shall be maintained throughout the test of items. This list shall contain items that must be corrected prior to accepting the system for beneficial use and commencement of the warranty period.

H. Provide copy of database of objects, and any programming tools used during the setup of the system.

4.16 TRAINING

A. Furnish the services of competent instructor(s) who shall give a minimum of (16) hours onsite instruction and orientation to the College's designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements of the equipment, the affected systems, and the software provided. The training shall be customized to reflect the actual system installed rather than being a general training course. Each instructor shall be thoroughly familiar with all aspects of the subject matter they are to teach.

B. Train designated staff of Owner's representative and Owner to enable them to:
1. Day-to-Day Operators:
   a. Proficiently operate the system
   b. Understand control system architecture and configuration
   c. Understand system components
   d. Understand system operation, including system control and optimizing routines (algorithms)
   e. Operate the workstation and peripherals
   f. Log on and off the system
   g. Access graphics, point reports, and logs
   h. Adjust and change system set points, time schedules, and holiday schedules
   i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
   j. Understand system drawings and the Operation and Maintenance manual
   k. Understand the job layout and location of control components
   l. Access data from various network and control nodes.
   m. Operate portable operator's terminals
2. Advanced operators:
   a. Make and change graphics on the workstation
   b. Create, delete, and modify alarms, including annunciation and routing of these
   c. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc basis and at user-definable time intervals
   d. Create, delete, and modify reports
   e. Add, remove, and modify system physical points
   f. Create, modify, and delete programming
   g. Add panels when required
   h. Add operator interface stations
   i. Create, delete, and modify system displays—both graphical and otherwise
   j. Perform system field checkout procedures
   k. Perform controller unit operation and maintenance procedures
   l. Perform workstation and peripheral operation and maintenance procedures
   m. Perform system diagnostic procedures

n. Configure hardware including PC boards, switches, communication, and I/0 points
o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
p. Adjust, calibrate, and replace system components

3. System managers and administrators:
   a. Maintain software and prepare backups
   b. Interface with job-specific, third-party operator software
   c. Add new users and understand password security procedures

C. These objectives will be divided into three logical groupings. Participants may attend one or more of these, depending on the level of knowledge required:
   1. Day-to-day operators
   2. Advanced operators
   3. System managers and administrators

D. Provide course outline and materials as per Submittals Article in Part 1 of this Specification. Instructor(s) shall provide one copy of training material per student.

E. Instructor(s) shall be factory-trained experienced in presenting this material.

F. Classroom training shall be done using a network of working controllers representative of the installed hardware.

PART 5 POINTS LIST AND SEQUENCE OF OPERATION

5.1 Refer to Controls Drawings for control schematics, points lists and sequence of operation

END OF SECTION 230923

SECTION 238106 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged rooftop air conditioning unit.
   2. Roof curb.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   2. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
   2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:
   1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA MG 1 - Motors and Generators.

F. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.
   2. NFPA 58 - Liquefied Petroleum Gas Code.
   3. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.

B. Integrated Part-Load Value (IPLV): Single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on basis of weighted operation at various load capacities for the equipment.

1.4 SUBMITTALS

A. Product Data: Submit data indicating:
1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Accessories.

B. Test Reports: Submit results of factory test at time of unit shipment.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Manufacturer’s Field Reports: Submit start-up report.

1.5 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 340/360.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Minimum heating efficiency.

E. Performance Requirements: Conform to minimum EER prescribed by ASHRAE 90.1 when tested in accordance with ARI 340/360.

F. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 5 years experience.

B. Installer: Company specializing in performing Work of this section with minimum 5 years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Division 01, Section 01 31 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept units on site. Inspect for damage.

B. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.9 COORDINATION

A. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.10 WARRANTY

A. Section 01 77 00 - Closeout Requirements and Section 01 78 00: Product warranties and product bonds.

B. Furnish five year manufacturer’s warranty for compressors.

C. Furnish five year manufacturer’s warranty for heat exchangers.

1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

1.12 EXTRA MATERIALS

A. Furnish one set of fan belts for each unit.

B. Furnish one set of disposable filters for each unit.

PART 2 PRODUCTS

2.1 ROOFTOP AIR CONDITIONING UNITS

A. Manufacturers:
1. McQuay.
2. Seasons 4.
3. Trane.

B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, variable frequency drive, evaporator coil, compressor, refrigeration circuit, condenser, gas-fired heating section, air filters, outdoor air section, and exhaust-return section.

C. Configuration: As indicated on Drawings.

D. Roof Mounting Curb: Galvanized steel, channel frame with gaskets, nailer strips. Full perimeter curb under entire unit.

E. Cabinet:
1. Designed for outdoor installation with weatherproof construction.
2. Panels: Galvanized steel with baked enamel finish meeting 500 hour salt spray test in accordance with ASTM B117. Furnish hinged access doors with handles and rubber gaskets at edges.
3. Interior Surfaces: Sheet metal lined creating double wall construction.

F. Supply Fan:
1. Fan: Statically and dynamically balanced, resiliently mounted.
2. Fan Drive: V-Belt type, Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Furnish solid shaft construction. Select Variable and adjustable pitch motor sheave to obtain required rpm with sheaves set at mid-position as recommended by manufacturer.
    a. Drive Rating: Minimum 1.5 times nameplate rating of motor.
3. Fan Assembly Mounting: Furnish spring-type vibration isolators.

G. Supply Fan Modulation:
1. Variable Frequency Drive:
    a. Furnished for supply fan and exhaust fan.
    b. Factory installed, wired, and tested.
    c. With bypass.
    d. Full digital control.
    e. Insulated Gate Bi-Polar Transistors used to produce output pulse width modulation waveform allowing quiet operation.
    f. NEMA 250 Type 1 enclosure.
    g. Self diagnostics.
    h. Proportional-integral-derivative setpoint control.
    i. Communication port.

j. Electronic thermal overload protection.

2. Controlled from duct static pressure and Alerton VLX Platinum controller provided and installed by BMS contractor in spec section 230923.
3. Field adjustable duct high limit safety control to protect duct work from excessive duct pressure provided and installed by BMS contractor in spec section 230923.

H. Evaporator Coil:
1. Constructed of seamless copper tubes mechanically expanded into copper fins. Factory leak tested under water.
2. Galvanized drain pan and piping connection.
3. Furnish for multiple circuited units.

I. Compressors:
1. Resiliently mounted with positive lubrication, and internal motor overload protection.
2. Furnish each compressor with independent refrigeration circuit.
3. Furnish vibration isolators.
4. Furnish short cycle protection.

J. Refrigeration circuit:
1. Dehydrate and factory charge each circuit with oil and refrigerant.
2. Furnish the following for each circuit:
a. Thermostatic expansion device.
b. Filter-drier.
c. Suction, discharge, and liquid line service valves with gauge ports.
d. Sight glass.
e. High and low pressure safety controls.

K. Condenser:
1. Constructed of copper tubing mechanically bonded to copper fins. Factory leak tested under water.
2. Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high efficiency fan motors.
3. Furnish factory installed coil guard.

L. Gas-Fired Heating Section:
1. Fuel: Natural gas.
2. Heat Exchanger: Stainless steel, of welded construction.
3. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device.

M. Air Filters: See schedules.

N. Outdoor Air Section:
~~a.~~**1.** Economizer: Economizer components and controls in accordance with ICC IECC provided and installed by BMS contractor in spec section 230923.

O. Exhaust and Return Section:
1. Modulating exhaust fans: Centrifugal type, statically and dynamically balanced, high efficiency motor. Motor permanently lubricated with built-in thermal overload protection. Furnish barometric dampers at fan outlet to prevent backdraft. Fans operated with volume control device based on field adjustable interior space pressure setpoint provided and installed by BMS contractor in spec section 230923.

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

2.3 SOURCE QUALITY CONTROL

A. Perform factory test of each unit. Test includes:
1. Dynamic trim balance of completed fan assembly.
2. Complete run check of electrical components and safety controls.
3. Pressure test, at manufacturer's rated pressure, of refrigerant coils and condenser coils prior to unit assembly.
4. Leak check of completed refrigerant circuits.
5. Compressor run check.

B. Make completed unit available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

C. Allow witnessing of factory inspections and test at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 INSTALLATION

A. Roof Curb:
1. Assemble roof curb.
2. Install roof curb level.
3. Coordinate curb installation and flashing.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
5. Install gasket material between unit base and roof curb.

B. Connect units to supply and return ductwork with flexible connections.

C. Install condensate piping with trap and route from drain pan to condensate drainage system.

D. Install components furnished loose for field mounting.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between unit and field installed accessories.

G. Provide fixed sheaves required for final air balance.

H. Install Work in accordance with the manufacturer's instructions.

END OF SECTION 238106

SECTION 238109 - CUSTOM PACKAGED OUTDOOR MULTIZONE AIR CONDITIONING UNIT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air conditioning equipment as indicated on the drawings and as specified. The new custom packaged outdoor multizone air conditioning unit shall be furnished by SEASONS•4. Provide materials, labor, tools, and all requirements necessary.

1.2 RELATED SECTIONS

A. Section 230500: Common Work Results for HVAC

B. Section 233100: HVAC Ducts & Casings

C. Section 230548: Vibration & Seismic Controls for HVAC Piping & Equipment

D. Section 230923: DDC Controls System for HVAC

E. Section 230593: Testing, Adjusting and Balancing for HVAC

1.3 SUBMITTALS

A. Make submittals in accordance with provisions of Section 230500: Common Work for HVAC.

B. Product Data: Include manufacturer's technical data for each AHU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.

D. Warranty: Special warranty specified in this specification.

1.4 QUALITY ASSURANCE

A. ARI Compliance:
   1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
   2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. 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.

1.5 INSTRUCTIONS AND MAINTENANCE DATA

A. Contractor shall provide instructions on equipment operation and maintenance procedure, as required, before or during completion test, to following School District Personnel:
1. Mechanical Inspector of project.
2. HVAC Maintenance Supervisor
3. Plant Manager

B. Instructions shall be entrusted to a qualified and experienced person, who has been adequately trained and is able to demonstrate correct operation and maintenance of equipment and related components.

PART 2 - PRODUCTS

2.1 MANUFACTURER DATA

A. Custom packaged outdoor multizone air conditioning unit manufactured by SEASONS – 4 Inc. The equipment must comply with the requirements and terms of ETL's Listing, Labeling and Follow-up Service Agreement and the complete unit must bear the ETL Label.

B. Units shall be run tested at factory for a minimum of four (4) hours and operation of all functions, safeties, and devices shall be verified. Operational test sheets shall be provided upon request. All parts shall be available at the local wholesaler level, therefore no OEM parts will be allowed.

C. Units shall be provided with a two (2) year parts and labor warranty, five (5) year extended compressor replacement warranty, ten (10) year heat exchanger warranty and a fifteen (15) year cabinet warranty. Maintenance warranty provided by Contractor.

2.2 UNIT DATA

A. Unit shall be factory manufactured for installation on new 12” sloped roof curb , high enough for proper “P” trapping. Roof curb will be anchored on the long sides and not the ends

therefore it will have to be build strong on the long sides to accept the anchorage and seismic loads for unit. Roof curb gasketing material shall be provided and ship loose with the unit.

B. Prior to fabrication of the equipment, a factory engineer shall visit the jobsite, measure the unit, and become familiar with the exact requirements of the project. A local manufacturer's representative shall not be considered as a substitute. The factory employee shall also be present at the installation to assist/supervise the unit installation and unit start up. The responsibility of these functions shall not be transferred to the local manufacturer's representative. A factory technician shall submit a start-up report after field installation and start-up.

C. Unit weight shall not exceed the weight shown in the equipment schedule.

2.3 MULTIZONE OUTDOOR PACKAGED AIR CONDITIONING UNIT

A. Equipment:
1. One Custom Packaged Outdoor Multizone Air Conditioning Unit (RTU-2).

B. Exterior Casing and Frame:
1. The unit frame shall be constructed of heavy gauge galvanized steel with a formed galvanized structural steel base. Lifting lugs shall be welded on the base frame for rigging the unit. All exterior panels must be fabricated from embossed Series 3003 aluminum, non-painted. The aluminum panels shall be fastened to the frame with stainless steel bolts. Panels must be isolated from the steel frame with dielectric gaskets to prevent galvanic corrosion. The roof of the unit must be pitched to provide positive drainage. Top seams must be covered with cap strips to prevent water leakage into the unit and the floor of each section shall have an aluminum deck to isolate the entire unit from the building. All seams must be caulked with silicone inside and out to prevent air and water leakage.
2. Access doors must be full height and provide access for all sections housing components requiring routine maintenance. Doors shall be supported on full-length continuous hinges and have a single handle – multi latch closure system. Access doors shall have stainless steel "hold backs" to prevent door closure during the performance of service procedures. When obstructions on the roof will interfere with access doors, provide lift off panels held in place by a minimum of four Vent-lok Series 260 latches.
3. All walls and doors in the air handling compartment must be double wall construction enclosing 2" thick polyurethane foam insulation. The roof must be double wall construction enclosing 2" thick polyurethane foam insulation. Liners shall be .040 thick aluminum sheet metal to protect the insulation during routine maintenance to the unit. Foil faced insulation is not acceptable. The floor of the air handling sections must be insulated with 1" thick foam board insulation.
4. All doors in the air handling section shall open against the pressure or shall include an additional number of latches equal to 50% of the number of latches used on the same size doors that open with the pressure.

C. Air Cooled Condensing Section
1. The air-cooled condensing section must be designed and manufactured by the unit manufacturer. Units incorporating condensing sections manufactured by a "third party"

and bolted to the unit frame or field piped are not acceptable. The floor of the air-cooled condenser section shall be crowned for water drainage and constructed of aluminum to resist the corrosive effects of the weather. All refrigerant piping shall be tested for leakage in the factory prior to shipment of the complete unit.

2. Unit shall have a minimum of four equal sized scroll compressors, independently circuited. Compressors must be heavy duty suction cooled, hermetic scroll type complete with forced feed lubrication, suction and discharge service valves, suction strainer, crankcase heater, and 3 phase solid state thermal motor protection. The compressors must be mounted on rubber in shear isolators to prevent transmission of any noise and vibration to the space below. The lead compressor shall be VFD type and modulate from 100% down to 20% of its capacity.
3. The independent refrigerant circuits shall be piped, tested, dehydrated and fully charged with oil and refrigerant 410a. The refrigerant circuit components shall include compressor, condenser with integral liquid sub-cooling, liquid line service and charging valve, replaceable core filter drier in the liquid line, replaceable core filter drier in the suction line, liquid line sight glass, and relief valve.
4. The air-cooled condenser coils must be a minimum of six rows deep, and have copper tubes expanded into a maximum of twelve aluminum fins per inch. Coils shall be tested at 600 PSIG and mounted vertically for complete surface utilization. Coils shall be counter flow with a minimum of 10 degrees of liquid sub-cooling and have adequate capacity to dissipate the total heat rejection of the compressors at design conditions. Condensers shall have 11 gauge guards to protect the coils from vandalism and weather related damage. The condenser coil hardware will be stainless steel.
5. Condenser fans shall be steel coated with epoxy enamel and have a steel hub locked on a stainless steel motor shaft with a keyway and square head set screws. Provide radius-spun venturi for efficient performance. Fans shall have vinyl coated external guards capable of being removed for service without removing the fan motor. Condenser fans shall have OSHA type bottom guards. Fans shall be direct driven by NEMA constructed, three phase motors operating at 1140 RPM. Motors must have stainless steel shafts to prevent "rust welding" of the fan hubs to the shaft. Each motor shall have a shaft slinger to prevent water seepage into the motor.
6. Condenser head pressure will be maintained down to an ambient of 30 deg F. Included with this feature is a VFD with manual bypass and line reactors to control condenser fan speed.
7. Provide the following corrosion prevention options: Stainless steel condenser coil casing, posts and stainless steel hardware (fasteners, screws, support pieces, etc.) Stainless steel compressor mounts and aluminum treadplate in condenser section floor.
8. Condenser coils shall be Electro-Fin coated for anti-corrosion purposes. See Electro-Fin spec section.

D. Cooling Coil Section:

1. Cooling coils must be installed downstream of the supply air blower and parallel with the heating section. Coils shall be direct expansion type and constructed of seamless tubes expanded into aluminum fins and be provided with thermostatic expansion valves, adjustable super heat controls, and external equalizers.
2. The cooling coil must be a minimum of four rows deep and have a maximum of ten copper fins per inch. Coils shall be tested at 600 PSIG and mounted vertically for complete surface utilization.

3. Provide corrosion prevention options for each cooling coil which includes a stainless steel coil casing and stainless steel hardware (fasteners, screws, support pieces, etc).
4. Each evaporator coil shall be provided with a positive draining IAQ type double pitched, stainless steel drain pan. The drain for the main drain pan must be metal and extend through the side of the unit.
5. Cooling unit to be split to allow for field coil removal in space allocated.

E. Heating Section:
1. The heater shall be a natural gas indirect fired type with capacity as scheduled and shall be installed downstream of the blower in the heating deck of the unit. Heaters installed downstream of the cooling coil are not acceptable. The furnace shall be design certified by the American Gas Association (A.G.A.) and bear the A.G.A. label. Provide stainless steel heat exchanger. The power vented burner shall include spark-ignited intermittent safety pilot with electronic flame supervision. The gas train shall be complete with a two-stage gas valve and be ready for connection to a natural gas supply with pressure between 7" and 14" WC.
2. Standard controls shall include a combination redundant gas valve consisting of combination pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shut-off, and manual shut-off, all in one body. Final adjustments must be made at startup of the unit. The heater must have an efficiency of 80%.
3. The heater furnace will infinitely modulate from 100% to 25%.

F. Multizone Damper Section - 3-Deck:
1. Unit shall have factory mounted multizone dampers in the hot, bypass, and cold deck. Dampers must be linked together to provide individual zone control with factory mounted and wired operators. Provide a single damper actuator per zone, multiple actuators are not acceptable. Each cold deck blade shall have a matching neutral deck. Each hot deck blade shall have a matching neutral deck. In no case may air from the cold deck mix with air from the hot deck. . The cold deck, bypass, and hot deck must be separated by double wall insulated dividers. Damper shafts shall be mounted in permanently lubricated nylon bearings to assure smooth operation. Damper blades must operate without clatter or binding.
2. Provide internal adjustable balancing dampers for each zone.

G. Supply Air Blower Section:
1. The supply air blower section shall consist of a four (4) 2 x 2 fan array. Each fan wheel shall be a single width/single inlet airfoil plenum type, secured to a machined, ground and polished solid steel shaft. The shaft shall be coated with a rust inhibitor and supported by two outboard bearings. The complete blower assembly must be dynamically balanced. Bearings shall be self-aligning ball bearing pillow block type and be designed for an L-50 life of 200,000 hours.
2. Each supply fan is connected to a direct drive motor, heavy inverter duty, premium efficiency totally enclosed fan cooled, 3-phase, 1800 rpm motor. Motor and blower assembly shall be mounted on a heavy duty steel frame base supported by RIS isolation. In addition to the isolators, the blower assembly must have seismic restraints designed for Seismic Zone 4.
3. Supply fan speed shall be controlled by a single Variable Frequency Drive (VFD) housed in a U.L. listed NEMA 1 enclosure, factory mounted and wired in the unit. The drive must include line side reactors. The drive shall have an advanced microprocessor type

utilizing a PWM/Voltage Vector design technique. Unit shall include controls to provide variable air volume and maintain constant static pressure at the factory mounted pressure sensor in the supply air plenum. A manually reset adjustable range high-pressure safety switch shall be included to prevent excessive pressure in the supply duct.

4. Blower drive shall include a piezometer ring and differential pressure transmitter.
5. Each fan in the fan array shall be lined with an additional 2" thick and 3#/cubic ft. density insulation acoustical board protected by a perforated metal liner with perforations selected for maximum sound attenuation.
6. Supply fans to be field removable without cutting panels for damaging unit.

H. Power Return Section
1. The return air blower wheel shall be a single width/single inlet airfoil plenum type secured to a machined, ground and polished solid steel shaft. The shaft shall be coated with a rust inhibitor and supported by two outboard bearings. The complete blower assembly must be dynamically balanced. Bearings shall be self-aligning ball bearing pillow block type and be designed for an L-50 life of 200,000 hours.
2. Blower drive shall include a fixed pitch motor sheave with multiple V-belts shall have a minimum service factor of 150%. Motors shall be premium efficiency heavy-duty open drip proof 3-phase, 1800 rpm, mounted on a heavy-duty sliding base. Motor and blower assembly shall be mounted on a heavy duty steel frame supported by 2 " deflection springs designed for 90-98% isolation efficiency. In addition to the spring isolators, the blower assembly shall have seismic restraints.
3. Blower speed shall be controlled by a Variable Frequency Drive (VFD) housed in a U.L. listed NEMA 1 enclosure, factory mounted and wired in the unit. The drive must include line side reactors. The drive shall have an advanced microprocessor type utilizing a PWM/Voltage Vector design technique. Unit shall include controls to provide variable air volume and maintain constant static pressure at the factory mounted pressure sensor in the supply air plenum. A manually reset adjustable range high-pressure safety switch shall be included to prevent excessive pressure in the supply duct.
4. Blower section shall be lined with an additional 1", 3-lb. density insulation protected by a perforated metal liner with perforations selected for maximum sound attenuation.

I. Filter Section:
1. The pre-filter section shall include UL Class 2, 2" thick, MERV 8 panel type filters. Access for filter maintenance shall be through a full height service door on the side of the unit. Filter support rails must include slide out "pulls" to facilitate removal of the filters.
2. The final-filter section shall include UL Class 2, 4" thick, MERV 13 panel type filters. Access for filter maintenance shall be through a full height service door on the side of the unit. Filter support rails must include slide out "pulls" to facilitate removal of the filters.

J. Return Air/Outside Air/Exhaust Air Section:
1. The unit shall have an outside air (ventilation) intake on one side of the unit and an exhaust air discharge on the opposite side. Outside air and exhaust air openings on the same side of the unit are not acceptable. Outside air intake shall have storm-proof louvers or hoods sized to prevent entrainment of rainwater into the unit and must include an aluminum bird screen.
2. Outside and return air dampers shall have factory-mounted operators. Damper shafts shall be mounted in permanently lubricated nylon bearings to assure smooth operation.

Damper blades must operate without clatter or binding. Motorized dampers shall be low leakage type limiting leakage to 6 CFM/ft2 at a pressure differential of 4 inches.

3. Exhaust dampers shall be gravity relief type sized to balance the building pressure during economizer operation. Dampers shall include a louver to divert rain from the face of the dampers.

K. Main Control Panel:

1. The unit shall have a single point electrical power connection in the same location as the unit being replaced. The new unit must be able to utilize the same power wiring as the unit being replaced. The main control panel must include a fused disconnect switch mounted in a weatherproof enclosure, flush mounted, on the side or end of the unit.
2. All components shall be identified with nametags and wired in accordance with the National Electric Code. The main control panel must include the following:
   a. A terminal block for single point power supply with fuses for all branch circuits.
   b. A 24-volt control transformer and 24-volt field wiring control terminal strip. Terminals shall be numbered for field connection of all controls in accordance with the wiring diagram.
   c. All wiring must be numbered and color-coded.
   d. A phase failure and low voltage protection relay.
   e. All refrigeration safety and operating controls.
   f. Temperature control components as required for the system described below under "Temperature Controls".
   g. Wiring diagrams must be laminated to the control panel door.
   h. A service light with switch and a 115 volt, (10) amp ground fault convenience outlet factory wired to its own transformer.
   i. Fan motor starters with three-phase overloads factory mounted and wired.
   j. Compressor and condenser fan motor starters.
   k. Condensing unit low ambient lockout set at 50 degrees F.
3. The above components are in addition to electrical components associated with other sections required to accomplish the sequence of control specified below.

L. Temperature Control Sequence

1. The unit shall be designed for continuous blower operation with terminals provided for remote OFF-AUTO unit control by the EMS.
2. When a zone requires full cooling the cold deck damper for that zone will modulate to 100% open. As cooling load for that zone decreases the cold deck damper modulates to close position and the bypass damper modulates to open position. When there is no cooling requirement for that zone the cold deck damper is fully closed and the bypass damper is fully open. The same damper operating sequence takes place in the heating mode.
3. When outside air as determined by a dry bulb outside air changeover control is available for cooling (economizer), it must be used as the first stage of cooling and the compressors may only used when outside air does not satisfy the load.
4. Unit shall have a morning warm up cycle activated at the end of the daily operating cycle of the unit. On activation, the outside air dampers shall remain closed until the return air temperature exceeds the setting (adjustable) of the factory mounted and wired morning warm up cycle sensor located in the return air opening of the unit. When the return air temperature rises above the setting of the return air sensor, the outside air dampers shall return to their normal automatic operating mode.

5. Unit shall have a morning pull-down cycle activated on startup if the return air temperature is above set-point. System will remain in pull-down until the temperature drops below set-point or thirty minutes have elapsed. In morning pull-down the OSA dampers will remain closed and cooling will be enabled and will be cycled to maintain desired supply set-point.

M. Temperature Controls
1. Unit shall have a complete factory installed Alerton temperature control system, campus standard, provided by Climatec, Inc., wired and installed in the factory by the unit manufacturer. See unit control diagrams for Alerton provided controls. Any unit controls not provided by Alerton must be provided by multizone unit manufacturer.
2. The operation of the multizone unit shall be controlled by a Alerton DDC integrated control system, including control of the fans, mechanical cooling and heating, new room temperature controls, economizer controls, damper operators and other miscellaneous functions. When programming of the controls is required, it must be included with the unit.

N. Other Controls:
1. Provide a photo-electronic type smoke detector mounted and wired in the supply and return air sections of the unit.
2. Provide a Magnehelic differential pressure gauge for each bank of filters. Gauge shall be mounted in the main unit control panel.
3. Provide field commissioning and EMS system connection of the controls by Climatec, Inc.
4. Unit must have terminal strips and interlocking relays factory mounted and wired to interlock with other components of the building. It is the responsibility of the control contractor to advise the HVAC unit manufacturer of any requirement for any additional interlocks not covered in this specification.

O. Electro-Fin Coating
1. Coating Materials – The materials shall be a cathodic epoxy electrodeposition coating formulated for high edge build consisting of composition as noted below.
   a. Resin feed component – The resin feed component shall consist of an epoxy or an epoxy-urethane resin combined with the necessary amounts of flow control agents.
   b. Pigment paste component – The pigment paste shall consist of a resin as above, volatile solvents, titanium dioxide and siliceous extenders. Hexavalent chromate, zinc chromate, or lead pigments shall not be sued alone or as a component part of any pigment.
2. Refrigerant Coils – Refrigerant coils contain a charge of dry nitrogen and are capped and sealed. Seals are not to be broken. Both connection ends are to be masked for a minimum distance of 1.0 inch.
3. Coil Connections – Coils shall be inspected for open tubes, headers, and capillary tubes and sealed to prevent contamination of cleaning or coating solutions to the interior coil surfaces.
4. Cleaning – Cleaning shall include complete coil immersion in a heated alkaline cleaning solution to remove light fin lubricants, machining oils, and residual factory contamination. The cleaning immersion shall be followed by complete coil immersion in fresh city water to neutralize and remove residual alkaline solution.

5. Coating – The coil shall be completely immersed in the coating bath including headers, casing and heat exchanger surfaces. The coating shall be electrodeposited to obtain a nominal dry film thickness of .001" +/- .0002"(mils). The coating shall be free from voids, checks, cracks, and blisters. The quality and application shall be such that any portion of the coil will meet a minimum 2000 hours of 5% salt spray testing to American Society for Testing and Materials (ASTM) B117 under the following criteria:
6. No loss of coating adhesion and no evidence of attack to the fin proper. Only 5% of the fin collars may show corrosion product.
7. Complete deterioration of the sample in any location is considered failure of the part on this test, and shall be cause for rejection.
8. Baking – The coating shall be cured by baking at a metal temperature not to exceed 400° F.
9. Allow the coil to cool to ambient temperature 65-95°F. A soft cloth or laboratory tissue should be saturated with Acetone. Applying medium pressure with the index finger, rub the same area of the primer for a minimum of 40 strokes (movement in one direction). Examine the coating for loss of film. The coating shall show no film softening when compared to an untested portion of the panel. Nonconformance shall constitute failure of this test and the coil shall be placed in bake oven for additional cure time and re-tested for conformance.
10. Process Quality – The coating process shall be carefully established and controlled to assure consistent and repeatable results. This includes documentation of coating composition, temperature, pH, and conductivity, including pretreatment of parts and baking procedures. All measuring and test equipment shall be calibrated and traceable to (National Institute of Standards and Testing) N.I.S.T.
11. No fins areas shall be bunched together , spread apart, cocked, or bowed. No fins shall be movable by hand on tubes, torn or bucked. Fins shall be straightened before the coil is shipped. When coils are direct shipped to the customer instead of the manufacturing facility originating the Purchase Order, the supplier shall document and notify the manufacturer Quality Assurance prior to shipping, if over 5% of the total face area of a coil requires straightening of fins.

P. Installation:
   1. The manufacturer must send an installation expert to the jobsite to advise on proper rigging and alignment of the equipment. The installing contractor should become familiar with the manufacturer's rigging and installation instructions.

Q. Check, Test, and Start-up:
   1. Unit must be checked out, tested, and placed into operation by the installing contractor under the supervision of an authorized representative of the manufacturer.

R. Warranty:
   1. The unit shall be provided with the following warranties:
      a. Two (2) year parts warranty by the unit manufacturer
      b. Two (2) year labor warranty by the unit manufacturer
      c. Five (5) year compressor warranty
      d. Ten (10) year gas heat exchanger warranty
      e. Fifteen (15) year cabinet warranty

S. Approved Manufacturers (listed manufacturers must comply with plans and specifications) and unit footring configuration based on roof restrictions:
   1. SEASONS-4 (Basis of Design)
   2. Governair
   3. Mamoth.

2.4 SUBSTITUTION

A. Any request for substitution of equipment other than the scheduled manufacturer must be submitted at least 14 days before bid time and must include the following:
   1. Manufacturers of proposed substitute equipment must send a technician to the jobsite to show a clear understanding of the project and be in compliance with all the requirements needed. During the manufacturer's visit, the old unit's ducts must be measured, the location of the utilities determined, and obstructions adjacent to the unit must be noted.
   2. Contractor to provide a preliminary submittal including the following items:
      a. Performance data.
      b. Dimensional data.
      c. Weight data.
      d. Documentation of proposed equipment with drawings and diagrams.
      e. Show required clearances around unit.
      f. Sequence of operation.
      g. Energy analysis on an annualized basis.
      h. Provide data as shown on schedule.
      i. Provide at least five successful multizone jobs with contact names and phone numbers.
      j. Provide an itemized list of any exceptions taken to the base bid specification.
      k. Provide a letter from an officer of the multizone manufacturer that the exceptions are the only deviations from the specification.
   3. Contractor to provide Seismic Drawings and Calculations, stamped by a registered professional structural engineer, showing the attachment of the new units to the existing steel per applicable codes.
   4. Contractor to provide equipment manufacturer’s letter stating compliance with delivery requirements as indicated in these bid documents.
   5. Owner representative’s decision on the merits of the substitution request shall be final. An approval of any substitute equipment shall not void compliance with all aspects of these specifications.
   6. Once reviewed and if approved, equipment substitution information shall be issued to all bidding contractors so as not to give an unfair advantage in bidding process.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas under which the work of this Section will be performed. Correct conditions detrimental to proper and timely completion of this work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EQUIPMENT DESIGN AND INSTALLATION

A. Application: No piece of equipment shall be installed in an application not recommended by manufacturer, or not approved by the District or the Architect.

B. Equipment Installation: Equipment installation shall be strictly in accordance with these specifications, and instructions of manufacturer. Equipment mounted on concrete foundations shall be grouted before piping is installed. All piping shall be installed in such a manner as not to place a strain on any of the equipment. Flanged joints shall be adequately extended before installation. All piping shall be graded, anchored, guided and supported, without low pockets.

C. Unit will be split into two (2) sections for shipping. It will be need to be assembled at the jobsite. The unit will be assembled by the installing contractor under the supervision of an authorized representative of the manufacturer.

D. Install seismic anchorage of units as required.

E. Erect equipment in a neat and workmanlike manner, properly aligned, leveled and adjusted for satisfactory operation.

F. Install so that connecting and disconnecting of piping and accessories can be readily accomplished, and so that all parts are readily accessible for inspection, service and repair. Space shall be provided to readily remove filters, coils, compressors and fan wheels.

3.3 FIELD TESTS AND INSPECTION

A. General: Perform all field inspections, field tests, and trial operations as specified in Section 10010. Provide all labor, equipment, and incidentals required for testing. The District Inspector shall have the right to witness all field tests and trial operations as specified in Section 230500.

B. Equipment and Material: Equipment and material certified as having been successfully tested by manufacturer, in accordance with referenced specifications and standards, will not require re-testing before installation. Equipment and materials not tested at the place of manufacture will be tested before or after installation, as applicable or necessary, to determine compliance with reference specifications and standards.

C. Start-Up and Operational Test: Systems shall be started up and initially operated with all components operating. Adjust safety and automatic control instruments as necessary to place them in proper operation. See also Section 230500.

D. Extent of Field Tests: After installation and before acceptance, work of this Section shall be subjected to all necessary field tests, including those specified in Section 230500.

E. Operation and Maintenance Data: Provide required operation and maintenance data as specified in Section 230500.

PART 4 - EQUIPMENT LIST

4.1 There is one (1) Custom Packaged Outdoor Multizone Air Conditioning Unit

UNIT SYMBOL	RTU-2
MANUFACTURER	SEASONS·4
TYPE	MULTIZONE
EER (MIN)	9.8

COOLING COIL	
TOT COOL CAP(BTUH-MIN)	598,680
SENS COOL CAP(BTUH-MIN)	443,308
FACE AREA (SQ FT-MIN)	40.0
ROWS (MIN)	4
FPI (MAX)	10
CIRCUITS (MIN)	4
EAT (FDB/FWB) (°F)	80.0/67.0
LAT (FDB/FWB) (°F)	61.7/58.4

SUPPLY FAN	
TYPE	AF SWSI PLENUM
NUMBER/SIZE (MIN)	4/24.5"
CFM	22,000
TSP (IN WC)	5.25
ESP (IN WC)	2.00
FAN SPEED (RPM) (MAX)	1748
BHP (MAX)	4 @ 6.52
HP (MAX)	4 @ 7.5
DRIVE	Variable Freq Drive

OUTDOOR AIR (CFM)	2,200 – 22,000

RETURN FAN	
TYPE	AF SWSI PLENUM
NUMBER/SIZE (MIN)	1/40.25"
CFM	19.800
TSP (IN WC)	1.00
ESP (IN WC)	0.50
FAN SPEED (RPM) (MAX)	618
BHP (MAX)	5.9

HP (MAX)	7.5
DRIVE	Variable Freq Drive

PRE-FILTERS	
TYPE	2" PLEATED; MERV 8
NUMBER / SIZE (IN)	28/16x20
FACE AREA (SQ FT-MIN)	62.2
FACE VEL (FPM) (MAX)	354

FILTERS	
TYPE	4" PLEATED; MERV 13
NUMBER / SIZE (IN)	28/16x20
FACE AREA (SQ FT-MIN)	62.2
FACE VEL (FPM) (MAX)	354

GAS HEATING	
TYPE	NATURAL GAS TUBULAR DUCT FURNACE
INPUT CAP. (BTUH)	650,000
OUTPUT CAP. (BTUH)	520,000
STAGING	MODULATING
GAS CONN SIZE (IN)	1”
MIN/MAX GAS PRES (IN WC)	7" / 14"

COMPRESSOR	
TYPE	Copeland Scroll
NO. (MAX)	4
INDEPENDENT CIRCUITS (MIN)	4 equal circuits
UNIT UNLOADING (%)	20% of circuit #1

CONDENSER COIL	
FACE AREA (SQ FT-MIN)	77.5
ROWS (MIN)	6
FPI (MAX)	12
TYPE	Cu tube, Al fin
FAN DIA (MIN)	30”
FAN RPM (MAX)	850
FAN QTY	6

HP (MAX)	1.0
DESIGN AMBIENT (°F)	100
OPERATIONAL AMBIENT (°F)	110

ELECTRICAL	
UNIT VOLTAGE	460/3/60
TOTAL COOLING AMPS	140.4
TOTAL HEATING AMPS	50.4
UNIT MCA	145
UNIT MOP	150
UNIT SCCR	65,000

OPERATING WEIGHT (LBS)	21,050

END OF SECTION 238109

SECTION 260513 - MEDIUM-VOLTAGE CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes medium voltage cable and cable terminations.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 48 - Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV.
   2. IEEE C2 - National Electrical Safety Code.
   3. IEEE 386 - Standard for Separable Insulated Connector Systems.

B. National Electrical Manufacturers Association:
   1. NEMA WC 3 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   3. NEMA WC 8 - Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Per Division 01 and the following.

B. Product Data: Submit for cable, terminations, separable connectors, and accessories.

C. Samples: Submit two each size cable, 24 inches in length.
   1. Select each length to include complete set of manufacturer markings.
   2. Attach tag indicating cable size and application information.

D. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

E. Qualifications: Submit documented experience of manufacturer and installer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual sizes and locations of cables.

B. Operation and Maintenance Data: Submit instructions for testing and cleaning cable and accessories.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer: Certified cable installer with minimum 3 years documented experience.

C. All splicing and terminations of medium voltage cable is to be done by one or the following college approved companies.
1. Industrial High Voltage.
2. Hampton Tedder.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cable ends from entrance of moisture.

PART 2 - PRODUCTS

2.1 MEDIUM VOLTAGE CABLE

A. Manufacturers:
1. Okonite Model OkoGuard Type MV-105.
2. General Cable Co.
3. Pirelli
4. Substitutions: Permitted.

B. Product Description: Single conductor, NEMA WC 8, ethylene propylene rubber (EPR) insulated cable with 133% insulation level. UL listed as Type MV-105 and sunlight resistant in accordance with UL 1072.

C. Voltage: 15kV.

D. Conductor: Single conductor, uncoated copper, compact stranded per ASTM B-496.

E. Strand Screen: Extruded semiconducting EPR strand screen. Meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA SC74 & S-97-682, AEIC CS8, and UL 1072.

F. Insulation: EPR. Meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AIEC CS8, and UL 1072.

G. Insulation Screen: Extruded semiconducting EPR insulation screen. Meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA SC74 & S-97-682, AEIC CS8, and UL 1072.

H. Shield: 5 mil bare copper tape helically applied.

I. Jacket: PVC, 80 mils minimum thickness. Meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, and UL 1072 for polyvinyl chloride jackets.

2.2 SEPARABLE CONNECTORS

A. Manufacturers:

B. Cooper Separable Connector System.
1. Thomas & Betts.
2. Substitutions: Not Permitted.

C. Product Description: Complete separable connector system using loadbreak/deadbreak elbows with bolted connections and deadfront modular construction for splicing and connection of medium voltage feeders and equipment.

D. Standards: Design, manufacture, and test all components to IEEE Standard 386 (Separable Insulated Connector Systems). Provide all components from same manufacturer.

E. Materials: Use copper bus and connection components for all components of the separable connector system.

F. Separable Connectors
1. Cooper Power Systems: Model 625 Series BOL-T type elbows. Sizes to match cable type and dimensions.
2. Accessories: All copper components, insulating plug with test point, test point on the T-body, compression lugs, cable adapters, connecting plug, shield adaptor, grounding kit, and jacket seals.
3. Current Ratings: 600 Amp Continuous; 25kA sym., 10 cycles; 10kA sym, 3 seconds.
4. Voltage Ratings:
   a. 15kV Class.
   b. 15.2kV Phase-to-Ground.
   c. 28kV Phase-to-Phase.
   d. 125kV BIL
   e. 40kV AC Withstand
   f. 78kV DC Withstand
   g. 19kV Corona Extinction.

G. Grounding Standoff Bushing: Cooper Power Systems, Model GSB625C Series. Complete with minimum 5 foot, #2/0AWG grounding conductor.

2.3 FIREPROOFING TAPE

A. Manufacturers:
1. 3M.
2. Substitutions: Permitted.

B. Description: Flexible, conformable fabric, coated on one side with flame retardant, flexible polymeric or chlorinated elastomer. Non-corrosive to and compatible with cable sheaths jackets. Does not support combustion.

C. Width: Approximately 3 inches (76mm).

D. Thickness: Not less than 0.03 inch (0.76mm).

E. Weight: Not less than 2.5 pounds per square yard.

2.4 CABLE IDENTIFICATION

A. Cable Identification Tags
1. Laminated three-layer plastic (1/8 inch thick minimum) with engraved white letters on black background color affixed to cables with plastic or nylon ties.
2. Engrave with routing and feeder number (example):
   a. “Routing: From MH-25"
   b. “Routing: To MH-26”
   c. “Originating Equipment: PMS-5”
   d. “Terminating Equipment: PMS-6”
   e. “Feeder Designation: “L1-3 LOOP L1”

B. Color Coding
1. Identify each conductor phase using colored electrical tape:
   a. Phase A: Yellow
   b. Phase B: Red
   c. Phase C: Blue

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conduit, trench and manholes are ready to receive cable.

B. Verify routing and termination locations of cable prior to rough-in.

3.2 PREPARATION

A. Use swab to clean conduits before pulling cables.

3.3 EXISTING WORK

A. De-energize the existing medium-voltage system prior to performing work on existing cables. Submit a written request to the Owner 14 days prior to de-energizing the system indicating the proposed dates and times for shutdown, the anticipated duration of the outage, and the affected circuits. Do not proceed with work until written authorization for the proposed shutdown is received from the Owner. Shutdowns will be scheduled at a time and day that is acceptable to the

Owner and will occur on weekends or at night. Shutdowns will be limited in time so that the campus will be operational during the day. All overtime and premium time work shall be included in the bid.

B. Remove abandoned medium-voltage cable.

C. Maintain access to existing medium-voltage cable and other installations remaining active and requiring access. Modify installation or provide access panel.

D. Extend existing medium-voltage cable installations using materials and methods as specified. Install separable connectors on all existing cables to extend or connect.

E. Clean and repair existing medium-voltage cable to remain.

3.4 INSTALLATION

A. Avoid abrasion and other damage to cables during installation.

B. Use suitable manufacturer approved lubricants and pulling equipment.

C. Sustain cable pulling tensions and bending radii below manufacturer's recommended limits. Pull all cables in one conduit together.

D. Use separable connectors for all splices and terminations. Use deadfront junctions and junction bars to connect separable connectors in manholes. Install devices per manufacturer's installation instructions. Install one grounding standoff bushing in a parking stand on one deadfront junction for each set of 3 conductors in one circuit. Ground cable shields at each termination and splice with minimum #6 bare copper. Ground all separable connector system components to ground system at each manhole and at equipment terminations. Provide stress relief for all cable terminations and connectors.

E. Install cables in manholes along wall providing longest route. Route cables a minimum of 3/4 of the manhole perimeter. Neatly rack in manhole. Install cables free of kinks and twists. Install cable bends with smooth radius not smaller than 12 times the cable diameter or the manufacturer' recommendation, whichever is greater.

F. Arrange cable in manholes to avoid interference with duct entrances.

G. Install tape at each splice, at all equipment terminations, and in all pull and junction boxes and manholes to identify cable phase.

3.5 FIREPROOFING

A. Apply fireproofing tape to cables when installed in manholes, cable rooms, pull boxes, or other enclosures.

B. Smooth out irregularities, at splices or other locations, with insulation putty before applying fireproofing tape.

C. Apply fireproofing tape tightly around cables spirally in half-lapped wrapping or in butt-jointed wrapping with second wrapping covering joints first.

D. Extend fireproofing 1 inch into conduit or duct.

E. Install tape with coated side toward cable.

F. Install random wrappings of plastic tape around fireproofing tape to prevent unraveling.

G. Install fireproofing to withstand a 200 ampere arc for 30 seconds.

3.6 FIELD QUALITY CONTROL

A. Inspect exposed cable sections for physical damage.

B. Inspect cable for proper connections.

C. Inspect shield grounding, cable supports, and terminations for proper installation.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Perform inspections and tests listed in NETA ATS, Section 7.3 including plot graphs.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect installed cables from entrance of moisture. If cable ends are not terminated in the same working day, seal with cable caps and silicone sealant to protect ends.

END OF SECTION 260513

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; metal clad cable; and wiring connectors and connections.

B. Related Sections:
   1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. California Fire Code

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper.

1.4 SUBMITTALS

A. Per Division 01 and the following.

B. Product Data: Submit for building wire and each cable assembly type.

C. Test Reports: Indicate procedures and values obtained.

1.5 CLOSEOUT SUBMITTALS

A. Per Division 01 and the following.

B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with Standards of Orange Coast College.

C. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

A. Per Division 01 and the following.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
1. AETNA.
2. American Insulated Wire Corp.
3. Colonial Wire.
4. Encore Wire.
5. General Cable Co.
6. Republic Wire.
7. Service Wire Co.
8. Southwire.
9. Superior Essex.
10. Subsititutions: Per Division 01.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

F. Insulation Material: Thermoplastic.

2.2 METAL CLAD CABLE

A. Manufacturers:
1. Diamond Wire & Cable Co.
2. Essex Group Inc.
3. General Cable Co.
4. Substitutions: Per Division 01.
5. AFC.

B. Conductor: Stranded only, copper.

PART 3 EXECUTION

3.1 EXAMINATION

A. Per Division 01.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:
1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

G. Provide crimp on fork terminals under binding screws. Use insulated ferrules to terminate in circuit-breaker lugs for device terminations. Do not place bare stranded conductors directly under screws.

H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

I. Size lugs in accordance with manufacturer’s recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

K. Multi-wire branch circuits to be provided with separate neutrals for each phase.

3.4 WIRE COLOR

A. General:
1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:

a. Black and red for single phase circuits at 120/240 volts.
b. Black, red, and blue for circuits at 120/208 volts single or three phase.
c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
   a. Black and red for single phase circuits at 120/240 volts.
   b. Black, red, and blue for circuits at 120/208 volts single or three phase.
   c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. Per Division 01 and the following.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

SECTION 26 05 43

UNDERGROUND DUCT BANKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Conduit.
   2. Duct.
   3. Underground Duct Banks.

1.02 DEFINITIONS

A. Duct - underground conduit.

1.03 RELATED SECTIONS

A. Section 26 05 13 - Medium Voltage Cable.

1.04 REFERENCES

A. ASTM A48 Gray Iron Castings.

B. IEEE C2 National Electrical Safety Code.

C. NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.

E. NFPA 70 - National Electrical Code.

1.05 SUBMITTALS FOR REVIEW

A. Section 01 30 30 - Submittal Requirements.

B. Product Data: Provide for conduit and manhole accessories.

C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, accessories and accessory locations for precast manholes. Include detailed drawings of all duct openings in each wall of each manhole. Provide data substantiating that materials comply with the contract documents.

1.06 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

B. Test Reports: Submit report of duct blockage tests.

1.07 SUBMITTALS FOR CLOSEOUT

A. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of IEEE C2.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Existing manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete duct bank system.

1.11 RECEIVING, STORING AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1-Standard Practices for Good Workmanship in Electrical Construction.

PART 2 PRODUCTS

2.01 RIGID STEEL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings: NEMA FB 1, steel.

2.02 RIGID NON-METALLIC CONDUIT

A. NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

2.03 ACCESSORIES

A. Underground Warning Tape: 6 inch wide plastic tape, detectable type, colored red for medium-voltage duct bank and yellow for telecommunications duct bank with suitable warning legend in black letters describing buried electrical lines; Medium-voltage – “Caution High Voltage Lines Below”, Telecommunications – “Caution Telephone/Data Lines Below”.

2.04 CORROSION PROTECTION TAPE

A. Pressure-sensitive, 10 mil thick, PVC based tape for corrosion protection of metal conduit and fittings.

B. Manufacturer: 3M, Type 50.

2.05 CONCRETE

A. Use concrete with maximum 1/2 inch coarse aggregate and Type 1 Portland cement (ASTM C 150 Standard Specification for Portland Cement) that has a slump of 6 to 7 inches and acquires a compressive strength of 3000 psi in 28 days.

B. Color concrete red for permanent marking of duct banks containing medium voltage cables.

2.06 RACEWAY MEASURING/PULLING TAPE

A. Furnish raceway measuring/pulling tape with permanently printed measurements in one-foot increments and minimum 1200 lb average breaking strength.

B. Manufacturer: Greenlee 39243

2.07 GROUNDING BUSHINGS

A. Provide NRTL listed, galvanized malleable iron, 150C rated insulated throat grounding bushings with lay-in type ground cable lugs for installation on rigid conduit.

B. Manufacturer: O-Z/Gedney, Type BLG.

2.08 DUCT PLUGS

A. Provide rubber duct plugs that will produce a positive seal in unused ducts against water and gas. Construct plugs using soft, expansible rubber compressed with galvanized steel plates and bolts.

B. Manufacturer: Condux, Jackmoon USA, Inc.

2.09 PRE-MOLD JOINT FILLER

A. Provide a closed cell expanded neoprene joint filler conforming to ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

B. Manufacturer: Williams Products, Inc., Type NN-1

PART 3 EXECUTION

3.01 DUCT BANK INSTALLATION

A. Install quantity and size of ducts as indicated on Drawings.

B. Use concrete encased rigid non-metallic conduit or use concrete encased rigid steel conduit in duct banks.

C. Make changes in direction of duct runs using minimum 12 foot radius sweeps. Submit for approval any locations requiring smaller sweeps. Do not heat conduit to deform. Use manufactured fittings for all changes of direction.

D. Stub-up Connections:
   1. Where ducts turn up into the surface, use PVC coated rigid steel elbows with minimum 36 inch radius. Non-metallic rigid conduit may be used for indoor stub-up connections that are not subject to physical damage.
   2. Extend conduits through concrete pad of floor with an adjustable top of coupling threaded inside for plugs, and set flush with the finished floor or equipment pad. Install zinc-plated malleable iron pipe plug in each unused duct stub-up.
   3. On metallic conduits, coat male threads with red colored, alkyd base, tank and structural primer that is suitable for galvanized steel; make up fittings wrench-tight.
   4. Ground metallic conduit exposed to contact according to the requirements of NFPA 70. Use exothermic welded connections for concealed grounding connections.

E. Install power duct to locate top of duct bank minimum 36 inches below finished grade and install telecommunications duct to locate top of duct bank at 24 inches minimum below finished grade. Install duct to locate top of duct bank at other depths as indicated on drawings.

F. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances and to drain to manholes.

G. Cut duct square using saw or pipe cutter; de burr cut ends.

H. Insert duct to shoulder of fittings; fasten securely.

I. Join nonmetallic duct using adhesive as recommended by manufacturer.

J. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum. Make all joints waterproof.

K. Install no more than equivalent of three 90 degree bends between pull points.

L. Provide suitable fittings to accommodate expansion and deflection where required.

M. Terminate duct at manhole entries using end bell.
   1. For ducts installed through holes cut by Contractor in existing manholes or pullboxes, pack opening with non-shrink grout. Feather the edge of the grout around bell end. Remove sharp edges and projections and fill voids within 6 inches of bell ends.
   2. For conduits and duct bank ground wire installed in duct terminations in new manholes, completely seal around ducts and ground wire using manhole manufacturer=s recommendations.

3. For concrete encased ducts installed in new manholes through a knockout panel, after removing forms from the end of the duct bank, rub the edge of the concrete around each bell and conform to the curvature of the bell end. Remove sharp edges and projections and fill voids within 6 inches of bell ends.

N. Stagger duct joints vertically in concrete encasement 6 inches minimum.

O. Use suitable separators and chairs installed not greater than 4 feet on centers.

P. Band ducts together before placing concrete.

Q. Securely anchor duct to prevent movement during concrete placement.

R. Concrete Encasement:
1. Use the smooth earth walls of trenches as forms for concrete encasement of ducts.
2. Place concrete using deflecting trough directing concrete through the duct assembly. Place concrete envelope as one monolithic pour where possible, taper any joints with a 10:1 slope. Allow for expansion/contraction of ducts. Place concrete starting at one end of duct bank allowing the free end to move.
3. Use mineral pigment to color concrete red for medium-voltage duct banks. Use 2.0 lb. of pigment per 94 lb. sack of cement.
4. Where conduits are stubbed out underground for future connection, install conduits 10 feet minimum beyond concrete encasement.

S. Provide the following minimum concrete cover at bottom, top, and sides of duct bank:
1. Medium-voltage duct banks - 7.5 inches.
2. Other dimensions where indicated on drawings.

T. Install a #4/0 AWG bare copper ground cable centered within each duct bank. Connect to ground cable in manholes using exothermic welds or IEEE 837 certified compression connectors.

U. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

V. Connect to existing concrete encasement using dowels.

W. Connect to manhole wall using dowels.

X. Provide raceway measuring/pulling tape in each empty duct except sleeves and nipples. Install with minimum 12 inches of slack at each end. Secure tape in manholes.

Y. Test each duct including stub-outs for blockage or deformation after concrete has cured for 24 hours.
1. Use a flexible mandrel/scraper not less than 12 in. long with a diameter approximately 1/4 in. less than the inside diameter of the duct.
2. Pull a mandrel behind a brush with stiff bristles.
3. Replace any duct section found blocked.

Z. Swab duct. Use duct plugs to protect installed duct against entrance of dirt and moisture.

AA. After ducts have been successfully tested for blockage, backfill trenches under provisions of Division 02.

BB. Interface installation of underground warning tape with backfilling. Install tape 12 inches below finished surface.

3.02 EXCAVATION AND BACKFILL

A. Make excavation for underground duct banks to depth required and to provide solid bearing.

B. Provide shoring of the excavation in accordance with all applicable codes and regulations. Install shoring by starting at the top of the excavation and working down or using an equivalent shoring system. Place braces and jacks in a true horizontal position with proper vertical spacing. Braces must be firmly secured to prevent kickouts. All materials used for shoring must be in good condition and of the right size to resist the lateral loads of the soil.

C. Keep excavation dry during installation of work.

D. Make trenches of sufficient width to receive work to be installed and provide specified concrete coverage on sides.

E. Backfill in 6 inch layers; use soil excavated; remove roots, rocks and sharp objects. Provide coarse sand as required for additional backfill material.

F. Moisture condition backfill soil and compact in accordance with ASTM D 1557 to 95% maximum density under paved areas and 90% maximum density under unpaved areas.

G. Overfill trenches to allow for settlement.

H. When a manhole or vault is placed in an unpaved area, slope the area around the entrance frame and cover to provide drainage away from the cover. Slope the final grading upward to within 1 inch of the top surface of the frame and cover.

I. If settlement occurs after final placement and backfill, provide all necessary repairs to restore the area, vaults, manholes, and duct banks.

3.03 DUCT PLUGGING AND SEALING

A. Install duct plugs in both ends of all unused ducts.

B. Install duct sealant in both ends of all ducts containing cables that cross any natural gas line.

C. Provide watertight cap on all conduits stubbed out underground for future connection.

END OF SECTION

SECTION 260900 – INSTRUMENTATION AND CONTROL FOR DYNAMIC GLAZING – VIEW INC.

PART 1 - GENERAL

1.1 SUMMARY

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

B. Section Includes: Control system for Manufacturer's Glass Dynamic Glass system. Work by the electrical subcontractor includes, but is not limited to, installation of the dynamic glass system's wiring and controls. Work also includes wiring and controls outside of the framing system.

C. Related Requirements:
1. Section 088000 – Glazing.
2. Division 26 - Electrical

1.2 DEFINITIONS

A. Refer to other divisions for industry standard glass and glazing definitions. The following apply to this section:
1. IGU: Insulating Glass Unit.
2. IGU Pigtail: Wire extruding from each Dynamic Glass insulating glass unit.
3. Window Controller: Control module for Dynamic Glass System.
4. IGU Cable: Wire that connects one IGU pigtail to one Window Controller.
5. IGU Splitter: Connects two IGU pigtails together.
6. Control Sensor: Photo sensor that detects light levels.
7. Wall Interface: Wall mounted user interface display.
8. Window Controller:
   a. Controller that sends voltage signal to one or multiple IGUs.
   b. A device connected to trunk line via a drop cable and responsible for facilitating power delivery to connected IGU(s)
9. Controls Integrated in Shop: For shop glazed units, in addition to dynamic glass.
   a. Note: Control components including window controller and cables can be integrated into the framing system by the glazier. This is the recommended method to ensure higher quality product and lower install cost and complexity.
10. Controls Integrated in Field: For field glazed units.
    a. Note: Control components including the window controller and cables need to be integrated into the framing system or building envelope by the Electrical Contractor.
11. BACnet: ASHRAE, ANSI, and ISO standard communications protocol for building automation and control networks.

1.3 SYSTEM DESCRIPTION

A. Basic controls: Dynamic Glass insulated glass units shall be operated by manufacturer's Dynamic Glass control system.

B. System / Performance requirements: Provide designated 110v – 240v circuit feed to Manufacturer's Dynamic Glass Control Panel.

1.4 SUBMITTALS

A. Comply with Division 01 General Requirements and submit for approval:
1. Product Data: Manufacturer's Dynamic Glass literature including data sheets, installation instructions, use restrictions and limitations.
2. Shop drawings: Prepared by electrical subcontractor.
   a. Interconnect wiring diagrams: Show framing system and integrated cables, cable routing, components, location of connectors, and exit from framing.
   b. Include identification, lengths, quantities and locations of cabling and components.

c. Large scale drawings for fabrication, installation and erections including plans, elevations, details, anchorages, connections and accessories along with head, jamb, sill and joining details. Provide templates for work installed by others.
d. Take accurate field measurements before fabrication and indicate same on shop drawings.

B. Ensure electrical schematics and shop drawings for control system have been reviewed and approved by manufacturer before being submitted.

1.5 QUALITY ASSURANCE

A. Installer qualifications:
1. Experienced with comparable installations and having successful performance on not less than 3 such installations.
2. Acceptable to manufacturer.

B. Pre-Installation Meetings: Conduct meeting to review procedures, schedules, safety, and coordination with other project elements.
1. Recommended Attendance: Architect, Contractor, glazing contractor, framing manufacturer, electrical contractor, automation engineer, Dynamic Glass manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with product requirements, delivery storage and handling provisions of Division 01 and the following:
1. Do not deliver components until job is ready for installation.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Store materials in original packaging, protected from exposure to harmful environmental conditions including static electricity, and at temperature and humidity conditions recommended by manufacturer.
4. All cables supplied by manufacturer shall have an installation temperature rating of -20 C to 80 C. If the cables are to be installed below 0 C, the cables shall be conditioned for 24 hours at room temperature prior to installation.

1.7 PROJECT CONDITIONS

A. Verify conditions including:
1. That frame channel dimensions are adequate for wire runs as designed.
2. That penetrations for frame/sensor cables are in place and correctly located.

B. Environmental Requirements: Install assemblies only in indoor, clean, climate controlled spaces using the final building mechanical system.

1.8 WARRANTY

A. For Balance of System (BOS) Components necessary for operation and control of insulating glass units, the manufacturer shall warrant the system free of defects in material and workmanship as follow:
1. Warranty period shall commence on the date of delivery of components by the system manufacturer.
2. Warranty period: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: View Dynamic Glass Instrumentation and Control assemblies as manufactured or supplied by:

VIEW Inc.

195 S. Milpitas Blvd, Milpitas, CA 95035
Telephone: 408-514-6512
E-mail: salesops@viewglass.com
Internet: http://www.viewglass.com.

B. Substitutions: Not permitted

C. Proposed substitutions: Will be reviewed only if submitted in writing for approval by the design professional of record a minimum of 10 working days prior to the bid date and made available to all bidders. Proposed substitutes shall be accompanied by review of specification noting compliance on a line-by-line basis.

2.2 MATERIALS

A. Dynamic Glass Control Panel:
1. Wall mounted enclosure housing power supplies and controllers operating control system, typically containing up to six Class 2 power outputs.
2. Power specification:
   a. Input Power: 100-240 VAC (single-phase), 50/60 Hz.
   b. Output Power (at each power output): 24VDC, 4.0A.
3. Components include:
   a. Master Controller.
   b. Network Controller.
   c. Class 2 Power supplies.
4. Where required, utilize a control panel with Class 1 power outputs:
   a. Input Power: 100-240 VAC (single-phase), 50/60 Hz.
   b. Output Power (at each power output): 30VDC, 4.0A.
   c. Class 1 power supplies are used in the control panel; all other components are the same as section 2.2 (A) (3).

B. Cabling: Provide cabling by system manufacturer using only approved parts and including:
1. Trunk line cable.
2. Trunk tee connector.
3. Drop line cable.
4. Trunk power cable.
5. Trunk power connector.
6. IGU cable.
7. IGU splitter.

C. Window controller: Controllers shall be connected to at least one insulating glass unit. Refer to definitions for functional description.

D. IGU pigtail: Manufacturer's custom cable as follows:
1. Length: 12 inches (300mm)
2. Termination: IP67 rated, environmentally sealed, 5/16 inch (8mm) circular connector.
3. Minimum diameter hole through framing: 7/16 inch (11mm).

E. Control Sensor:
1. Outdoor Photo sensor: up to 100,000 Lux.
2. To be determined by manufacturer's engineering team.

F. Optional Accessories:
1. Power Injection Panel: Used in installations requiring additional power as determined by manufacturer.
2. Pull Box: Used to conceal and protect cable connections to control panel.
3. Wall Interface:
   a. Wall-mounted hardware or software-based interface for overriding the tinting of a zone or a group of zones
   b. Note: Hardware-based version requires connection to window controller.

G. AC Wiring: Supplied under other sections by Electrical contractor.

H. Ethernet Wiring: Supplied under other sections by Electrical contractor or IT facilities installers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site conditions and ensure that:
   1. Controls network is comprised of a single linear trunk line from control panel to end of façade and each window controller branches off trunk line.
   2. Equipment, conduit, gang boxes, and other related materials are installed and ready to receive Work of this Section.
   3. Conduit and boxes are concealed.

B. Correct conditions deemed unsatisfactory and do not proceed until required corrections are complete.

3.2 CONTROLS INSTALLATION

A. Using approved submittals, install products in accordance with manufacturer's instructions, recommendations, restrictions and limitations and in environment meeting specified conditions.

B. Options for Control Integration:
   1. In-Shop: Install Window Controller, cables and other control components per framing manufacturer's wiring diagram.
   2. In-Field: Install Window Controller, cables and other control components per interconnect wiring diagrams.

C. Install Trunk Line cables according to the instructions to form a linear network.
   1. Utilize trunk tees and drop cables as required to connect Window Controllers.
   2. Ensure Trunk Line cable is connected with Trunk Tees as required for its entire length.
   3. Ensure Trunk Line cable has trunk terminators installed at each end of line.

D. Ensure Trunk line wire run lengths comply with Manufacturer's Dynamic Glass Control System Design Rules.
   1. Refer to approved interconnect drawings for details.

E. Install drop cables from Trunk Tees to Window Controllers.

F. Install Window Controllers using provided mounting holes.
   1. Ensure Controllers are accessible for service after installation.

G. Ensure wire run between Window Controller and the IGU pigtail is 15 feet or less.

H. When multiple IGUs are connecting to a single Window Controller, utilize an IGU Splitter and IGU cable.

I. Do not modify IGU pigtails, especially the pre-terminated connector. Contact manufacturer's product support if connector is damaged.

3.3 PROGRAMMING OF DYNAMIC GLASS SYSTEM

A. Initial Programming Confirmation: Confirm and define specific programming requirements for Manufacturer's Dynamic Glass system controls.

B. Pre-programming of Controls: Pre-program controls at factory to match initial programming requirements.

C. Final programming: Using manufacturer's personnel, modify and complete programming at end of commissioning period.

END OF SECTION 26 09 00

The information contained in this publication is offered for assistance in the specification of View inc. products. It is not intended to be complete and View inc. Does not assume any responsibility for the adequacy of the specification for a particular application. Due to continual research and product improvement, the specifications are subject to change without notice and without incurring obligation. Actual performance may vary in specific applications. An appropriate and qualified design professional must verify suitability of the product for use in a particular application, as well as review final specifications. Contact View Inc. sales to obtain up-to-date information relevant to your specific project or warranty information.

END OF SECTION

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Networked lighting control system and components.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution requirements for interfacing direct digital control systems with lighting control system specified in this section.
   2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
   3. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
   4. Section 26 05 53 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
   5. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 REFERENCES

A. Federal Communications Commission:
   1. Standard for Radio Frequency Equipment.

B. Government Electronics and Information Technology Association:
   1. EIA 709.1 - Control Network Protocol Specification.

C. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. California Electrical Code

E. Underwriters Laboratories Inc.:
   1. UL 50 - Enclosures for Electrical Equipment.
   2. UL 67 - Panelboards.
   3. UL 508 - Industrial Control Equipment.
   4. UL 916 - Energy Management Equipment.

1.3 SYSTEM DESCRIPTION

A. Provide networked lighting control system consisting of components manufactured by single source.

B. Provide networked lighting control system consisting of:
   1. Multiple relay panels linked over network wiring using open protocol for communications.
   2. Multiple relay panels linked over network wiring using open protocol for communications, and be fully compliant with EIA 709.1.
   3. Relay panels and programmable switches connected together by networked wiring system extending from panel locations with single communications bus to allow switches to communicate with panels.
   4. System connected to single time clock mounted in interior of relay panel.
   5. Single point connection BACnet IP integration with Building Automation System spec section 230923.

1.4 SUBMITTALS

A. Per Division 01 and the following.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
   1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches, data line, and network time clock.
   2. Drawings for each panel showing hardware configuration and numbering.
   3. Panel wiring schedules.
   4. Include typical wiring diagrams for each component.

C. Product Data: Submit manufacturer’s standard product data for each system component.

D. Manufacturer's Installation Instructions: Submit for each system component.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Submit in writing system has been installed, adjusted, and tested in accordance with manufacturer's recommendations.

F. Manufacturer's Field Reports: Submit system startup report indicating date of completion and acknowledgment of programming completion. Indicate acceptance of component and equipment installation, interconnecting wiring, and start-up of system software.

1.5 CLOSEOUT SUBMITTALS

A. Per Division 01 and the following.

B. Project Record Documents: Record the following information:
   1. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.
   2. Drawings for each panel showing hardware configuration and numbering.

C. Operation and Maintenance Data:
   1. Submit manufacturer’s published installation instructions, operating instructions, programming instructions, and operator’s guide.
   2. System user's guide and programmer's guide.

3. Instruction books and manufacturer's printed materials.
4. Recommended renewal parts list.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Comply with CEC as applicable to electrical wiring work.

C. Comply with NEMA 250 for type of electrical equipment enclosures.

D. Provide panelboards with UL listing in accordance with UL 50, UL 67, and UL 916.

E. Provide equipment complying with FCC emissions' standards in part 15 subpart J for Class A application.

F. Perform Work in accordance with campus standard.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing lighting control system listed in this section, with minimum ten years documented experience.

B. Installer: Company specializing in performing work of this section approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Per Division 01 and the following.

B. Preinstallation Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
1. Low voltage wiring requirements.
2. Separation of power and low voltage/data wiring.
3. Wire labeling.
4. Lighting management hub locations and installation.
5. Sensor locations, in accordance with layout provided by lighting control manufacturer as part of sensor layout and tuning services specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS". Lighting control manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
6. Control locations.
7. Computer jack locations.
8. Load circuit wiring.
9. Network wiring requirements.
10. Connections to other equipment and other Lutron equipment.

11. Installer responsibilities.
12. Power panel locations.
13. Single point BACnet IP integration with BMS.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Per Division 01 and the following.

B. Accept system components on site in manufacturer’s packaging. Inspect for damage.

C. Protect components by storing in manufacturer’s containers indoor protected from weather.

1.10 WARRANTY

A. Per Division 01 and the following.

B. Furnish five year manufacturer’s warranty for each system component.

1.11 MAINTENANCE SERVICE

A. Per Division 01 and the following.

B. Furnish service and maintenance of system for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including checkout and adjustments.

C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period.

D. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, with maximum 4 hour response time.

E. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 EXTRA MATERIALS

A. Furnish 20 percent of total number of relays.

B. Furnish two of each switch type.

C. Furnish two of each occupancy sensor type.

D. Furnish two of each photocell type.

E. Furnish one replacement key for each locking panelboard.

PART 2 PRODUCTS

2.1 NETWORKED LIGHTING CONTROL SYSTEM

A. Manufacturers:
   1. Basis of Design Manufacturer: Lutron Electronics Company, Inc.; www.lutron.com.
   2. Source limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
   3. Substitutions: Per Division 01.

2.2 DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

A. Include as part of the base bid additional costs for manufacturer's sensor layout and tuning services; Lutron LSC-SENS-LT:
   1. Lighting control manufacturer to design occupancy/vacancy and/or daylight sensor layout (wired and/or wireless sensors) that provides adequate coverage and performs according to required sequence of operations.
   2. Lighting control manufacturer to visit site for preinstallation meeting and system startup; lighting control manufacturer to coordinate with Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
   3. Any additional sensors or hardware required to meet sequence of operation to be furnished by lighting control manufacturer at no additional cost.
   4. Lighting control manufacturer to provide up to two additional post-startup on-site service visits for fine-tuning of sensor calibration.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relating humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4.2.

F. Dimming and Switching (Relay) Equipment:
   1. Designed so that electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.
   2. Inrush Tolerance:

a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.
b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.

3. Surge Tolerance:
   a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.
   b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
5. Dimming Requirements:
   a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage per cycle), frequency shifts (plus or minus 2 Hz change in frequency per second) dynamic harmonics, and line noise.
      1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
   b. Incorporate electronic “soft-start” default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
   c. Utilize air gap off to disconnect the load from line supply.
   d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
   e. Load Types:
      1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
      2) Provide capability of being field-configured to have load types assigned per circuit.
   f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.
   g. Line Voltage Dimmers:
      1) Dimmers for Magnetic Low Voltage (MLV) Transformers:
         a) Provide circuitry designed to control and provide symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
         b) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.
      2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
   h. Low Voltage Dimming Modules:
      1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.
      2) Single low voltage dimming module; capable of controlling the following light sources:
         a) 0-10V analog voltage signal.
            (1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.

(2) Sink current according to IEC 60929.
(3) Source current.
b) 10-0V reverse analog voltage signal.
c) DSI digital communication.
d) DALI broadcast communication per IEC 60929:
(1) Logarithmic intensity values complying with IEC 60929.
(2) Linear intensity values for use with LED color intensity control.
e) PWM per IEC 60929.

6. Switching Requirements:
   a. Rated Life of Relays: Minimum of 1,000,000 cycles at fully rated current for all lighting loads.
   b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

G. Device Finishes:
1. Standard Colors: Comply with NEMA WD1 where applicable.
2. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
3. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

~~4.~~H. BMS Integration:
~~5.~~1. Provide single point system BACnet IP integration with Building Automation System specified in spec section 230923.
~~6.~~2. Provide BACnet PIC statement of read writeable points.

2.3 LED DRIVERS

A. Product: Lutron Hi-lume A-Series.

B. General Requirements:
1. Designed for 10 year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
3. Maximum Inrush Current: 2 amperes for 120V and 277V drivers.
4. UL 8750 recognized or listed as applicable.
5. Comply with IEC 61347-2-13 as applicable.
6. Surge Tolerance: Designed and tested to withstand surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
7. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
8. Class A sound rating; Inaudible in a 27 dBA ambient.
9. No visible change in light output with a variation of plus or minus 10 percent line voltage input.
10. Total Harmonic Distortion (THD): Less than 20 percent; comply with ANSI C82.11.
11. Drivers to track evenly across multiple lamp lengths and all light levels.

12. Constant Current Drivers:
    a. Support from 200 mA to 2.1 A (in 10 mA steps) to ensure a compatible driver exists.
    b. Support LED arrays up to 90w (in 10 mA steps).
13. Constant Voltage Drivers:
    a. Support from 10 V to 40 V (in 0.5 V steps) to ensure a compatible driver exists.
    b. Support LED arrays up to 90W.
14. Configuration tool available to optimize the following for LED fixtures:
    a. Light level.
    b. Efficacy.
    c. Thermal performance.

C. Digital Control:
1. Dimming Range: 100 to one percent relative light output.
2. Lights automatically return to the setting prior to power interruption.
3. Operate from input voltage of 120 V through 277 V at 60 Hz.
4. Each driver responds independently to:
    a. Up to 32 occupant sensors.
    b. Up to 16 daylight sensors.
5. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by three percent to 27 percent).

2.4 POWER INTERFACES

A. Provide power interfaces as indicated or as required to control the loads as indicated.

B. General Requirements:
1. Phase independent of control input.
2. Rated for use in air-handling spaces as defined in UL 2043.
3. Utilize air gap off to disconnect the load from line supply.
4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

C. Product(s):
1. Phase-Adaptive Power Module with 3-Wire Fluorescent Input; Lutron PHPM-WBX: Provides interface for fluorescent ballast control input to provide full 16 A circuit output for compatible loads.

2.5 MAIN UNITS (LUTRON GRAFIC EYE QS)

A. Product: Lutron GRAFIK Eye QS.

B. Provide main units with configuration and quantity of zones as indicated or as required to control the loads as indicated.

C. Connects to lighting management hub via RS485.

D. Engrave units with button, zone, and scene descriptions as indicated on the drawings.

E. Integrated Wireless Capability:
   1. Provide wireless communication inputs for:
      a. Occupancy sensors.
      b. Daylight sensors.
      c. Wireless controller.
   2. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).
   3. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.

F. Preset Lighting Control with Zone Override:
   1. Intensity for each zone indicated by means of one illuminated bar graph per zone.
   2. User-programmable zone and scene names.
   3. Utilize air gap off to disconnect the load from line supply.
   4. Astronomical time clock and programmer interface provides access to:
      a. Scene selections.
      b. Fade zone to a level.
      c. Fine-tuning of preset levels with scene raise/lower.
      d. Lock out scenes and zones.
      e. Fine-tuning of light levels with individual zone raise/lower.
      f. Terminal block for wired infrared signal input.
      g. Enable/disable wall station.
   5. Light intensity with real time energy savings by digital display.
   6. Fade time indicated by digital display for current scene while fading.
   7. Integral wide angle infrared receiver.
   8. For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.
   9. Direct Low-Voltage Control of Digital Ballasts and LED drivers (120V, 220/240V, 277V and/or 347V Lighting):
      a. Electronically link a digital fluorescent lighting ballast to a zone for both dimming and turning on/off.
      b. Electronically assign daylight sensors to digital ballasts and line voltage dimmers for proportional daylight harvesting.
      c. Single integral controller with Class 1 or Class 2 isolated digital output signal conforming to IEC 60929; capable of direct control without interface.
   10. Creates daylighting rows independent of control zones.
   11. Capable of re-zoning without re-wiring using programming display on unit.
   12. Outputs can be virtually mapped to other device's outputs.
   13. Zone raise/lower buttons capable of controlling local lighting loads connected to the main unit or remote lighting zones in the system.

G. Provides one direct-wired occupancy sensor connection without interface or powerpack.

2.6 LIGHTING CONTROL MODULES (LUTRON ENERGI SAVR NODE)

A. Provide lighting control modules as indicated or as required to control the loads as indicated.

B. General Requirements:
   1. Listed to UL 508 as industrial control equipment.

2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
    a. Occupancy sensors.
    b. Daylight sensors.
    c. IR receivers for personal control.
6. Connects to lighting management hub via RS485.
7. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
8. Contact Closure Input:
    a. Directly accept contact closure input from a dry contact closure or sold-state output without interface to:
        1) Activate scenes.
            a) Scene activation from momentary or maintained closure.
        2) Enable or disable after hours.
            a) Automatic sweep to user-specified level after user-specified time has elapsed.
            b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
            c) Occupant can reset timeout by interacting with the lighting system.
        3) Activate or deactivate demand response (load shed).
            a) Load shed event will reduce lighting load by user-specified amount.
9. Emergency Contact Closure Input:
    a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
    b. Allow configurable zone response during emergency state.
    c. Disable control operation until emergency signal is cleared.
10. Supplies power for control link for keypads and control interfaces.
11. Distributes sensor data among multiple lighting control modules.
12. Capable of being controlled via wireless sensors and controls.

C. 0-10V Lighting Control Modules:
1. Product: Lutron 0-10V Energi Savr Node; Model QSN-4T16-S.
2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
3. Single low voltage dimming module; capable of controlling following light sources:
    a. 0-10V analog voltage signal.
        1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
        2) Sink current per IEC 60929.
    b. 10V-0V analog voltage signal.
        1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
        2) Sink current per IEC 60929.
4. Switching:
    a. Rated Life of Relay: Minimum of 1,000,000 cycles at fully rated current for all lighting loads.
    b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.

c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
d. Module to integrate up to four individually controlled zones, each with a capacity of up to 16 amps of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads).
e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. Digital Fixture Lighting Control Modules:
1. Product(s):
a. Lutron EcoSystem Energi Savr Node; Model QSN-1ECO-S: One EcoSystem Digital Link.
b. Lutron EcoSystem Energi Savr Node; Model QSN-2ECO-S: Two EcoSystem Digital Links.
2. Provide smart diagnostics for system verification.
3. Provide testing capability using manual override buttons.
4. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

2.7 DIGITAL DIMMING BALLAST AND SWITCHING MODULES (LUTRON ECOSYSTEM)

A. Provide digital dimming ballast and switching modules as indicated or as required to control the loads as indicated.

B. General Requirements:
1. Provide continuous 3-wire signal dimming to compatible 3-wire electronic dimming ballasts.
2. Utilize air gap off to disconnect the load from line supply.
3. Connect without interface to:
a. Occupancy sensor.
b. Daylight sensor.
c. Personal control input (wall station or infrared receiver).
4. Generate digital communication commands to distribute ballast and sensor data on the digital bus.
5. If power is interrupted and subsequently restored, lights automatically return to the setting prior to power interruption.
6. Each ballast module responds independently to:
a. Up to 32 occupancy sensors.
b. Up to 64 personal control inputs.
c. Two daylight sensors.
7. Unique internal reference number visible displayed on module cover.
8. Averages two independent daylight harvesting inputs internally.
9. Responds to digital load shed command.
a. Sets high end trim.
b. Automatically scales light output proportional to load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast to automatically set the maximum light output at 90 percent and lower current light output by 3 percent to 27 percent).
10. Provide integral fault protection to prevent ballast module failure in the event of a mis-wire.

C. Product(s):
   1. 3-Wire Ballast Module, 16 Amp; Lutron EcoSystem Model C5-BMJ-16A:
      a. Integrates up to 16 amps of 3-wire electronic dimming ballasts into EcoSystem digital control system as a single zone.
      b. Integrates up to 16 amps of switched high intensity discharge (HID) lighting load into EcoSystem digital control system as a single zone.

2.8 LIGHTING MANAGEMENT HUBS

A. Product: Lutron Quantum Light Management Hub.

B. Provided in a pre-assembled NEMA listed enclosure with terminal blocks listed for field wiring.

C. Connects to controls and power panels via RS485.

D. Enables light management software to control and monitor compatible dimming ballasts and ballast modules, power panels, power modules, and window treatments.
   1. Utilizes Ethernet connectivity to light management computer utilizing one of the following methods:
      a. Dedicated network.
      b. Dedicated VLAN.
      c. Shared network with Building Management System (BMS).
      d. Corporate network where managed switches are configured to allow multicasting and use of IGMP.

E. Integrates control station devices, power panels, shades, preset lighting controls, and external inputs into a single customizable lighting control system with:
   1. Multiple Failsafe Mechanisms:
      a. Power failure detection via emergency lighting interface.
      b. Protection: Lights go to full on if ballast wires are shorted.
      c. Distributed architecture provides fault containment. Single hub failure or loss of power does not compromise lights and shades connected to other lighting management hubs.
   2. Manual overrides.
   3. Automatic control.
   4. Central computer control and monitoring.

F. Furnished with astronomical time clock.

G. Maintains a backup of the programming in a non-volatile memory capable of lasting more than ten years without power.

2.9 LIGHTING MANAGEMENT SYSTEM COMPUTERS

A. No computers to be provided. Lighting control system manufacturer field service representative to perform system start-up without on-site computer.

2.10 LIGHTING MANAGEMENT SYSTEM SOFTWARE

A. Provide system software license and hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Configuration Setup Software:
   1. Product: Lutron Q-Design.
   2. Suitable to make system programming and configuration changes.
   3. Windows-based, capable of running on either central server or a remote client over TCP/IP connection.
   4. Allows manufacturer (either remotely or with on-site service call) or end-user (with training) to:
      a. Capture system design:
         1) Geographical layout.
         2) Load schedule zoning.
         3) Equipment schedule.
         4) Equipment assignment to lighting management hubs.
         5) Daylighting design.
      b. Define the configuration for the following in each area:
         1) Lighting scenes.
         2) Control station devices.
         3) Interface and integration equipment.
         4) Occupancy/after hours.
         5) Partitioning.
         6) Daylighting.
         7) Emergency lighting.
         8) Night lights.
      c. Startup:
         1) Addressing.
         2) Daylighting.
         3) Provide customized conditional programming.

C. Control and Monitor Software:
   1. Product: Lutron Q-Admin.
   2. Basic System View: The system navigation and status reporting is performed using a tree view of the building.
   3. Control of Lights:
      a. Area lights can be monitored for on/off status.
      b. All lights in an area can be turned on/off or sent to a specific level.
      c. For areas that have been zoned, these areas may be sent to a predefined lighting scene, and individual zones may be controlled.
      d. Area lighting scenes can be modified in real-time, changing the levels that zones go to when a scene is activated.
      e. High and low end of area lighting can be tuned/trimmed.
      f. Control and monitor area partition status.
   4. Occupancy:
      a. Area occupancy can be monitored.

b. Area occupancy can be disabled to override occupancy control or in case of occupancy sensor problems.
c. Area occupancy settings including level that lights turn on to when area is occupied, and level that lights turn off to when area is unoccupied can be changed in real-time.

5. Daylighting:
   a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
   b. Daylight target levels can be changed for each daylit area.
   c. Daylight status can be monitored.
6. Load Shedding; Lutron IntelliDemand: Allows the building manager to monitor whole building lighting power usage and apply a customized load shed reduction to selected areas, thereby reducing a building's power usage; load shedding triggered via Quantum software, BACnet, or OpenADR.
7. Scheduling: Schedule time of day and astronomic time clock events to automate functions.
8. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:
   a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas or meter groups.
   b. Power Reports: Show power usage trend over a period of time for one or more areas or meter groups.
   c. Activity Report: Show what activity has taken place over a period of time for one or more areas. Activity includes occupant activities (e.g. wall controls being pressed), building manager operation (e.g. controlling/changing areas using the control and monitor tool), and device failures (e.g. keypads or ballasts that are not responding).
   d. Lamp Failure Report: Shows which areas are currently reporting lamp failures.
   e. Sensor Level Report: Shows the light level in footcandles of any photosensor in the system.
   f. Alert Activity Report: Capable of generating historical reports of all alert activity within the system.
9. Diagnostics: Allows the building manager to check on the status of all equipment in the lighting control system. Devices to be listed with a reporting status of OK, missing, or unknown.
10. Alerts and Alarms: Monitors the system for designated events/triggers and automatically generates alerts according to configured response criteria.
    a. Capable of monitoring for the following events/triggers:
       1) A failed piece of equipment (e.g. ballast, control, sensor, etc.); alert cleared when equipment is replaced.
       2) A lamp outage (for compatible EcoSystem digital electronic dimming ballasts only); alert cleared when lamp is replaced.
       3) Low battery conditions in battery-operated sensors and controls; alert cleared when battery is replaced.
       4) Luminaires with lamp operating hours in excess of designated time.
       5) A load shed event; alert generated for beginning and end of trigger.
       6) Energy usage higher than designated threshold target.
       7) Potential light level condition discrepancies (daylight sensors not agreeing with expected lighting status).

b. Capable of generating alerts through visible changes in software or through email messages.
c. Capable of customizing the frequency of alerts and providing notifications immediately or through daily, weekly, or monthly summaries.
d. Capable of sending different alerts to different system users.
e. Capable of generating historical reports of all alert activity within the system.

11. Administration:
    a. Users: Allows new user accounts to be created and existing user accounts to be edited.
        1) Supports Active Directory (LDAP) tying user accounts to network accounts.
    b. Area and feature access can be restricted based on login credentials with three levels of access rights (Admin, Programmer, Controller) and customized access levels available.
    c. Publish Graphical Floor Plan: Allows admin user to publish new graphical floor plan files, allowing users to monitor the status of lights, occupancy of areas, and daylighting status.
    d. Back-Up Project Database: Allows admin user to back up the project database that holds all the configuration information for the system, including keypad programming, areas scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
    e. Publish Project Database: Allows admin user to send a new project database to the server and download the new configuration to the system. The project database holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.
12. Virtual Global Buttons: Provide global scene control or modes of operation across entire system.
13. Provides control/monitoring of partition status to automatically reconfigure how the space operates based on the partition's open/closed status.

2.11 CONTROL STATIONS

A. Provide control stations with configuration as indicated or as required to control the loads as indicated.

B. Wired Control Stations:
    1. General Requirements:
        a. Class 2 (low voltage).
        b. UL listed.
        c. Control stations can be replaced without reprogramming.
    2. Product(s):
        a. Multi-Scene Wired Control:
            1) Product(s):
                a) Lutron seeTouch QS.
            2) Allows control of any devices part of the lighting control system.
            3) Utilize RS485 wiring for low-voltage communication.
            4) Functionality:
                a) Upon button press, LEDs to immediately illuminate.

b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
c) Allows for easy reprogramming without replacing unit.
d) Replacement of units does not require reprogramming.

5) Provide faceplates with concealed mounting hardware.
6) Engrave wall stations with button, zone, and scene descriptions as indicated on the drawings.
7) Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
8) Software Configuration:
   a) Customizable control station device button functionality:
      (1) Buttons can be programmed to perform single defined action.
      (2) Buttons can be programmed to perform defined action on press and defined action on release.
      (3) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
9) Control station device LEDs to support logic that defines when it is illuminated:
   a) Scene logic (logic is true when all zones are at defined levels).
   b) Room logic (logic is true when at least one zone is on).
   c) Pathway (logic is true when at least one zone is on).
   d) Last scene (logic is true when spaces are in defined scenes).
10) Contact Closure Interface: Accepts both momentary and maintained contact closures.

2.12 LOW-VOLTAGE CONTROL INTERFACES

A. Provide low-voltage control interfaces as indicated or as required to control the loads as indicated.

B. Connects to lighting management hub via RS485.

C. UL listed.

D. RS232 and Ethernet Interface:
   1. Product: Lutron Model QSE-CI-NWK-E.
   2. Provide ability to communicate via Ethernet or RS232 to audiovisual equipment, touchscreens, etc.
   3. Allow creation of custom output strings.
   4. Provide control of:
      a. Light scene selections.
      b. Fine-tuning of light scene levels with raise/lower.
      c. Simulate system wall station button presses and releases.
   5. Provide status monitoring of:
      a. Light scene status.
      b. Wall station button presses and releases.
      c. Wall station LEDs.

6. Provide ability to send custom output strings.

E. Sensor Modules:
1. Products:
a. Sensor module with both wired and wireless inputs; Lutron Model QSM2-4W-C.
2. Wired Modules:
a. Provide wired inputs for:
1) Daylight sensors.
2) IR receivers for personal control.
3) Digital ballast wall stations.
3. Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.13 WIRED SENSORS

A. Wired Daylight Sensors:
1. Digital Interior Daylight Sensor:
a. Product: Lutron Model EC-DIR-WH.
b. Use Class 2 wiring for low voltage communication.
c. Can be replaced without reprogramming.
d. Open-loop basis for daylight sensor control scheme.
e. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
f. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
g. Provide linear response from 0 to 500 footcandles.
h. Integral IR receiver for personal control.
i. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
j. Constructed via sonic welding.
k. Color: White.

2.14 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory Testing; Lutron Standard Factory Testing:
1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.
3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for two hours.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those standards.

B. Install products in accordance with manufacturer's instructions.

C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.

D. Sensor Locations: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

E. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

F. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

G. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

H. Identify system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Per Division 01 and the following.

B. See article "SYSTEM STARTUP" below for requirements related to testing and inspection.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 SYSTEM STARTUP

A. Provide services of a manufacturer's certified service representative to perform system startup.

B. Manufacturer's Startup Services; Lutron Standard Startup Services:
   1. Manufacturer's certified service representative to conduct minimum of three site visits to ensure proper system installation and operation.
   2. Conduct first visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".

3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:
    a. Verify sensor locations, in accordance with layout provided by lighting control manufacturer as part of sensor layout and tuning services specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS"; lighting control manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
    b. Verify connection of power wiring and load circuits.
    c. Verify connection and location of controls.
    d. Energize lighting management hubs and download system data program.
    e. Address devices.
    f. Verify proper connection of panel links (low voltage/data) and address panel.
    g. Verify system operation control by control.
    h. Verify proper operation of manufacturer's interfacing equipment.
    i. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
    j. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by lighting control manufacturer as part of sensor layout and tuning services where specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
    k. Obtain sign-off on system functions.
    l. Verify and configure BACnet IP integration with Building Automation System provided in spec section 230923.
4. Conduct third site visit to train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 COMMISSIONING

A. Per Division 01.

3.7 CLOSEOUT ACTIVITIES

A. Training:
    1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.
        a. Include training on software to be provided:
            1) Configuration software used to make system programming and configuration changes.
            2) Control and monitor.

3.8 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 26 09 43

GENERAL NOTES

1. THE FOOTPRINT OF NEW BUILDING STRUCTURES SHOULD BE OVER-EXCAVATED TO DEPTH OF AT LEAST FIVE (5) FEET BELOW GROUND SURFACE OR THREE (3) FEET BELOW PLANNED FOOTINGS, WHICHEVER IS DEEPER. THE LATERAL LIMITS OF THE OVER-EXCAVATION SHOULD EXTEND AT LEAST 5 FEET BEYOND THE BUILDING FOOTPRINT, WHERE FEASIBLE, PER PROJECT SOILS REPORT.
2. FOR THE SIDEWALKS, PAVEMENT, AND FLATWORK AREAS, AT LEAST 2 FEET OF THE UPPER SOILS BELOW FINISHED GRADE SHOULD BE OVER-EXCAVATED AND REPLACED WITH NON-EXPANSIVE COMPACTED FILL MATERIAL PER PROJECT SOILS REPORT. THE EXCAVATION TO REMOVE UNSUITABLE SOILS SHOULD EXTEND AT LEAST 2 FEET BEYOND THE PROPOSED IMPROVEMENT LIMITS.
3. SEE LANDSCAPE PLANS FOR TURF AND HARDSCAPE LIMITS AND COMPOSITION.

LEGEND

- GENERAL LIMIT OF WORK LINE
- 6" P.C.C. SIDEWALK
- 4" P.C.C. SIDEWALK
- LANDSCAPE AREA - REFER TO LANDSCAPE PLANS

CONSTRUCTION NOTES

1. CONSTRUCT 4" THICK PCC SIDEWALK OVER 24" NON-EXPANSIVE FILL PER DETAIL ON SHEET C5.0. SEE LANDSCAPE PLANS FOR FINISH AND REINFORCEMENT.
2. CONSTRUCT CONCRETE SEAT WALL PER LANDSCAPE PLANS
3. PROTECT EXISTING PCC CONCRETE SIDEWALK
4. PROTECT EXISTING INLET AND ADJUST GRATE TO GRADE AS REQUIRED
5. PROTECT EXISTING LIGHT POLE
6. PROTECT EXISTING UTILITY VAULT AND ADJUST TO GRADE
7. PROTECT EXISTING ELECT VAULT AND ADJUST TO GRADE
8. PROTECT EXISTING COMMUNICATION VAULT AND ADJUST TO GRADE
9. REMOVE EXISTING SD INLET AND PLUG END
10. CONSTRUCT 36" CROSS GUTTER PER DETAIL 10 ON SHEET C5.0
11. CONSTRUCT NON-SKID STRIP PER LANDSCAPE PLANS AND DETAIL 11 ON SHEET C5.0
12. CONSTRUCT CONCRETE BANDING PER LANDSCAPE PLANS
13. CONSTRUCT 6" CURB PER DETAIL 13 ON SHEET C5.0
14. SAWCUT AND REMOVE EXISTING CURB AND GUTTER
15. SAWCUT AND REMOVE EXISTING PC PAVEMENT
16. CONSTRUCT FULL DEPTH AC PAVEMENT PER DETAIL 16 ON SHEET C5.0
17. PROTECT EXISTING TREE
18. PROTECT EXISTING CURB AND GUTTER
19. CONSTRUCT PCC CONCRETE DRIVEWAY APRON
20. CONSTRUCT MODIFIED 6" CURB & GUTTER PER DETAIL 20 ON SHEET C5.0
21. PROTECT EXISTING WATER VALVE
22. CONSTRUCT 6" CURB PER DETAIL 24 ON SHEET C5.0
23. CONSTRUCT 7.5" THICK PCC SIDEWALK OVER 24" NON-EXPANSIVE FILL PER DETAIL 23 ON SHEET C5.0. SEE LANDSCAPE PLANS FOR FINISH AND REINFORCEMENT.
24. CONSTRUCT ADA RAMP W/ TRUNCATED DOMES PER ARCHITECTURAL PLANS AND DETAILS.

CONSUMER SCIENCE AND DESIGN
FF=68.95

SCIENCE HALL (TO REMAIN)
FF=67.27

JOURNALISM BUILDING (TO REMAIN)
FF=67.33

NEW PLANETARIUM BUILDING
F.F.=68.40

(N) PLANETARIUM

LEWIS CENTER FOR APPLIED SCIENCES (TO REMAIN)
FF=68.99

BUSINESS EDUCATION BUILDING (TO REMAIN)
FF=67.20

LIBRARY BUILDING (TO REMAIN)
FF=69.33

SEE SHEET C3.1 FOR ENLARGEMENT

EX. ELECT. VAULT TO BE PROTECTED IN PLACE

LANDSCAPE AREA

N

20 0 20 40
scale 1"= 20' feet

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REGISTERED PROFESSIONAL ENGINEER MICHAEL S. OSKORUS No. C 11360 CIVIL STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS		
#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION	465
DATE	12/15/2014
DRAWN BY	MO
CHECKED BY	MSO

SHEET TITLE
PRECISE GRADING PLAN

SHEET NUMBER

C3.0

CONSTRUCTION DOCUMENTS 12/15/2014

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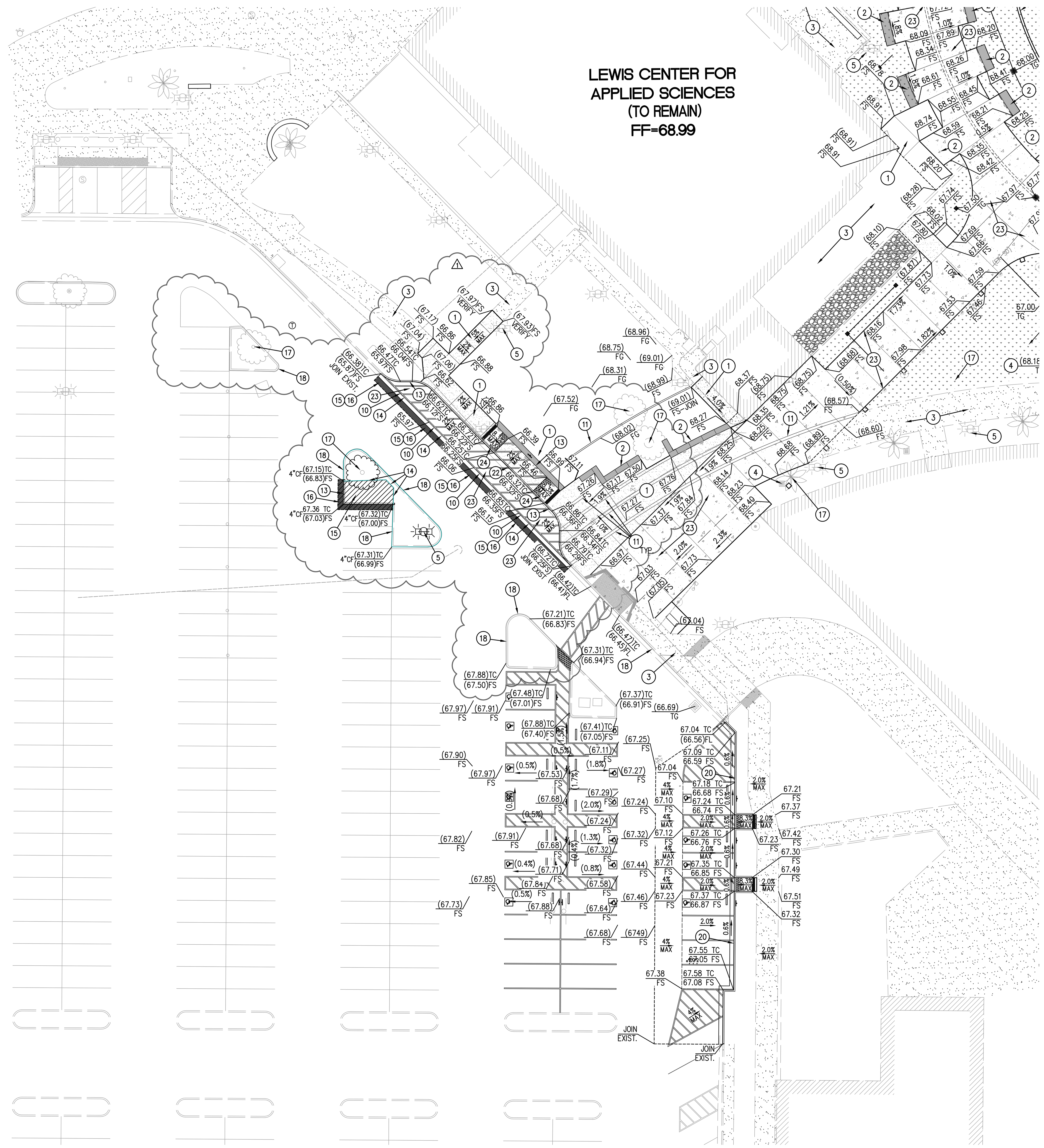

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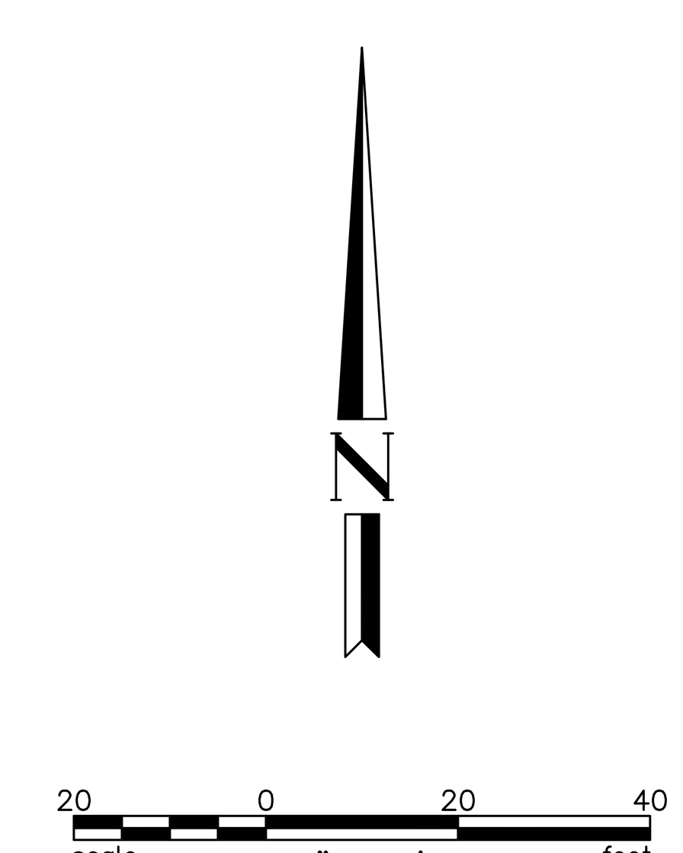

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Ren. 6-30-17
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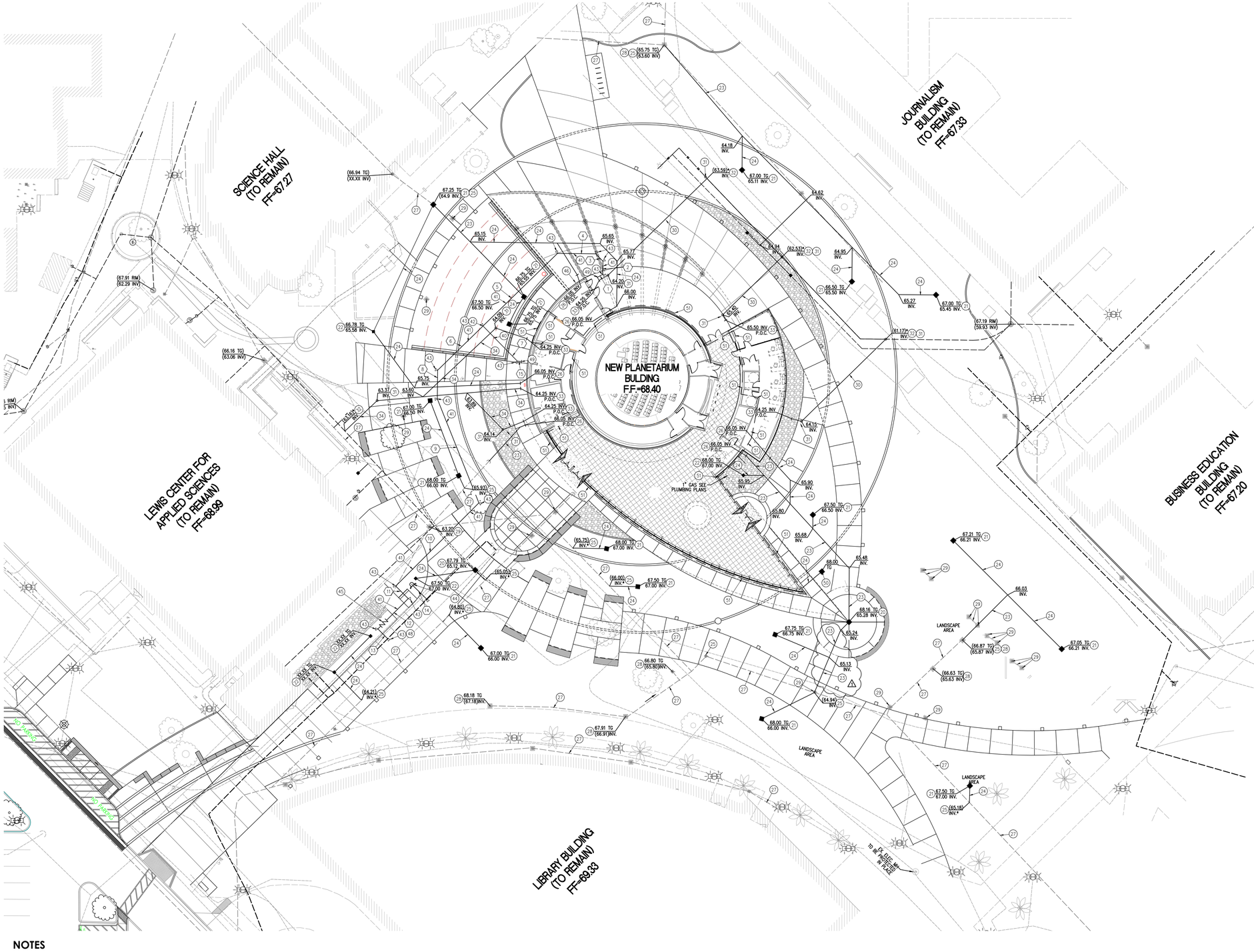

CONSTRUCTION NOTES

STORM DRAIN

20. INSTALL 12" x 12" PEDESTRIAN RATED GRATED INLET PER NDS #1200 & #1214 OR APPROVED EQUAL
21. INSTALL 12" x 12" GRATED INLET PER NDS #1200 & #1212 OR APPROVED EQUAL
22. INSTALL 12" x 12" ATRIUM GRATE PER NDS #1200 & #1280 OR APPROVED EQUAL
23. INSTALL 6" SDR-35 PVC STORM DRAIN
24. INSTALL 4" SDR-35 PVC STORM DRAIN
25. CONNECT TO EXISTING STORM DRAIN PIPE
26. ROOF DRAIN P.O.C – SEE PLUMBING PLANS
27. PROTECT EXISTING STORM DRAIN LINE
28. PROTECT EXISTING GRATED INLET, ADJUST TO GRADE AS REQUIRED.
29. REMOVE EXISTING STORM DRAIN INLET, PLUG AND CAP END OF INLET PIPE AS REQUIRED.
30. INSTALL 24"x24" SUBDRAIN DRYWELL PER DETAIL 5.0 ON SHEET C5.0.
51. INSTALL 4" SDR-35 PVC PERFORACTED SUBDRAIN, SEE ARCHITECTURAL AND STRUCTURAL PLANS FOR LAYOUT

SEWER

30. INSTALL 4" SDR-35 PVC SEWER LATERAL
31. INSTALL 4" SEWER CLEAN OUT PER DETAIL 3.1 ON SHEET C5.0
32. INSTALL SEWER WYE AND CONNECT TO EXISTING SEWER LINE
33. SEWER P.O.C – SEE PLUMBING PLANS
34. INSTALL 6" SDR-35 PVC SEWER LATERAL

WATER

40. INSTALL 2" AWWA, CLASS C900, CL-235 DOMESTIC WATER LINE
41. INSTALL 6" AWWA, CLASS C900, CL-235 DOMESTIC WATER LINE
42. INSTALL 6" x 6" x 2" TEE
43. CONSTRUCT THRUST BLOCK PER DETAIL 4.3 ON SHEET C5.0
44. RELOCATE EXISTING FIRE HYDRANT AND ASSEMBLY
45. INSTALL 6" DETECTOR CHECK ASSEMBLY PER DETAIL 4.5 ON SHEET C5.0
46. INSTALL FDC SEE FIRE SPRINKLER PLANS FOR LOCATION
47. NOT USED
48. CONSTRUCT 6" HOT TAP
49. WATER P.O.C – SEE PLUMBING PLANS

GENERAL NOTES

1. THE PIPE SUBGRADE SHOULD BE LEVEL, FIRM, UNIFORM, FREE OF LOOSE MATERIALS AND PROPERLY GRADED TO PROVIDE UNIFORM BEARING AND SUPPORT TO THE ENTIRE SECTION OF THE PIPE PLACED ON BEDDING MATERIAL. PROTRUDING OVERSIZE PARTICLES LARGER THAN TWO (2) INCHES IN THE LARGEST DIMENSION, IF ANY, SHOULD BE REMOVED FROM THE TRENCH BOTTOM AND REPLACED WITH COMPACTED MATERIALS.
2. OVER-EXCAVATION OF THE SOILS IN THE BOTTOM OF THE TRENCH AND REPLACEMENT WITH GRANULAR MATERIAL MAY BE NEEDED IF SOFT CLAY SOILS ARE ENCOUNTERED. GRANULAR MATERIALS, SUCH AS GRAVEL, MAY BE USED TO STABILIZE THE BOTTOM OF THE TRENCH EXCAVATION.
3. TRENCH BACKFILL SHALL BE COMPACTED TO 90 PERCENT OF THE LABORATORY MAXIMUM DRY DENSITY AS PER ASTM STANDARD 01557 TEST METHOD. AT LEAST THE UPPER TWELVE (12) INCHES OF TRENCH UNDERLYING PAVEMENTS SHOULD BE COMPACTED TO AT LEAST 95 PERCENT OF THE LABORATORY MAXIMUM DRY DENSITY.
4. PROTECT ALL SEWER, WATER, GAS, ELECTRIC AND STORM DRAIN LINES, VALVES, VAULTS, CLEAN OUTS, MANHOLES, ETC. UNLESS OTHERWISE NOTED.
5. ADJUST VALVES, CLEANOUTS AND MANHOLES AS REQUIRED.
6. CONTRACTOR TO FIELD VERIFY ALL PIPE LOCATIONS AND INVERTS AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES.
7. NOTIFY OWNER OF ANY CONFLICTS BETWEEN PROPOSED LANDSCAPING AND EXISTING UTILITIES. ADJUST PER OWNER'S DIRECTION.

EXISTING UTILITY INVERT NOTE

CONTRACTOR TO FIELD VERIFY ALL PIPE LOCATIONS AND INVERTS OF EXISTING SEWER AND STORM DRAIN AT ALL PROPOSED POINTS OF CONNECTION AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES PRIOR TO INSTALLATION OF ANY SEWER AND STORM LINES OR APPURTENANCES.

NOTES

1. INSPECTIONS ARE REQUIRED: 1) PRIOR TO POURING THRUST BLOCKS, 2) FOR HYDROSTATIC TESTING, AND 3) FOR FLUSH.
2. INSTALLATION, INSPECTION, AND TESTING SHALL CONFORM TO 2013 NFPA 13 AND 2013 NFPA 24.
3. PRIVATE FIRE HYDRANTS SHALL BE APPROVED WET BARREL STYLE WITH A MINIMUM OF ONE 2 1/2" AND ONE 4" OUTLET. THE 4" OUTLET SHALL FACE THE FIRE DEPARTMENT ACCESS ROAD. ALL OUTLETS SHALL BE PROVIDED WITH NATIONAL STANDARD THREADS (NST).
4. FIRE HYDRANT SUPPLY PIPING SHALL BE A MINIMUM OF SIX INCHES IN DIAMETER. THE LOWEST OPERATING NUT SHALL BE A MINIMUM OF 18" ABOVE GRADE AND THE HYDRANT FLANGE SHALL BE A MINIMUM OF 2" ABOVE GRADE.
5. FIRE HYDRANTS SHALL BE A MINIMUM OF 40 FEET FROM ALL STRUCTURES. A KEYED GATE VALVE SHALL BE PROVIDED FOR EACH HYDRANT IN AN ACCESSIBLE LOCATION. VALVES SHALL NOT BE LOCATED IN PARKING STALLS.
6. ALL PIPES SHALL BE APPROVED FOR USE IN FIRE SERVICE SYSTEMS (CLASS 150 MINIMUM). CLASS 200 PIPE SHALL BE USED WHERE THE PRESSURE MAY EXCEED 150 PSI
7. ALL FERROUS PIPE AND FITTING SHALL BE PROTECTED WITH LOOSE 8 MIL POLYETHYLENE TUBE. THE ENDS OF THE TUBE AND ANY SPLICES MADE FOR TEE'S OR OTHER PIPING COMPONENTS SHALL BE SEALED WITH 2" TAPE, APPROVED FOR UNDERGROUND USE. ALL BOLTED JOINTS SHALL BE CLEANED AND THOROUGHLY COATED WITH ASPHALT OR OTHER CORROSION RETARDING MATERIAL AFTER ASSEMBLY AND PRIOR TO POLY-TUBE INSTALLATION
8. A 12" BED OF CLEAN FILL SAND SHALL BE PROVIDED BELOW AND ABOVE THE PIPE (TOTAL 24").
9. ALL BOLTS USED FOR UNDERGROUND CONNECTIONS SHALL BE STAINLESS STEEL.
10. A MINIMUM OF 30" OF COVER, FROM FINISH GRADE TO THE TOP OF THE PIPE, SHALL BE PROVIDED. WHEN SURFACE LOADS ARE EXPECTED, A MINIMUM OF 36" COVER SHALL BE PROVIDED.
11. THRUST BLOCKS, OR OTHER APPROVED METHOD OF THRUST RESTRAINT, SHALL BE PROVIDED WHEREVER PIPE CHANGES DIRECTION. PROVIDE DETAILS AND CALCULATIONS FOR SIZING THRUST BLOCKS BASE ON ACTUAL SOIL CONDITIONS.
12. THE TRENCH SHALL BE EXCAVATED FOR THRUST BLOCKS AND INSPECTED PRIOR TO POUR. ALL CORROSION PROTECTION SHALL BE IN PLACE.
13. A HYDROSTATIC TEST (200 PSI FOR TWO HOURS OR 50 PSI OVER MAXIMUM STATIC PRESSURE, WHICHEVER IS GREATER) SHALL BE BACK-FILLED BETWEEN THE JOINTS TO PREVENT MOVEMENT OF THE PIPE.
14. THE SYSTEM SHALL HE THOROUGHLY FLUSHED BEFORE CONNECTION IS MADE TO OVERHEAD PIPING. FLOW SHALL BE THROUGH A MINIMUM OF A 4" HOSE OF PIPE.
15. PRIVATE HYDRANTS, SPRINKLER CONTROL VALVES, DETECTOR CHECK ASSEMBLIES, POST INDICATING VALVES AND FIRE DEPARTMENT CONNECTIONS SHALL BE PAINTED OSHA RED.
16. ALL CONTROL VALVES SHALL BE LOCKED IN THE OPEN POSITION. VALVES SHALL BE MONITORED IF THEY SERVE 100 OR MORE SPRINKLER HEADS.

WATER LINE DATA		
	DISTANCE	BEARING
1	3.00'	N 60°00'00" E
2	6.43'	N 00°43'22" E
3	5.00'	N 44°16'38" W
4	18.69'	N 89°16'38" W
5	50.90'	N 45°43'22" E
6	31.00'	N 45°43'22" E
7	24.00'	N 44°16'38" W
8	14.00'	N 00°43'22" E
9	54.82'	N 21°46'38" E
10	57.50'	N 45°00'00" E
11	8.64'	N 45°00'00" W
12	21.00'	N 45°00'00" E
13	6.71'	N 45°00'00" W
14	10.50'	N 45°15'00" W
15	2.00'	N 82°14'03" E

N

20 0 20 40
scale 1"= 20' feet

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REGISTERED PROFESSIONAL ENGINEER MARK S OSKORS No. C-64139 CIVIL STATE OF CALIFORNIA

SEALS / APPROVALS

REGISTERED ARCHITECT MICHAEL S. OSKORS No. C 11360 STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

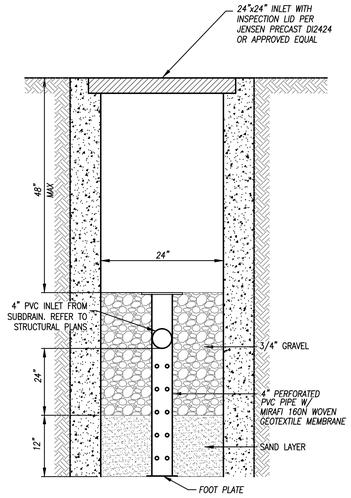
#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY MO
CHECKED BY MSO

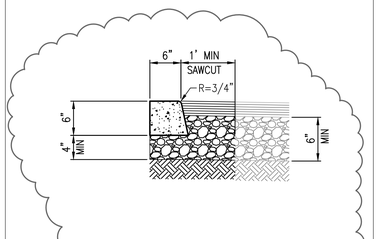
SHEET TITLE
UTILITY PLAN

SHEET NUMBER
C4.0

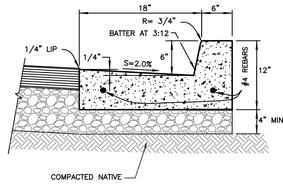
CONSTRUCTION DOCUMENTS 12/15/2014



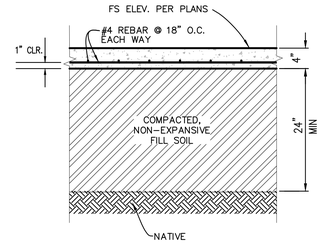
DRYWELL DETAIL | SCALE N.T.S. | 50



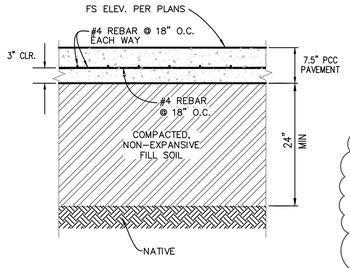
⚠ 0" CURB DETAIL | SCALE 1" = 1'-0" | 22



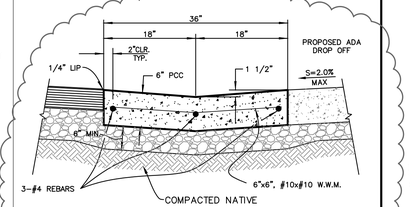
MODIFIED 6" CURB & GUTTER DETAIL | SCALE 1" = 1'-0" | 20



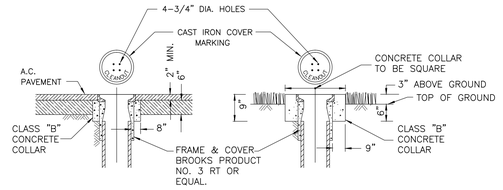
SIDEWALK DETAIL | SCALE 1" = 1'-0" | 1

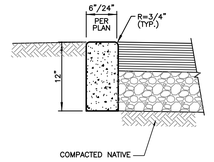


PCC PAVING FOR VEHICULAR TRAFFIC | SCALE 1" = 1'-0" | 23

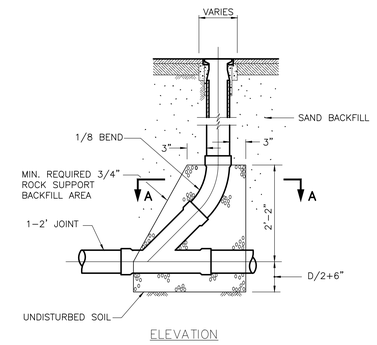


⚠ 3' CONCRETE GUTTER DETAIL | SCALE 1" = 1'-0" | 10

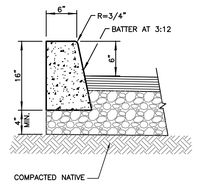




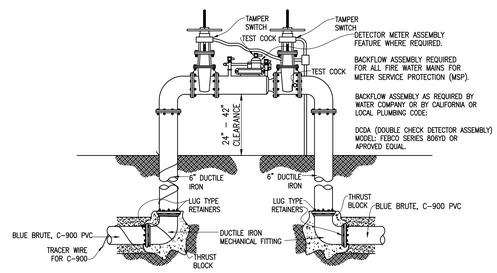
MOW STRIP DETAIL | SCALE 1" = 1'-0" | 11



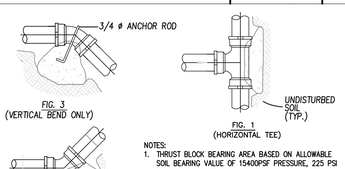
CLEAN OUT DETAIL | SCALE 1" = 1'-0" | 31



6" CURB DETAIL | SCALE 1" = 1'-0" | 13



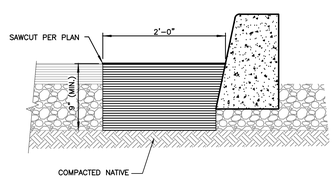
6" DCC ASSEMBLY DETAIL | SCALE N.T.S. | 45



NOTES:
1. THRUST BLOCK BEARING AREA BASED ON ALLOWABLE SOIL BEARING VALUE OF 1540PSF PRESSURE, 225 PSI LINE PRESSURE WITH 3'-0" COVER MIN. AND MINIMUM SAFETY FACTOR OF 1.2.
2. ALL THRUST BLOCKS SHALL BE PORTLAND CEMENT CONCRETE MIX 560-C-3250 AND PLACED AGAINST UNDISTURBED SOIL.
3. FOR SOIL LOAD BEARING AREA AT 1000 PSF, INCREASED BY 1/2.

SIZE OF PIPE	MIN. BEARING AREA, SQ. FT. FIG. 1 TEE	FIG. 2 90°	FIG. 2 45°	FIG. 2 22½°	FIG. 2 11¼°	MIN. VOLUME, CU. FT. FIG. 3 45°	FIG. 3 22½°	FIG. 3 11¼°
4"	3	4	2	1	1	20	11	6
6"	6	8	4	2	1	44	22	12
8"	10	13	7	4	2	76	41	22
10"	15	20	11	6	3	120	60	35

THRUST BLOCK DETAIL | SCALE 1" = 1'-0" | 43



FULL DEPTH AC PAVEMENT DETAIL | SCALE 1" = 1'-0" | 16

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REGISTERED PROFESSIONAL ENGINEER MARK S OSKORUS No. C 64159 CIVIL STATE OF CALIFORNIA

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SHEET TITLE
DETAILS

SHEET NUMBER

C5.0

CONSTRUCTION DOCUMENTS 12/15/2014

SCIENCE HALL
FF=67.27

CONSUMER SCIENCE AND DESIGN
FF=68.95

JOURNALISM BUILDING
FF=67.33

LEWIS CENTER FOR APPLIED SCIENCES
FF=68.99

BUSINESS EDUCATION BUILDING
FF=67.20

LIBRARY BUILDING
FF=69.33

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SEE SHEET C6.1
FOR PARKING LOT
DIMENSIONS

scale 1"= 20' (20 0 20 40 feet)

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PROJECT IDENTIFICATION 465

DATE 12/15/2014

DRAWN BY MO

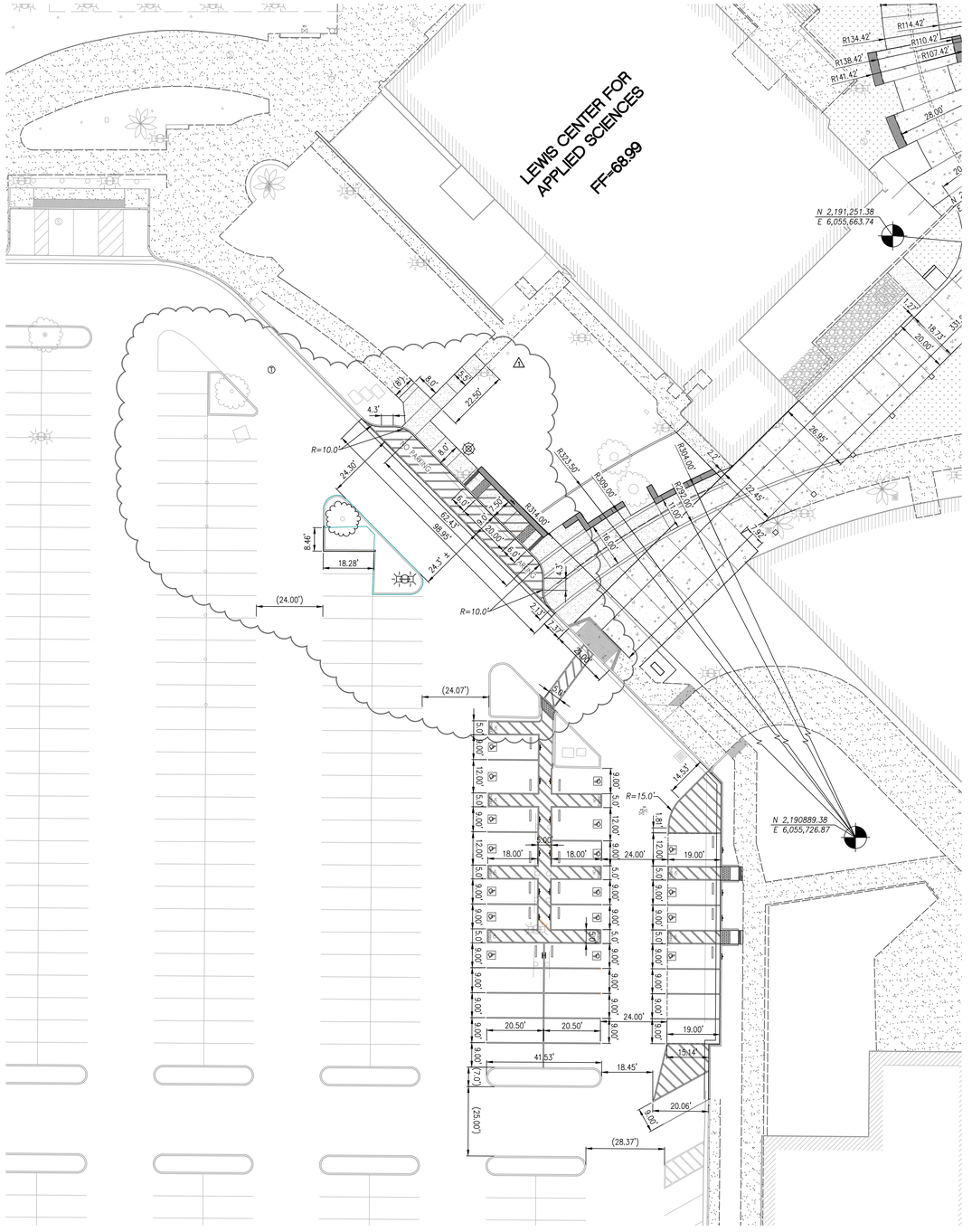
CHECKED BY MSO

SHEET TITLE
HORIZONTAL CONTROL PLAN

SHEET NUMBER

C6.0

CONSTRUCTION DOCUMENTS 12/15/2014



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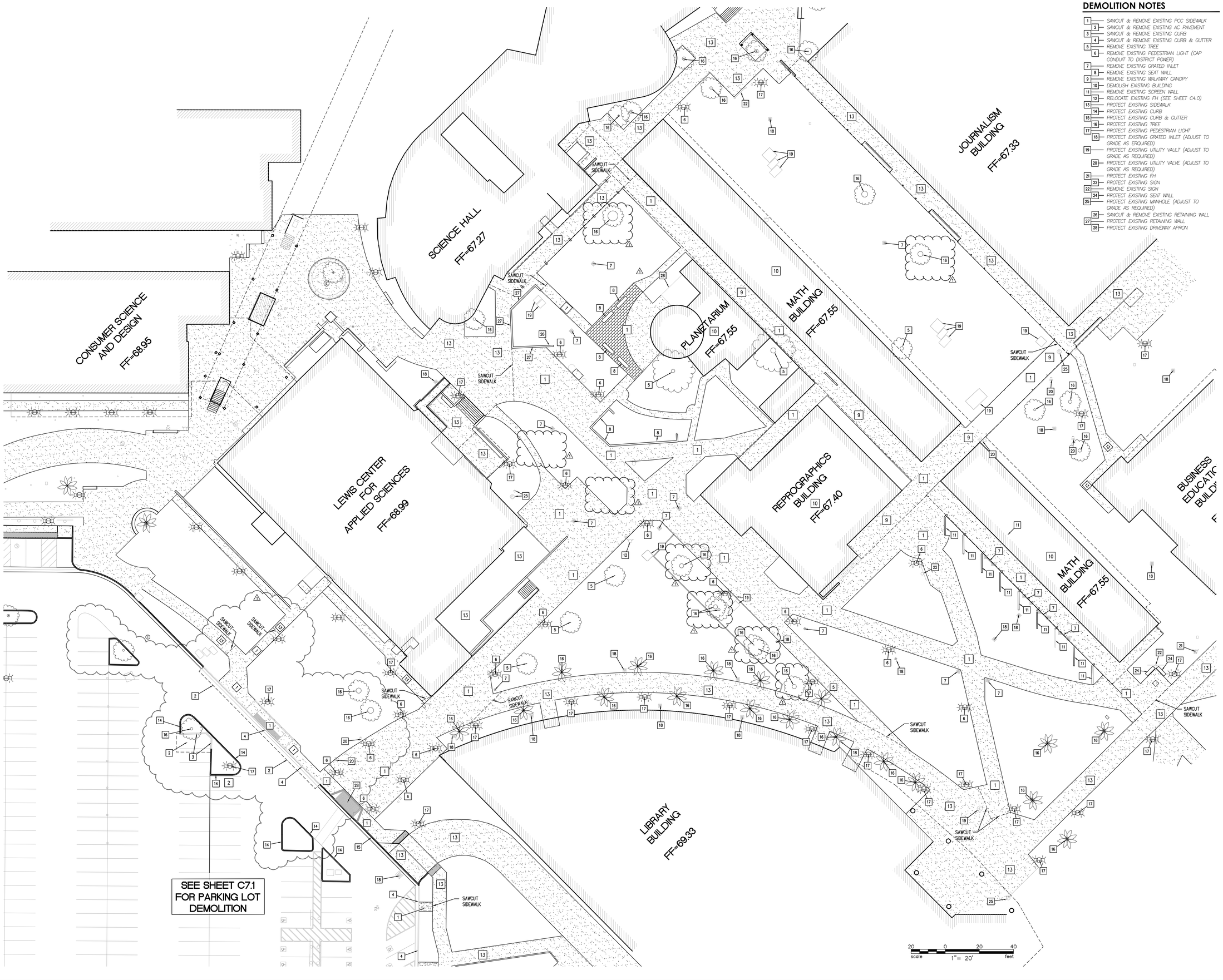
PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY MO
CHECKED BY MSO

SHEET TITLE
HORIZONTAL CONTROL PLAN PARKING LOT

SHEET NUMBER
C6.1

CONSTRUCTION DOCUMENTS 12/15/2014



DEMOLITION NOTES

1. SAWCUT & REMOVE EXISTING PCC SIDEWALK
2. SAWCUT & REMOVE EXISTING AC PAVEMENT
3. SAWCUT & REMOVE EXISTING CURB
4. SAWCUT & REMOVE EXISTING CURB & GUTTER
5. REMOVE EXISTING TREE
6. REMOVE EXISTING PEDESTRIAN LIGHT (CAP CONDUIT TO DISTRICT POWER)
7. REMOVE EXISTING GRATED INLET
8. REMOVE EXISTING SEAT WALL
9. REMOVE EXISTING WALKWAY CANOPY
10. DEMOLISH EXISTING BUILDING
11. REMOVE EXISTING SCREEN WALL
12. RELOCATE EXISTING FH (SEE SHEET C4.0)
13. PROTECT EXISTING SIDEWALK
14. PROTECT EXISTING CURB
15. PROTECT EXISTING CURB & GUTTER
16. PROTECT EXISTING TREE
17. PROTECT EXISTING PEDESTRIAN LIGHT
18. PROTECT EXISTING GRATED INLET (ADJUST TO GRADE AS ERQUIRED)
19. PROTECT EXISTING UTILITY VAULT (ADJUST TO GRADE AS REQUIRED)
20. PROTECT EXISTING UTILITY VALVE (ADJUST TO GRADE AS REQUIRED)
21. PROTECT EXISTING FH
22. PROTECT EXISTING SIGN
23. REMOVE EXISTING SIGN
24. PROTECT EXISTING SEAT WALL
25. PROTECT EXISTING MANHOLE (ADJUST TO GRADE AS REQUIRED)
26. SAWCUT & REMOVE EXISTING RETAINING WALL
27. PROTECT EXISTING RETAINING WALL
28. PROTECT EXISTING DRIVEWAY APRON

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SEALS / APPROVALS

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Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

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COSTA MESA, CA 92626

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PROJECT IDENTIFICATION	465
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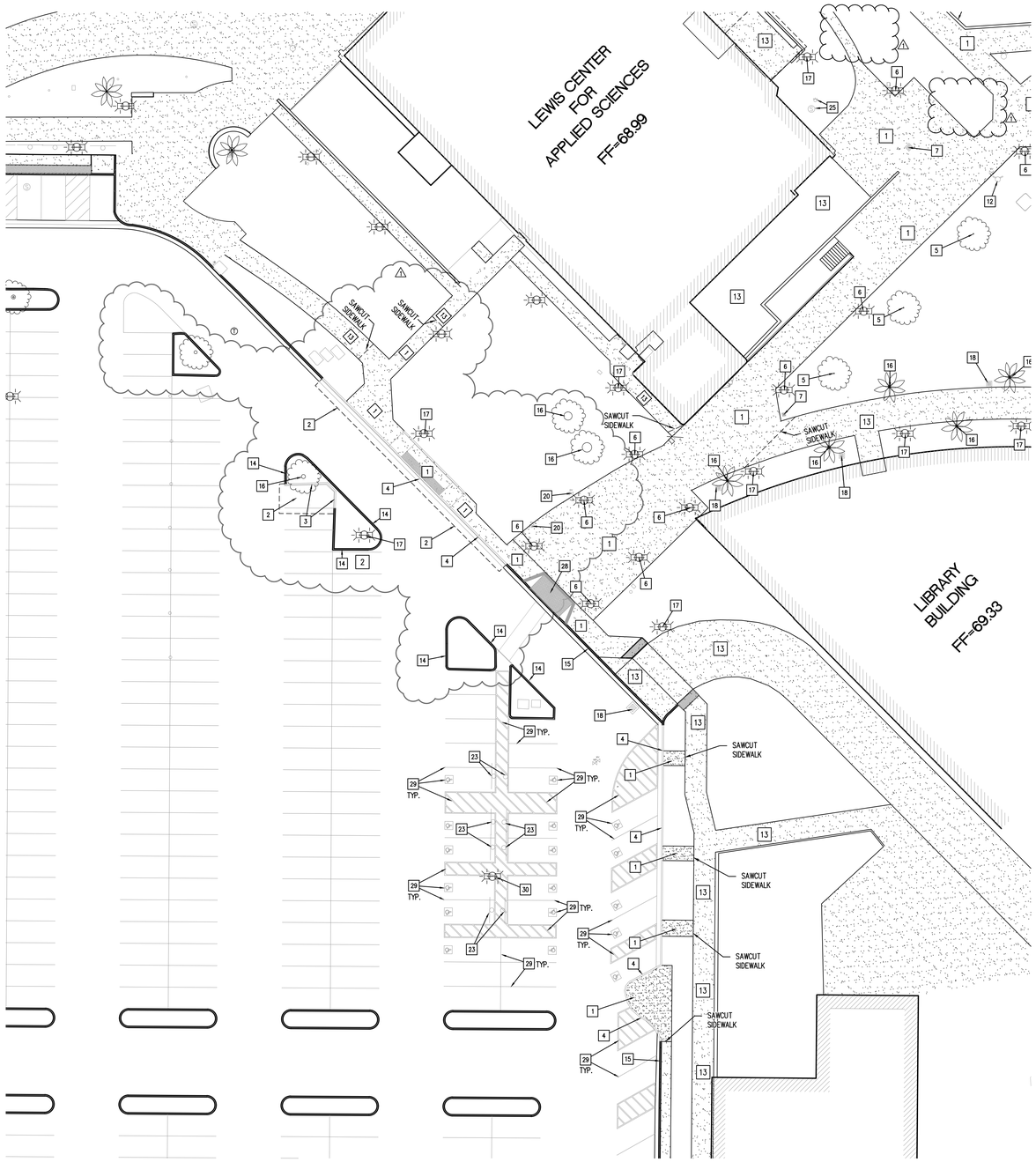
CHECKED BY	MSO

SHEET TITLE
DEMOLITION PLAN

SHEET NUMBER
C7.0

CONSTRUCTION DOCUMENTS 12/15/2014



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2. SAWCUT & REMOVE EXISTING AC PAVEMENT
3. SAWCUT & REMOVE EXISTING CURB
4. SAWCUT & REMOVE EXISTING CURB & GUTTER
5. REMOVE EXISTING TREE
6. REMOVE EXISTING PEDESTRIAN LIGHT (CAP CONDUIT TO DISTRICT POWER)
7. REMOVE EXISTING GRATED INLET
8. REMOVE EXISTING SEAT WALL
9. REMOVE EXISTING WALKWAY CANOPY
10. DEMOLISH EXISTING BUILDING
11. REMOVE EXISTING SCREEN WALL
12. RELOCATE EXISTING FH (SEE SHEET C4.0)
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14. PROTECT EXISTING CURB
15. PROTECT EXISTING CURB & GUTTER
16. PROTECT EXISTING TREE
17. PROTECT EXISTING PEDESTRIAN LIGHT
18. PROTECT EXISTING GRATED INLET (ADJUST TO GRADE AS ERQUIRED)
19. PROTECT EXISTING UTILITY VAULT (ADJUST TO GRADE AS REQUIRED)
20. PROTECT EXISTING UTILITY VALVE (ADJUST TO GRADE AS REQUIRED)
21. PROTECT EXISTING FH
22. PROTECT EXISTING SIGN
23. REMOVE EXISTING SIGN
24. PROTECT EXISTING SEAT WALL
25. PROTECT EXISTING MANHOLE (ADJUST TO GRADE AS REQUIRED)
26. SAWCUT & REMOVE EXISTING RETAINING WALL
27. PROTECT EXISTING RETAINING WALL
28. PROTECT EXISTING DRIVEWAY APRON
29. REMOVE PARKING STALL STRIPING
30. PROTECT PARKING LOT LIGHT
31. PROTECT PARKING STALL STRIPING

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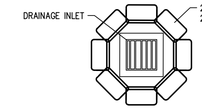
DEMOLITION PLAN

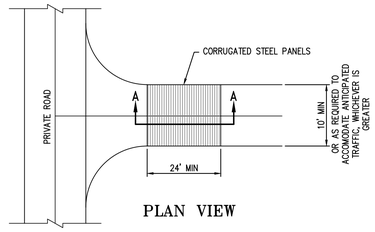
SHEET NUMBER
C7.1

CONSTRUCTION DOCUMENTS 12/15/2014

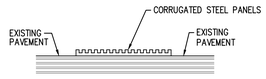


NOTES:
GRAVEL BAGS TO BE INSTALLED AT ALL AREA DRAINS

E1 | DRAINAGE INLET GRAVEL BAG DETAIL
SCALE: N.T.S.



PLAN VIEW



SECTION A-A

E2 | GRAVEL BAG DETAIL
SCALE: N.T.S.

E3 | STABILIZED CONSTRUCTION ENTRANCE DETAIL
SCALE: N.T.S.

CONSTRUCTION NOTES

(E1) INSTALL DRAINAGE INLET GRAVEL BAG CHECK DAM PER DETAIL HEREON
(E2) INSTALL GRAVEL BAGS PER DETAIL HEREON
(E3) CONSTRUCT STABILIZED CONSTRUCTION ENTRANCE/ EXIT PER DETAIL HEREON
(E4) INSTALL 6' HIGH CHAIN LINK FENCE.
(E5) INSTALL 6' HIGH CHAIN LINK DOUBLE GATE.

LEGEND

GENERAL LIMIT OF WORK LINE
6" P.C.C. SIDEWALK
4" P.C.C. SIDEWALK
LANDSCAPE AREA - REFER TO LANDSCAPE PLANS
GRAVEL BAG AND C.L. FENCE LINE
GRAVEL BAG INLET CHECK DAM

SCIENCE HALL
(TO REMAIN)
FF=67.27

JOURNALISM BUILDING
(TO REMAIN)
FF=67.33

CONSUMER SCIENCE AND DESIGN
FF=68.95

NEW PLANETARIUM BUILDING
FF=68.40

(N) PLANETARIUM

LEWIS CENTER FOR APPLIED SCIENCES
(TO REMAIN)
FF=68.99

BUSINESS EDUCATION BUILDING
(TO REMAIN)
FF=67.20

LIBRARY BUILDING
(TO REMAIN)
FF=69.33

N

20 0 20 40
scale 1"= 20' feet

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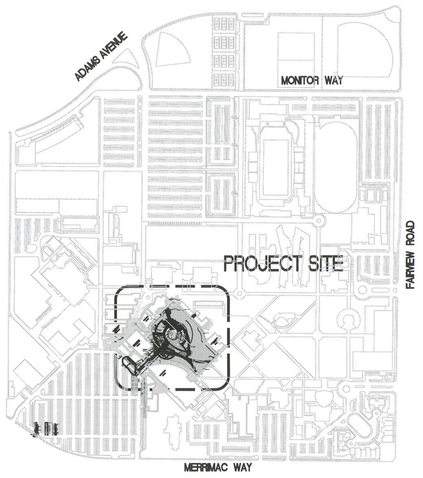
PROJECT IDENTIFICATION	465
DATE	12/15/2014
DRAWN BY	MO
CHECKED BY	MSO

SHEET TITLE
EROSION CONTROL PLAN

SHEET NUMBER
C8.0

CONSTRUCTION DOCUMENTS 12/15/2014



VICINITY MAP

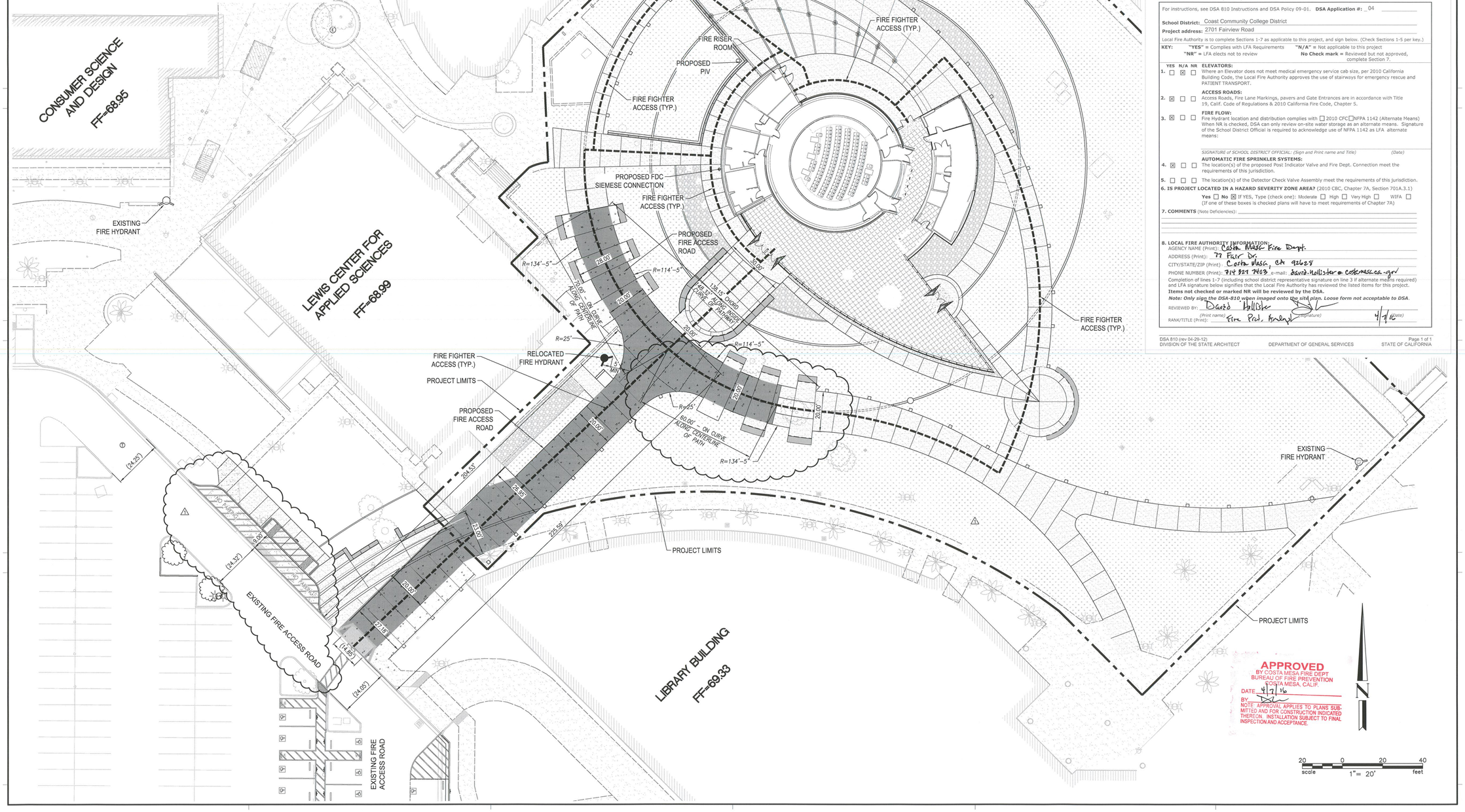
FOR FIRE ACCESS ONLY
REFER TO CIVIL FOR
SITE IMPROVMENTS

GENERAL NOTES

1. FIRE ACCESS TO CAMPUS IS OFF OF FAIRVIEW ROAD, HARBOR BOULEVARD, ADAMS AVENUE, MERRIMAC WAY AND MONITOR WAY. SEE EXISTING CAMPUS FIRE ACCESSIBILITY PLAN FOR EXACT LOCATIONS.
2. FIRE DEPARTMENT VEHICULAR ACCESS ROADS SHALL BE HARD SCAPE ALL WEATHER ACCESS IN ACCORDANCE WITH THE DEPARTMENT'S ALL WEATHER ACCESS REQUIREMENTS, FIRE CODE 503.2.3.
3. ALL FIRE HYDRANTS SHALL MEASURE 6" x 4" x 2-1/2", BRASS OR BRONZE, CONFORMING TO AMERICAN WATER WORKS ASSOCIATION STANDARD C503, OR APPROVED EQUAL, AND SHALL BE INSTALLED IN COMPLIANCE WITH THE ORANGE COUNTY FIRE AUTHORITY FIRE CODES AND REGULATIONS.
4. ALL ON-SITE FIRE HYDRANTS SHALL BE INSTALLED, TESTED AND APPROVED PRIOR TO BUILDING OCCUPANCY.

LEGEND

- FIRE ACCESS PATH
- PCC PAVEMENT / SIDEWALK
- 5' WIDE FIREFIGHTER ACCESS ROUTE
- PROJECT LIMITS
- PROPOSED RELOCATED FIRE HYDRANT
- EXISTING FIRE HYDRANT



DSA 810

LOCAL FIRE AUTHORITY REVIEW

For instructions, see DSA 810 Instructions and DSA Policy 09-01. **DSA Application #:** 04

School District: Coast Community College District

Project address: 2701 Fairview Road

Local Fire Authority is to complete Sections 1-7 as applicable to this project, and sign below. (Check Sections 1-5 per key.)

KEY: **"YES"** = Complies with LFA Requirements **"N/A"** = Not applicable to this project
"NR" = LFA elects not to review **No Check mark** = Reviewed but not approved, complete Section 7.

	YES	N/A	NR	
1.	☐	☒	☐	**ELEVATORS:** Where an Elevator does not meet medical emergency service cab size, per 2010 California Building Code, the Local Fire Authority approves the use of stairways for emergency rescue and PATIENT TRANSPORT.
2.	☒	☐	☐	**ACCESS ROADS:** Access Roads, Fire Lane Markings, pavers and Gate Entrances are in accordance with Title 19, Calif. Code of Regulations & 2010 California Fire Code, Chapter 5.
3.	☒	☐	☐	**FIRE FLOW:** Fire Hydrant location and distribution complies with ☐ 2010 CFC ☐ NFPA 1142 (Alternate Means) When NR is checked, DSA can only review on-site water storage as an alternate means. Signature of the School District Official is required to acknowledge use of NFPA 1142 as LFA alternate means:
				SIGNATURE of SCHOOL DISTRICT OFFICIAL: (Sign and Print name and Title) *(Date)*
4.	☒	☐	☐	**AUTOMATIC FIRE SPRINKLER SYSTEMS:** The location(s) of the proposed Post Indicator Valve and Fire Dept. Connection meet the requirements of this jurisdiction.
5.	☐	☐	☐	The location(s) of the Detector Check Valve Assembly meet the requirements of this jurisdiction.

6. IS PROJECT LOCATED IN A HAZARD SEVERITY ZONE AREA? (2010 CBC, Chapter 7A, Section 701A.3.1)
Yes ☐ No ☒ If YES, Type (check one): Moderate ☐ High ☐ Very High ☐ WIFA ☐
(If one of these boxes is checked plans will have to meet requirements of Chapter 7A)

7. COMMENTS (Note Deficiencies):

8. LOCAL FIRE AUTHORITY INFORMATION:
AGENCY NAME (Print): Costa Mesa Fire Dept.
ADDRESS (Print): 77 Fair Dr.
CITY/STATE/ZIP (Print): Costa Mesa, CA 92626
PHONE NUMBER (Print): 714 327 7403 e-mail: david.hollister@costamesaca.gov

Completion of lines 1-7 (including school district representative signature on line 3 if alternate means required) and LFA signature below signifies that the Local Fire Authority has reviewed the listed items for this project.
Items not checked or marked NR will be reviewed by the DSA.
Note: Only sign the DSA-810 when imaged onto the sitd plan. Loose form not acceptable to DSA.

REVIEWED BY: David Hollister *(Signature)*
(Print name) RANK/TITLE (Print): Fire Prev. Engr. *(Date)* 4/7/16

DSA 810 (rev 04-29-12) DIVISION OF THE STATE ARCHITECT | DEPARTMENT OF GENERAL SERVICES | Page 1 of 1 STATE OF CALIFORNIA

APPROVED
BY COSTA MESA FIRE DEPT
BUREAU OF FIRE PREVENTION
COSTA MESA, CALIF.
DATE 4/7/16
BY
NOTE: APPROVAL APPLIES TO PLANS SUBMITTED AND FOR CONSTRUCTION INDICATED THEREON. INSTALLATION SUBJECT TO FINAL INSPECTION AND ACCEPTANCE.

N

scale 1" = 20' (20 0 20 40 feet)

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949.675.6442 www.hpiarchitecture.com

CONSULTANTS

Hall & Foreman, Inc.
Engineering · Planning · Surveying
17782 17TH ST, SUITE 200 · TUSTIN, CA 92780-1947 · 714-665-4500

REGISTERED PROFESSIONAL ENGINEER
MARK S OSBORNE
No.C-62159
CIVIL
STATE OF CALIFORNIA

SEALS / APPROVALS

ARCHITECT C 11360

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1	04/20/2016	Addendum 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
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FIRE HYDRANT & ACCESS APPROVAL

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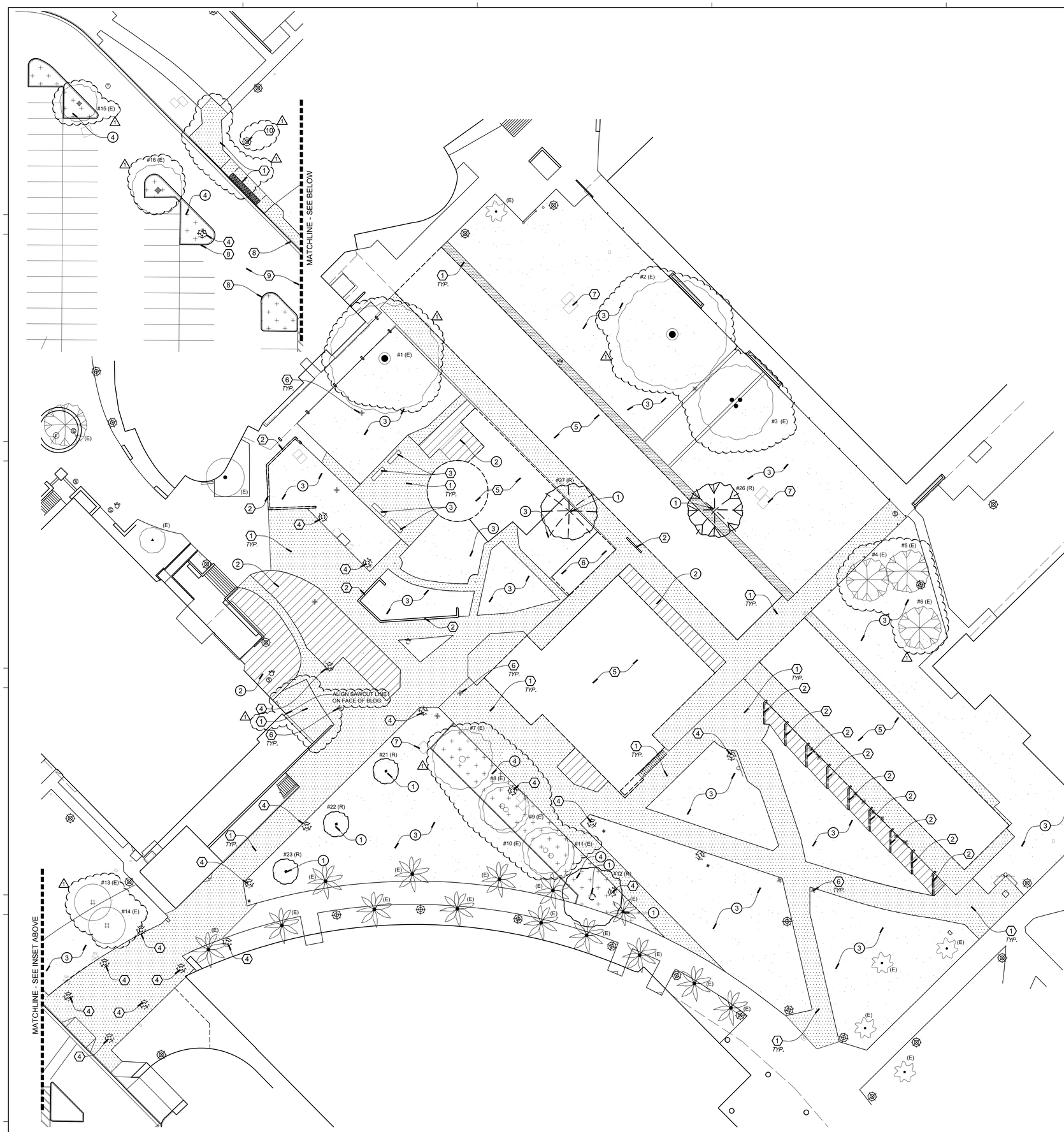

DEMOLITION LEGEND:

HARDSCAPE ITEMS :

1. DEMOLISH AND REMOVE FROM SITE EXISTING CONCRETE AND BRICK PAVING. SAWCUT TO EDGE OF PROPOSED PLANTER AREA, OR AS SHOWN - REFER TO CONSTRUCTION PLAN, SHEET L2.1, FOR ULTIMATE PAVING CONFIGURATION.
2. DEMOLISH AND REMOVE FROM SITE EXISTING WALL.
3. DEMOLISH AND REMOVE FROM SITE EXISTING CONCRETE BENCHES.
4. DEMOLISH AND REMOVE FROM SITE EXISTING LIGHT FIXTURE. CUT AND CAP WIRES TO A MINIMUM OF 6" BELOW FINISH GRADE AND PROVIDE "SAFE/OFF" CONDITION.
5. EXISTING BUILDING. REFER TO ARCHITECT'S SHEETS FOR BUILDING DEMOLITION INFORMATION.
6. EXISTING AREA DRAIN. REFER TO CIVIL ENGINEER'S SHEETS FOR DRAINAGE DEMOLITION INFORMATION.
7. EXISTING UTILITY. REFER TO CIVIL ENGINEER'S SHEETS FOR DRAINAGE DEMOLITION INFORMATION.
8. EXISTING CURB. REFER TO CIVIL ENGINEER'S SHEETS FOR DRAINAGE DEMOLITION INFORMATION.
9. EXISTING A.C. PAVING. REFER TO CIVIL ENGINEER'S SHEETS FOR DRAINAGE DEMOLITION INFORMATION.
10. EXISTING LIGHT FIXTURE TO BE REMOVE AND SALVAGED ON-SITE FOR REUSE. REMOVE EXISTING FOOTING, CUT / CAP EXISTING CONDUIT 12" BELOW GRADE, AND PROVIDE "SAFE/OFF" CONDITION.

PLANTING AND IRRIGATION ITEMS :

1. DEMOLISH AND REMOVE FROM SITE EXISTING TREE. NOTE: CONTRACTOR SHALL TAG ALL TREES TO BE REMOVED FOR REVIEW AND APPROVAL BY COLLEGE'S AUTHORIZED REPRESENTATIVE PRIOR TO DEMOLITION. REFER TO EXISTING TREE LEGEND FOR SPECIES DESCRIPTION.
2. DEMOLISH AND REMOVE FROM SITE ALL EXISTING SHRUBS AND GROUNDCOVER IN AREA INDICATED BY HATCH. PREPARE SOIL FOR NEW PLANTING PER SPECIFICATIONS. RETAIN EXISTING IRRIGATION EQUIPMENT TO THE EXTENT POSSIBLE.
3. DEMOLISH AND REMOVE FROM SITE EXISTING TURF. REMOVE WEEDS, ROOTS, STONES, ETC. AND PREPARE SOIL FOR NEW PLANTING OR PAVING AS REQUIRED. RETAIN EXISTING IRRIGATION EQUIPMENT TO THE EXTENT POSSIBLE.
4. DEMOLISH AND REMOVE FROM SITE EXISTING DECOMPOSED GRANITE. PREPARE SOIL FOR NEW PLANTING PER SPECIFICATIONS. RETAIN EXISTING IRRIGATION EQUIPMENT TO EXTENT POSSIBLE.

NOTE: CONTRACTOR MAY RE-USE EXISTING IRRIGATION MAINLINE AND SLEEVING TO EXTENT POSSIBLE. REFER TO IRRIGATION PLAN, SHEET L4.1, FOR ADDITIONAL INFORMATION.

DEMOLITION NOTES

A. REMOVE ITEMS NOT REQUIRED FOR FILL OR RE-USE FROM THE PROJECT SITE, AND DISPOSE OF IN ACCORDANCE WITH LOCAL CODES. DO NOT BURN RUBBISH OR DEBRIS ON SITE.

B. ANY DAMAGE TO EXISTING PLANT MATERIAL OR HARDSCAPE ELEMENTS THAT ARE TO REMAIN (I.E. CURBS, WALKS, WALLS, ADJACENT PROPERTY, ETC.) SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

C. CONTRACTOR SHALL LIST ALL EXISTING TREES TO REMAIN THAT HAVE HAD WORK PERFORMED WITHIN 6' OF TRUNK ON PLANT MATERIAL GUARANTEE. PROTECT TREES IN PLACE: DO NOT COMPACT SOIL UNDER DRIP LINE, DO NOT PARK VEHICLES WITHIN DRIP LINE, DO NOT STORE MATERIALS WITHIN DRIP LINE, OR OTHERWISE HARM TREES WHICH ARE TO REMAIN.

D. ALL SURFACES WHERE GROUNDCOVER HAS BEEN REMOVED SHALL BE GRUBBED AND BROUGHT TO A CONSISTENT GRADE HAVING NO IRREGULARITIES, TO THE SATISFACTION OF THE OWNER.

E. VERIFY LOCATIONS OF ALL UNDERGROUND UTILITY LINES, PIPES, VAULTS, OR BOXES PRIOR TO ANY EXCAVATION. NOTIFY OWNER IMMEDIATELY AND REPAIR ANY SUCH ITEMS IF DAMAGED. REPAIRS SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER.

F. CONTRACTOR SHALL NOTIFY OWNER IMMEDIATELY IF FIELD CONDITIONS SHOULD VARY FROM THOSE SHOWN ON PLAN.

G. LOCATIONS OF EXISTING SITE ELEMENTS (I.E. SIGNS, LIGHTS, VENTS, HYDRANTS, TRANSFORMERS, ETC.) ARE APPROXIMATE. NOTIFY THE OWNER IMMEDIATELY IF THE LOCATION OF THESE ITEMS INTERFERES WITH THE PROPER EXECUTION OF WORK.

H. VISIT THE SITE PRIOR TO SUBMITTING BID.

I. ALL TREES TO BE REMOVED SHALL HAVE ROOTS GROUND TO 3' BELOW FINISH GRADE.

J. ALL CLEARED AREAS SHALL BE TREATED WITH HERBICIDE FOR WEED CONTROL PER LANDSCAPE SPECIFICATION 02950, SECTION 3.01, B. ENSURE THAT AREAS ARE FREE OF KIKUYU GRASS AND OTHER WEEDS PRIOR TO INSTALLING NEW PLANTING OR HARDSCAPE.

EXISTING TREE LEGEND

SYMBOL	BOTANICAL / COMMON NAME	SYMBOL	BOTANICAL / COMMON NAME
	AGONIS FLEXUOSA 'AFTER DARK' / PEPPERMINT WILLOW		EUCALYPTUS SIDEROXYLON / RED IRONBARK
	BAUHINIA X BLAKEANA / HONG KONG ORCHID TREE		FICUS MICROCARPA / INDIAN LAUREL FIG
	BRAHEA ARMATA / MEXICAN BLUE PALM		JUNIPERUS K. 'TORULOSA' / HOLLYWOOD JUNIPER
	CALLISTEMON CITRINUS / LEMON BOTTLEBRUSH		MAGNOLIA GRANDIFLORA / SOUTHERN MAGNOLIA
	CEDRUS SPP. / CEDAR		PLATANUS RACEMOSA / CALIFORNIA SYCAMORE
	EUCALYPTUS CITRIODORA / LEMON-SCENTED GUM		PYRUS C. 'BRADFORDII' / BRADFORD PEAR
	SCHINUS TEREBINTHIFOLIUS / BRAZILIAN PEPPER		SYAGRUS ROMANZOFFIANUM / QUEEN PALM
			WASHINGTONIA ROBUSTA / MEXICAN FAN PALM

NOTE: THE LETTER (E) NEXT TO A TREE SYMBOL INDICATES A TREE TO BE PROTECTED IN PLACE. THE LETTER (R) NEXT TO A TREE SYMBOL INDICATES A TREE TO BE REMOVED.

0 10 20 40 60

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT Thomas J. Ridge (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

LICENSED ARCHITECT RENEWAL 08/31/2015 No. C 11360 STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

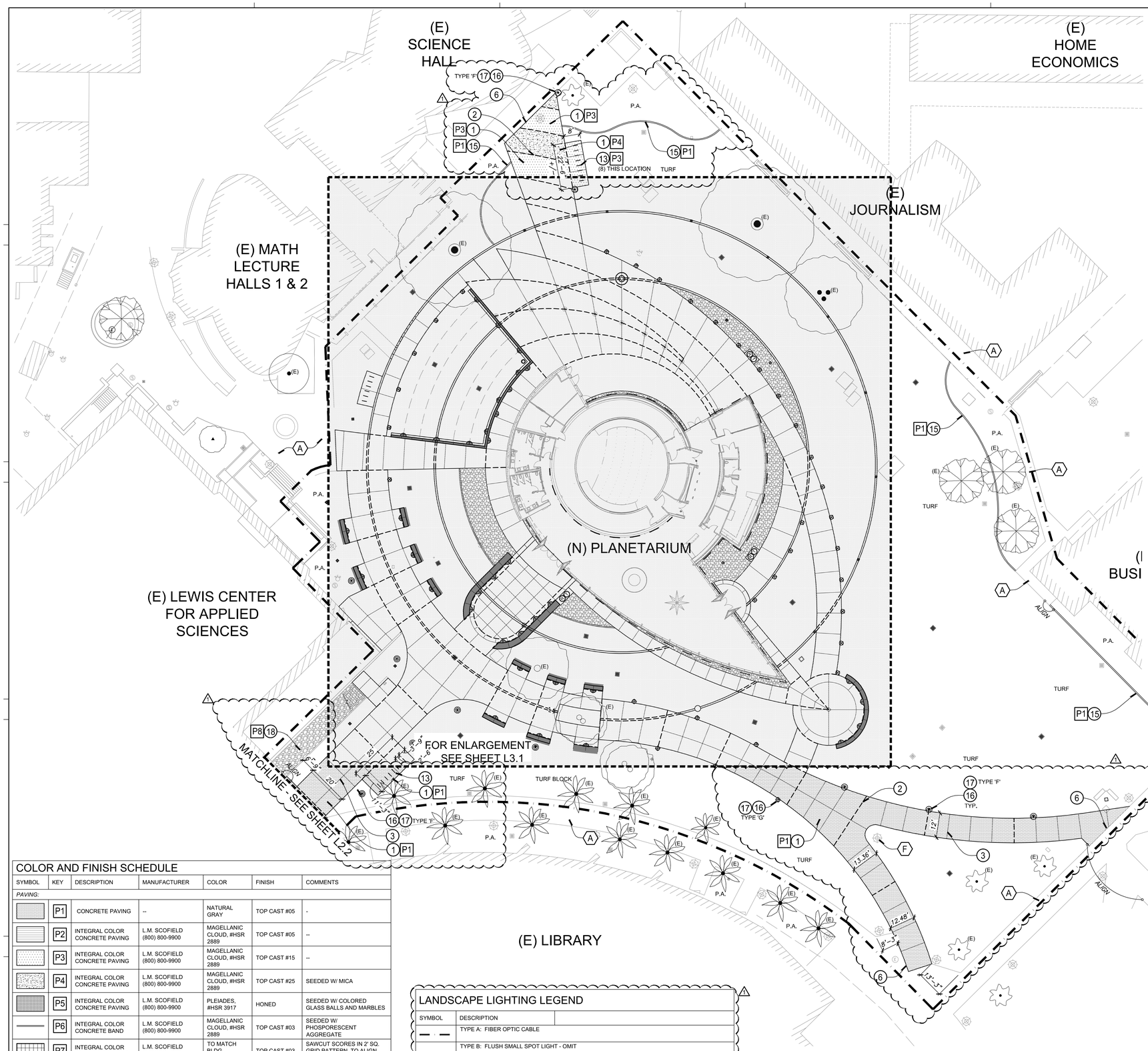
SUBMITTALS		
#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY RLA
CHECKED BY --

SHEET TITLE
DEMOLITION PLAN

SHEET NUMBER
L1.1

COLLEGE CHANGES 03/29/2016



HARDSCAPE LEGEND

SYMBOL	DESCRIPTION	DETAIL REF.
1	CONSTRUCT CONCRETE PAVING	B
2	CONSTRUCT ISOLATION OR EXPANSION JOINT	A
3	CONSTRUCT SAWCUT CONTROL JOINT	A
4	CONSTRUCT TOOLED CONTROL JOINT	A
5	CONSTRUCT CONCRETE BAND	C
6	CONSTRUCT NEW TO EXISTING PAVING CONNECTION	A
7	CONSTRUCT 10" WIDE CONCRETE CURB / BAND	G
8	CONSTRUCT CONCRETE PLANET BENCH	E
9	CONSTRUCT CONCRETE PLANET IN PLANTER AREA	F
10	CONSTRUCT CONCRETE SEAT WALL	H
11	CONSTRUCT CONCRETE SEAT WALL WITH CAP AND SEEDED AGGREGATE	I
12	CONSTRUCT 1' WIDE CONCRETE RETAINING WALL @ SLOPED TURF AREA	J
13	FURNISH AND INSTALL STAINLESS STEEL 'RING' BIKE RACK. AVAILABLE THROUGH LANDSCAPE FORMS AT (800) 430-6209 OR APPROVED EQUAL	P
14	CONSTRUCT DECOMPOSED GRANITE PAVING	L
15	CONSTRUCT 6" WIDE CONCRETE MOWSTRIP	N
16	CONSTRUCT CONCRETE BASE FOR LIGHT BOLLARD / COLUMN. REFER TO ELECTRICAL ENGINEER'S SITE LIGHTING PLAN.	K
17	FURNISH AND INSTALL LIGHT FIXTURE. SEE LANDSCAPE LIGHTING SCHEDULE THIS SHEET FOR REFERENCE. SEE ELECTRICAL SHEETS FOR QUANTITIES AND ADDITIONAL INFORMATION.	--
18	FURNISH AND INSTALL 5"-6" LAYER OF LOOSE DECORATIVE AGGREGATE.	O
19	FURNISH AND INSTALL METAL TRASH AND RECYCLE RECEPTACLES. AVAILABLE THROUGH MAGLIN AT (877) 260-9393 OR APPROVED EQUAL. TRASH: MLWR650-32 SERIES W/ SILVER CAN AND LID; METAL LASER 2 FINISH; BLACK LINER; BLACK TEXT BAND AND WHITE LETTERING READING 'TRASH'. RECYCLE: MLWR650-32 SERIES W/ SILVER CAN AND LID; METAL LASER 2 FINISH; BLACK LINER; BLUE TEXT BAND AND WHITE LETTERING READING 'RECYCLE'. SECURE TO CONCRETE PAVING WITH GALVANIZED EXPANSION ANCHORS.	--

THE FOLLOWING ITEMS ARE FOR REFERENCE ONLY:

A	EXISTING PAVING TO REMAIN
B	CONCRETE CURB PER CIVIL ENGINEER'S SHEETS
C	EXISTING UTILITY TO BE PROTECTED IN PLACE
D	BUILDING OVERHANG PER ARCHITECT'S SHEETS
E	PAVING PER ARCHITECT'S SHEETS
F	EXISTING LIGHT FIXTURE TO BE PROTECTED IN PLACE
G	WALK-OFF MAT PER ARCHITECT'S SHEETS
H	PROPOSED LOCATION OF FUTURE SIGNAGE ELEMENT
I	FIRE CONNECTION PER CIVIL ENGINEER'S SHEETS
J	CIRCULAR BRONZE PLAQUE WITH ART WORK. TO BE DETERMINED BY COLLEGE.

GRADING & DRAINAGE NOTES

A. CROSS SLOPE OF SIDEWALK TO BE A MAXIMUM OF 2%.

B. SLOPE ALL HARDSCAPE TO ACHIEVE POSITIVE DRAINAGE AWAY FROM BUILDING.

C. VERIFY GRADES WITH CIVIL ENGINEER'S SHEETS.

SYMBOL LEGEND

CONTROL JOINT
EXPANSION JOINT
LOW LIMIT OF WORK
P.A. PLANTER AREA

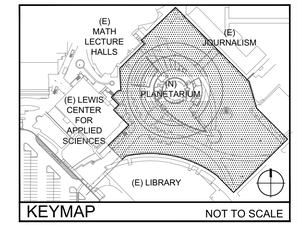
COLOR AND FINISH SCHEDULE

SYMBOL	KEY	DESCRIPTION	MANUFACTURER	COLOR	FINISH	COMMENTS
PAVING:						
	P1	CONCRETE PAVING	--	NATURAL GRAY	TOP CAST #05	-
	P2	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #05	--
	P3	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #15	--
	P4	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #25	SEEDED W/ MICA
	P5	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	PLEIADES, #HSR 3917	HONED	SEEDED W/ COLORED GLASS BALLS AND MARBLES
	P6	INTEGRAL COLOR CONCRETE BAND	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #03	SEEDED W/ PHOSPORESCENT AGGREGATE
	P7	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	TO MATCH BLDG. FLOORING	TOP CAST #03	SAWCUT SCORES IN 2' SQ. GRID PATTERN, TO ALIGN W/ BLDG. INTERIOR
	P8	5"-6" LAYER DECORATIVE AGGREGATE	SEPULVEDA BLDG. MATERIALS (800) 966-4726	40% - DESERT PLUMB 40% - VOLCANIC 20% - GINGER CRYSTAL		$\frac{3}{4}$" - 1" SIZE RANGE
	P9	DECOMPOSED GRANITE	SOUTHWEST BOULDER & STONE (949) 347-2100	TO MATCH EXISTING	--	--
NOTE: CONTRACTOR SHALL PREPARE 4' SQ. SAMPLE OF ALL PAVING FINISHES, PER SPECIFICATIONS, FOR REVIEW AND APPROVAL BY OWNER AND LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.						
WALLS						
	W1	INTEGRAL COLOR CAST-IN-PLACE CONCRETE SEATWALL	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #03 CAP / STRIATED SIDES	SEEDED W/ SHELLS AND FOSSILS
	W2	INTEGRAL COLOR CAST-IN-PLACE CONCRETE RETAINING WALL	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #05	--

LANDSCAPE LIGHTING LEGEND

SYMBOL	DESCRIPTION
	TYPE A: FIBER OPTIC CABLE
	TYPE B: FLUSH SMALL SPOT LIGHT - OMIT
	TYPE C: RECESSED WALL LIGHT
	TYPE D: CURB MOUNTED SMALL SPOT - OMIT
	TYPE E: UPLIGHT AT PLANET BENCH - OMIT
	TYPE F: POST TOP LIGHT
	TYPE G: LIGHT BOLLARD
	TYPE H: WALL MOUNTED FLOOD LIGHT - OMIT
	EXISTING POST TOP LIGHT

NOTE: REFER TO ELECTRICAL ENGINEER'S SHEETS FOR LIGHT SPECIFICATIONS AND CIRCUITRY. SITE LIGHTING SHOWN HERE FOR DESIGN INTENT ONLY.



KEYMAP NOT TO SCALE

FOR HARDSCAPE ENLARGEMENT - SEE SHEET L3.1
FOR HARDSCAPE DETAILS - SEE SHEETS L4.1 & L4.2
FOR LANDSCAPE SPECIFICATIONS - SEE SEPARATE BOOKLET

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT Logan J. Ridge 5613 (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

LICENSED ARCHITECT RICHARD L. MARTIN No. C 11360 STATE OF CALIFORNIA

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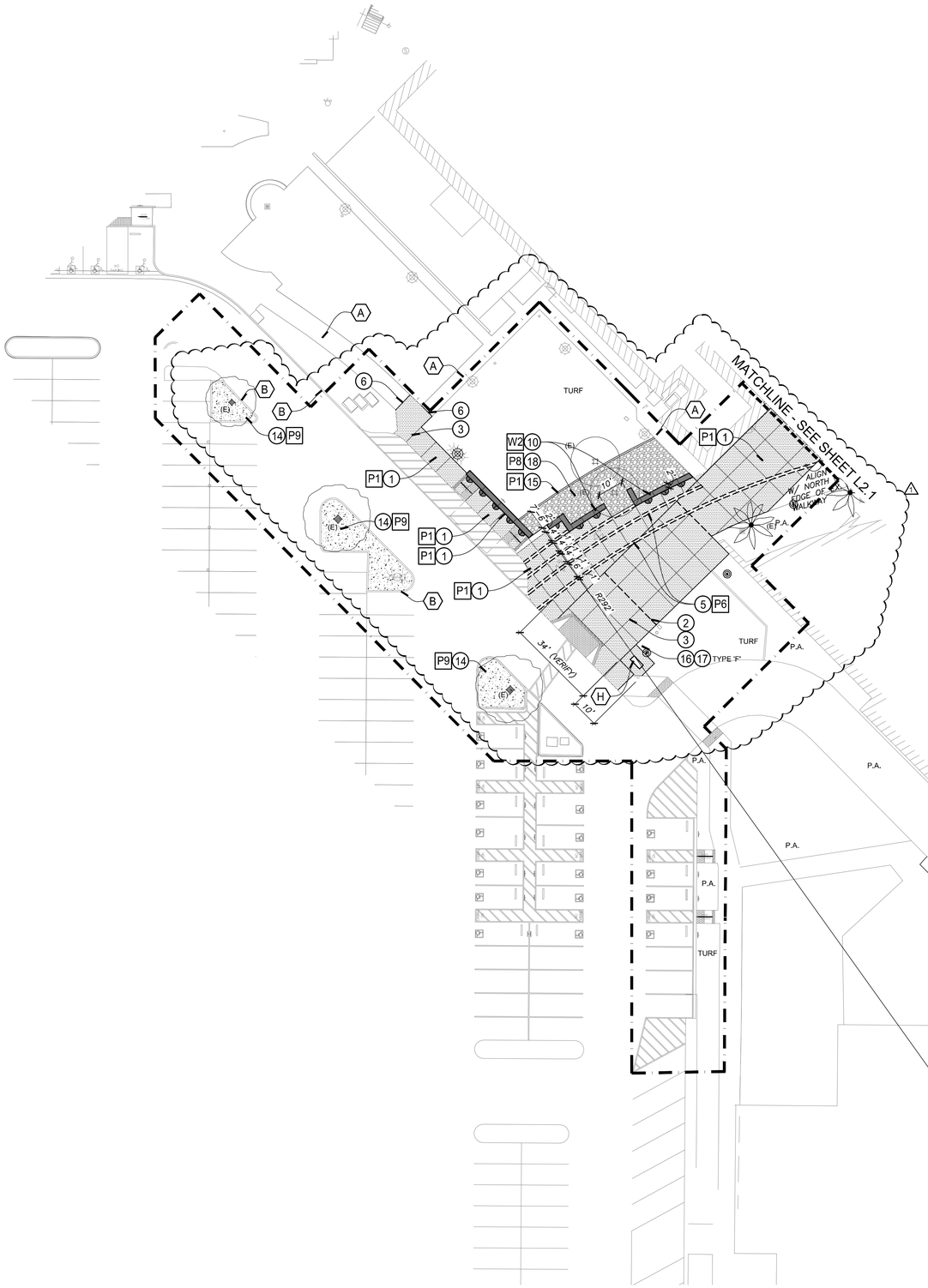

COLOR AND FINISH SCHEDULE

SYMBOL	KEY	DESCRIPTION	MANUFACTURER	COLOR	FINISH	COMMENTS
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NOTE: CONTRACTOR SHALL PREPARE 4' SQ. SAMPLE OF ALL PAVING FINISHES, PER SPECIFICATIONS, FOR REVIEW AND APPROVAL BY OWNER AND LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.						
WALLS						
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LANDSCAPE LIGHTING LEGEND

SYMBOL	DESCRIPTION
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	EXISTING POST TOP LIGHT

NOTE: REFER TO ELECTRICAL ENGINEER'S SHEETS FOR LIGHT SPECIFICATIONS AND CIRCUITRY. SITE LIGHTING SHOWN HERE FOR DESIGN INTENT ONLY.

HARDSCAPE LEGEND

SYMBOL	DESCRIPTION	DETAIL REF.
1	CONSTRUCT CONCRETE PAVING	B
2	CONSTRUCT ISOLATION OR EXPANSION JOINT	A
3	CONSTRUCT SAWCUT CONTROL JOINT	A
4	CONSTRUCT TOOLED CONTROL JOINT	A
5	CONSTRUCT CONCRETE BAND	C
6	CONSTRUCT NEW TO EXISTING PAVING CONNECTION	A
7	CONSTRUCT 10" WIDE CONCRETE CURB / BAND	G
8	CONSTRUCT CONCRETE PLANET BENCH	E
9	CONSTRUCT CONCRETE PLANET IN PLANTER AREA	F
10	CONSTRUCT CONCRETE SEAT WALL	H
11	CONSTRUCT CONCRETE SEAT WALL WITH CAP AND SEEDED AGGREGATE	I
12	CONSTRUCT 1' WIDE CONCRETE RETAINING WALL @ SLOPED TURF AREA	J
13	FURNISH AND INSTALL STAINLESS STEEL 'RING' BIKE RACK. AVAILABLE THROUGH LANDSCAPE FORMS AT (800) 430-6209 OR APPROVED EQUAL	P
14	CONSTRUCT DECOMPOSED GRANITE PAVING	L
15	CONSTRUCT 6" WIDE CONCRETE MOWSTRIP	N
16	CONSTRUCT CONCRETE BASE FOR LIGHT BOLLARD / COLUMN. REFER TO ELECTRICAL ENGINEER'S SITE LIGHTING PLAN.	K
17	FURNISH AND INSTALL LIGHT FIXTURE. SEE LANDSCAPE LIGHTING SCHEDULE THIS SHEET FOR REFERENCE. SEE ELECTRICAL SHEETS FOR QUANTITIES AND ADDITIONAL INFORMATION.	--
18	FURNISH AND INSTALL 5"-6" LAYER OF LOOSE DECORATIVE AGGREGATE.	O
19	FURNISH AND INSTALL METAL TRASH AND RECYCLE RECEPTACLES. AVAILABLE THROUGH MAGLIN AT (877) 260-9393 OR APPROVED EQUAL TRASH: MLWR650-32 SERIES W/ SILVER CAN AND LID; METAL LASER 2 FINISH; BLACK LINER; BLACK TEXT BAND AND WHITE LETTERING READING 'TRASH'. RECYCLE: MLWR650-32 SERIES W/ SILVER CAN AND LID; METAL LASER 2 FINISH; BLACK LINER; BLUE TEXT BAND AND WHITE LETTERING READING 'RECYCLE'. SECURE TO CONCRETE PAVING WITH GALVANIZED EXPANSION ANCHORS.	--

THE FOLLOWING ITEMS ARE FOR REFERENCE ONLY:	
A	EXISTING PAVING TO REMAIN
B	CONCRETE CURB PER CIVIL ENGINEER'S SHEETS
C	EXISTING UTILITY TO BE PROTECTED IN PLACE
D	BUILDING OVERHANG PER ARCHITECT'S SHEETS
E	PAVING PER ARCHITECT'S SHEETS
F	EXISTING LIGHT FIXTURE TO BE PROTECTED IN PLACE
G	WALK-OFF MAT PER ARCHITECT'S SHEETS
H	PROPOSED LOCATION OF FUTURE SIGNAGE ELEMENT
I	FIRE CONNECTION PER CIVIL ENGINEER'S SHEETS
J	CIRCULAR BRONZE PLAQUE WITH ART WORK. TO BE DETERMINED BY COLLEGE.

GRADING & DRAINAGE NOTES

A. CROSS SLOPE OF SIDEWALK TO BE A MAXIMUM OF 2%.

B. SLOPE ALL HARDSCAPE TO ACHIEVE POSITIVE DRAINAGE AWAY FROM BUILDING.

C. VERIFY GRADES WITH CIVIL ENGINEER'S SHEETS.

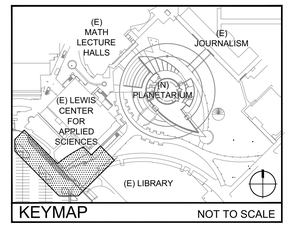
SYMBOL LEGEND

CONTROL JOINT

EXPANSION JOINT

LOW LIMIT OF WORK

P.A. PLANTER AREA



KEYMAP NOT TO SCALE

FOR HARDSCAPE ENLARGEMENT - SEE SHEET L3.1
FOR HARDSCAPE DETAILS - SEE SHEETS L4.1 & L4.2
FOR LANDSCAPE SPECIFICATIONS - SEE SEPARATE BOOKLET

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT Thomas J. Ridge (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

ELECTRONICALLY SIGNED AND STAMPED PROFESSIONAL ENGINEER INGC 11360 STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges

COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

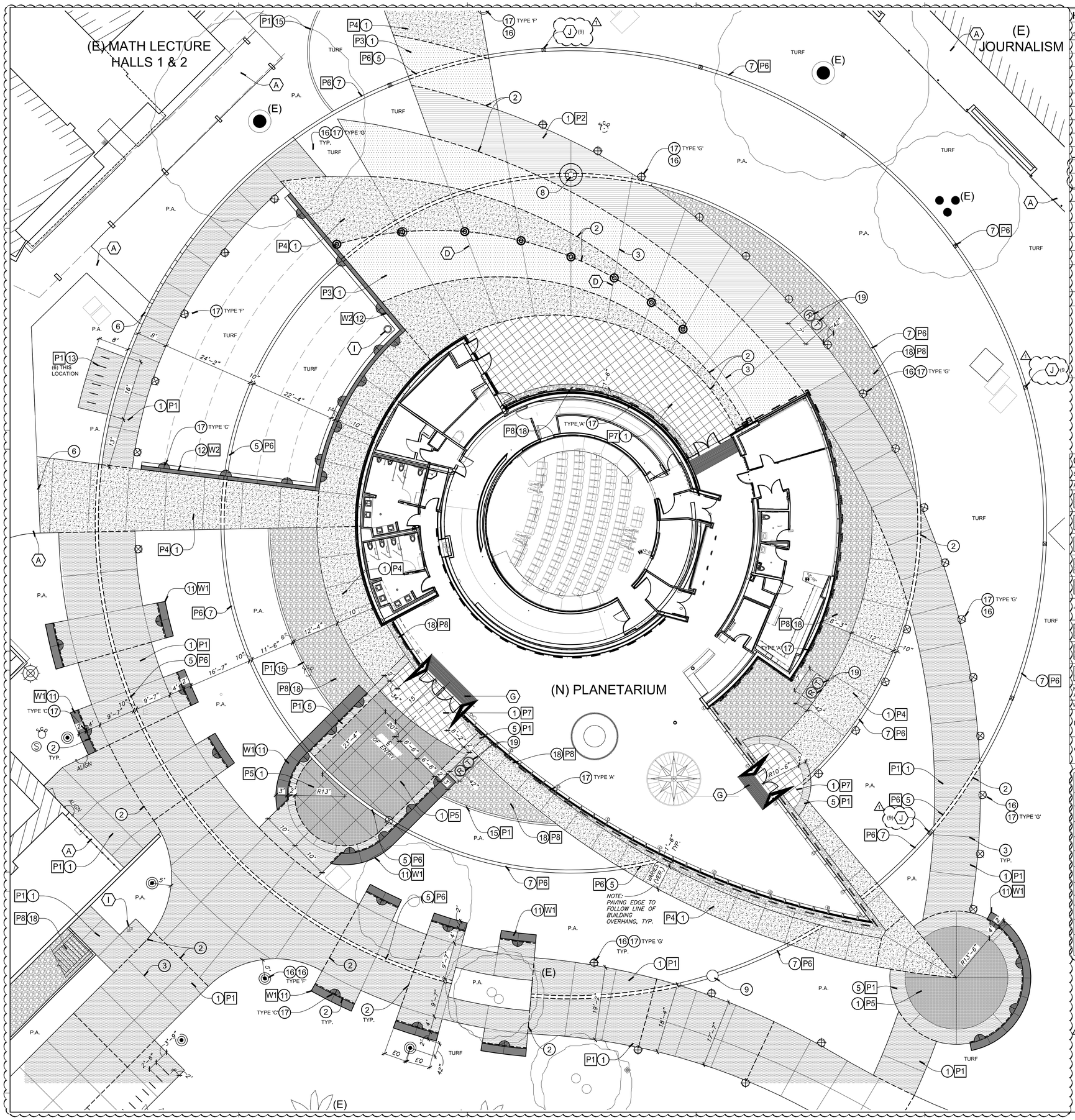
SUBMITTALS		
#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY RLA
CHECKED BY --

SHEET TITLE
HARDSCAPE PLAN

SHEET NUMBER
L2.2

COLLEGE CHANGES 03/29/2016



HARDSCAPE LEGEND

SYMBOL	DESCRIPTION	DETAIL REF.
1	CONSTRUCT CONCRETE PAVING	B
2	CONSTRUCT ISOLATION OR EXPANSION JOINT	A
3	CONSTRUCT SAWCUT CONTROL JOINT	A
4	CONSTRUCT TOOLED CONTROL JOINT	A
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13	FURNISH AND INSTALL STAINLESS STEEL 'RING' BIKE RACK. AVAILABLE THROUGH LANDSCAPE FORMS AT (800) 430-6209 OR APPROVED EQUAL	P
14	CONSTRUCT DECOMPOSED GRANITE PAVING	L
15	CONSTRUCT 6" WIDE CONCRETE MOWSTRIP	N
16	CONSTRUCT CONCRETE BASE FOR LIGHT BOLLARD / COLUMN. REFER TO ELECTRICAL ENGINEER'S SITE LIGHTING PLAN.	K
17	FURNISH AND INSTALL LIGHT FIXTURE. SEE LANDSCAPE LIGHTING SCHEDULE THIS SHEET FOR REFERENCE. SEE ELECTRICAL SHEETS FOR QUANTITIES AND ADDITIONAL INFORMATION.	--
18	FURNISH AND INSTALL 5"-6" LAYER OF LOOSE DECORATIVE AGGREGATE.	O
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COLOR AND FINISH SCHEDULE

SYMBOL	KEY	DESCRIPTION	MANUFACTURER	COLOR	FINISH
PAVING:					
	P1	CONCRETE PAVING	--	NATURAL GRAY	TOP CAST #05
	P2	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #05
	P3	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #15
	P4	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #25
	P5	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	PLEIADES, #HSR 3917	HONED
	P6	INTEGRAL COLOR CONCRETE BAND	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #03
	P7	INTEGRAL COLOR CONCRETE PAVING	L.M. SCOFIELD (800) 800-9900	TO MATCH BLDG. FLOORING	TOP CAST #03
	P8	5"-6" LAYER DECORATIVE AGGREGATE	SEPULVEDA BLDG. MATERIALS (800) 966-4726	40% - DESERT PLUMB 40% - VOLCANIC 20% - GINGER CRYSTAL	
	P9	DECOMPOSED GRANITE	SOUTHWEST BOULDER & STONE (949) 347-2100	TO MATCH EXISTING	--

NOTE: CONTRACTOR SHALL PREPARE 4' SQ. SAMPLE OF ALL PAVING FINISHES, PER SPECIFICATIONS, FOR APPROVAL BY OWNER AND LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

WALLS

W1	INTEGRAL COLOR CAST-IN-PLACE CONCRETE SEATWALL	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #03 CAP / STRIATED SIDES
W2	INTEGRAL COLOR CAST-IN-PLACE CONCRETE RETAINING WALL	L.M. SCOFIELD (800) 800-9900	MAGELLANIC CLOUD, #HSR 2889	TOP CAST #05

LANDSCAPE LIGHTING LEGEND

SYMBOL	DESCRIPTION
	TYPE A: FIBER OPTIC CABLE
	TYPE B: FLUSH SMALL SPOT LIGHT - OMIT
	TYPE C: RECESSED WALL LIGHT
	TYPE D: CURB MOUNTED SMALL SPOT - OMIT
	TYPE E: UPLIGHT AT PLANET BENCH - OMIT
	TYPE F: POST TOP LIGHT
	TYPE G: LIGHT BOLLARD
	TYPE H: WALL MOUNTED FLOOD LIGHT - OMIT
	EXISTING POST TOP LIGHT

NOTE: REFER TO ELECTRICAL ENGINEER'S SHEETS FOR LIGHT SPECIFICATIONS AND CIRCUITRY. SITE LIGHTING SHOWN HERE FOR DESIGN INTENT ONLY.

0 5 10 20 30

FOR COMPLETE LEGENDS AND SCHEDULES - SEE SHEET L2.1
FOR HARDSCAPE DETAILS - SEE SHEETS L4.1 & L4.2
FOR LANDSCAPE SPECIFICATIONS, SEE SEPARATE BOOKLET

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT Ronald J. Ridge 2693 (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

LICENSED ARCHITECT NO. C 11360 REGISTERED CALIFORNIA

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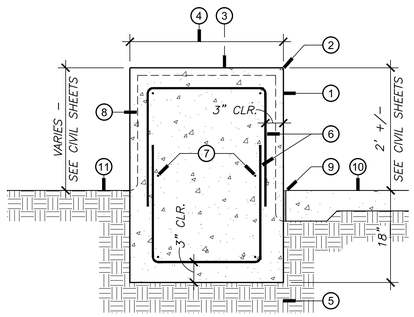
HARDSCAPE PLAN ENLARGEMENT

SHEET NUMBER
L3.1

COLLEGE CHANGES 03/29/2016



LEGEND:

1. CIP CONCRETE FREESTANDING LOW WALL - SEE WALL SCHEDULE FOR COLOR AND FINISH.
2. ¾" STONE-RUBBED "CARPET EDGE" RADIUS ON EDGES.
3. SLOPE TOP OF WALL 1% MINIMUM TOWARDS PLANTER AREA, IF APPLICABLE. SLOPE TOWARDS DIRECTION OF SURFACE FLOW IF PAVING OCCURS ON BOTH SIDES.
4. WIDTH OF WALL VARIES - SEE HARDSCAPE PLAN FOR DIMENSION.
5. 90% COMPACTED SUBGRADE - VERIFY WITH GEOTECHNICAL SOILS REPORT.
6. #3 BARS LAPPED TOP AND BOTTOM AT 16" O.C. - PROVIDE MINIMUM 12" OF OVERLAP.
7. (6) #3 BARS HORIZONTAL; EQUALLY SPACED.
8. 1/8" WIDE BY 2" DEEP CONTINUOUS SAWCUT CONTRACTION JOINT - SEE HARDSCAPE PLAN FOR LOCATION.
9. ISOLATION JOINT.
10. ADJACENT PAVING - SEE HARDSCAPE PLAN FOR COLOR AND FINISH.
11. FINISH GRADE.

NOTES:
A. ENSURE THAT FORM SEAMS ARE NOT PRESENT ONCE FORMS ARE STRIPPED.

H CONCRETE SEAT WALL

SCALE: 1" = 1'-0"

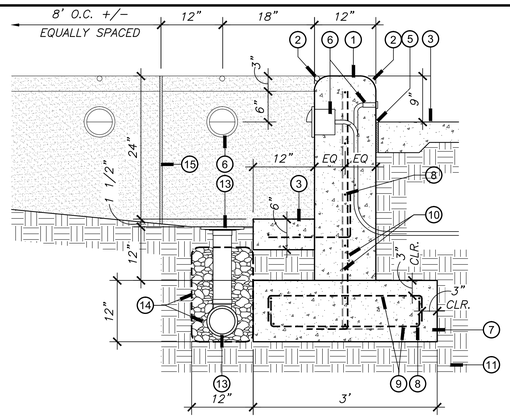
LEGEND:

1. P.I.P. INTEGRAL COLOR CONCRETE FREESTANDING LOW WALL WITH SEDIMENTARY AGGREGATE FINISH BY J&M CONCRETE CONTRACTORS AT (714) 978-2222 - SEE WALL SCHEDULE FOR COLOR AND FINISH.
2. WALL SURFACE TREATMENTS BY J&M CONCRETE CONTRACTORS. ALTERNATING BANDS OF EARTH STRATA TEXTURE WITH STONES, MINERALS, SHELLS, SKELETONS, BONES, ETC. BAND TREATMENTS TO BE CONSISTENT ON TOP, BOTTOM, AND SIDES OF WALL.
3. INTEGRAL COLOR P.I.P. CONCRETE WALL CAP. COLOR TO MATCH WALL. FINISH TO BE LIGHT SANDBLAST.
4. 3" CONTINUOUS RADIUS WITH STAINLESS STEEL SKATEBOARDS DETERRENT SPHERES INSTALLED 4' O.C. AND CENTERED ON RADIUS.
5. ADJACENT FINISH SURFACE - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
6. FINISH GRADE.
7. ISOLATION JOINT.
8. RECESSED WALL LIGHT AND CONDUIT - SEE ELECTRICAL SHEETS.
9. (6) #3 BARS CONTINUOUS HORIZONTAL EQUALLY SPACED.
10. #3 TIES 18" O.C.
11. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITH REQUIREMENTS NOTES IN THE GEOTECHNICAL SOILS REPORT.
12. 1/8" WIDE BY 2" DEEP CONTINUOUS SAWCUT CONTRACTION JOINT - SEE HARDSCAPE PLAN FOR LOCATION.

NOTES:
A. ENSURE THAT FORM SEAMS ARE NOT PRESENT ONCE FORMS ARE STRIPPED.
B. WALL MOCK-UP'S ARE REQUIRED ON THIS PROJECT FOR REVIEW AND APPROVAL PRIOR TO START OF WORK.
C. REINFORCING, FOOTING DIMENSIONS, AND BASE INFORMATION ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT AND ON THE STRUCTURAL ENGINEERING SHEETS.
D. AGGREGATES AVAILABLE THROUGH KRC ROCK AT (800) 572-7625.
E. CHEMSTAIN AVAILABLE THROUGH L.M. SCHOFIELD AT (800) 800-9900.

I CONCRETE SEAT WALL WITH CAP AND SEEDED AGGREGATE

SCALE: 1" = 1'-0"



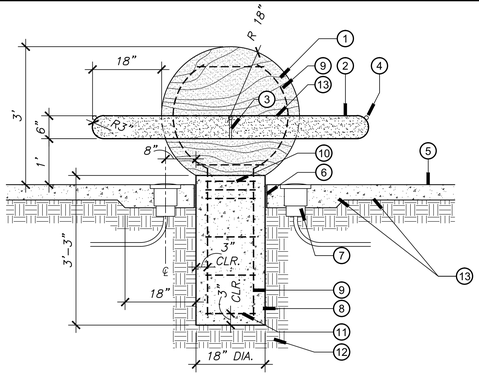
LEGEND:

1. P.I.P. INTEGRAL COLOR CONCRETE RETAINING WALL WITH LIGHT SANDBLAST FINISH - VERIFY COLOR AND TEXTURE WITH WALL SCHEDULE.
2. 3" CONTINUOUS RADIUS WITH STAINLESS STEEL SKATEBOARDS DETERRENT SPHERES INSTALLED 4' O.C. AND CENTERED ON RADIUS.
3. ADJACENT FINISH SURFACE - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
4. NOT USED.
5. ISOLATION JOINT.
6. RECESSED WALL LIGHT AND CONDUIT - SEE ELECTRICAL SHEETS FOR MAKE AND MODEL.
7. CONTINUOUS CONCRETE FOOTING.
8. (10) #4 BARS CONTINUOUS HORIZONTAL EQUALLY SPACED.
9. #4 BARS 12" O.C. LAPPED TOP AND BOTTOM OF FOOTING.
10. #4 BARS VERTICAL 12" O.C.. ALTERNATE DIRECTION EACH BAR. PROVIDE 8" LONG 90° HOOK AT BOTTOM.
11. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITH REQUIREMENTS NOTES IN THE GEOTECHNICAL SOILS REPORT.
12. CONTINUOUS 6" THICK CONCRETE MOW STRIP WITH (2) #3 BARS CONTINUOUS HORIZONTAL CENTERED IN SLAB. PROVIDE #3 BY 24" LONG TIES INTO WALL 18" O.C.
13. CONTINUOUS PERFORATED DRAIN PIPE WITH FLAT SQUARE NDS AREA DRAIN. SEE CIVIL SHEETS FOR PIPE SIZE, DRAIN QUANTITY, ETC.
14. ¾" DRAINAGE GRAVEL WRAPPED WITH SINGLE LAYER OF MIRAFI 140N FILTER FABRIC. PROVIDE MIN. 12" FABRIC OVERLAP.
15. WALL EXPANSION/CONTRACTION JOINT - SEE HARDSCAPE SHEETS FOR JOINT LOCATIONS.

NOTES:
A. ENSURE THAT FORM SEAMS ARE NOT PRESENT ONCE FORMS ARE STRIPPED.
B. WALL MOCK-UP'S ARE REQUIRED ON THIS PROJECT FOR REVIEW AND APPROVAL PRIOR TO START OF WORK.
C. REINFORCING, FOOTING DIMENSIONS, AND BASE INFORMATION ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT AND ON THE STRUCTURAL ENGINEERING SHEETS.

J 1' WIDE CONCRETE RETAINING WALL @ SLOPED TURF AREA

SCALE: 1" = 1'-0"



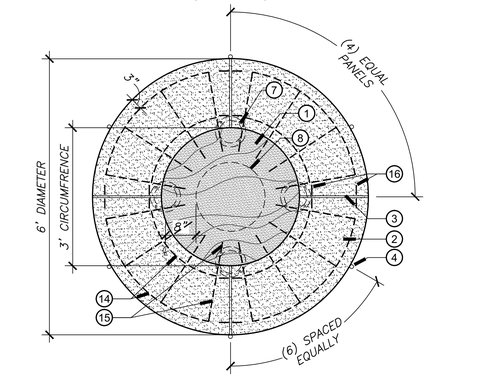
LEGEND:

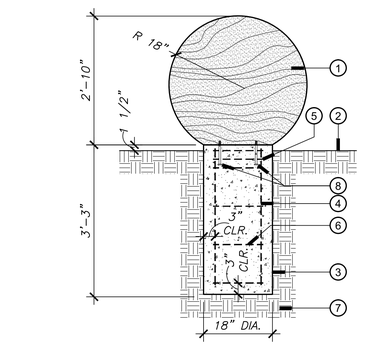
1. PRE-CAST CONCRETE SPHERE PLANET ELEMENT WITH CONTRASTING TEXTURE PATTERN. COLOR AND FINISH TO BE DETERMINED BY LANDSCAPE ARCHITECT.
2. PER-CAST CONCRETE BENCH PANEL. COLOR AND FINISH TO BE DETERMINED BY LANDSCAPE ARCHITECT.
3. PRE-CAST CONCRETE BENCH PANEL JOINT.
4. STAINLESS STEEL SKATEBOARD DETERRENT SPHERE.
5. ADJACENT CONCRETE PAVING - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
6. ISOLATION JOINT.
7. BLUE/PURPLE LED UP LIGHT - SEE ELECTRICAL SHEETS FOR COLOR AND FINISH.
8. CONCRETE CAISSON FOOTING.
9. (4) #4 BARS VERTICAL, EQUALLY SPACED WITH STANDARD HOOKS AT TOP VERTICAL BARS.
10. (3) #4 BARS WITHIN TOP 6" OF CAISSON.
11. #4 BARS 10" O.C. REMAINDER OF CAISSON.
12. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITH REQUIREMENTS NOTES IN THE GEOTECHNICAL SOILS REPORT.
13. (3) #4 TIES AT 12" O.C.
14. #4 BARS AT12" O.C. AND 3" CLR. FROM EDGES.
15. #4 TIES AT 8" O.C. EQUALLY SPACED. CONNECT TO CENTER SPHERE. PROVIDE 8" MINIMUM DRILLED AND EPOXY SET CONNECTION.
16. PROVIDE (2) DRILLED AND EPOXY SET DOWELS AT EACH PANEL JOINT.

NOTES:
A. PRE-CAST CONCRETE ELEMENTS AVAILABLE THROUGH QUICK CRETE PRODUCTS AT (866) 703-3434.
B. REINFORCING, FOOTING DIMENSIONS, AND BASE INFORMATION ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT AND ON THE STRUCTURAL ENGINEERING SHEETS.

E PRE-CAST CONCRETE PLANET BENCH

SCALE: ¾" = 1'-0"





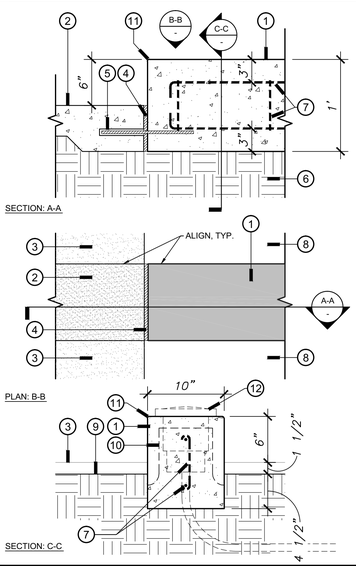
LEGEND:

1. PRE-CAST CONCRETE SPHERE PLANET ELEMENT WITH CONTRASTING TEXTURE PATTERN. COLOR AND FINISH TO BE DETERMINED BY LANDSCAPE ARCHITECT.
2. FINISH GRADE.
3. CONCRETE CAISSON FOOTING.
4. (4) #4 BARS VERTICAL, EQUALLY SPACED.
5. (3) #4 BARS WITHIN TOP 6" OF CAISSON.
6. #4 BARS 10" O.C. REMAINDER OF CAISSON.
7. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITH REQUIREMENTS NOTES IN THE GEOTECHNICAL SOILS REPORT.
8. (4) ¾" DIA. BY 6" LONG GALVANIZED THREADED ANCHOR BOLTS SET IN 2" DIA. BY 6" DEEP GROUT POCKETS FILLED WITH NON-SHRINK GROUT.

NOTES:
A. PRE-CAST CONCRETE ELEMENTS AVAILABLE THROUGH QUICK CRETE PRODUCTS AT (866) 703-3434.
B. REINFORCING, FOOTING DIMENSIONS, AND BASE INFORMATION ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT AND ON THE

F PRE-CAST CONCRETE PLANET IN LANDSCAPE

SCALE: ¾" = 1'-0"



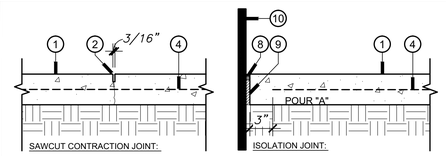
LEGEND:

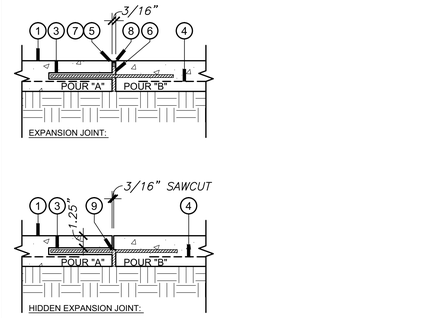
1. RAISED CONCRETE MOW CURB - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
2. CONCRETE BAND - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
3. ADJACENT CONCRETE PAVING - SEE HARDSCAPE PLAN FOR COLOR AND FINISH.
4. EXPANSION JOINT - SEE DETAIL #A, SHEET L4.1.
5. PLASTIC "SPEED DOWEL" WITH 12" LONG SMOOTH STEEL DOWELS AT 24" O.C.
6. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITHREQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
7. (2) #3 BARS CONTINUOUS HORIZONTAL WITH #3 TIES AT 18" O.C.
8. ADJACENT PLANTER AREA.
9. FINISH GRADE.
10. ¼" WIDE BY 1.5" DEEP CONTINUOUS SAWCUT CONTRACTION JOINT - SEE HARDSCAPE PLAN FOR LOCATIONS.
11. ¼" RADIUS ON EDGES, TYP.
12. EMBEDDED LED UPLIGHT CENTERED IN CURB- SEE ELECTRICAL SHEETS FOR MAKE, MODEL AND LOCATIONS.

NOTES:
A. PAVING THICKNESS, BASE PREPARATION, AND REINFORCING ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
B. PROVIDE MOCK-UP PER SPECIFICATIONS.
C. SEAL EXPOSED PORTIONS OF CONCRETE PAVING PER SPECIFICATIONS.

G 10" WIDE RAISED CONCRETE CURB

SCALE: 1½" = 1'-0"





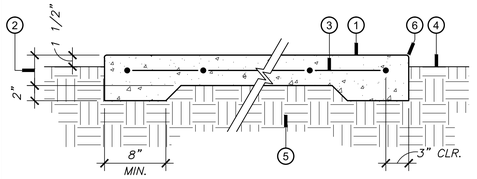
LEGEND:

1. CONCRETE PAVING - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
2. 3/16" WIDE SAWCUT CONTRACTION JOINT - CUT TO 1/4 DEPTH OF SLAB. PROVIDE TIGHT "CARPET EDGE" RADIUS ON EDGE OF PAVING BEFORE SAWCUTTING.
3. PLASTIC "SPEED DOWEL" WITH 12" LONG SMOOTH STEEL DOWELS AT 24" O.C.
4. REBAR - SEE DETAIL "B", THIS SHEET.
5. ¾" RADIUS.
6. JOINT FILLER - SEE SPECIFICATIONS.
7. BACKER ROD - SEE SPECIFICATIONS.
8. 2-PART COLORED POLYURETHANE SEALANT - SEE SPECIFICATIONS. APPLY SILICA #30 SAND TO SURFACE OF SEALANT WHILE STILL TACKY AT ISOLATION JOINT ONLY.
9. ½" THICK POLYFOAM EXPANSION MATERIAL - SPRAY GLUE TO SIDE OF POUR "A".
10. FIXED VERTICAL EDGE, I.E. WALL, COLUMN, THRESHOLD, STEPS, OR CURB.
11. NEW CONCRETE PAVING - FLUSH WITH EXISTING CONCRETE PAVING.
12. COLD JOINT WITH ½" TOOLED EDGE.
13. #4 x 18" LONG SMOOTH STEEL DOWELS AT 30" O.C. DRILLED AND EPOXIED WITH SIMPSON "SET 22" EPOXY INTO EXISTING CONCRETE PAVING - MIN. 3" EMBED.
14. EXISTING CONCRETE PAVING.
15. CONTRACTION JOINT WITH TOOLED 1/4" RADIUS AT EDGES AND 1/4 DEPTH OF SLAB.

NOTES:
A. ENSURE THAT NO CONCRETE SLURRY STAINS BOND WITH EXISTING PAVING - USE PIERI "FACE-OFF", OR SIMILAR PRODUCT, TO ELIMINATE SLURRY STAINS ON ADJACENT SURFACES.

A CONCRETE PAVING JOINTS

SCALE: 1 ½" = 1'-0"



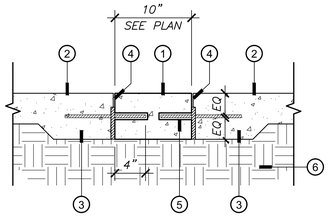
LEGEND:

1. CONCRETE PAVING - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
2. PAVING THICKNESS:
   PEDESTRIAN: 4"
   VEHICULAR: 6"
3. REINFORCING AT PAVING:
   PEDESTRIAN PAVING: #3 BARS AT 24" O.C. BOTH WAY, CENTER IN SLAB.
   VEHICULAR PAVING: #4 BARS AT 18" O.C. BOTH WAYS, CENTER IN SLAB
4. FINISH GRADE.
5. 90% COMPACTED SUBGRADE - VERIFY WITH REQUIREMENTS NOTES IN THE GEOTECHNICAL SOILS REPORT.
6. 1/4" TOOLED RADIUS.

NOTES:
A. PAVING THICKNESS, BASE PREPARATION, AND REINFORCING ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
B. PROVIDE MOCK-UP PER SPECIFICATIONS.
C. SEAL EXPOSED PORTIONS OF CONCRETE PAVING PER SPECIFICATIONS.

B CONCRETE PAVING

SCALE: 1 ½" = 1'-0"



LEGEND:

1. CONCRETE BAND - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
2. ADJACENT CONCRETE PAVING - SEE HARDSCAPE PLAN FOR COLOR AND FINISH.
3. THICKENED EDGE AT PAVING - SEE DETAIL #B, SHEET L4.1.
4. HIDDEN EXPANSION JOINT - SEE DETAIL #A, SHEET L4.1.
5. PLASTIC "SPEED DOWEL" WITH 12" LONG SMOOTH STEEL DOWELS AT 18" O.C.
6. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITHREQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.

NOTES:
A. PAVING THICKNESS, BASE PREPARATION, AND REINFORCING ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
B. PROVIDE MOCK-UP PER SPECIFICATIONS.
C. SEAL EXPOSED PORTIONS OF CONCRETE PAVING PER SPECIFICATIONS.

C CONCRETE BAND

SCALE: 1 ½" = 1'-0"

D NOT USED

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT Thomas Jay Ridge (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

LICENSED ARCHITECT RENEWAL 08/31/2015 STATE OF CALIFORNIA No. C 11360

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges

COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

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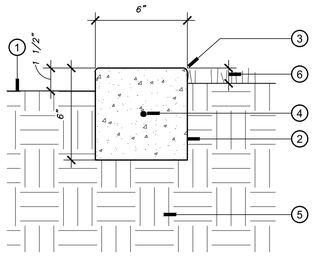
SHEET NUMBER
L4.1

COLLEGE CHANGES 03/29/2016



LEGEND:

1. FINISH GRADE OF SHRUB AREA.
2. CONCRETE MOWCURB - SEE HARDSCAPE PLAN FOR COLOR AND FINISH.
3. 1/4" RADIUS ON EXPOSED EDGES.
4. #4 REBAR CONTINUOUS CENTERED IN CURB.
5. 90% COMPACTED SUBGRADE AND BASE MATERIAL.
6. FINISH GRADE AT TURF/D.G. AREA. PROVIDE 1" GRADE DROP AT TURF AREA AND ½" MAX. GRADE DROP BETWEEN TOP OF CURB AND FINISH SURFACE OF DECOMPOSED GRANITE.

NOTES:

A. PROVIDE 1/8" WIDE X 1 1/2" DEEP SAWCUT CONTRACTION JOINTS AT 10' O.C. AND AT CHANGES OF DIRECTION.

(N) CONCRETE MOW STRIP

NOT TO SCALE

SECTION
2" = 1'-0"

LEGEND:

1. 4" THICK DECORATIVE GRAVEL - REFER TO COLOR AND FINISH SCHEDULE.
2. SOIL SEPARATOR FABRIC - PROVIDE CONTINUOUS LAYER BETWEEN GRAVEL AND SOIL. EXTEND PERIMETER EDGES UP AGAINST EDGING 3" MIN. AND SECURE WITH PINS AT 18" O.C. TO PREVENT VERTICAL MOVEMENT. OVERLAP ANY SPLICES 12" MINIMUM.
3. ADJACENT BUILDING FOOTING
4. 90% COMPACTED SUBGRADE - VERIFY WITH SOIL ENGINEER'S REPORT
5. CONCRETE MOW STRIP OR ADJACENT PAVING, PER PLAN.
6. FINISH GRADE OF PLANTER AREA

(O) LOOSE GRAVEL INFILL

SCALE: 2" = 1'-0"

LEGEND:

1. 'RING' EMBEDDED BIKE RACK - SEE SITE FURNITURE LEGEND FOR COLOR AND FINISH
2. FINISH SURFACE - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
3. 3" DIAMETER BY 6-3/4" DEEP CORE DRILLED HOLE. SET BIKE RACK WITH NON-SHRINK GROUT. COLOR AND TEXTURE OF GROUT TO MATCH ADJACENT CONCRETE PAVING.
4. PROVIDE THICKENED PAVING SECTION AT EACH BIKE RACK TO ACCOMMODATE CORE DRILLED HOLES.

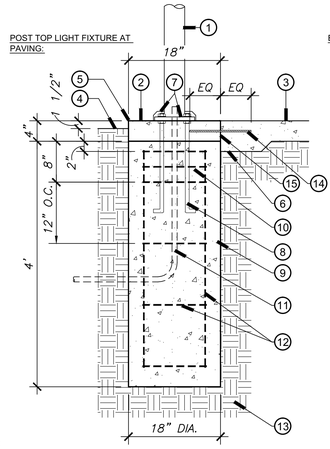
NOTES:

A. REVIEW MANUFACTURER'S RECOMMENDED INSTALLATION GUIDE PRIOR TO STARTING WORK.

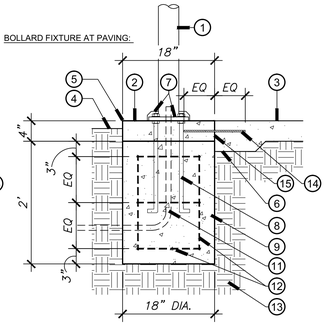
(P) BIKE RACK

SCALE: 1" = 1'-0"

POST TOP LIGHT FIXTURE AT PAVING:



BOLLARD FIXTURE AT PAVING:

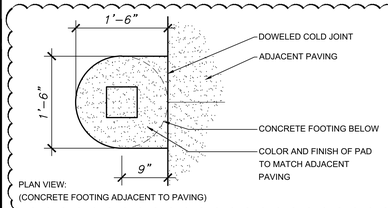


LEGEND:

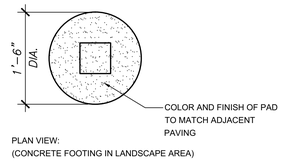
1. LIGHT BOLLARD / POST TOP LIGHT - SEE ELECTRICAL PLANS FOR MAKE AND MODEL.
2. FINISH SURFACE OF LIGHT FIXTURE PEDESTAL - COLOR AND FINISH TO MATCH ADJACENT CONCRETE PAVING.
3. ADJACENT CONCRETE PAVING - SEE HARDSCAPE SHEETS FOR COLOR AND FINISH.
4. FINISH GRADE.
5. ¼" RADIUS ON EDGES.
6. PROVIDE THICKENED EDGE AT PAVING - SEE DETAIL #B, SHEET L4.1.
7. BOLT COVER AND ANCHOR PLATE PER MANUFACTURER.
8. ANCHOR BOLT QUANTITY PER MANUFACTURE. PROVIDE MINIMUM 14" EFFECTIVE EMBEDMENT.
9. CONCRETE CAISSON FOOTING.
10. (3) #4 TIES WITHIN TOP 8" OF FOOTING - 1st TIE TO BE 2" FROM TOP OF CAISSON.
11. ELECTRICAL CONDUIT - SEE ELECTRICAL SHEETS FOR SIZE AND QUANTITY.
12. VERTICAL BARS WITH HORIZONTAL TIES:
    BOLLARD: (4) #3'S VERTICAL WITH #3 TIES EQUALLY SPACED.
    POST TOP: (5) #4'S VERTICAL WITH #4 TIES 12" O.C.
    PROVIDE STANDARD HOOKS AT TOP OF VERTICAL BARS.
13. 90% COMPACTED SUBGRADE - VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
14. PROVIDE (2) #4 BY 12" LONG DOWELS EQUALLY SPACED.
15. COLD JOINT.

NOTES:

A. REINFORCING, FOOTING DIMENSIONS, AND BASE INFORMATION ARE SHOWN FOR BID PURPOSES ONLY. VERIFY AND COMPLY WITH REQUIREMENTS NOTED IN THE GEOTECHNICAL SOILS REPORT AND ON THE STRUCTURAL ENGINEERING SHEETS.



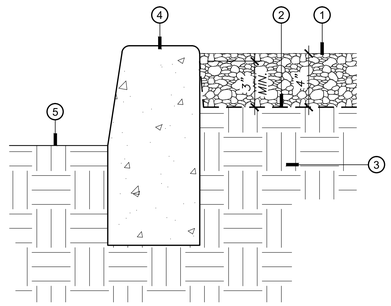
PLAN VIEW:
(CONCRETE FOOTING ADJACENT TO PAVING)



PLAN VIEW:
(CONCRETE FOOTING IN LANDSCAPE AREA)

(K) BOLLARD/PEDESTRIAN LIGHT FIXTURE BASE

SCALE: 1 ½" = 1'-0"



LEGEND:

1. 4" THICK LAYER OF STABILIZED DECOMPOSED GRANITE - SEE HARDSCAPE SHEETS FOR COLOR & SUPPLIER.
2. SINGLE LAYER OF MIRAFI 140N FILTER FABRIC SOIL SEPARATOR. WRAP FABRIC UP VERTICAL EDGES MINIMUM OF 3" AND SECURE WITH SOIL STAPLES AT 18" O.C. TO PREVENT VERTICAL MOVEMENT. OVERLAP SPLICES 12" MINIMUM.
3. 90% COMPACTED SUBGRADE - VERIFY WITH REQUIREMENMTS NOTED IN THE GEOTECHNICAL SOILS REPORT.
4. CONCRETE CURB.
5. FINISH SURFACE.

(L) DECOMPOSED GRANITE PAVING AT CURB

SCALE: 3" = 1'-0"

(M) NOT USED

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CONSULTANTS

REGISTERED LANDSCAPE ARCHITECT
Roger Ridge
(Signature)
12/15/2014
(Date)
STATE OF CALIFORNIA

SEALS / APPROVALS

ELECTRONICALLY SIGNED AND SEALED
NO. C 11360
PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

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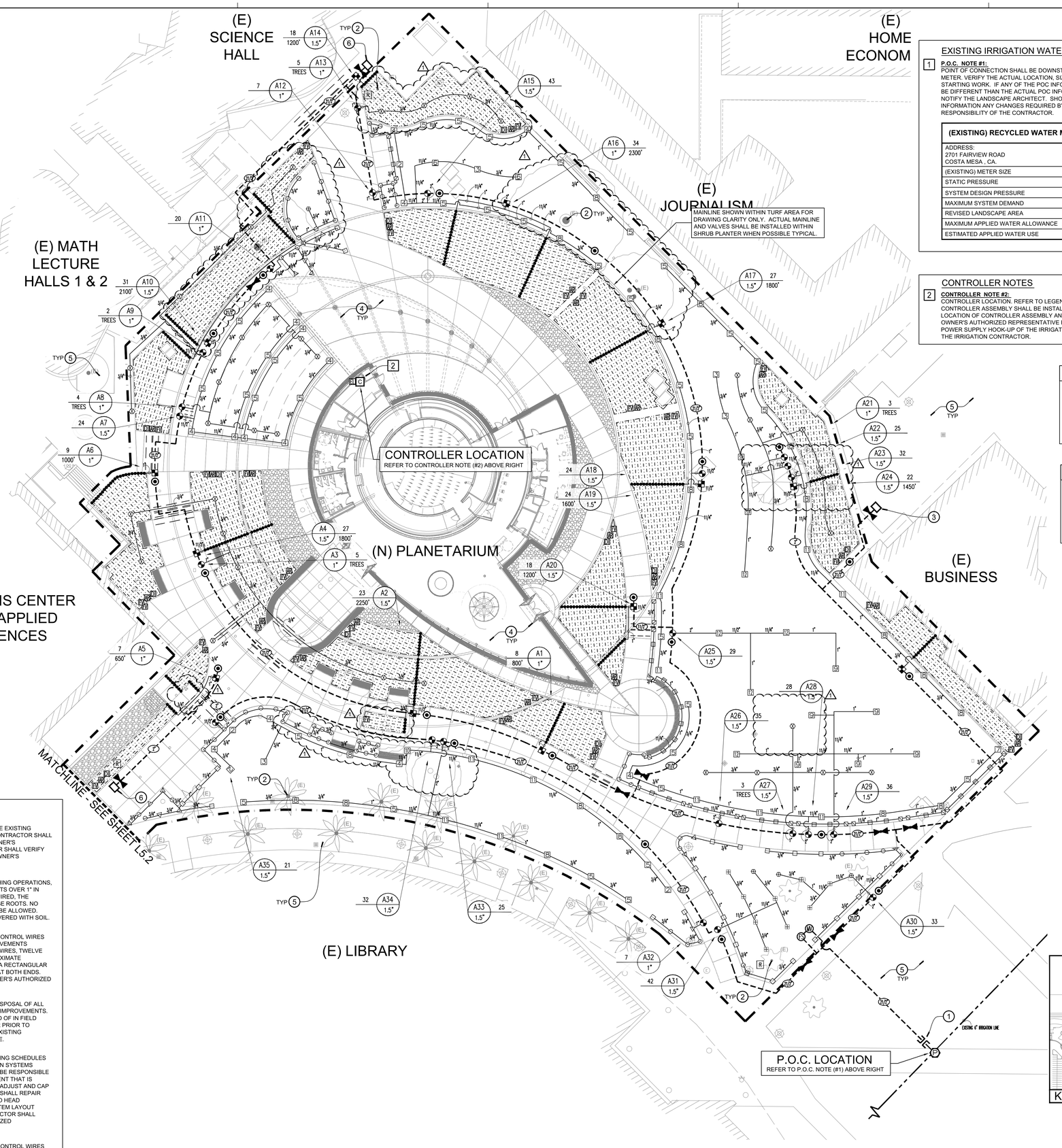


EXISTING IRRIGATION WATER METER NOTES

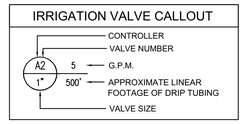
1 **P.O.C. NOTE #1:**
POINT OF CONNECTION SHALL BE DOWNSTREAM OF EXISTING RECYCLED WATER IRRIGATION METER. VERIFY THE ACTUAL LOCATION, SIZE AND WATER PRESSURE IN THE FIELD PRIOR TO STARTING WORK. IF ANY OF THE POC INFORMATION SHOWN ON THESE DRAWING IS FOUND TO BE DIFFERENT THAN THE ACTUAL POC INFORMATION GATHERED IN THE FIELD, IMMEDIATELY NOTIFY THE LANDSCAPE ARCHITECT. SHOULD THE CONTRACTOR FAIL TO VERIFY THE POC INFORMATION ANY CHANGES REQUIRED BY LOW PRESSURE OR VOLUME SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

(EXISTING) RECYCLED WATER METER INFORMATION	
ADDRESS: 2701 FAIRVIEW ROAD COSTA MESA , CA.	WATER PURVEYOR: MESA CONSOLIDATED WATER DISTRICT PH.# (949) 631-1200
(EXISTING) METER SIZE	4"
STATIC PRESSURE	110 PSI.
SYSTEM DESIGN PRESSURE	67 PSI.
MAXIMUM SYSTEM DEMAND	46 GPM
REVISED LANDSCAPE AREA	70,620 SQ. FT.
MAXIMUM APPLIED WATER ALLOWANCE (MAWA)	2,021,425 GAL./ YR.
ESTIMATED APPLIED WATER USE (EAWU)	1,747,655 GAL./ YR.

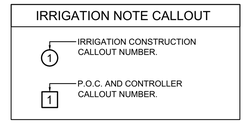
CONTROLLER NOTES

2 **CONTROLLER NOTE #2:**
CONTROLLER LOCATION. REFER TO LEGEND FOR CONTROLLER MAKE AND MODEL NUMBER. CONTROLLER ASSEMBLY SHALL BE INSTALLED IN A STAINLESS STEEL ENCLOSURE. FINAL LOCATION OF CONTROLLER ASSEMBLY AND ELECTRICAL POC SHALL BE CONFIRMED WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK. THE 120 VOLT POWER SUPPLY HOOK-UP OF THE IRRIGATION CONTROLLER SHALL BE THE RESPONSIBILITY OF THE IRRIGATION CONTRACTOR.

IRRIGATION VALVE CALLOUT



IRRIGATION NOTE CALLOUT



IRRIGATION CONSTRUCTION NOTES

1. **MAINLINE CONNECTION NOTE:**
CONTRACTOR SHALL CONNECT PROPOSED NEW IRRIGATION MAINLINE TO THE EXISTING IRRIGATION SYSTEM MAINLINE LOCATED IN THIS APPROXIMATE LOCATION. CONTRACTOR SHALL VERIFY ACTUAL EXISTING IRRIGATION MAINLINE LOCATION IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK. CONTRACTOR SHALL VERIFY ALL IRRIGATION CONNECTION AND DISCONNECTION POINTS IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK.

2. **TRENCHING IN VICINITY OF EXISTING TREES**
WHENEVER ROOTS OF EXISTING TREES ARE ENCOUNTERED DURING TRENCHING OPERATIONS, THE CONTRACTOR SHALL REROUTE MAIN LINE TRENCHES. DO NOT CUT ROOTS OVER 1" IN DIAMETER. ALL CUTS SHALL BE A CLEAN SHARP CUT. IF TRENCHING IS REQUIRED, THE CONTRACTOR SHALL HAND DIG THE TRENCHES TAKING CARE NOT TO DAMAGE ROOTS. NO MECHANICAL TRENCHING WITHIN THE DRIPLINE OF THE EXISTING TREE WILL BE ALLOWED. PROTECT ALL ROOTS EXPOSED TO SUNLIGHT WITH MOIST BURLAP UNTIL COVERED WITH SOIL.

3. **STUB-OUT NOTE:**
CONTRACTOR SHALL PROVIDE IRRIGATION MAINLINE STUB-OUT AND SPARE CONTROL WIRES AT THIS APPROXIMATE LOCATION FOR FUTURE ADJACENT IRRIGATION IMPROVEMENTS CONNECTION. CONTRACTOR SHALL ROUTE A MINIMUM OF TWO (2) COMMON WIRES, TWELVE (12) ADDITIONAL SPARE CONTROL WIRES FROM CONTROLLER TO THIS APPROXIMATE LOCATION. CONTRACTOR SHALL INSTALL SAID STUB-OUT AND WIRES WITHIN A RECTANGULAR PLASTIC VALVE BOX. SPARE WIRES SHALL BE RED COLOR LABELED "SPARE" AT BOTH ENDS. CONTRACTOR SHALL VERIFY EXACT STUB-OUT LOCATION IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK.

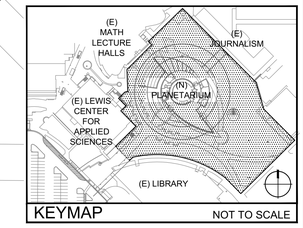
4. **REMOVAL AND DISPOSAL NOTE:**
CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLETE REMOVAL AND DISPOSAL OF ALL EXISTING IRRIGATION EQUIPMENT AFFECTED BY THE PROPOSED IRRIGATION IMPROVEMENTS. CONTRACTOR SHALL VERIFY ALL EQUIPMENT TO BE REMOVED AND DISPOSED OF IN FIELD PRIOR TO COMMENCING WORK. CONTRACTOR SHALL MEET WITH THE OWNER PRIOR TO BEGINNING DEMOLITION OR ANY OTHER WORK, AND WALK SITE TO LOCATE EXISTING CONTROLLER AND LINES AND OTHER IRRIGATION TO BE PROTECTED IN PLACE.

5. **PERIMETER IRRIGATION NOTE:**
ALL ADJACENT SYSTEMS SHALL MAINTAIN AUTOMATIC PROGRAMMED WATERING SCHEDULES THROUGHOUT CONSTRUCTION , NO DISRUPTION OF THE EXISTING IRRIGATION SYSTEMS WATERING WILL BE ALLOWED DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR/MODIFICATION OF ALL ADJACENT IRRIGATION SYSTEMS EQUIPMENT THAT IS AFFECTED BY PROPOSED IRRIGATION IMPROVEMENTS. CONTRACTOR SHALL ADJUST AND CAP OFF EXISTING ADJACENT IRRIGATION SYSTEMS AS REQUIRED. CONTRACTOR SHALL REPAIR SAID SYSTEMS TO A LIKE NEW MANNER, PROVIDING COMPLETE 100% HEAD TO HEAD COVERAGE WITH NO PONDING, RUNOFF, OR OVER-SPRAY IN ALL AREAS. SYSTEM LAYOUT SHALL APPROVED BY THE OWNER'S AUTHORIZED REPRESENTATIVE. CONTRACTOR SHALL CONFIRM ALL AREAS REQUIRING MODIFICATION WITH THE OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO BIDDING AND COMMENCING WORK.

6. **STUB-OUT NOTE:**
CONTRACTOR SHALL PROVIDE IRRIGATION MAINLINE STUB-OUT AND SPARE CONTROL WIRES AT THIS APPROXIMATE LOCATION FOR FUTURE ADJACENT IRRIGATION IMPROVEMENTS CONNECTION. CONTRACTOR SHALL ROUTE A MINIMUM OF TWO (2) COMMON WIRES, SIX (6) ADDITIONAL SPARE CONTROL WIRES FROM CONTROLLER TO THIS APPROXIMATE LOCATION. CONTRACTOR SHALL INSTALL SAID STUB-OUT AND WIRES WITHIN A RECTANGULAR PLASTIC VALVE BOX. SPARE WIRES SHALL BE RED COLOR LABELED "SPARE" AT BOTH ENDS. CONTRACTOR SHALL VERIFY EXACT STUB-OUT LOCATION IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK.

RECYCLED WATER:
THE DESIGN SHALL PROVIDE FOR CONNECTION OF RECYCLED WATER. PLANS SHALL BE IN ACCORDANCE WITH THE WATER DISTRICT RECYCLED GUIDELINES. A RECYCLED WATER USE PERMIT SHALL BE OBTAINED PRIOR TO RECEIVING A RECYCLED WATER CONNECTION.

FOR IRRIGATION LEGEND & CALCULATIONS - SEE SHEET L6.1
FOR IRRIGATION NOTES - SEE SHEET L6.2
FOR IRRIGATION DETAILS - SEE SHEETS L6.3 - L6.4
FOR SPECIFICATIONS - SEE SEPARATE BOOKLET



KEYMAP NOT TO SCALE

0 10 20 40 60

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CONSULTANTS

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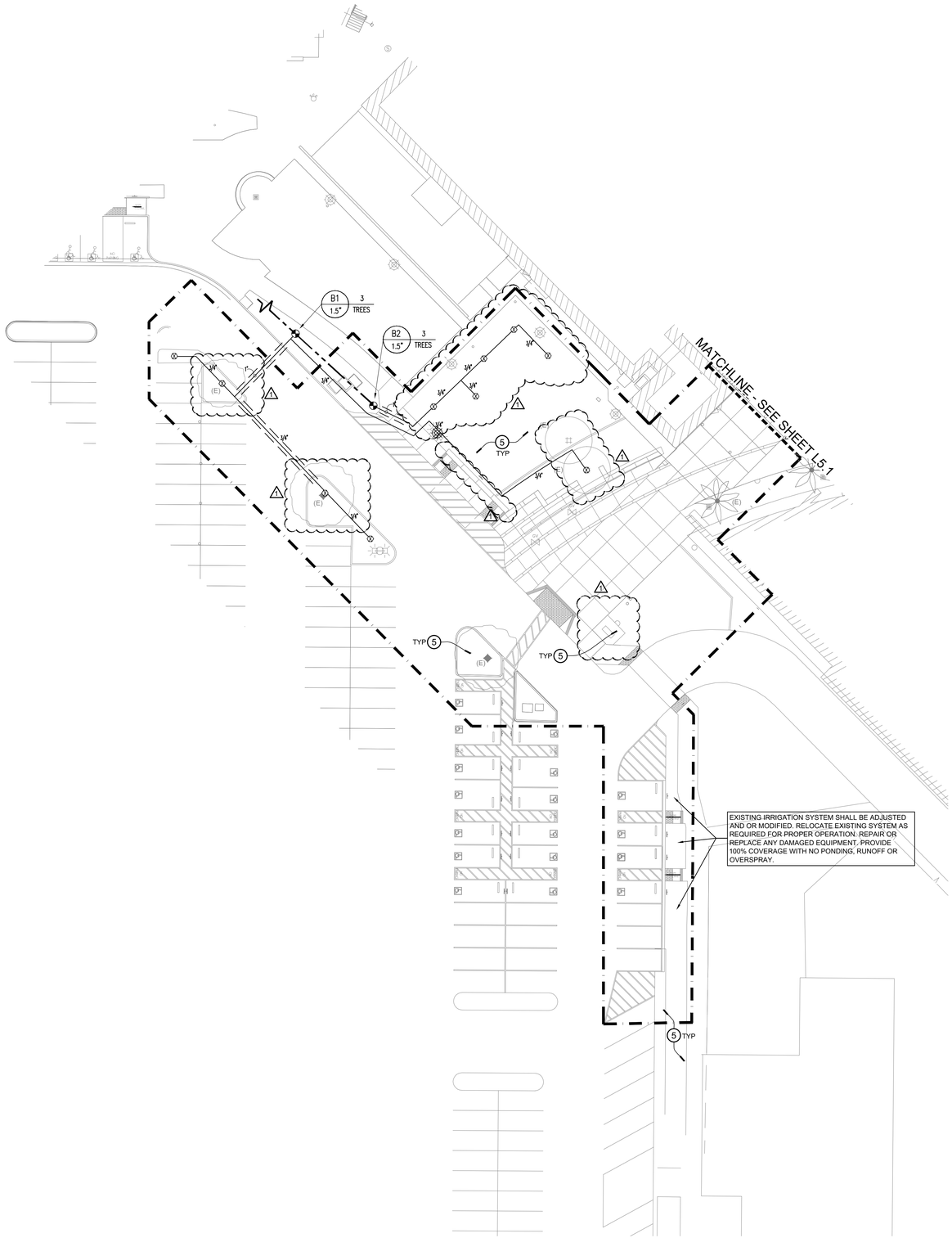

IRRIGATION CONSTRUCTION NOTES

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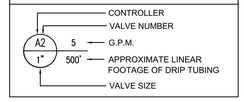
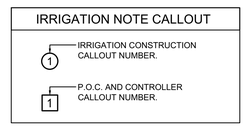
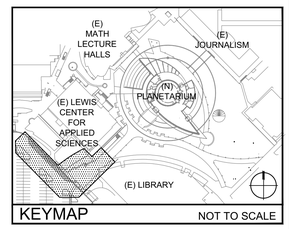
2. **TRENCHING IN VICINITY OF EXISTING TREES** WHENEVER ROOTS OF EXISTING TREES ARE ENCOUNTERED DURING TRENCHING OPERATIONS, THE CONTRACTOR SHALL REROUTE MAIN LINE TRENCHES. DO NOT CUT ROOTS OVER 1" IN DIAMETER. ALL CUTS SHALL BE A CLEAN SHARP CUT. IF TRENCHING IS REQUIRED, THE CONTRACTOR SHALL HAND DIG THE TRENCHES TAKING CARE NOT TO DAMAGE ROOTS. NO MECHANICAL TRENCHING WITHIN THE DRIPLINE OF THE EXISTING TREE WILL BE ALLOWED. PROTECT ALL ROOTS EXPOSED TO SUNLIGHT WITH MOIST BURLAP UNTIL COVERED WITH SOIL.
3. **STUB-OUT NOTE:** CONTRACTOR SHALL PROVIDE IRRIGATION MAINLINE STUB-OUT AND SPARE CONTROL WIRES AT THIS APPROXIMATE LOCATION FOR FUTURE ADJACENT IRRIGATION IMPROVEMENTS CONNECTION. CONTRACTOR SHALL ROUTE A MINIMUM OF TWO (2) COMMON WIRES, TWELVE (12) ADDITIONAL SPARE CONTROL WIRES FROM CONTROLLER TO THIS APPROXIMATE LOCATION. CONTRACTOR SHALL INSTALL SAID STUB-OUT AND WIRES WITHIN A RECTANGULAR PLASTIC VALVE BOX. SPARE WIRES SHALL BE RED COLOR LABELED "SPARE" AT BOTH ENDS. CONTRACTOR SHALL VERIFY EXACT STUB-OUT LOCATION IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK.
4. **REMOVAL AND DISPOSAL NOTE:** CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLETE REMOVAL AND DISPOSAL OF ALL EXISTING IRRIGATION EQUIPMENT AFFECTED BY THE PROPOSED IRRIGATION IMPROVEMENTS. CONTRACTOR SHALL VERIFY ALL EQUIPMENT TO BE REMOVED AND DISPOSED OF IN FIELD PRIOR TO COMMENCING WORK. CONTRACTOR SHALL MEET WITH THE OWNER PRIOR TO BEGINNING DEMOLITION OR ANY OTHER WORK, AND WALK SITE TO LOCATE EXISTING CONTROLLER AND LINES AND OTHER IRRIGATION TO BE PROTECTED IN PLACE.
5. **PERIMETER IRRIGATION NOTE:** ALL ADJACENT SYSTEMS SHALL MAINTAIN AUTOMATIC PROGRAMMED WATERING SCHEDULES THROUGHOUT CONSTRUCTION , NO DISRUPTION OF THE EXISTING IRRIGATION SYSTEMS WATERING WILL BE ALLOWED DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR/MODIFICATION OF ALL ADJACENT IRRIGATION SYSTEMS EQUIPMENT THAT IS AFFECTED BY PROPOSED IRRIGATION IMPROVEMENTS. CONTRACTOR SHALL ADJUST AND CAP OFF EXISTING ADJACENT IRRIGATION SYSTEMS AS REQUIRED. CONTRACTOR SHALL REPAIR SAID SYSTEMS TO A LIKE NEW MANNER, PROVIDING COMPLETE 100% HEAD TO HEAD COVERAGE WITH NO PONDING, RUNOFF, OR OVER-SPRAY IN ALL AREAS. SYSTEM LAYOUT SHALL APPROVED BY THE OWNER'S AUTHORIZED REPRESENTATIVE. CONTRACTOR SHALL CONFIRM ALL AREAS REQUIRING MODIFICATION WITH THE OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO BIDDING AND COMMENCING WORK.
6. **STUB-OUT NOTE:** CONTRACTOR SHALL PROVIDE IRRIGATION MAINLINE STUB-OUT AND SPARE CONTROL WIRES AT THIS APPROXIMATE LOCATION FOR FUTURE ADJACENT IRRIGATION IMPROVEMENTS CONNECTION. CONTRACTOR SHALL ROUTE A MINIMUM OF TWO (2) COMMON WIRES, SIX (6) ADDITIONAL SPARE CONTROL WIRES FROM CONTROLLER TO THIS APPROXIMATE LOCATION. CONTRACTOR SHALL INSTALL SAID STUB-OUT AND WIRES WITHIN A RECTANGULAR PLASTIC VALVE BOX. SPARE WIRES SHALL BE RED COLOR LABELED "SPARE" AT BOTH ENDS. CONTRACTOR SHALL VERIFY EXACT STUB-OUT LOCATION IN FIELD WITH OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCING WORK.

IRRIGATION VALVE CALLOUT



IRRIGATION NOTE CALLOUT





RECYCLED WATER:
THE DESIGN SHALL PROVIDE FOR CONNECTION OF RECYCLED WATER. PLANS SHALL BE IN ACCORDANCE WITH THE WATER DISTRICT RECYCLED GUIDELINES. A RECYCLED WATER USE PERMIT SHALL BE OBTAINED PRIOR TO RECEIVING A RECYCLED WATER CONNECTION.

FOR IRRIGATION LEGEND & CALCULATIONS - SEE SHEET L6.1
FOR IRRIGATION NOTES - SEE SHEET L6.2
FOR IRRIGATION DETAILS - SEE SHEETS L6.3 - L6.4
FOR SPECIFICATIONS - SEE SEPARATE BOOKLET

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REGISTERED LANDSCAPE ARCHITECT Thomas J. Ridge (Signature) 12/15/2014 (Date) STATE OF CALIFORNIA

SEALS / APPROVALS

LICENSED ARCHITECT RICHARD L. ALDRICH No. C 11360 STATE OF CALIFORNIA

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FILE#: 30-C3
A#: 04-113620
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PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
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COSTA MESA, CA 92626

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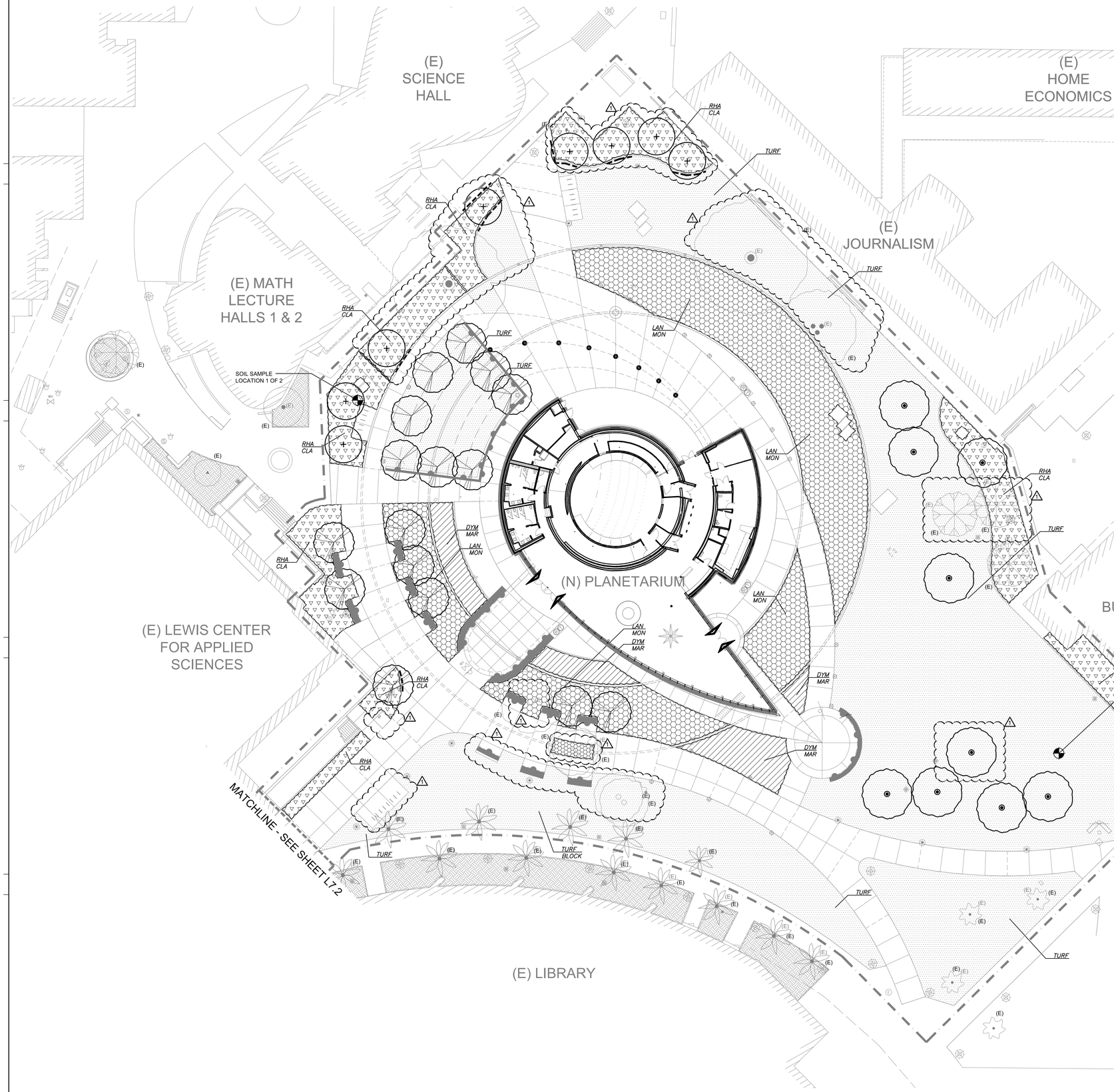
SHEET TITLE
IRRIGATION PLAN

SHEET NUMBER
L5.2

COLLEGE CHANGES 03/29/2016



EXISTING TREE LEGEND

SYMBOL	BOTANICAL / COMMON NAME	SYMBOL	BOTANICAL / COMMON NAME
	AGONIS FLEXUOSA 'AFTER DARK' / PEPPERMINT WILLOW		EUCALYPTUS SIDEROXYLON / RED IRONBARK
	BAUHINIA X BLAKEANA / HONG KONG ORCHID TREE		FICUS MICROCARPA / INDIAN LAUREL FIG
	BRAHEA ARMATA / MEXICAN BLUE PALM		JUNIPERUS K. 'TORULOSA' / HOLLYWOOD JUNIPER
	CALLISTEMON CITRINUS / LEMON BOTTLEBRUSH		MAGNOLIA GRANDIFLORA / SOUTHERN MAGNOLIA
	CEDRUS SPP. / CEDAR		PLATANUS RACEMOSA / CALIFORNIA SYCAMORE
	EUCALYPTUS CITRIODORA / LEMON-SCENTED GUM		PYRUS C. 'BRADFORDII' / BRADFORD PEAR
	SCHINUS TEREBINTHIFOLIUS / BRAZILIAN PEPPER		SYAGRUS ROMANZOFFIANUM / QUEEN PALM
			WASHINGTONIA ROBUSTA / MEXICAN FAN PALM

NOTE: TREES MARKED WITH THE LETTER (E) ARE EXISTING TREES TO BE PROTECTED IN PLACE. FOR EXISTING TREES TO BE REMOVED, REFER TO LANDSCAPE DEMOLITION PLAN, SHEET L1.1.

EXISTING SHRUBS, VINES AND GROUNDCOVERS

EXISTING TURF

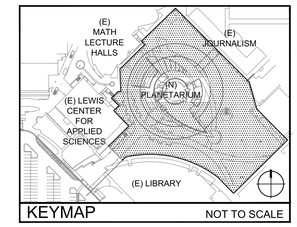
PLANTING LEGEND

SYMBOL	BOTANICAL / COMMON NAME	MINIMUM SIZE	COMMENTS	QTY.	WUCOLS	DETAIL
TREES:						
	ARBUTUS X 'MARINA' / MARINA STRAWBERRY TREE	36" BOX STD.	8'H X 3'W X 1-1/2" CAL.	1: 0	MOD. (0.4-0.6)	A
	FICUS MICROCARPA 'GREEN GEM' / GREEN GEM INDIAN LAUREL FIG	36" BOX STD.	11'H X 4'W X 1-1/2" CAL.	1: 9	MOD. (0.4-0.6)	A
	LAGERSTROEMIA 'NATCHEZ' / NATCHEZ CRAPE MYRTLE	36" BOX STD.	12'H X 6'W X 1-1/2" CAL.	1: 16	MOD. (0.4-0.6)	A
	LOPHOSTEMON CONFERTUS / BRISBANE BOX	24" BOX STD.	10'H X 4'W X 1" CAL.	1: 8	MOD. (0.4-0.6)	A
	PYRUS C. 'BRADFORDII' / BRADFORD PEAR	36" BOX STD.	14'H X 8' W X 3" CAL.	1: 2	MOD. (0.4-0.6)	A
	EUCALYPTUS SIDEROXYLON / RED IRON BARK	24" BOX STD.	12'H X 5' W X 2" CAL.	5	LOW. (0.1-0.3)	A
SHRUBS, VINES & GROUNDCOVERS:						
	DYMONDIA MARGARETAE / DYMONDIA	FLATS	PLANT 12" O.C.	PER PLAN	LOW (0.1-0.3)	B, C
	LANTANA MONTEVIDENSIS / TRAILING LANTANA	1 GAL.	PLANT 36" O.C.	1,462	LOW (0.1-0.3)	B, C
	RHAPHIOLEPIS INDICA 'CLARA' / WHITE INDIAN HAWTHORN	1 GAL.	PLANT 36" O.C.	1: 1,066	MOD. (0.4-0.6)	B, C
	TURF 'MARATHON 2E' / SODDED TURF	SOD	--	PER PLAN	HIGH (0.7-0.9)	--

DENOTES SOIL SAMPLE LOCATION - REFER TO NOTE 'H' OF PLANTING NOTES, SHEET L8.1, FOR ADDITIONAL INFORMATION.

ROOT BARRIERS SHALL BE INSTALLED AT ALL TREES WITHIN 5 FEET OF ANY HARDSCAPE, PAVEMENT, CURB OR WALLS. ROOT BARRIERS ARE TO BE 'UB24-2' BY DEEP ROOT CORPORATION, (800) 458-7668, INSTALLED PER MANUFACTURER'S SPECIFICATIONS. NOTE: ROOT BARRIERS SHALL NOT BE WRAPPED AROUND THE ROOTBALL.

NOTES:



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LICENSED ARCHITECT RENEWAL 08/31/2015 No. C 11360 STATE OF CALIFORNIA

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SHEET NUMBER
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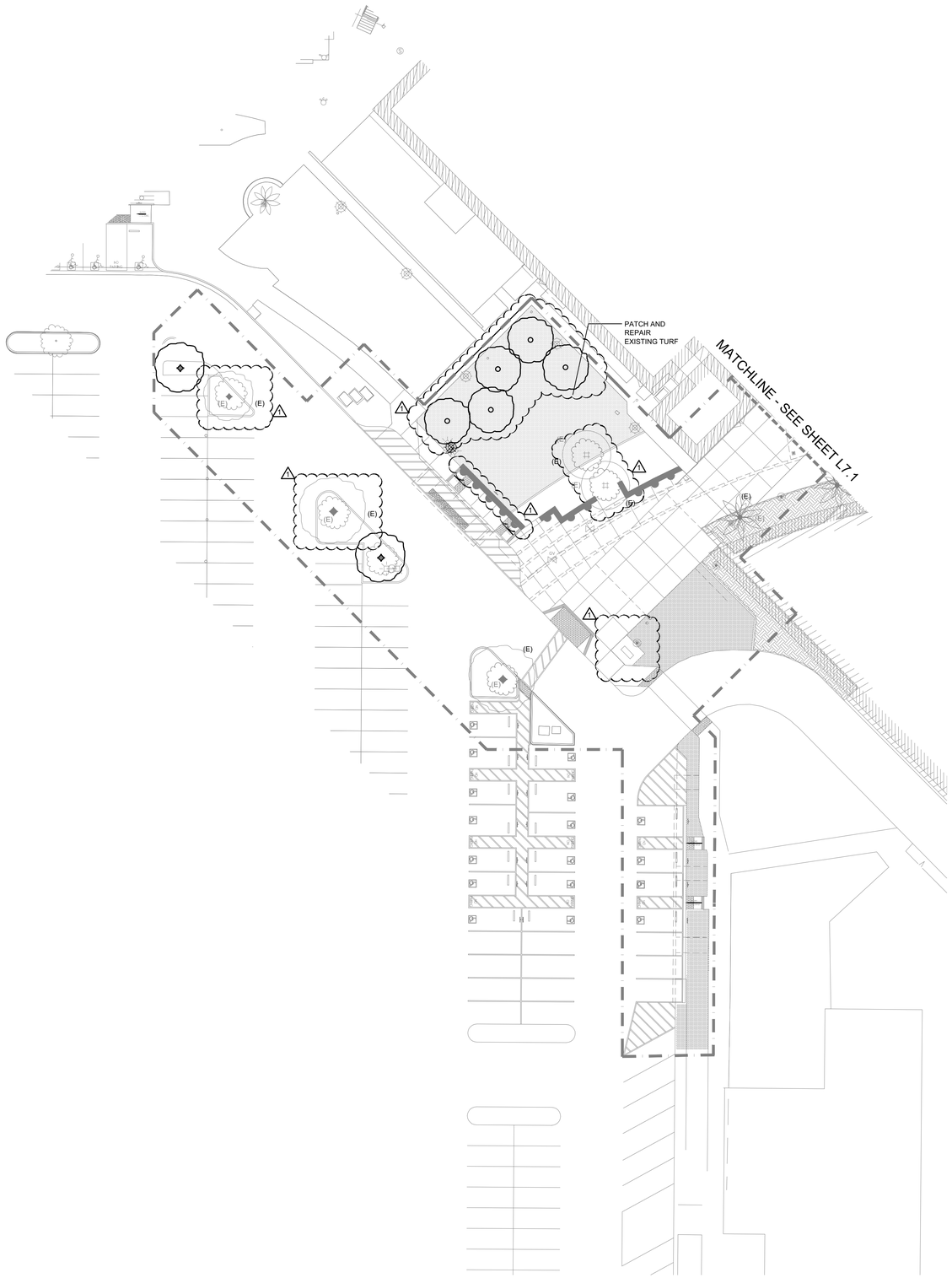
COLLEGE CHANGES 03/29/2016



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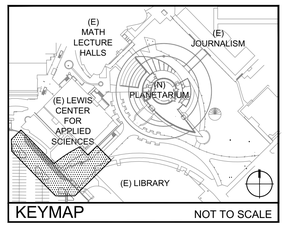
NOTES:
MULCH ALL LANDSCAPE AREAS (EXCLUDING TURF) HAVING LESS THAN A 2:1 SLOPE WITH A 3" LAYER OF MEDIUM GRIND BARK MULCH, PER SPECIFICATIONS, AT THE CONCLUSION OF PLANTING OPERATIONS. NO TREES OR TREE CANOPIES ALLOWED IN UTILITY EASEMENTS, TYPICAL.



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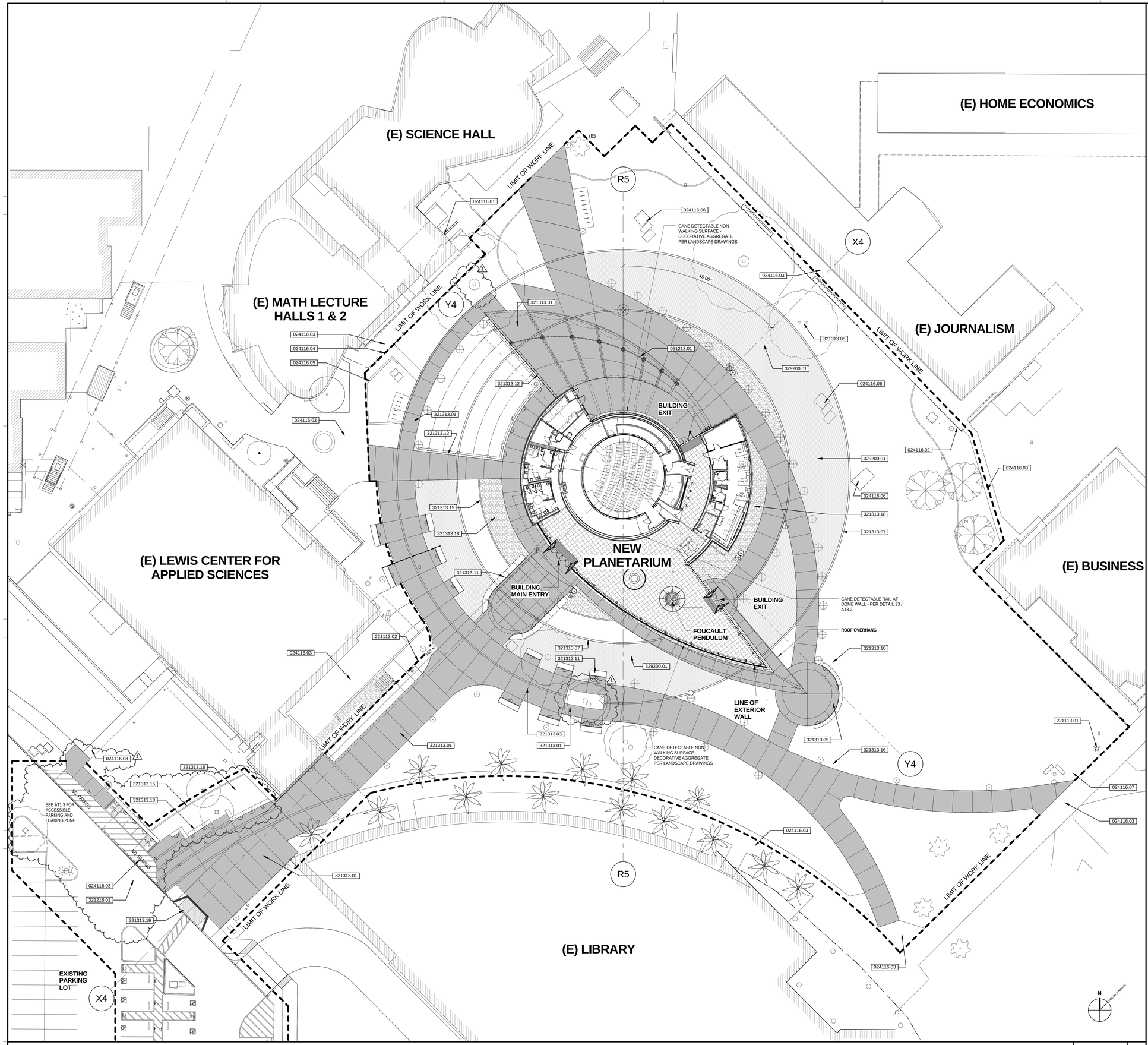

KEYNOTES

SPEC SECTION	DESCRIPTION
024116.01	Protect in place (E) Building - Patch and repair (E) Exterior Building Wall where (E) Canopy has been removed - See Civil Demolition Plan C7.0
024116.02	Protect in place (E) Canopy - Patch and repair metal flashing at Fascia where (E) Canopy has been removed - See Civil Demolition Plan C7.0
024116.03	Protect in place (E) Hardscape - See Civil and Landscape Demolition Plan C7.0 and L1.1
024116.04	Protect in place (E) Canopy - See Civil Demolition Plan C7.0
024116.05	Protect in place (E) Site Wall - See Civil Demolition Plan C7.0
024116.06	Protect in place (E) Utility Vault - See Civil Demolition Plan C7.0 and Electrical Demolition Plan ED.01 and ED.02
024116.07	Protect in place (E) Light Pole - See Civil Demolition Plan C7.0 and Electrical Demolition Plan ED.01 and ED.02
051213.01	Architecturally Exposed Exterior Structural Steel Trellis per Structural Drawings. Steel to be protected by 3 coat high performance paint system per Specifications - Basis of Design: Carboline
221113.01	(E) Fire Hydrant - See Civil Utility Sheet C4.0
221113.02	Relocated Fire Hydrant - See Civil Utility Sheet C4.0
321216.02	Traffic Paint Striping and/or Markings - See AT1.3 for additional information
321313.01	Concrete Paving per Civil and Landscape Drawings
321313.03	Concrete Paving Control Joint per Landscape Drawings
321313.05	Concrete Band per Landscape Drawings
321313.07	10" wide curb/band per Landscape Drawings
321313.10	2' Wide Concrete Seat Wall per Landscape Drawings
321313.11	3' Wide Concrete Seat Wall per Landscape Drawings
321313.12	Retaining Wall per Civil and Landscape Drawing Detail J/L4.1
321313.15	6" wide Mowstrip per Landscape Drawings
321313.16	Concrete base for light bollard per Landscape and Electrical Drawings
321313.18	Loose gravel infill per Landscape Drawings
321313.19	Driveway Apron Curb Cut per Civil Drawings
329200.01	Planting Area per Landscape Drawings

SITE PLAN LEGEND

- CONCRETE PAVING - SEE CIVIL & LANDSCAPE DRAWINGS
- LIMIT OF WORK LINE

SITE PLAN GENERAL NOTES

1. REFER TO CIVIL DRAWINGS FOR GRADING AND SITE UTILITIES INFORMATION.
2. REFER CIVIL PRECISE GRADING PLAN C3.0 AND LANDSCAPE DETAILS H, I, AND J, SHEET L4.1 FOR SITE WALL DESIGNS.
3. REFER TO CIVIL, PLUMBING, AND FIRE PROTECTION DRAWINGS FOR FIRE SERVICES CONNECTIONS.
4. CONTRACTOR IS TO PROVIDE TEMPORARY PEDESTRIAN PROTECTION.
5. CONTRACTOR IS TO PROVIDE TEMPORARY CONSTRUCTION GATES AT ALL ENTRANCES TO THE PROJECT.
6. ALL BUILDING ENTRANCES & EXTERIOR GROUND LEVEL EXITS SHALL HAVE A 2% MAX. (MIN. 5'-0") SLOPE AWAY FROM DOORS.
7. PATH OF TRAVEL (P.O.T.) NOTES:
   - PATH OF TRAVEL (P.O.T.) AS INDICATED IS A BARRIER FREE ACCESS ROUTE WITHOUT ANY ABRUPT VERTICAL CHANGES EXCEEDING 1/2" BEVELED AT A SLOPE NOT STEEPER THAN 1:2, EXCEPT THAT LEVEL CHANGES DO NOT EXCEED 1/4" VERT., AND IS AT LEAST 48" WIDE.
   - SURFACE IS SLIP RESISTANT, STABLE, FIRM, CROSS-SLOPE DOES NOT EXCEED 2% AND SLOPE IN THE DIRECTION OF TRAVEL IS LESS THAN 5%, UNLESS OTHERWISE INDICATED.
   - P.O.T. SHALL BE MAINTAINED FREE OF OVERHANGING OBSTRUCTIONS TO 80" MIN. (2013 CBC 11B-307.4) AND PROTRUDING OBJECTS GREATER THAN 4" PROJECTION FROM WALL AND ABOVE 27" AND LESS THAN 80" (2013 CBC 11B-307)
   - ARCHITECT TO VERIFY THAT ALL BARRIERS IN THE P.O.T. HAVE BEEN REMOVED OR WILL BE REMOVED UNDER THIS PROJECT, AND P.O.T. COMPLIES WITH CBC 11B
8. REFER TO MECHANICAL, PLUMBING, ELECTRICAL, AND TELECOM SITE PLANS FOR ADDITIONAL SITE UTILITIES WORK.
9. PATCH AND REPAIR EXISTING HARDSCAPE AND LANDSCAPE AS NEEDED AT BUILDING PERIMETER AREAS WHERE DEMOLITION WORK AT THE EXTERIOR AFFECTS THE EXISTING SITE CONDITION.
10. REFER TO LANDSCAPE PLANS FOR ALL HARDSCAPE, SITE FURNITURE, PLANTING, FENCING, SITE WALL, AND IRRIGATION INFORMATION.

SITE DEMOLITION NOTES

1. REFER TO SPECIFICATIONS AND THE FOLLOWING DRAWINGS FOR BUILDING, UTILITY AND SITE DEMOLITION REQUIREMENTS:
   - CIVIL SHEET C7.0
   - LANDSCAPE SHEET L1.1
   - PLUMBING SHEET PD.01
   - ELECTRICAL SHEET ED.01 AND ED.02

SITE PLAN | SCALE 1" = 20'-0" | 1

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CONSULTANTS

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REGISTERED PROFESSIONAL ENGINEER — MICHAEL SCOTT — No. C 11360 — CIVIL — STATE OF CALIFORNIA

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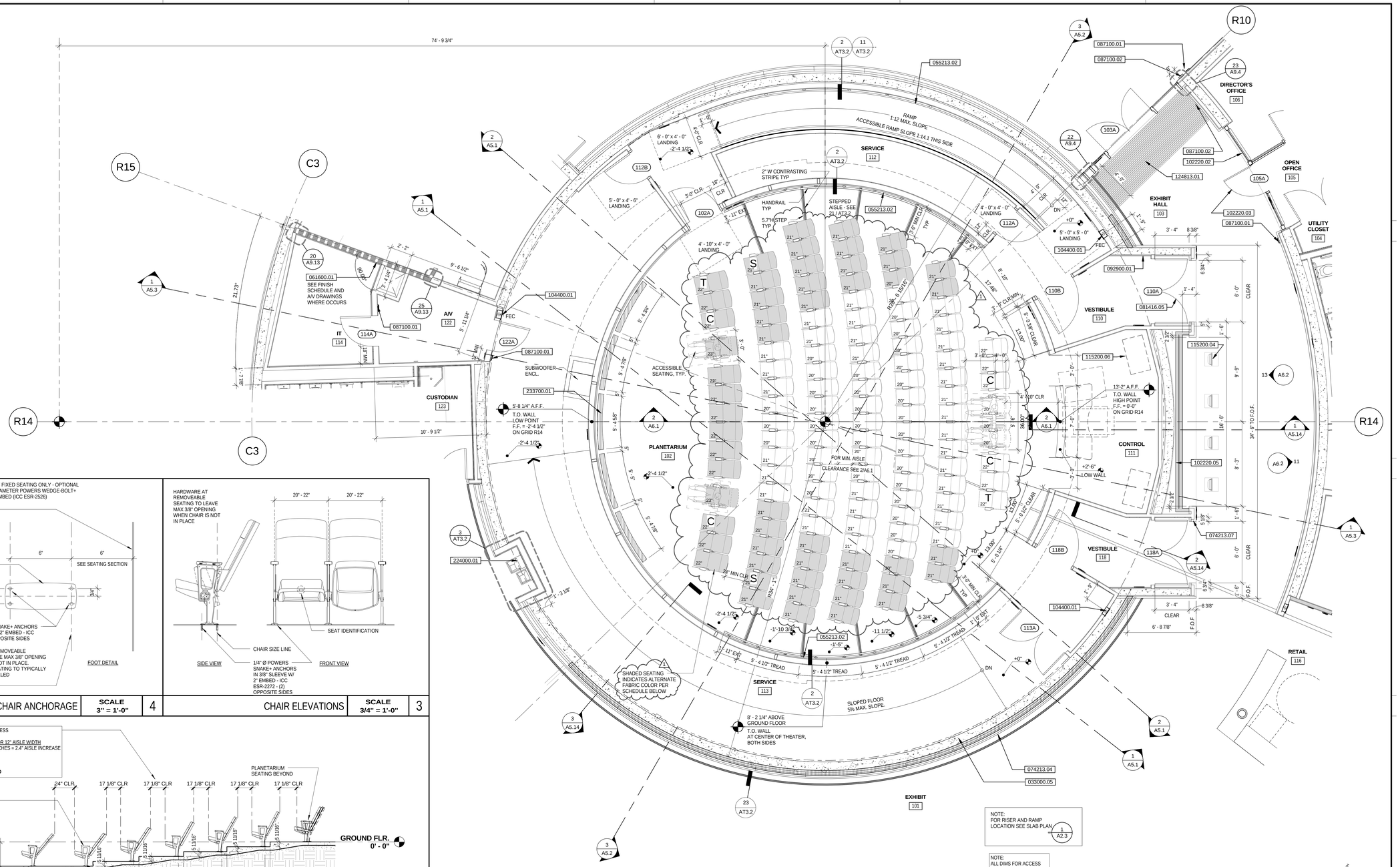
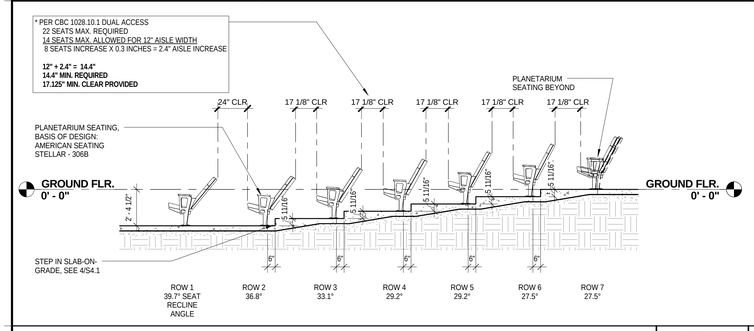


ENLARGED PLAN - PLANETARIUM 102 & EXHIBIT HALL 103

SCALE 1/4" = 1'-0" | 1



CHAIR ANCHORAGE

SCALE 3" = 1'-0" | 4

CHAIR ELEVATIONS

SCALE 3/4" = 1'-0" | 3

SECTION THROUGH PLANETARIUM SEATING

SCALE 1/4" = 1'-0" | 2

SEATING COUNT

THEATER SEATING TO BE OFCI
CHAIR BASIS OF DESIGN: AMERICAN SEATING

(4)	-	ADA SEATS	STELLAR 3068
(4)	-	COMPANION SEATS	(40) - 20" CHAIR
(2)	-	SEMI-AMBULANT SEATS	(69) - 21" CHAIR
(2)	-	TRANSFER SEATS	(16) - 22" CHAIR
(116)	-	REGULAR SEATS	(2) - 23" CHAIR
(129)	-	TOTAL SEATS	(129) - TOTAL

MIDDLE STANDARDS:
(116) - 3512 LEVEL FLOOR

END STANDARDS
(2) - 136 LEVEL FLOOR
(24) - 3512 LEVEL FLOOR
(26) - TOTAL

ACCESSORIES INCLUDED
(2) - ADA ENDS - HINGED ARM
(14) - END PANELS
(14) - ROW IDENTIFICATION TAGS
(129) - SEAT IDENTIFICATION TAGS
(129) - OVERSIZED TABLET ARM

NOTE:
1. PROVIDE LAPTOP TABLET ARM AT EACH SEAT.
2. VERIFY STANDARDS AND ACCESSORIES QTY WITH FIELD CONDITIONS AND MANUF.

SEATING MATERIALS AND FINISHES

SEATING TYPE AND MODEL: AMERICAN SEATING - STELLAR 3068

FINISHES:

STEEL FRAME: OY-FPF STEEL GRAY

BACK OF SEAT, SIDE PANEL AND TABLET ARM: FORMICA LAMINATE 8848-58 FQ BLACKENED LENGO

SEAT FABRIC
SEAT: MOMENTUM – PATTERN: CANTER / COLOR: TANGO
SEAT BACK: MOMENTUM – PATTERN: KNACK / COLOR: FILAMENT
HEAD REST: MOMENTUM – PATTERN: CANTER / COLOR: TANGO

HEAD REST EXCEPTION: HEAD REST TO BE MOMENTUM - PATTERN: CANTER / COLOR: STORM WHERE SEATS ARE SHADED IN PLAN

ARMREST COLOR: M0 MAPLE

TABLET EDGES: BURNISHED TO HIDE PLY END GRAIN

SEAT BACK EDGES: BURNISHED TO HIDE PLY END GRAIN

END PANEL: CURVED PANEL WITH BURNISHED EDGE TO HIDE END GRAIN

FLOOR PLAN LEGEND

- NON RATED STUD WALL.
- ONE HOUR RATED STUD WALL. UL #U419 PER DETAIL 3/A9.11
- STONE VENEER WITH RAINSCREEN SYSTEM.
- CONCRETE WALL.
- CUSTOMIZED PREFABRICATED WALL
- FEC — RECESSED FIRE EXTINGUISHER CABINET SEE DETAILS 1 & 2, SHEET A9.12. FIRE EXTINGUISHER MUST COMPLY W/ TITLE 19, ARTICLE 5 AND CBC TABLE 906.3 DISTRIBUTION SHALL NOT EXCEED 75 FT TRAVEL DISTANCE FROM ANYWHERE IN THE BUILDING
- 000000.10 — KEYNOTE, REFER TO KEYNOTE LEGEND.
- 101 — DOOR TAG - SEE DOOR SCHEDULE, SHEET A8.1.
- X — WALL TYPE - SEE SHEET A9.11.
- X — GLAZED SYSTEM TYPE - SEE SHEET A8.1,A8.2, AND A8.3

FLOOR PLAN GENERAL NOTES

1. ALL DIMENSIONS ARE TO FACE OF STUD OR CENTERLINE OF COLUMN UNLESS OTHERWISE NOTED.
2. REFER TO SHEETS AT1.2 & AT2.1 FOR WALL RATINGS, EGRESS, AND OCCUPANCY LOADS.
3. SEE SHEET A9.11 FOR WALL TYPES.
4. FIRE EXTINGUISHERS MUST COMPLY WITH TITLE 19, ARTICLE 5. DISTRIBUTION SHALL NOT EXCEED 75 FEET TRAVEL DISTANCE FROM ANYWHERE IN THE BUILDING.
5. PAINT ALL EXPOSED STRUCTURAL STEEL, DUCTWORK, CONDUIT, CABLE TRAYS, FIRE SPRINKLER PIPES, PLUMBING PIPING, AND METAL DECK AT OPEN GRID CEILING AT EXHIBIT AREA. COLOR: "CHARCOAL GRAY"
6. ALL DIMS FOR ACCESS COMPLIANCE ARE TO F.O. FINISH U.O.N.

KEYNOTES

SPEC SECTION	DESCRIPTION
033000.05	Concrete Dome per Structural Drawings
055213.02	1 1/2" Stainless Steel Handrail - wall mounted
061600.01	3/4" AC fire retardant treated plywood backboard o/ drywall. Place plywood on all (4) walls of Electrical/Network Equipment Room with bottom of plywood at 1'-9" A.F.F. and top of plywood at 8'-0" A.F.F. Apply 2 coats of white paint min. (fire retardant label to remain unpainted and visible at top of wall)
074213.04	Metal Panel System @ Exterior Concrete Dome - Alum Plate Rainscreen Per Specifications, Powder Coated Factory Finish, Basis of Design: Overly
074213.07	Metal Panel System - Interior, Basis of Design: Alucobond Panel System - 4mm, ICC-ES ESR-1114
081416.05	Clad wood door per schedule
087100.01	Card Reader Surface Mounted 42" A.F.F. on unsecured side. Provide electrical box, conduit, etc. per Electrical and Telecom Drawings.
087100.02	Surface Mounted Door Activation Switch for Automatic Operator - One High and One Low
092900.01	Gypsum Board, Paint per Finish Schedule
102220.02	Customized Prefabricated Wall - "Laminated" Clear Glazing - Basis of Design: DIRTT Environmental Solutions

KEYNOTES

SPEC SECTION	DESCRIPTION
102220.03	Interior Door with vision panel -"Laminated" Clear glazing by manufacturer. See Door Schedule. Basis of Design: DIRTT Environmental Solutions
102220.05	Customized Prefabricated Wall- "Laminated Backpainted" Glass Finish and Integrated Flat Panel Display System. Removable access panels for A/V equipment - Basis of Design: DIRTT Environmental Solutions
104400.01	Recessed Fire Extinguisher Cabinet w/ Class 2A-10B:C Fire Extinguisher per specifications
115200.04	iPad Standalone Kiosk - See A/V drawings
115200.06	Audiovisual and Theatre Equipment - See Audiovisual and Theatre Drawings
124813.01	Recessed Entrance Floor Mat - Basis of Design: Matsinc. Ultra Track - VV Embedded Frame
224000.01	Accessible 'Hi-Lo' Drinking Fountain per Plumbing Drawings
233700.01	Linear Recessed Floor Diffuser per Mechanical Drawings

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PROJECT IDENTIFICATION 465
DATE 12/15/2014
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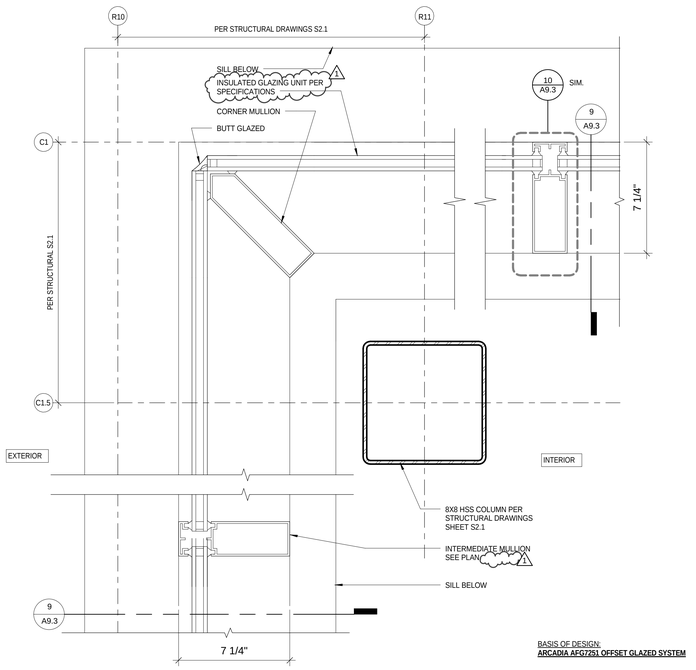
CHECKED BY AS

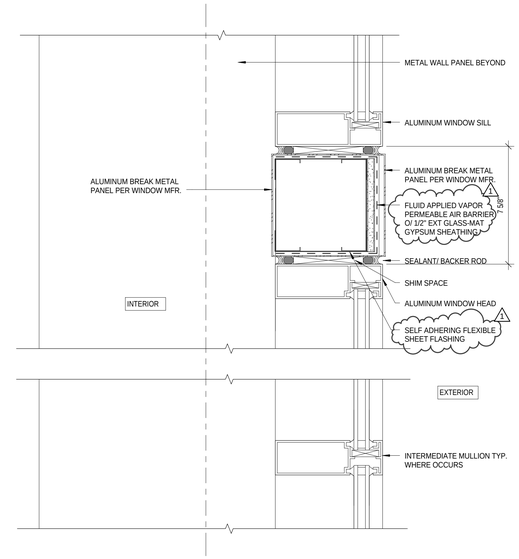
SHEET TITLE
ENLARGED PLANS - PLANETARIUM THEATER & EXHIBIT

SHEET NUMBER
A6.1



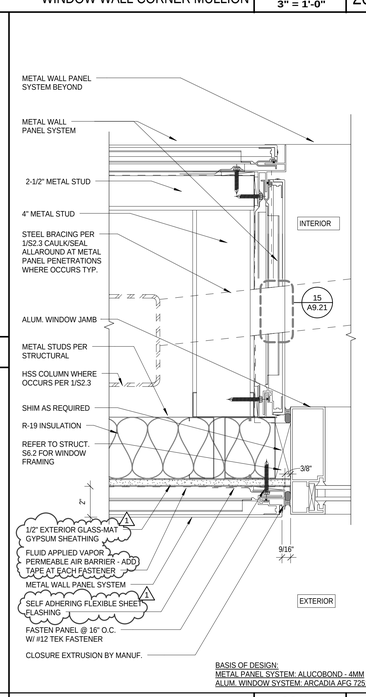
BASIS OF DESIGN:
ARCADIA AFG7251 OFFSET GLAZED SYSTEM

WINDOW WALL CORNER MULLION | SCALE 3" = 1'-0" | 20



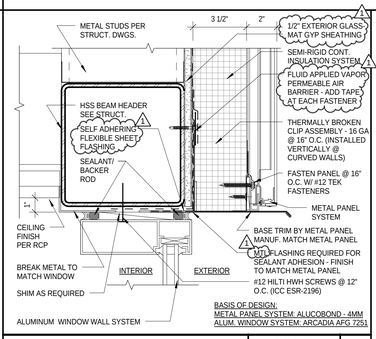
BASIS OF DESIGN:
ALUM. WINDOW SYSTEM: ARCADIA AFG7251 OFFSET GLAZED SYSTEM

WINDOW SECT.@ PENDULUM TOWER | SCALE 3" = 1'-0" | 2



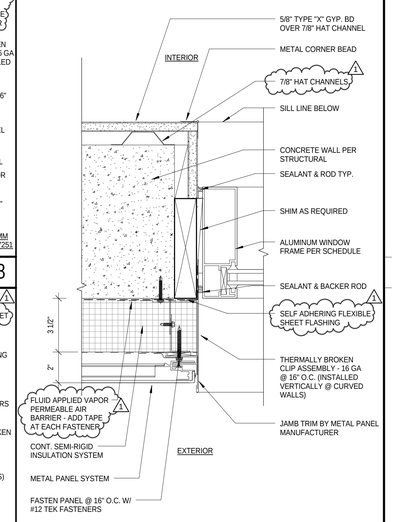
BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4MM
ALUM. WINDOW SYSTEM: ARCADIA AFG 7251

WINDOW JAMB @ PENDULUM TOWER | SCALE 3" = 1'-0" | 14



BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4MM
ALUM. WINDOW SYSTEM: ARCADIA AFG 7251

ALUM. WINDOW HEAD | SCALE 3" = 1'-0" | 8



BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4MM
ALUM. WINDOW SYSTEM: ARCADIA AFG 7251

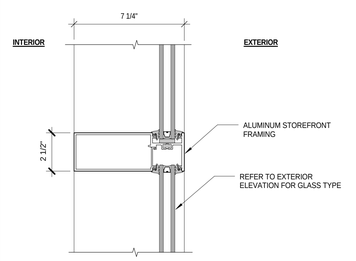
ALUM. WINDOW JAMB | SCALE 3" = 1'-0" | 4

BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND- 4MM
ALUM. WINDOW SYSTEM: ARCADIA AFG 7251

ALUM. WINDOW SILL | SCALE 3" = 1'-0" | 9

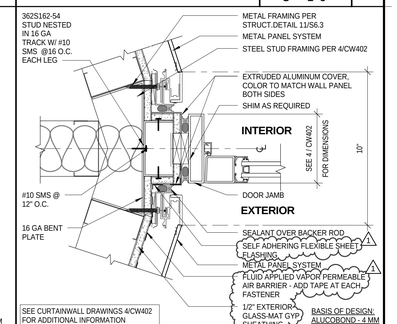
SEE CURTAIN WALL DRAWINGS 6/CW403 FOR ADDITIONAL INFORMATION

DOOR JAMB CENTER MULLION | SCALE 3" = 1'-0" | 15



BASIS OF DESIGN:
ARCADIA AFG7251 OFFSET GLAZED SYSTEM

TYPICAL WINDOW WALL MULLION | SCALE 3" = 1'-0" | 10



SEE CURTAINWALL DRAWINGS 4/CW402 FOR ADDITIONAL INFORMATION

BASIS OF DESIGN:
ALUCOBOND - 4 MM

EXTERIOR STOREFRONT DOOR JAMB @ ENTRY DOORS | SCALE 3" = 1'-0" | 5

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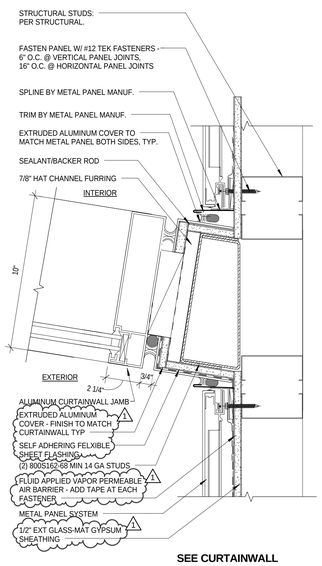
SHEET TITLE
ALUMINUM WINDOW DETAILS

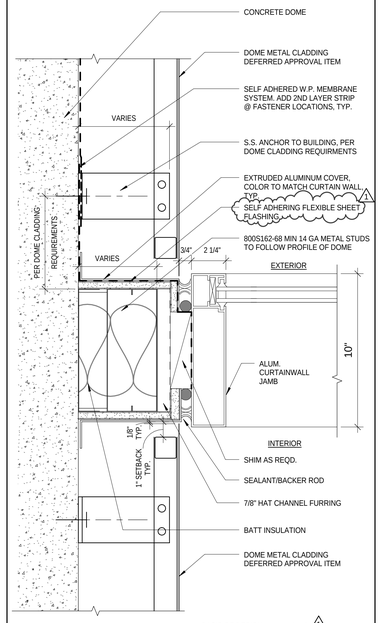
SHEET NUMBER
A9.3



SEE CURTAINWALL DETAIL 3/CW401 FOR ADDITIONAL INFORMATION

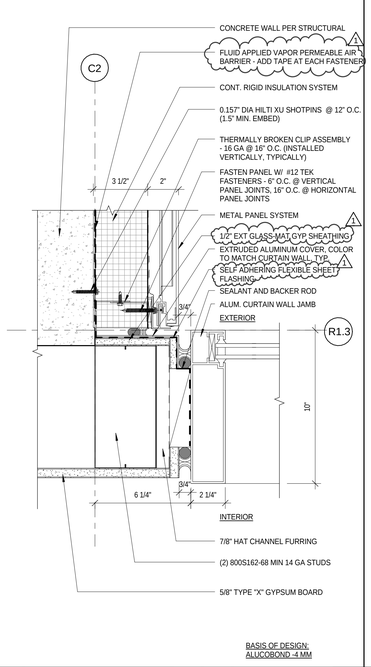
BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4 MM
CURTAINWALL SYSTEM: ARCADIA OPG-3000

SKEWED CURTAINWALL JAMB AT METAL PANEL | SCALE 3" = 1'-0" | 26



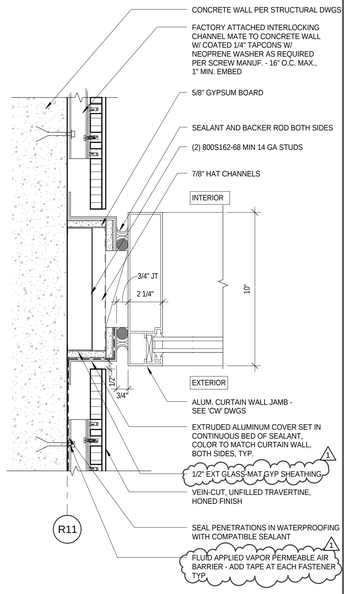
BASIS OF DESIGN:
METAL PANEL SYSTEM: OVERLY (DEFERRED APPROVAL ITEM)
CURTAINWALL SYSTEM: ARCADIA OPG-3000

CURTAINWALL JAMB AT DOME | SCALE 3" = 1'-0" | 22



BASIS OF DESIGN:

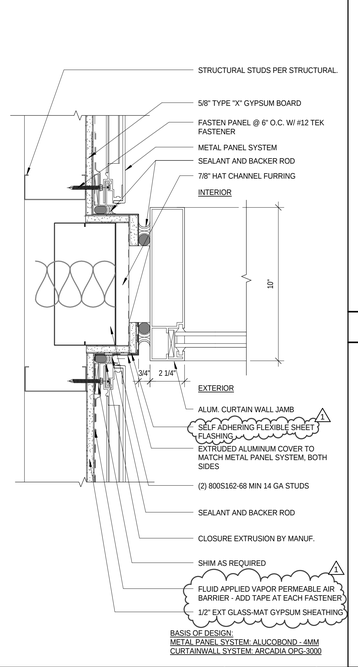
CURTAINWALL JAMB AT GRIDS R1.3 AND C2 | SCALE 3" = 1'-0" | 16



SEE CURTAINWALL DETAIL 8 / CW404 FOR ADDITIONAL INFORMATION

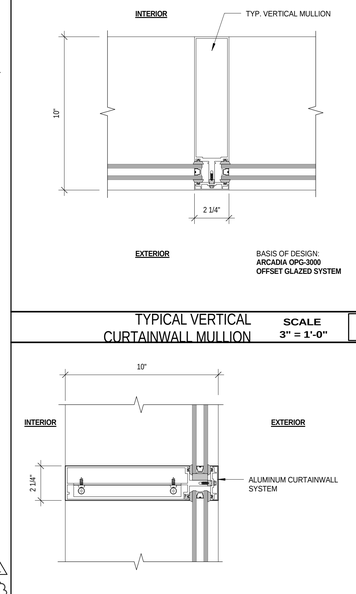
BASIS OF DESIGN:

CURTAINWALL JAMB AT STONE VENEER | SCALE 3" = 1'-0" | 12



BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4MM
CURTAINWALL SYSTEM: ARCADIA OPG-3000

CURTAINWALL JAMB AT METAL PANEL | SCALE 3" = 1'-0" | 7

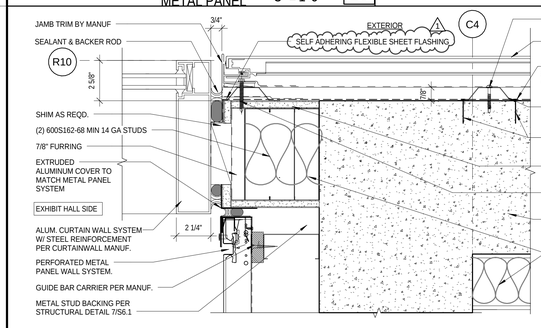


BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

TYPICAL VERTICAL CURTAINWALL MULLION | SCALE 3" = 1'-0" | 1

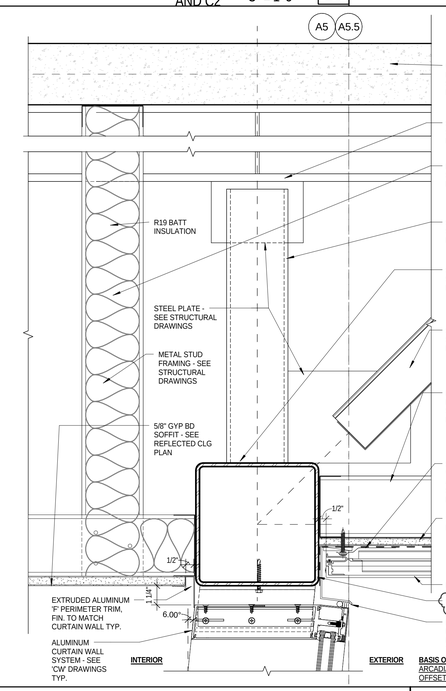
BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

TYPICAL HORIZONTAL CURTAINWALL MULLION - NON-TILTED | SCALE 3" = 1'-0" | 2



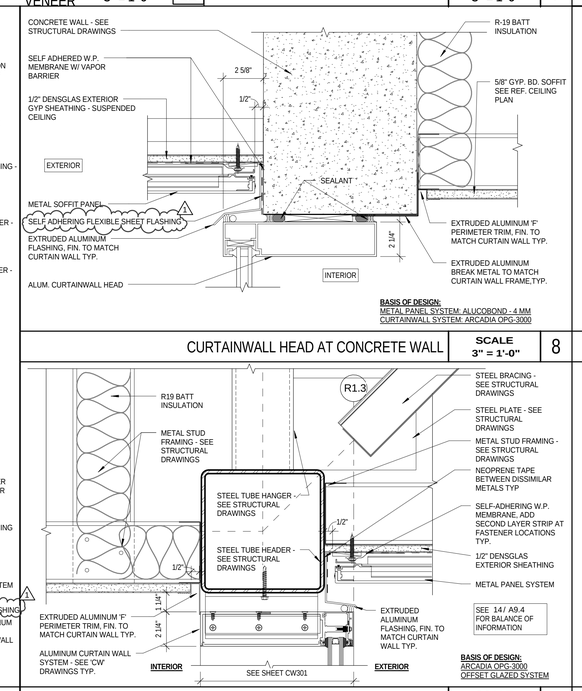
BASIS OF DESIGN:
EXTERIOR METAL PANE: ALUCOBOND - 4 MM
INTERIOR METAL PANEL: ARMSTRONG METALWORKS
ALUM. WINDOW SYSTEM: ARCADIA AFG 7251

CURTAINWALL JAMB | SCALE 3" = 1'-0" | 23



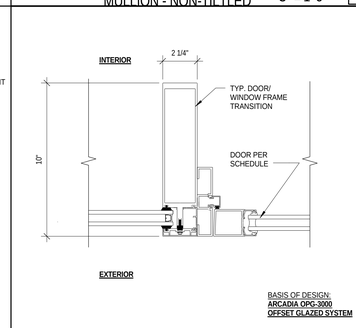
BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

CURTAIN WALL HEAD AT TILTED CONDITION | SCALE 3" = 1'-0" | 14



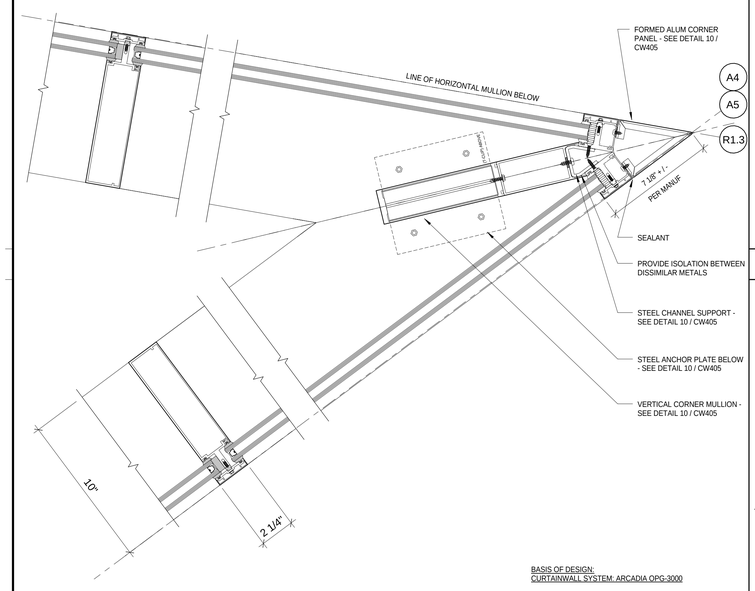
BASIS OF DESIGN:
METAL PANEL SYSTEM: ALUCOBOND - 4 MM
CURTAINWALL SYSTEM: ARCADIA OPG-3000

CURTAINWALL HEAD AT CONCRETE WALL | SCALE 3" = 1'-0" | 8



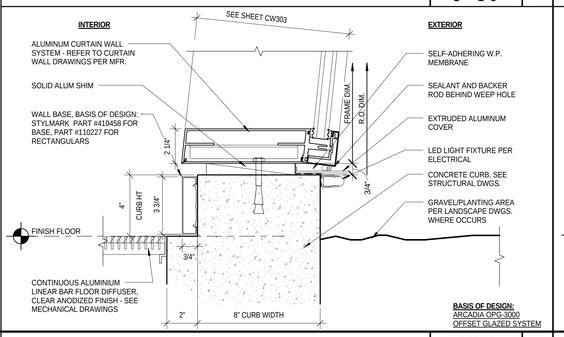
BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

CURTAINWALL DOOR /WINDOW JAMB | SCALE 3" = 1'-0" | 3



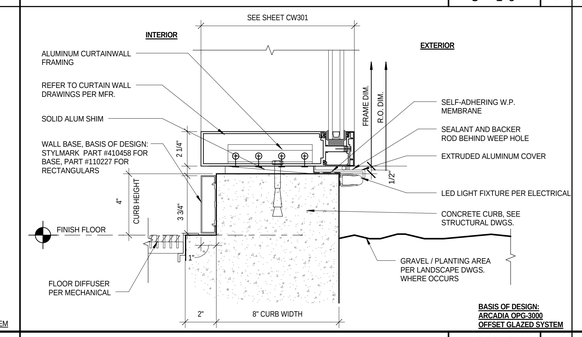
BASIS OF DESIGN:
CURTAINWALL SYSTEM: ARCADIA OPG-3000

CURTAINWALL CORNER MULLION | SCALE 3" = 1'-0" | 25



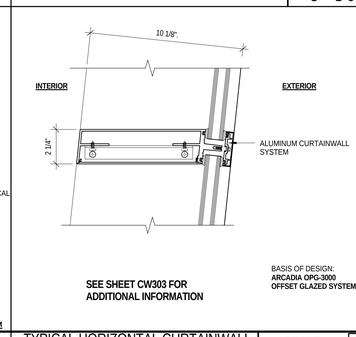
BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

CURTAINWALL SILL DETAIL - TILTED | SCALE 3" = 1'-0" | 15



BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

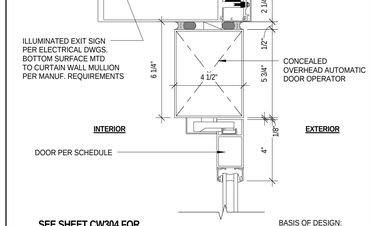
CURTAIN WALL HEAD AT STEEL BEAM | SCALE 3" = 1'-0" | 9



SEE SHEET CW303 FOR ADDITIONAL INFORMATION

BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

TYPICAL HORIZONTAL CURTAINWALL MULLION - TILTED | SCALE 3" = 1'-0" | 5



SEE SHEET CW304 FOR ADDITIONAL INFORMATION

BASIS OF DESIGN:
ARCADIA OPG-3000
OFFSET GLAZED SYSTEM

CURTAINWALL DOOR /WINDOW HEAD | SCALE 3" = 1'-0" | 4

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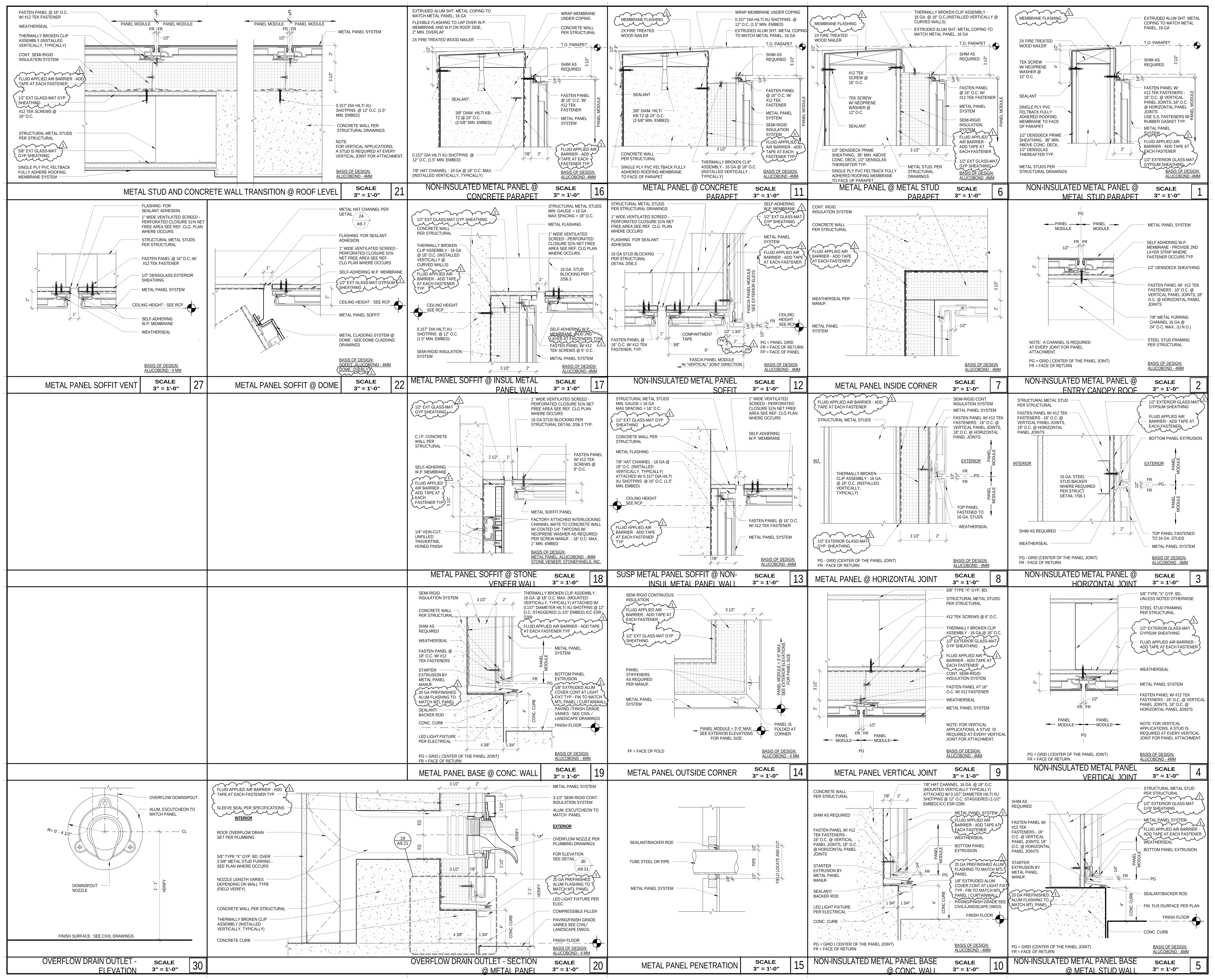
SHEET TITLE
CURTAINWALL DETAILS

SHEET NUMBER
A9.4



METAL STUD AND CONCRETE WALL TRANSITION @ ROOF LEVEL
SCALE 3" = 1'-0" 21
NON-INSULATED METAL PANEL @ CONCRETE PARAPET
SCALE 3" = 1'-0" 16
METAL PANEL @ CONCRETE PARAPET
SCALE 3" = 1'-0" 11
METAL PANEL @ METAL STUD PARAPET
SCALE 3" = 1'-0" 6
NON-INSULATED METAL PANEL @ METAL STUD PARAPET
SCALE 3" = 1'-0" 1
METAL PANEL SOFFIT VENT
SCALE 3" = 1'-0" 27
METAL PANEL SOFFIT @ DOME
SCALE 3" = 1'-0" 22
METAL PANEL SOFFIT @ INSUL METAL PANEL WALL
SCALE 3" = 1'-0" 17
NON-INSULATED METAL PANEL SOFFIT
SCALE 3" = 1'-0" 12
METAL PANEL INSIDE CORNER
SCALE 3" = 1'-0" 7
NON-INSULATED METAL PANEL @ ENTRY CANOPY ROOF
SCALE 3" = 1'-0" 2
METAL PANEL SOFFIT @ STONE VENEER WALL
SCALE 3" = 1'-0" 18
SUSP METAL PANEL SOFFIT @ NON-INSUL METAL PANEL WALL
SCALE 3" = 1'-0" 13
METAL PANEL @ HORIZONTAL JOINT
SCALE 3" = 1'-0" 8
NON-INSULATED METAL PANEL @ HORIZONTAL JOINT
SCALE 3" = 1'-0" 3
METAL PANEL BASE @ CONC. WALL
SCALE 3" = 1'-0" 19
METAL PANEL OUTSIDE CORNER
SCALE 3" = 1'-0" 14
METAL PANEL VERTICAL JOINT
SCALE 3" = 1'-0" 9
NON-INSULATED METAL PANEL VERTICAL JOINT
SCALE 3" = 1'-0" 4
OVERFLOW DRAIN OUTLET - ELEVATION
SCALE 3" = 1'-0" 30
OVERFLOW DRAIN OUTLET - SECTION @ METAL PANEL
SCALE 3" = 1'-0" 20
METAL PANEL PENETRATION
SCALE 3" = 1'-0" 15
NON-INSULATED METAL PANEL BASE @ CONC. WALL
SCALE 3" = 1'-0" 10
NON-INSULATED METAL PANEL BASE @ METAL STUD WALL
SCALE 3" = 1'-0" 5

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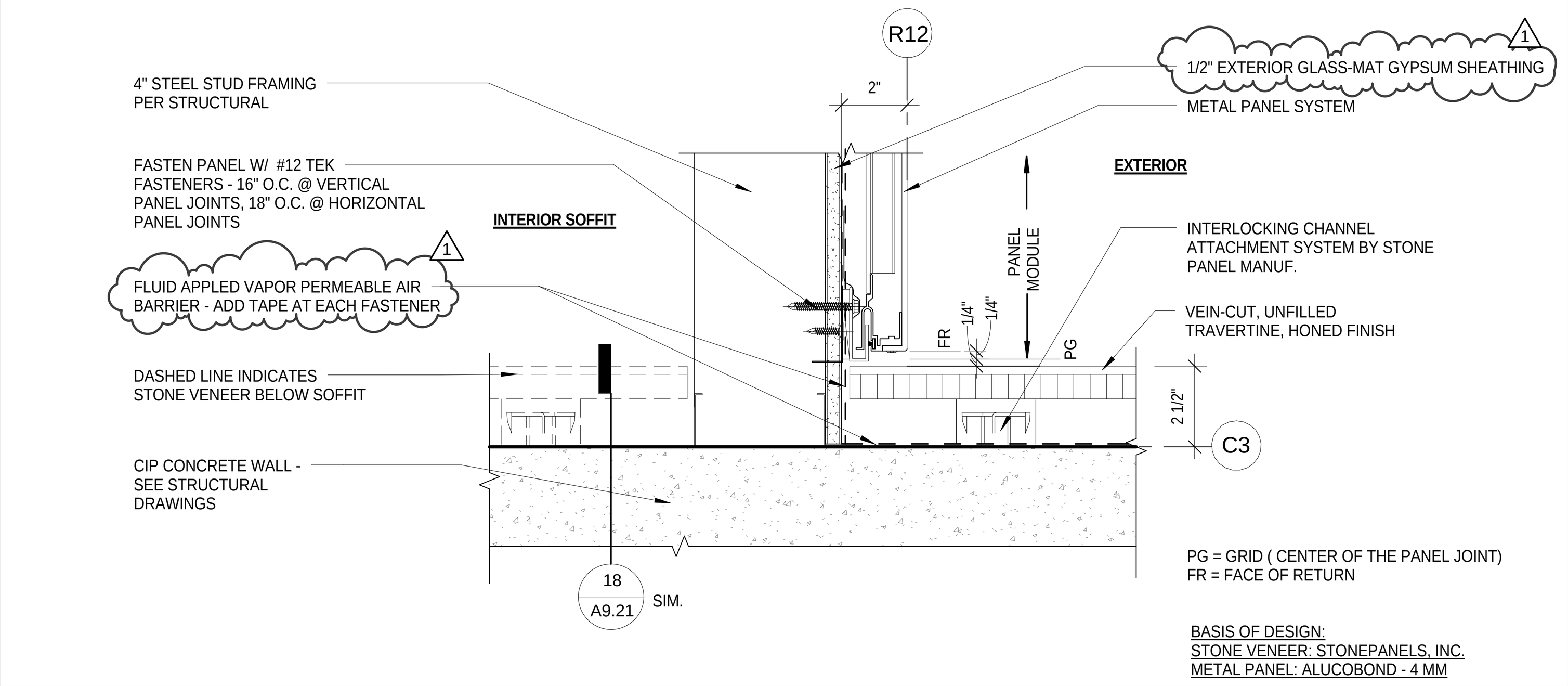
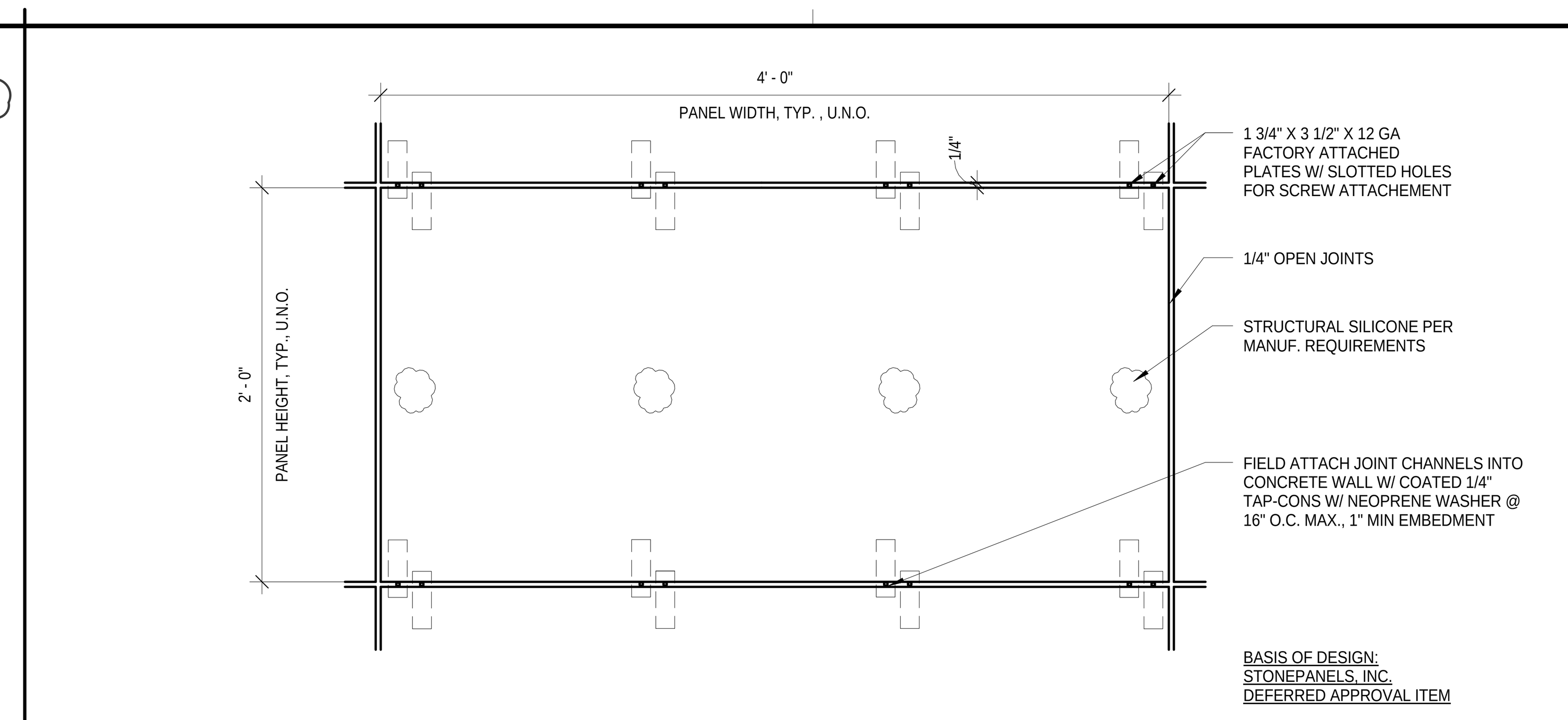
SHEET TITLE
EXTERIOR DETAILS

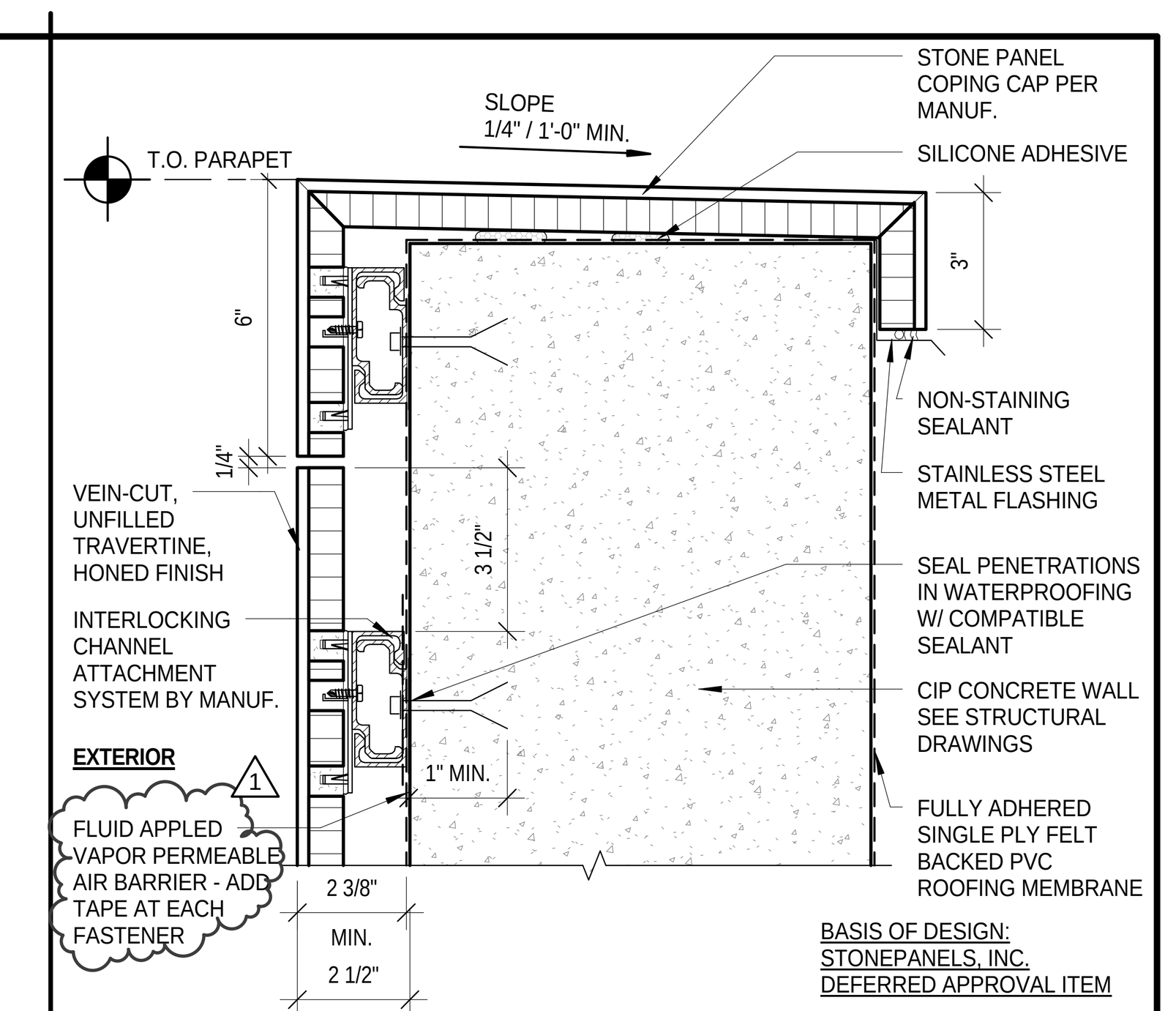
SHEET NUMBER
A9.21



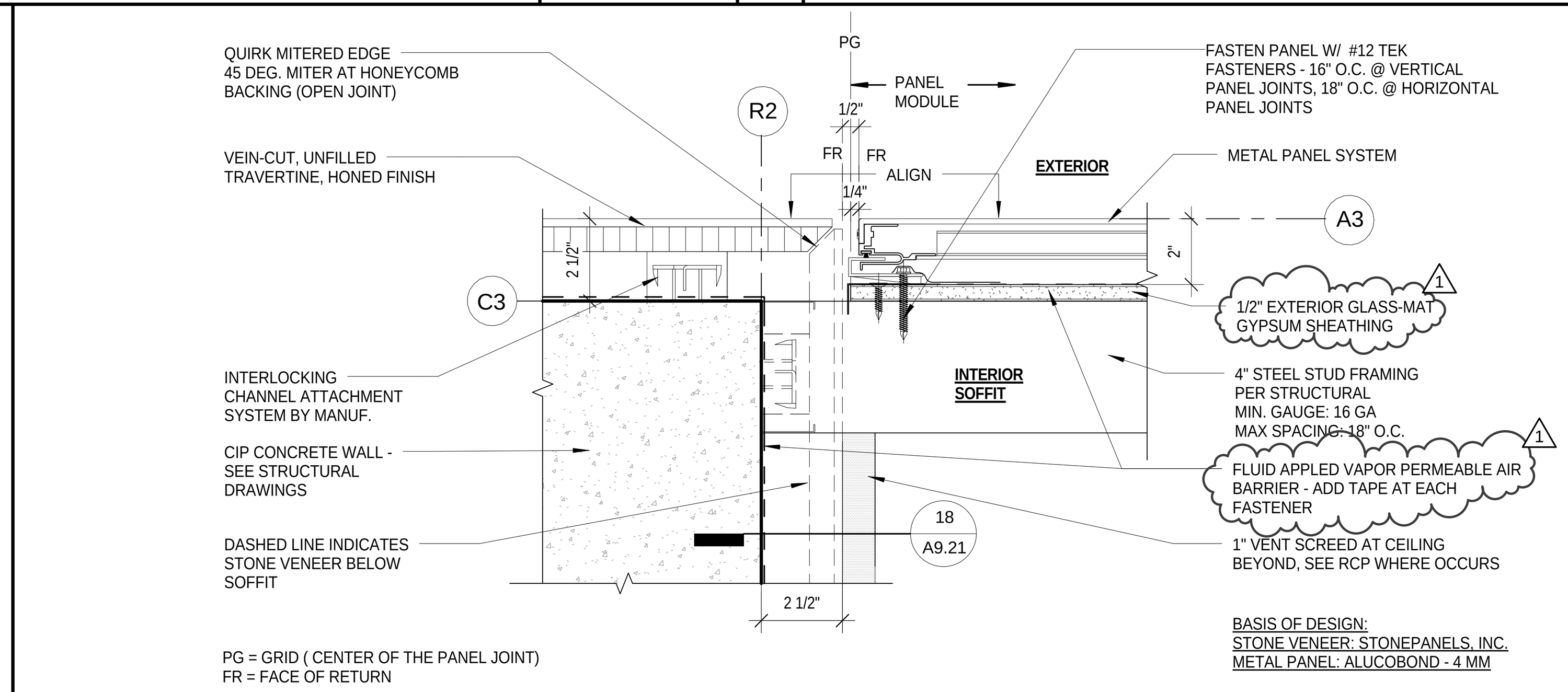
METAL PANEL / STONE VENEER PANEL TRANSITION @ SOFFIT INSIDE CORNER - PLAN VIEW | SCALE 3" = 1'-0" | 16



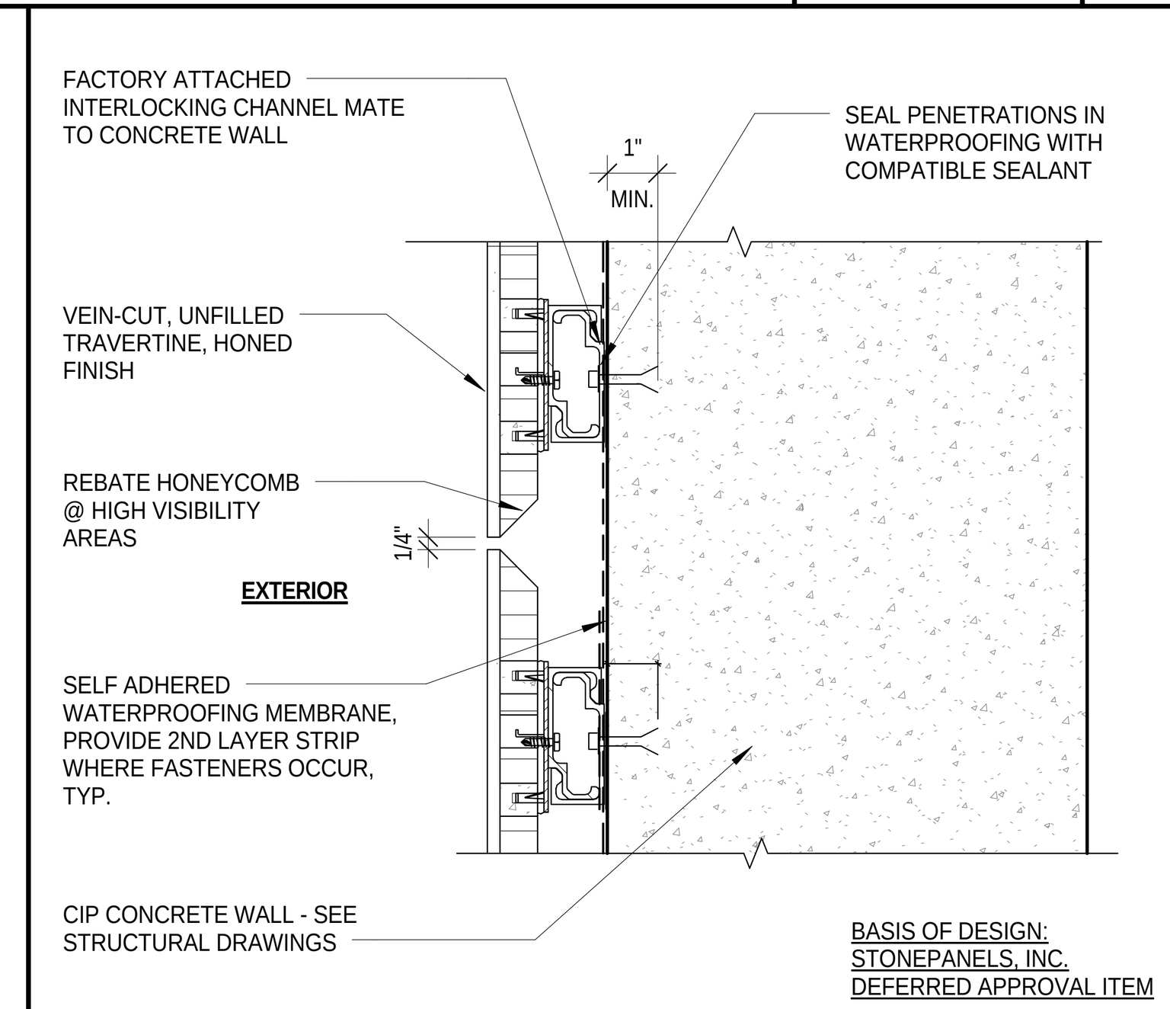
TYPICAL STONE VENEER PANEL ELEVATION | SCALE 1 1/2" = 1'-0" | 6



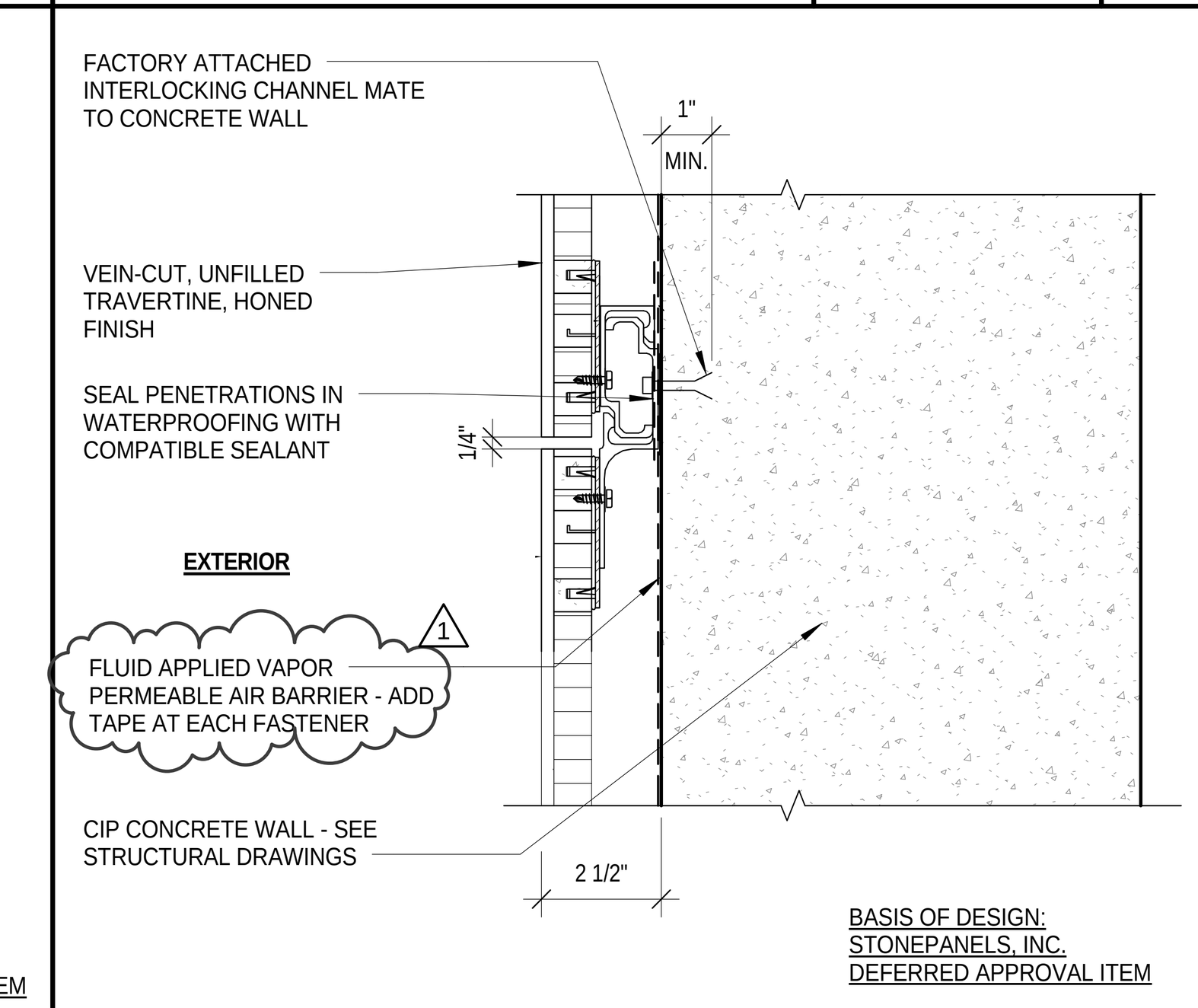
STONE VENEER PARAPET COPING | SCALE 3" = 1'-0" | 1



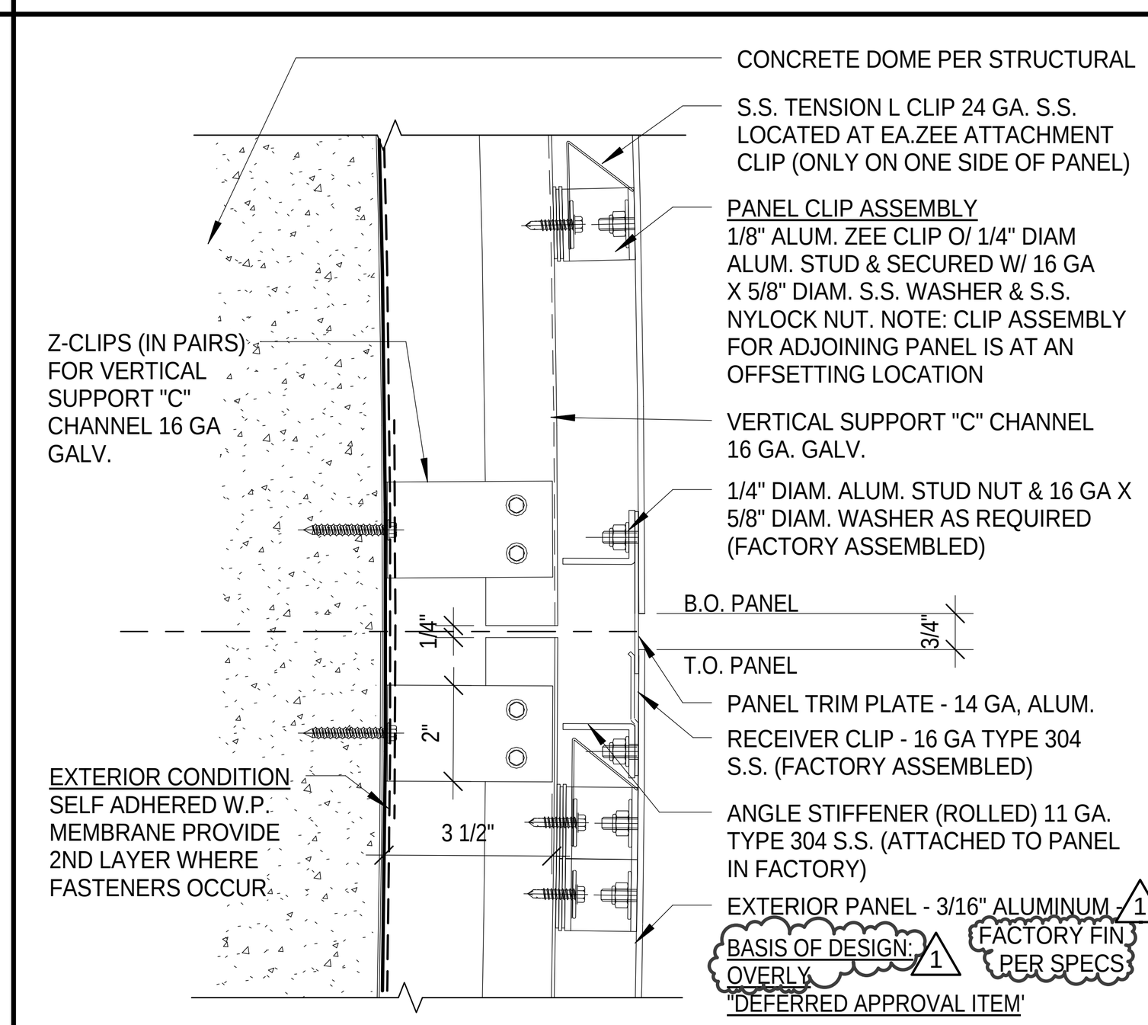
METAL PANEL / STONE VENEER PANEL TRANSITION @ SOFFIT - PLAN VIEW | SCALE 3" = 1'-0" | 12



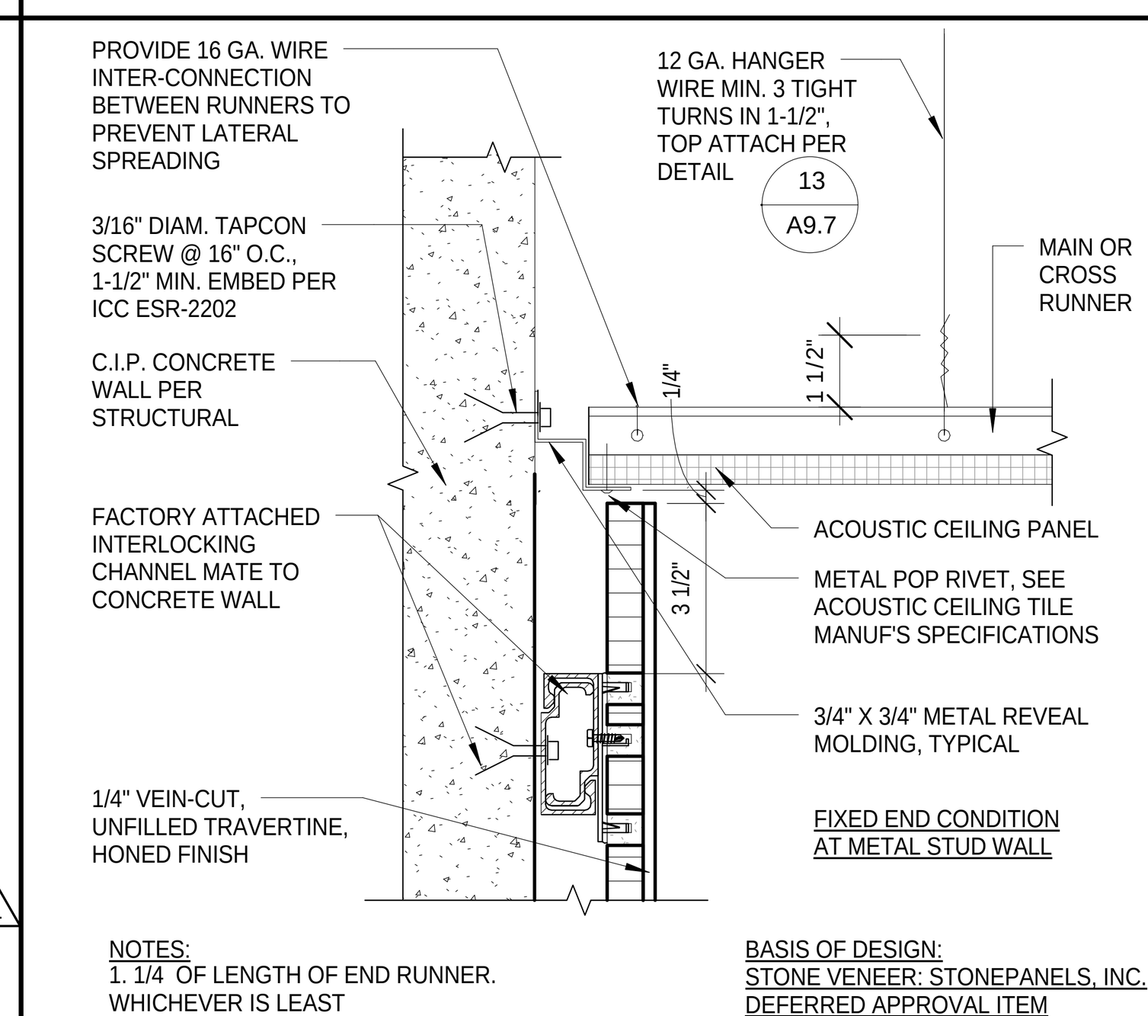
STONE VENEER HORIZONTAL JOINT (REBATE HONEYCOMB) | SCALE 3" = 1'-0" | 7



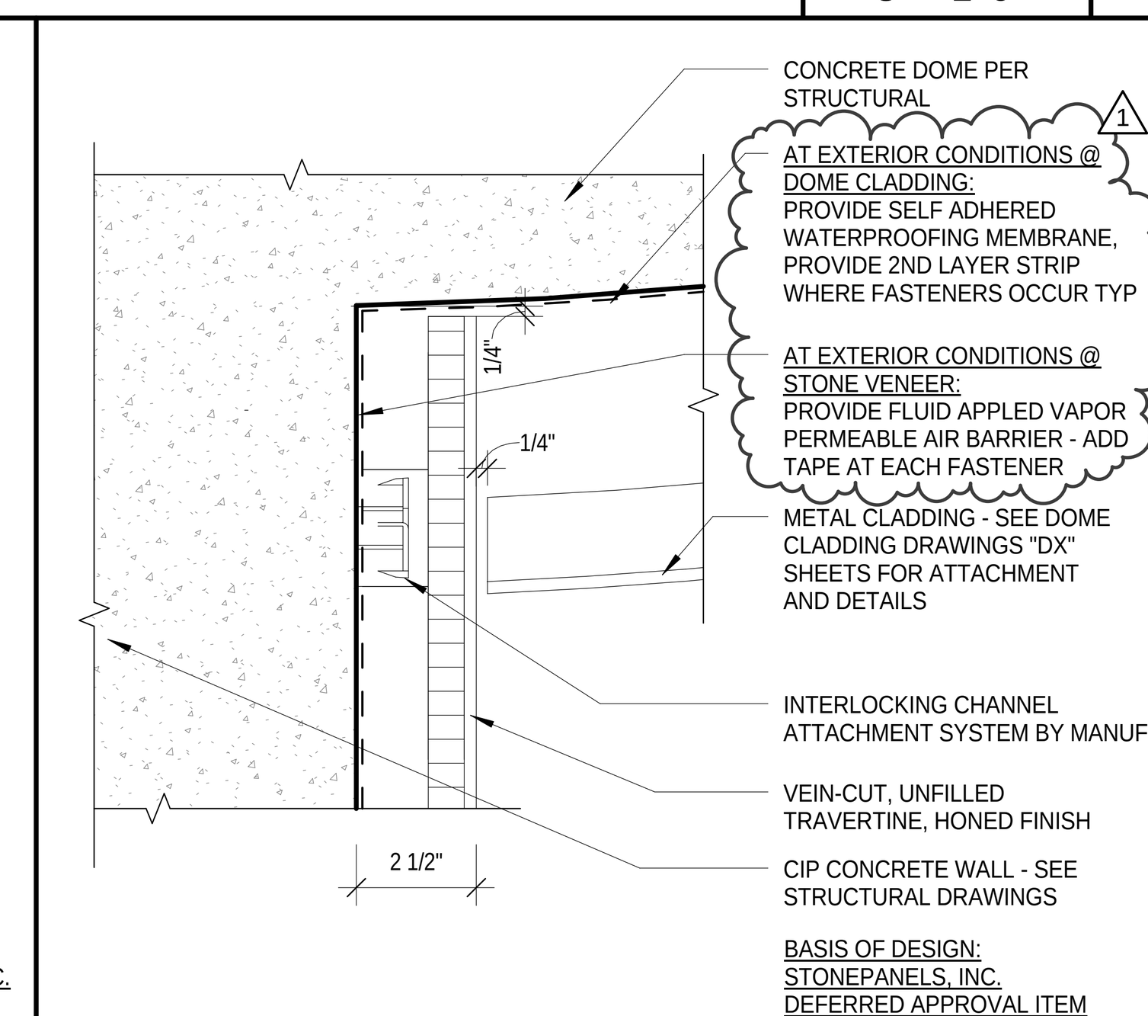
STONE VENEER HORIZONTAL JOINT | SCALE 3" = 1'-0" | 2



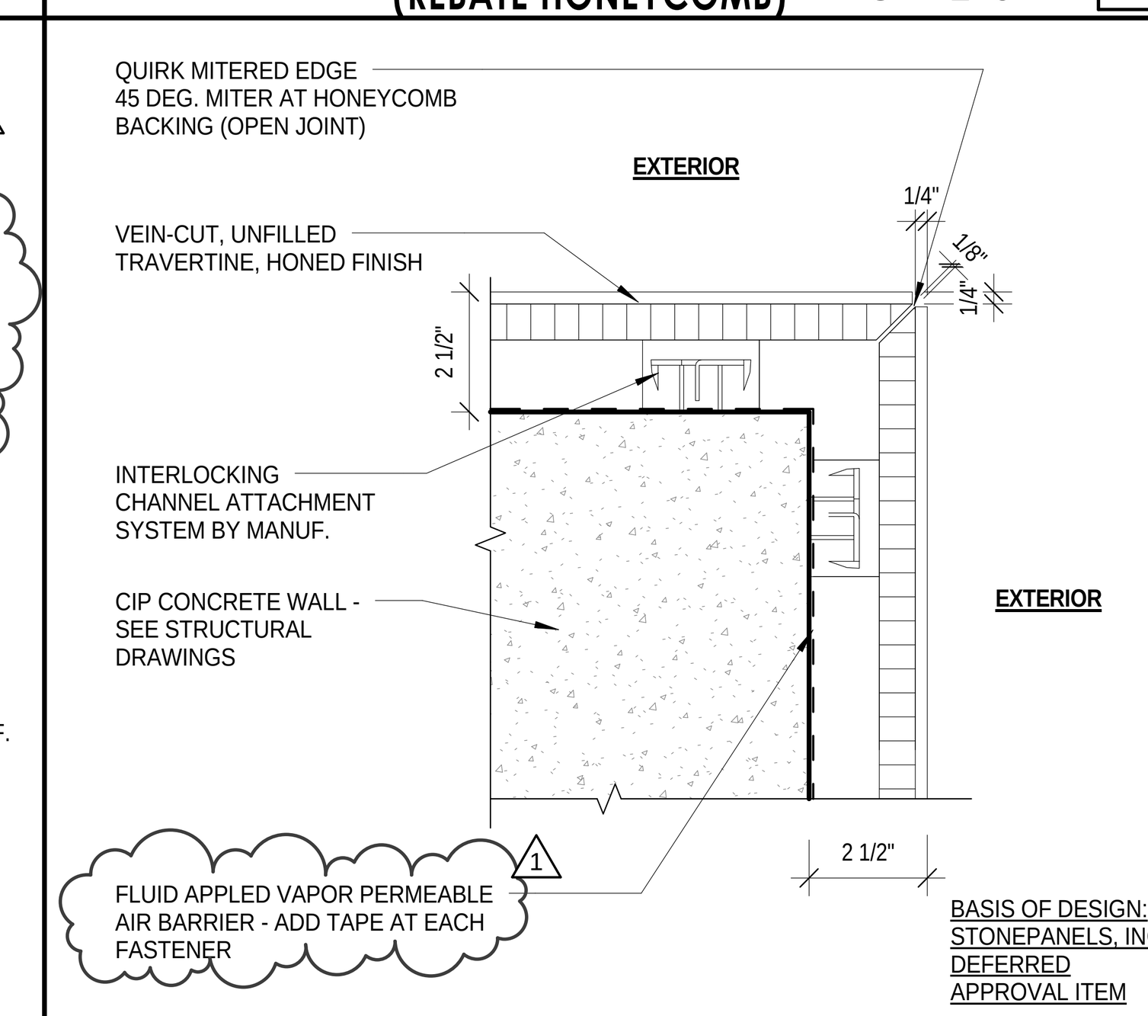
DOME CLADDING @ HORIZONTAL JOINT | SCALE 3" = 1'-0" | 23



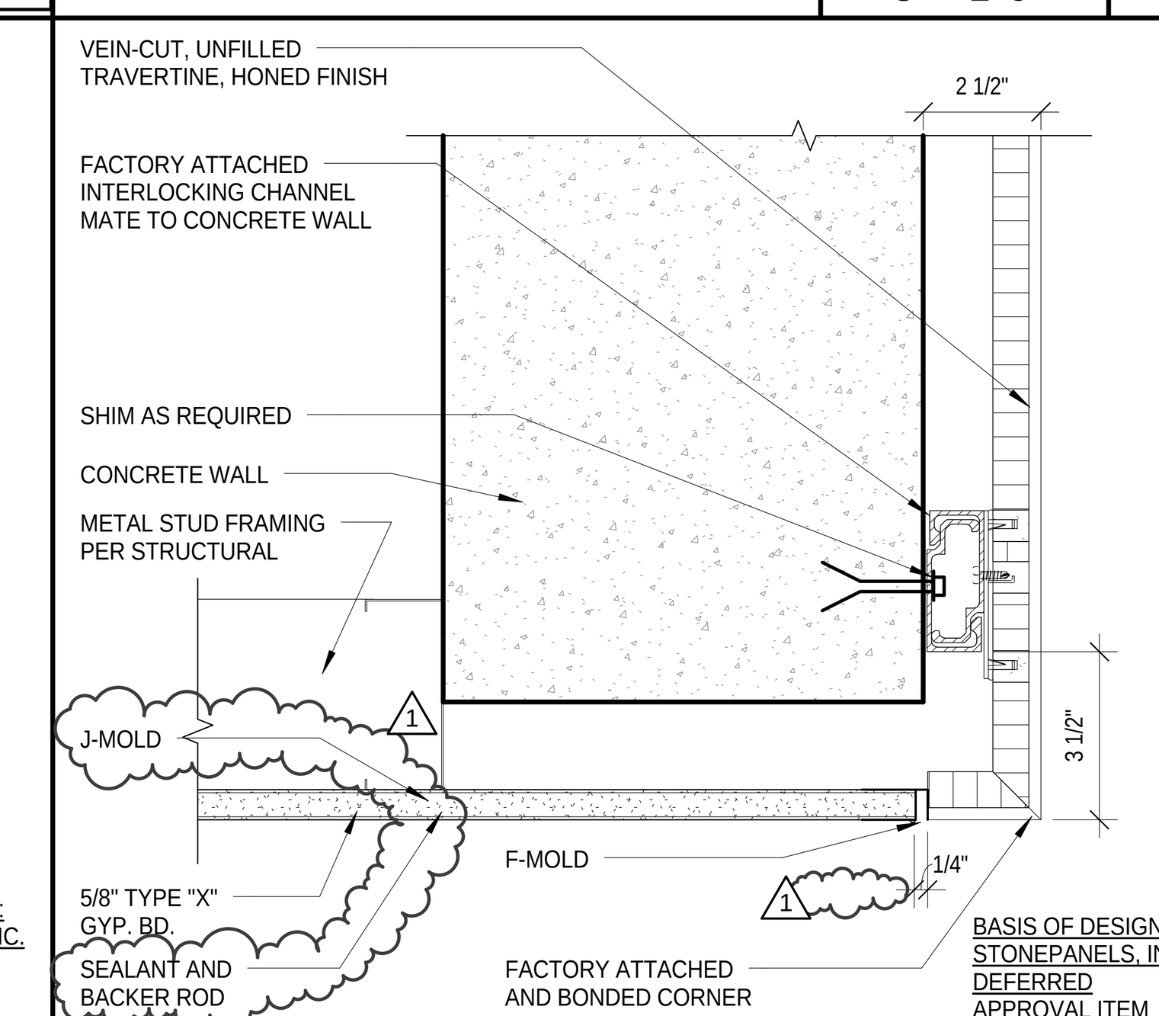
INTERIOR SUSP. ACT TILE CEILING @ STONE VENEER WALL | SCALE 3" = 1'-0" | 18



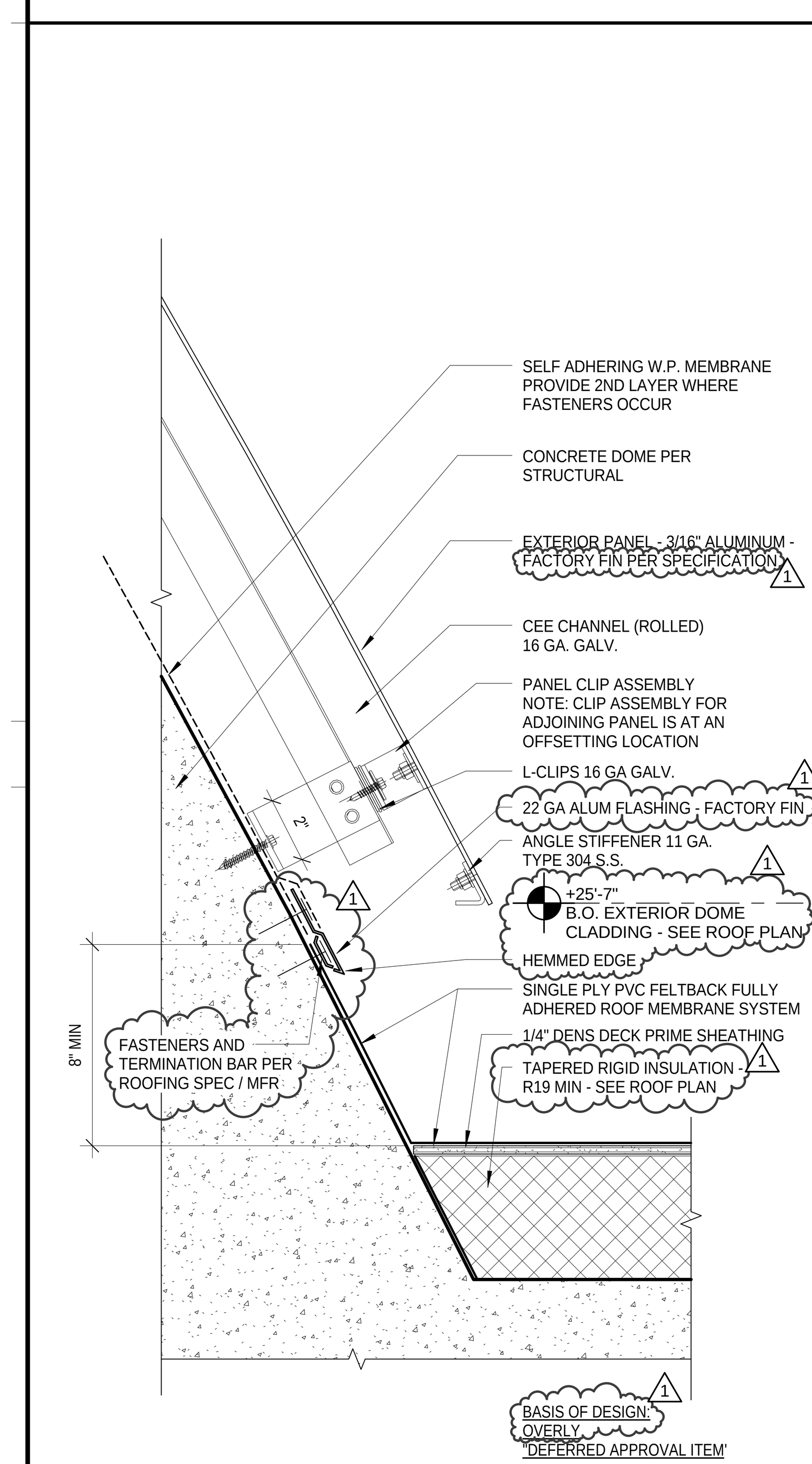
STONE VENEER @ DOME PANEL - PLAN VIEW | SCALE 3" = 1'-0" | 13



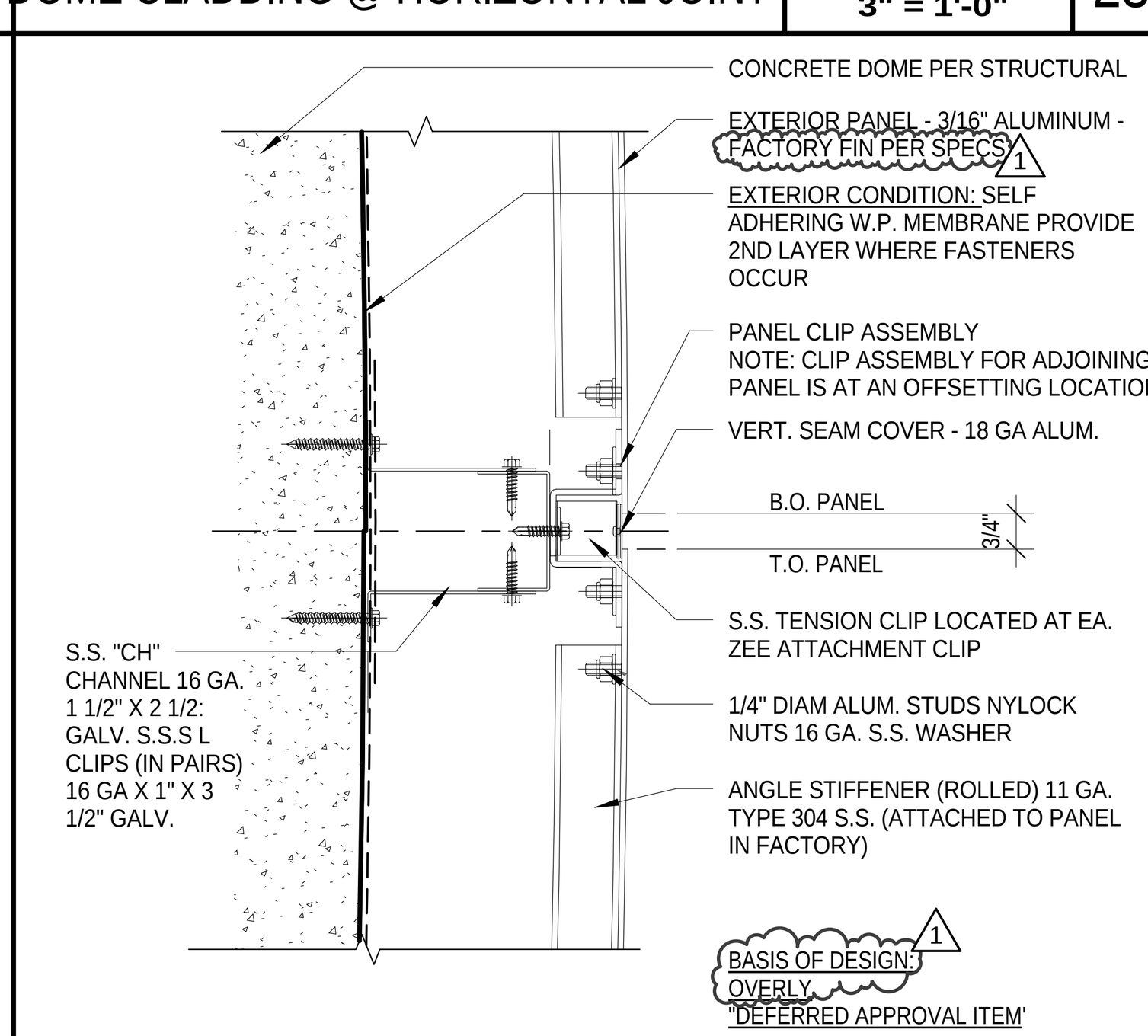
STONE VENEER QUIRK MITER OUTSIDE CORNER - PLAN VIEW | SCALE 3" = 1'-0" | 8



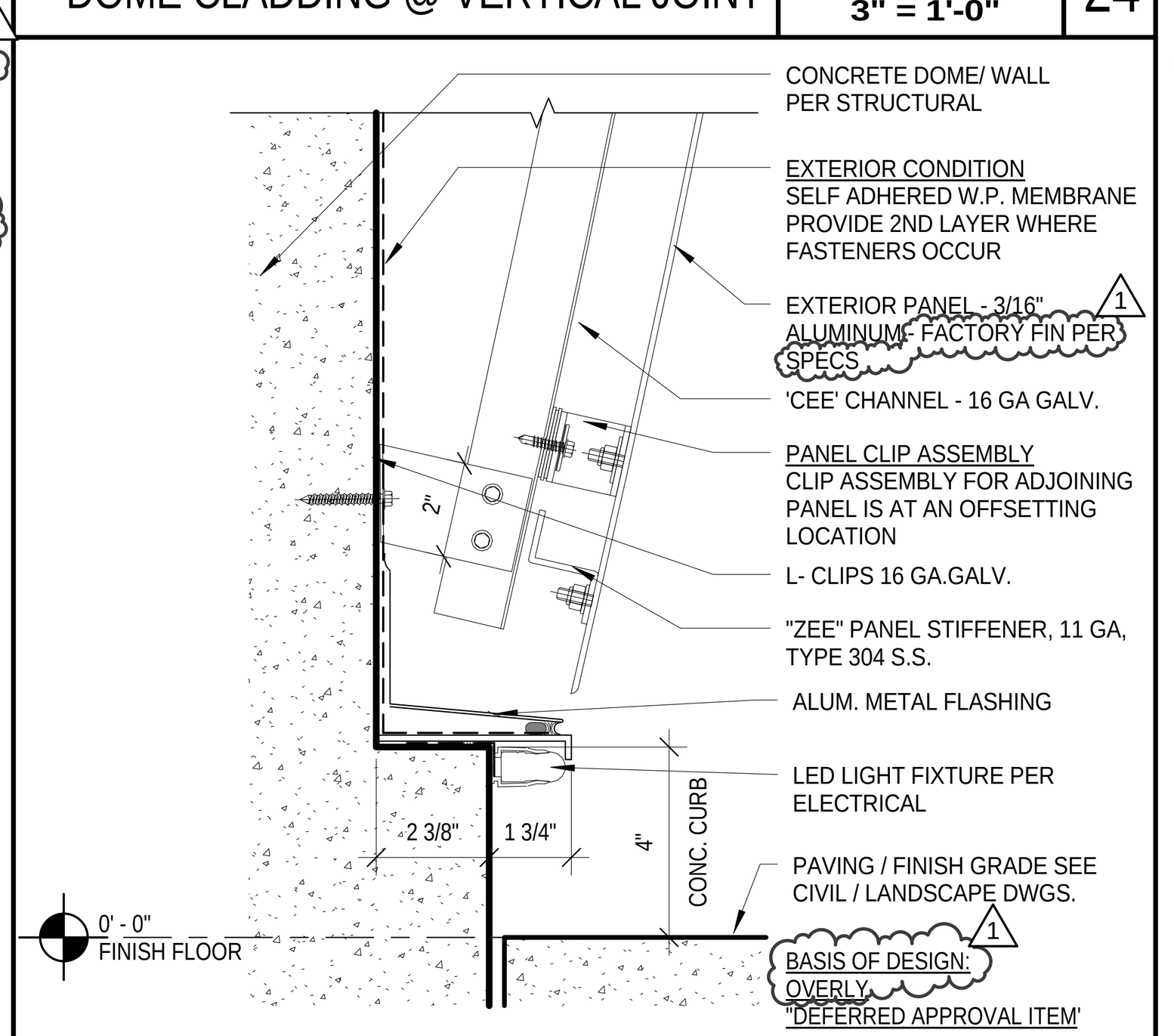
STONE VENEER SOFFIT | SCALE 3" = 1'-0" | 3



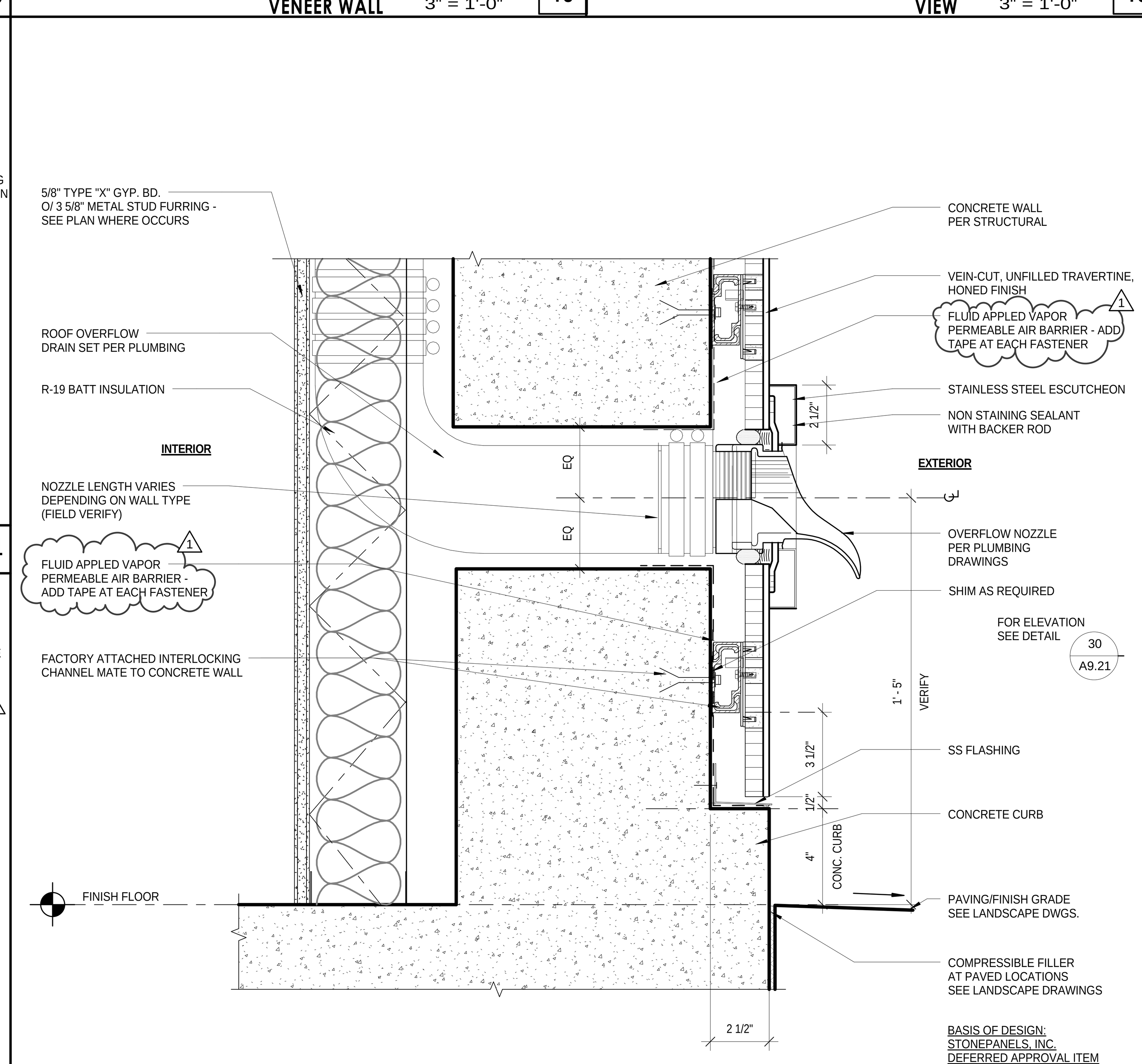
DOME CLADDING @ ROOF DECK | SCALE 3" = 1'-0" | 30



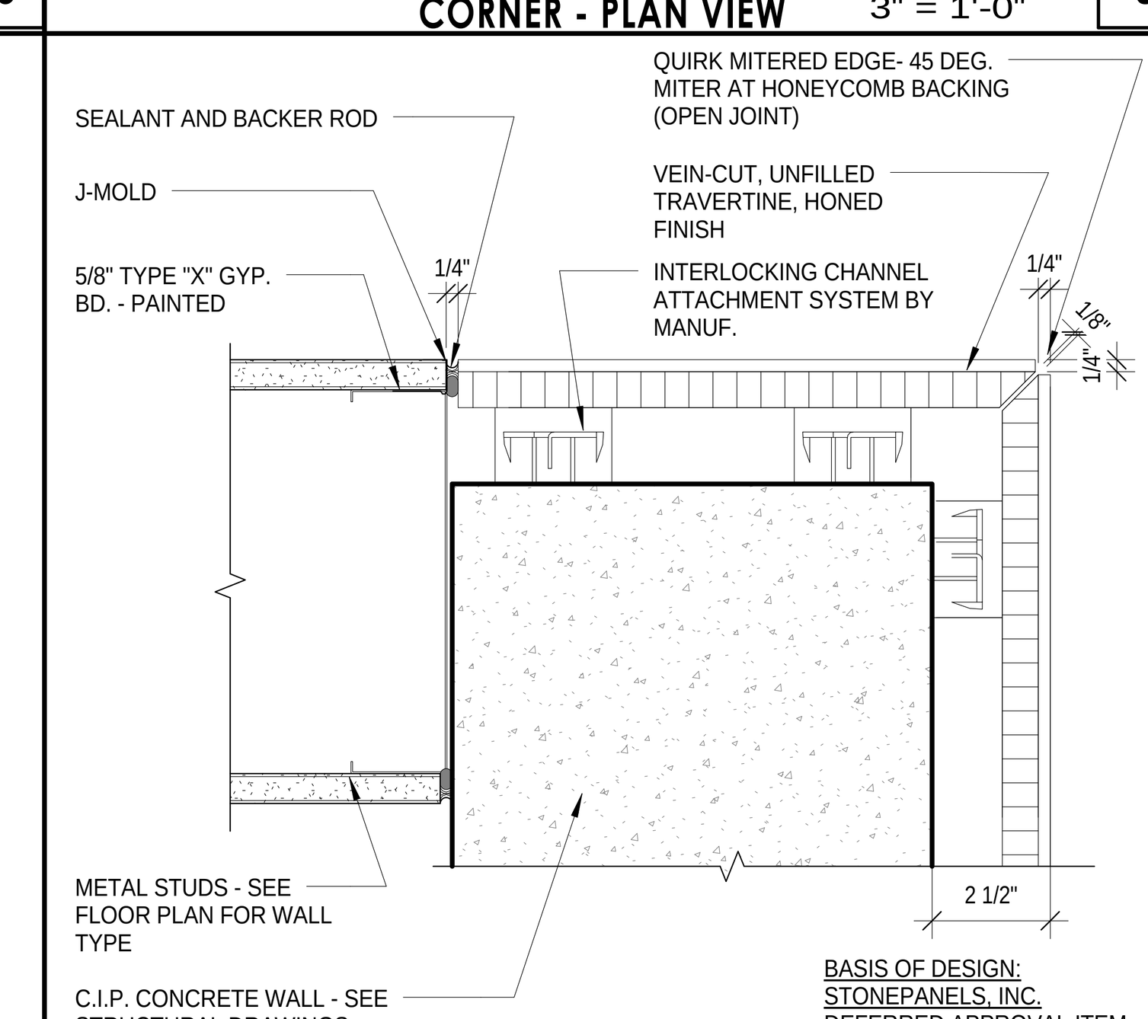
DOME CLADDING @ VERTICAL JOINT | SCALE 3" = 1'-0" | 24



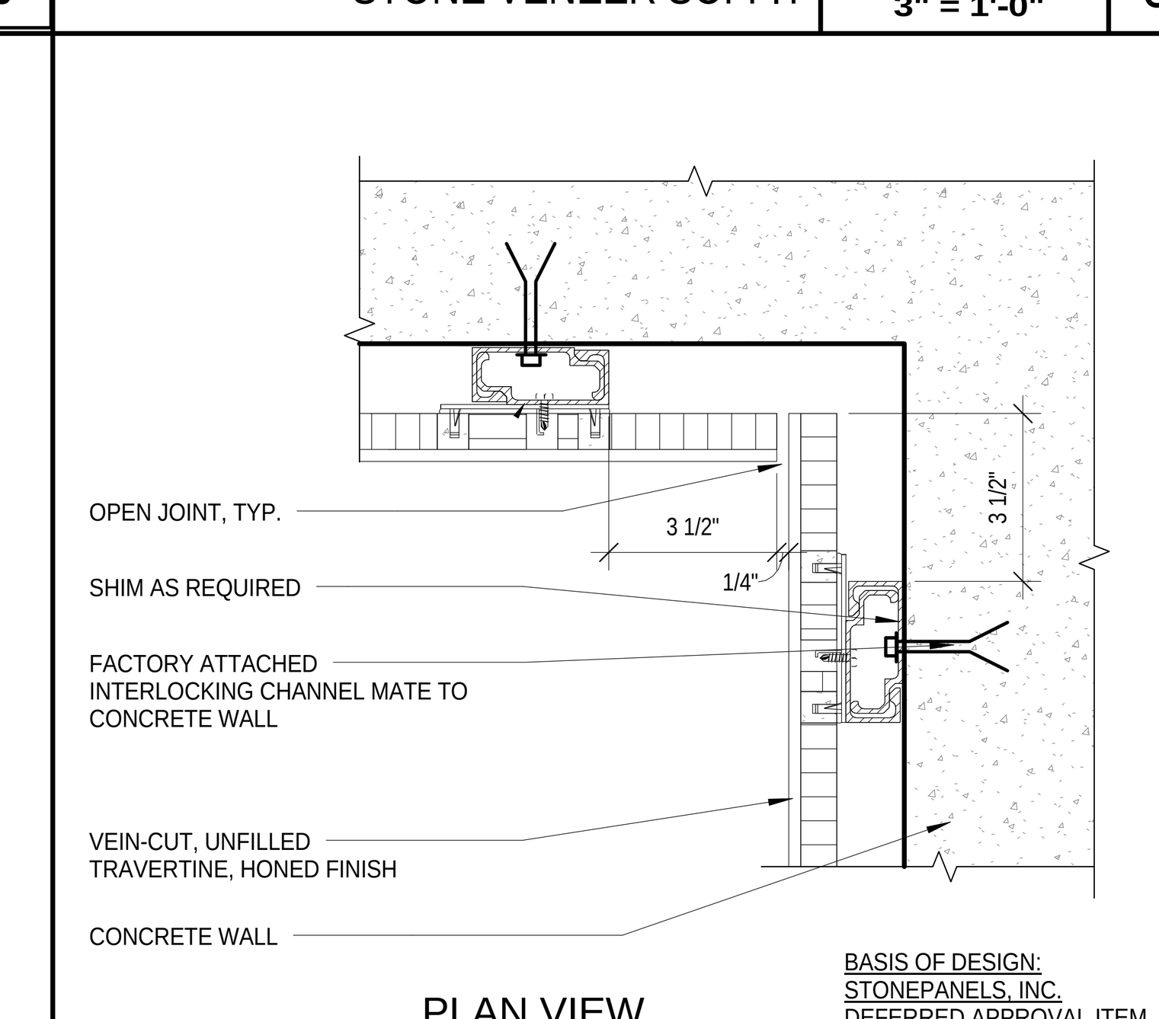
DOME CLADDING @ BASE | SCALE 3" = 1'-0" | 25



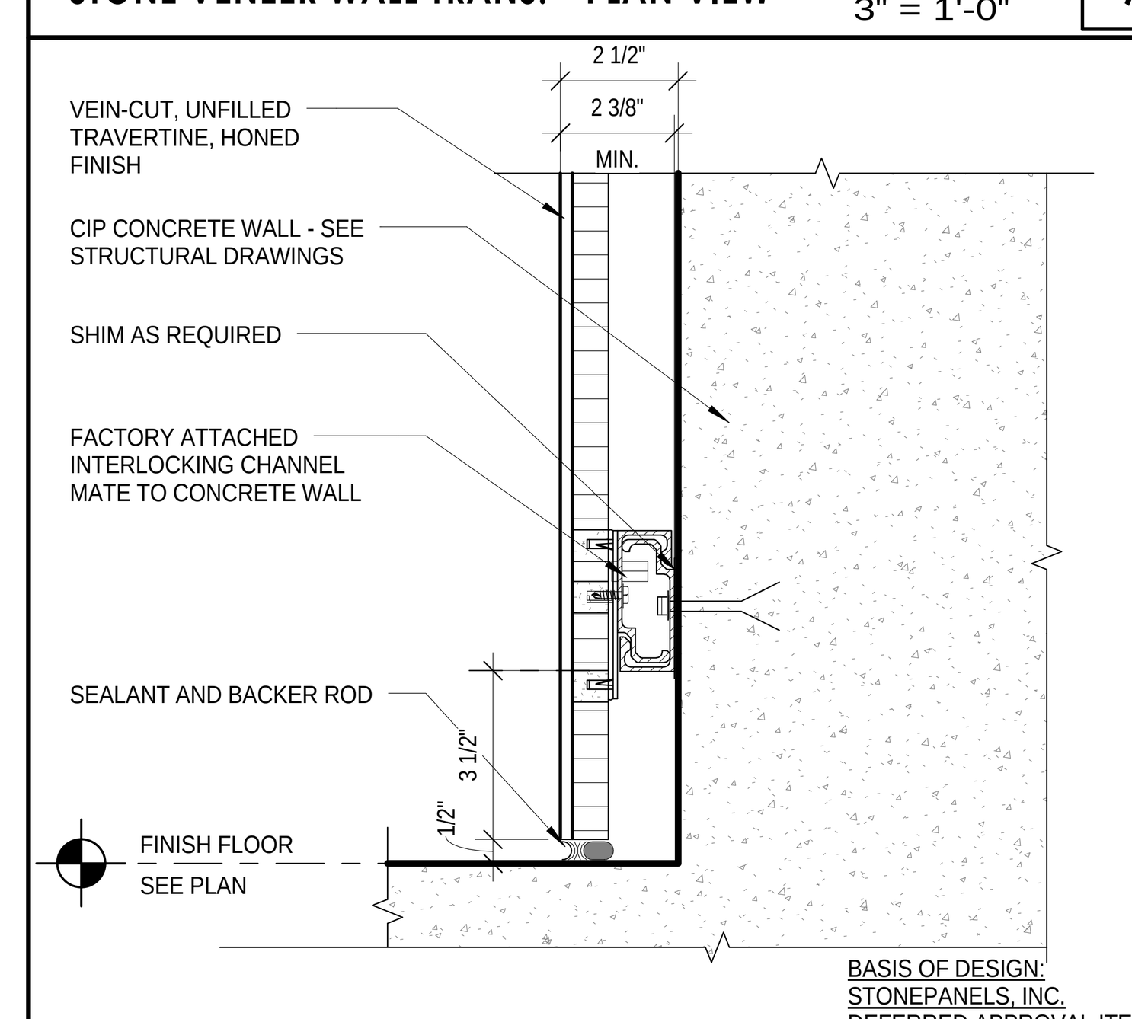
OVERFLOW DRAIN OUTLET - SECTION @ STONE VENEER | SCALE 3" = 1'-0" | 15



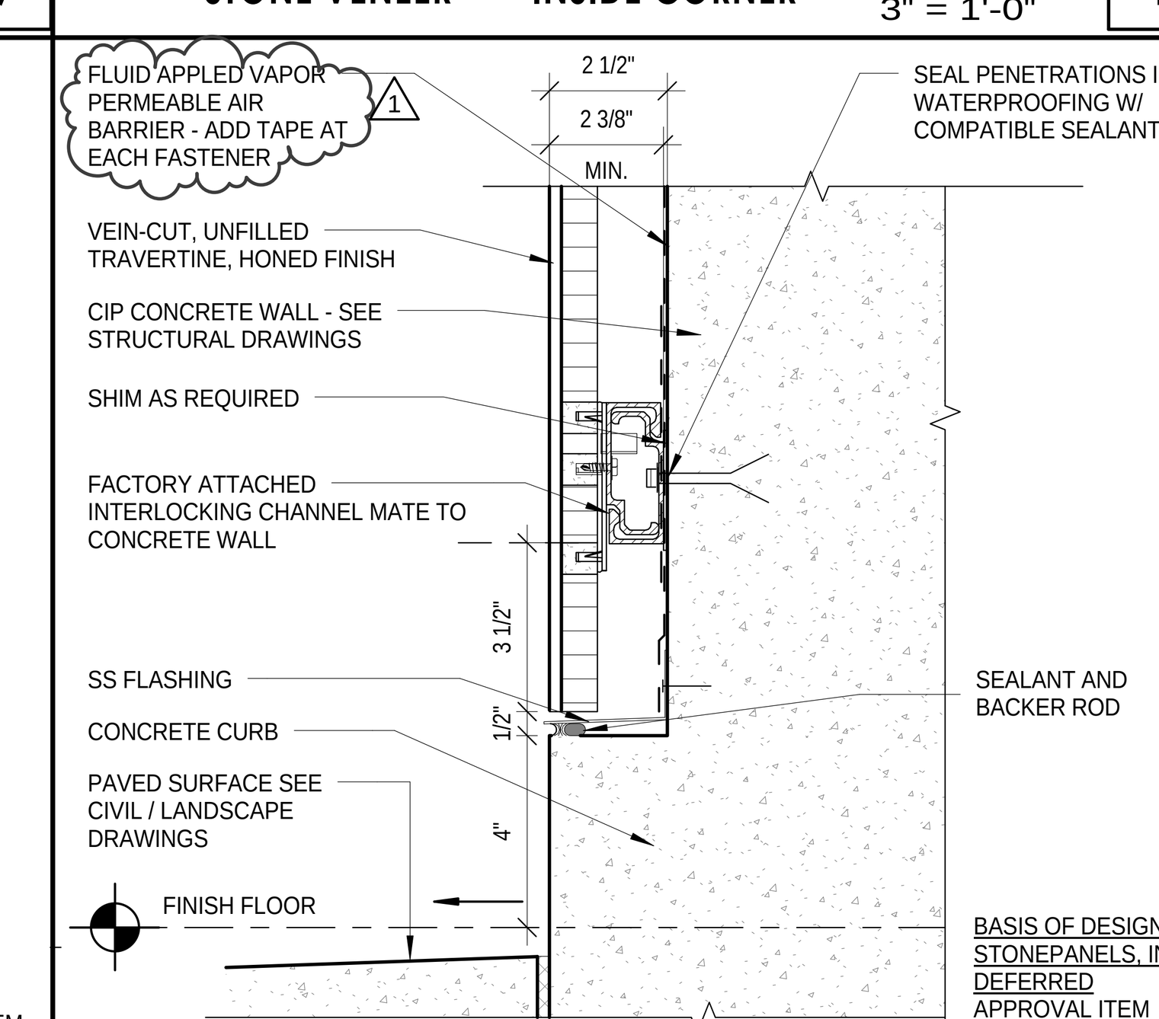
STONE VENEER WALL TRANS. - PLAN VIEW | SCALE 3" = 1'-0" | 9



STONE VENEER - INSIDE CORNER | SCALE 3" = 1'-0" | 4



STONE VENEER BASE @ INTERIOR WALL | SCALE 3" = 1'-0" | 10



STONE VENEER BASE @ EXTERIOR WALL | SCALE 3" = 1'-0" | 5

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CONSULTANTS

SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _______ FLS _______ SS _______
DATE _______

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges

COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465

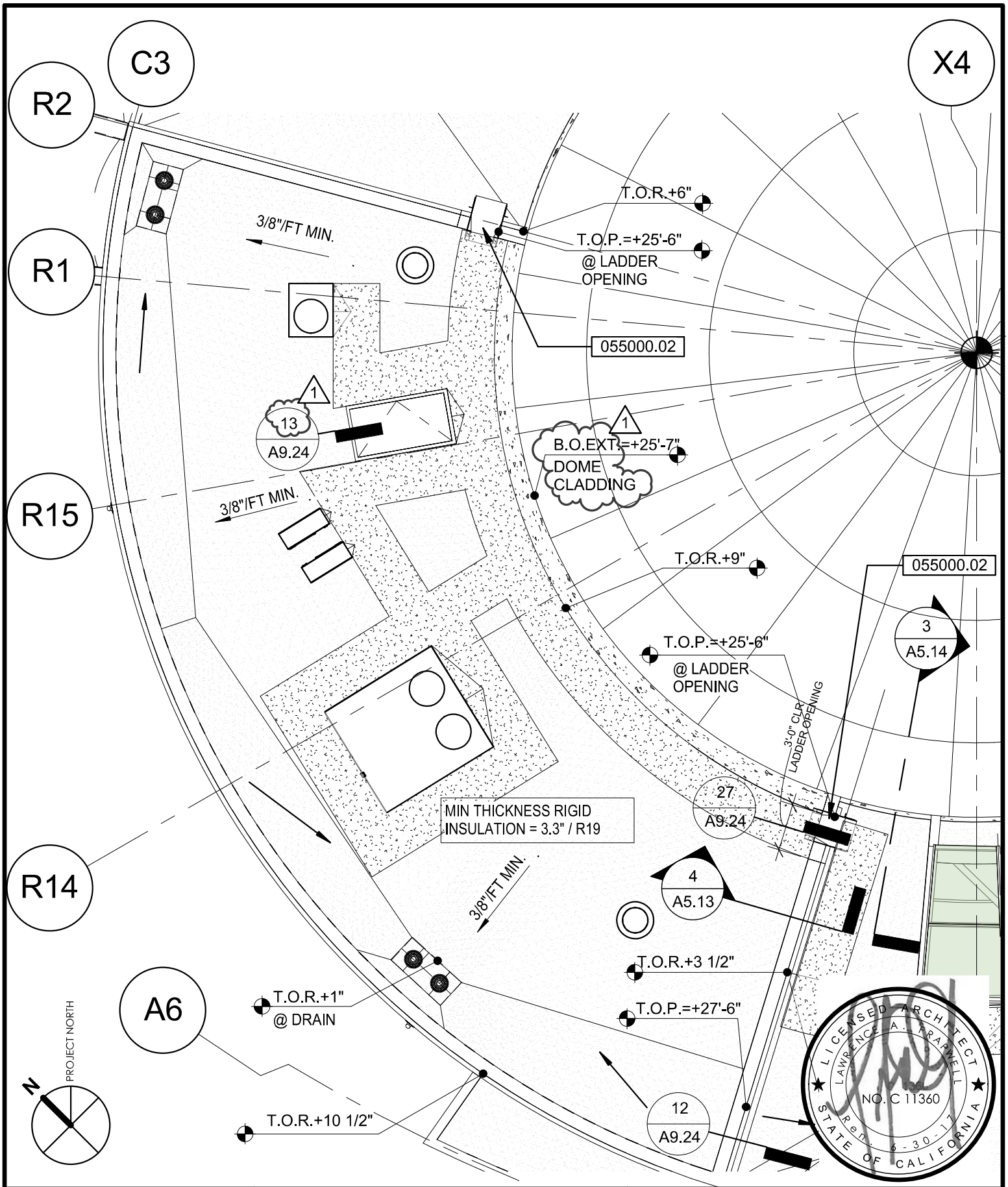
DATE 12/15/2014

DRAWN BY Author

CHECKED BY Checker

SHEET TITLE
STONE VENEER RAINSCREEN AND DOME CLADDING DTLS

SHEET NUMBER
A9.22



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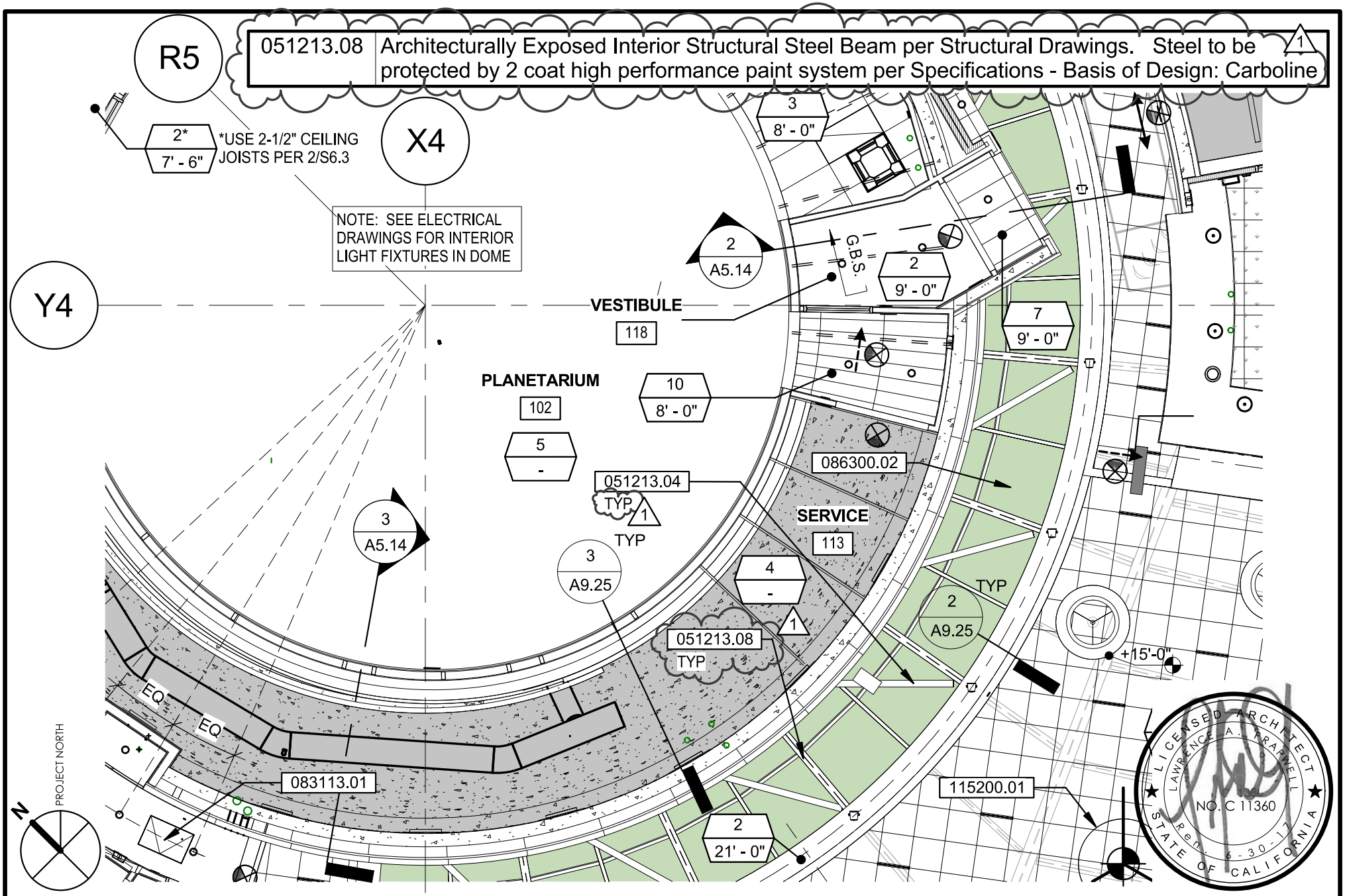
PROJECT TITLE:
COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
ROOF PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKA-1
SHT. REF. NO.: A2.4	DATE: 04/20/16	



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PROJECT TITLE:
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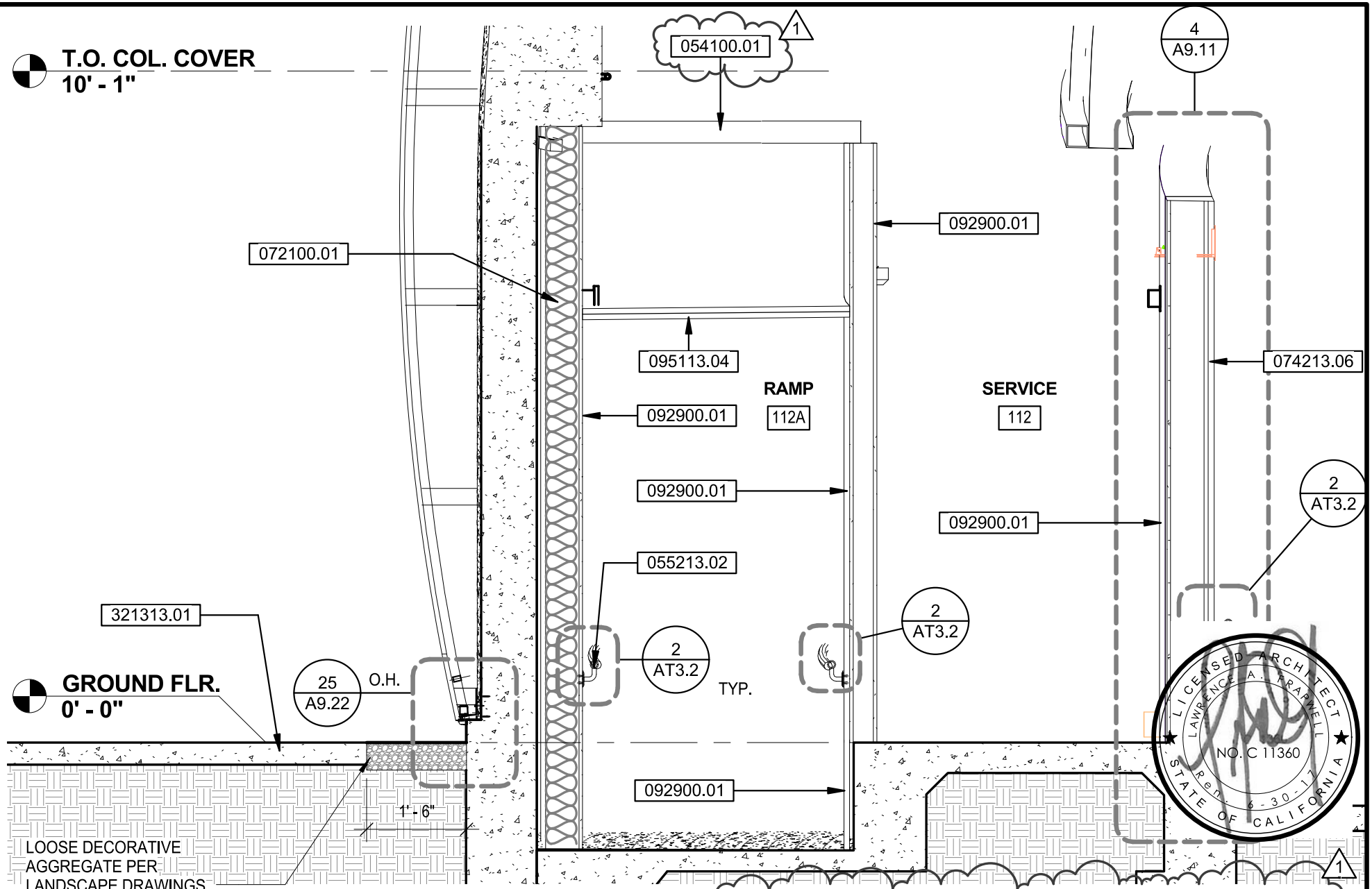
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
REFLECTED CEILING PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKA-2
SHT. REF. NO.: A3.1	DATE: 04/20/16	

C:\Users\MStuart\Documents\OCC Planetarium_Arch_RVT2014_mstuart.rvt 4/12/2016 1:58:43 PM



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COMMUNITY PLANETARIUM
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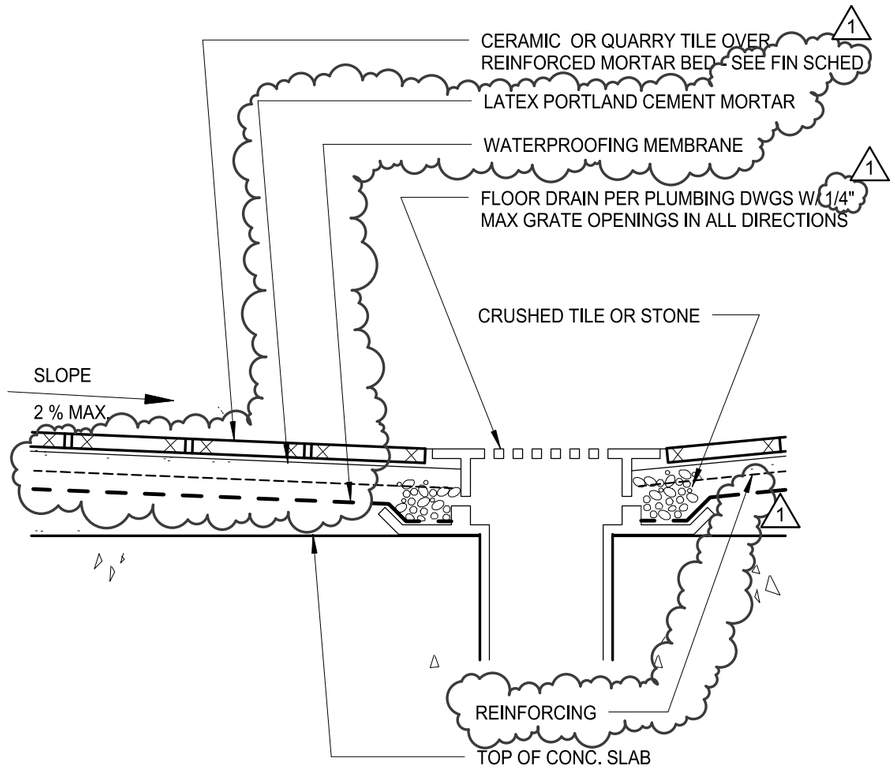
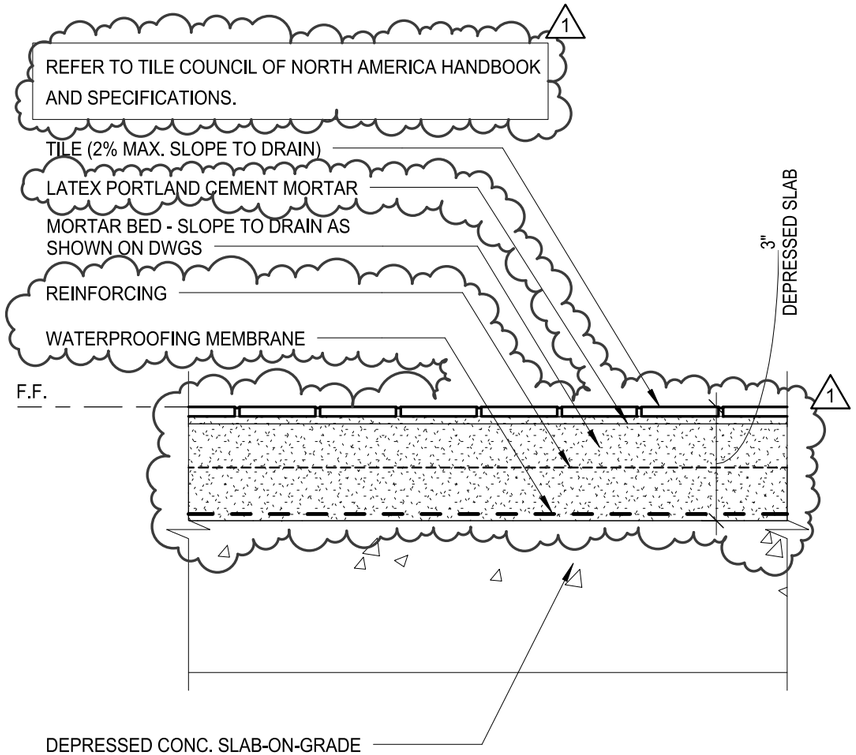
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
WALL SECTION

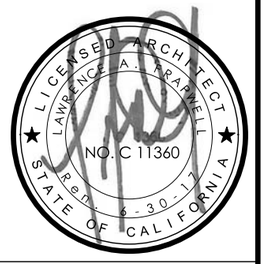
ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/2" = 1'-0"	SKA-3
SHT. REF. NO.: A5.15	DATE: 04/20/16	



FLOOR DRAIN | SCALE 3" = 1'-0" | 20



TILE FLOORING | SCALE 3" = 1'-0" | 15



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PROJECT TITLE:
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COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: TILE FLOORING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1	3" = 1'-0"	SKA-4
SHT. REF. NO.: A9.9	DATE: 04/20/16	

DOOR SCHEDULE-

DOOR NUM.	DOOR							DOOR MATERIAL	DOOR	FRAME		RATED ASSEMBLY (IN MINUTES)	DETAILS			HDWR SET	PANIC HDWR	REMARKS
	ROOM	PAIR	WIDTH	HEIGHT	THK.	TYPE	CORE		FACE / FIN	MATERIAL	FINISH		HEAD	JAMB	THRESHOLD			
101A	EXHIBIT	X	6' - 0"	7' - 5"	1 3/4"	C	AL	AL/GL	FF3	AL	FF3	-	2/A9.2	5/A9.3	25/A9.1	14	X	2, 3, 4, 12
101B	EXHIBIT	X	6' - 0"	7' - 5"	1 3/4"	C	AL	AL/GL	FF3	AL	FF3	-	2/A9.2	5/A9.3	25/A9.1	14	X	2, 3, 4, 12
101C	EXHIBIT	X	6' - 0"	7' - 5"	1 3/4"	C	AL	AL/GL	FF3	AL	FF3	-	2/A9.2	5/A9.3	25/A9.1	14	X	2, 3. 4, 12

1

LICENSED ARCHITECT
LAWRENCE A. FRAMPELL
NO. C 11360
Ren. 6-30-17
STATE OF CALIFORNIA

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COAST COMMUNITY COLLEGE DISTRICT
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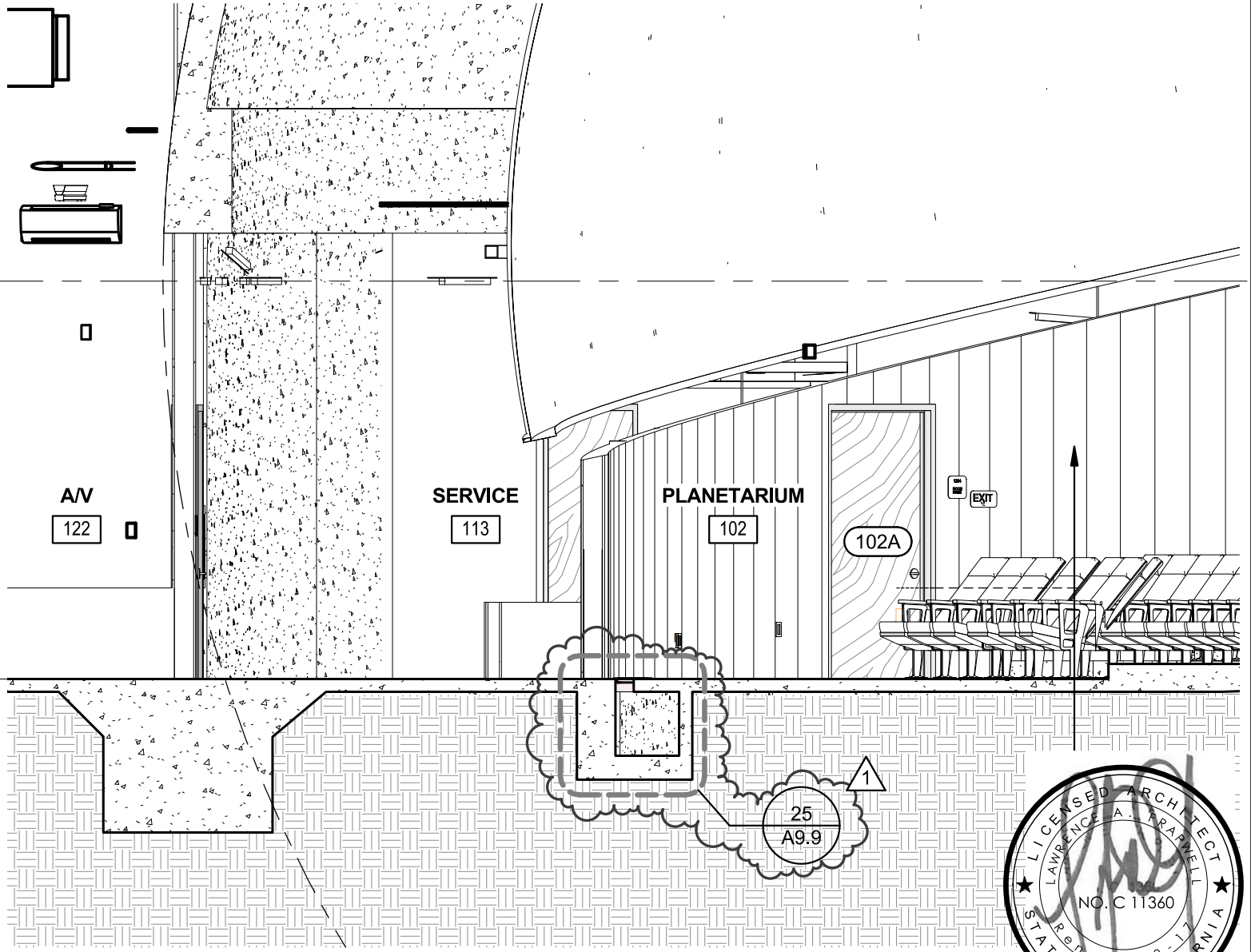
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DOOR SCHEDULE

ISSUED FOR: ADDENDUM 1A
SCALE:
SK NO.: SKA-5
SHT. REF. NO.: A8.1
DATE: 04/20/16



LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
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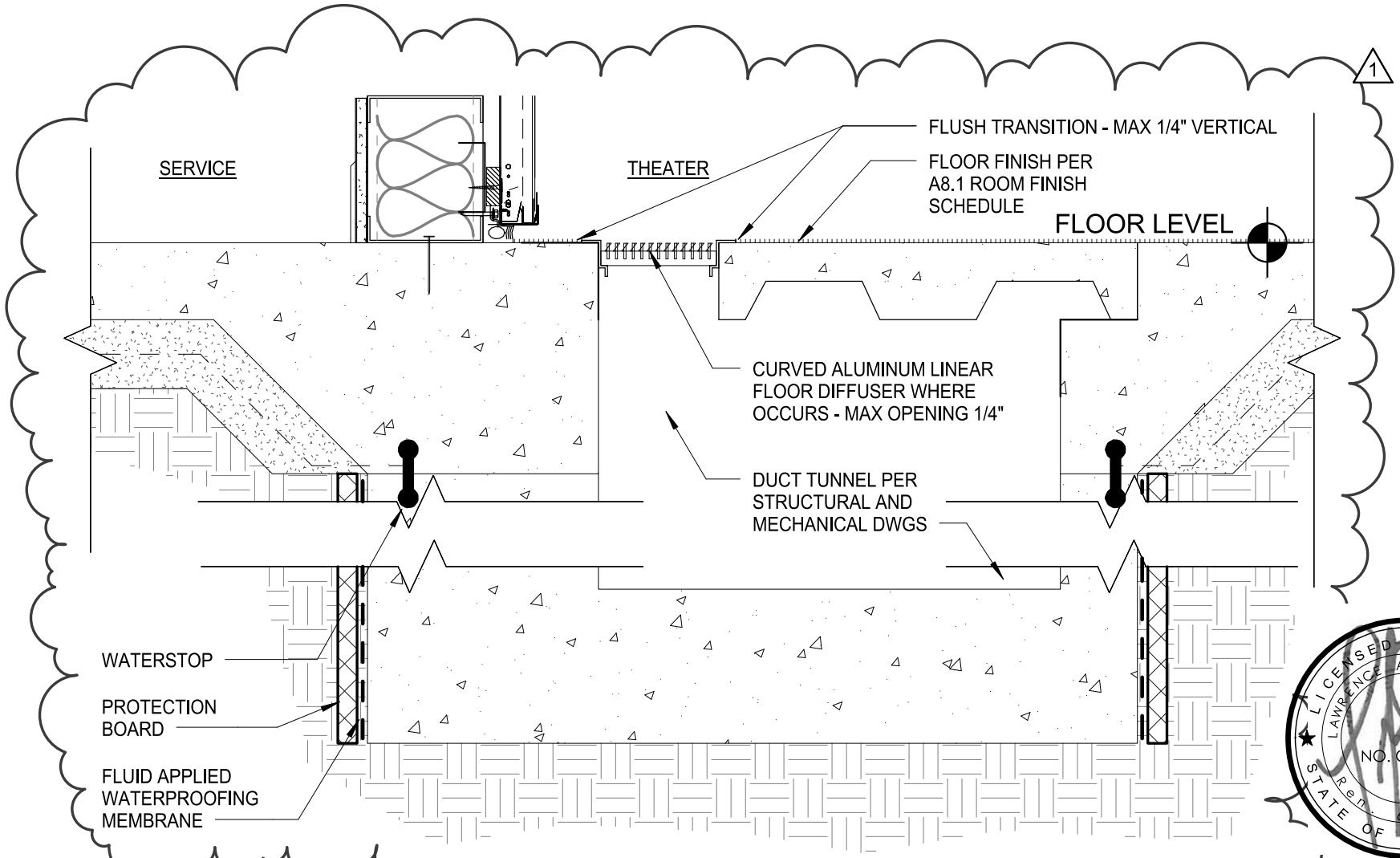
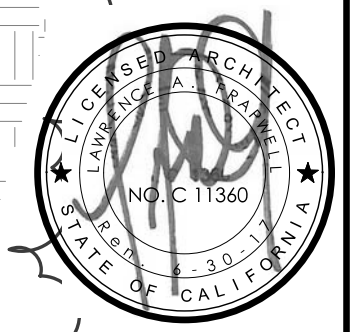
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
FLOOR DIFFUSER DETAIL

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/4" = 1'-0"	SKA-6.1
SHT. REF. NO.: A5.3	DATE: 04/20/16	





FLOOR DIFFUSER AT THEATER- | SCALE 1 1/2" = 1'-0" | 25

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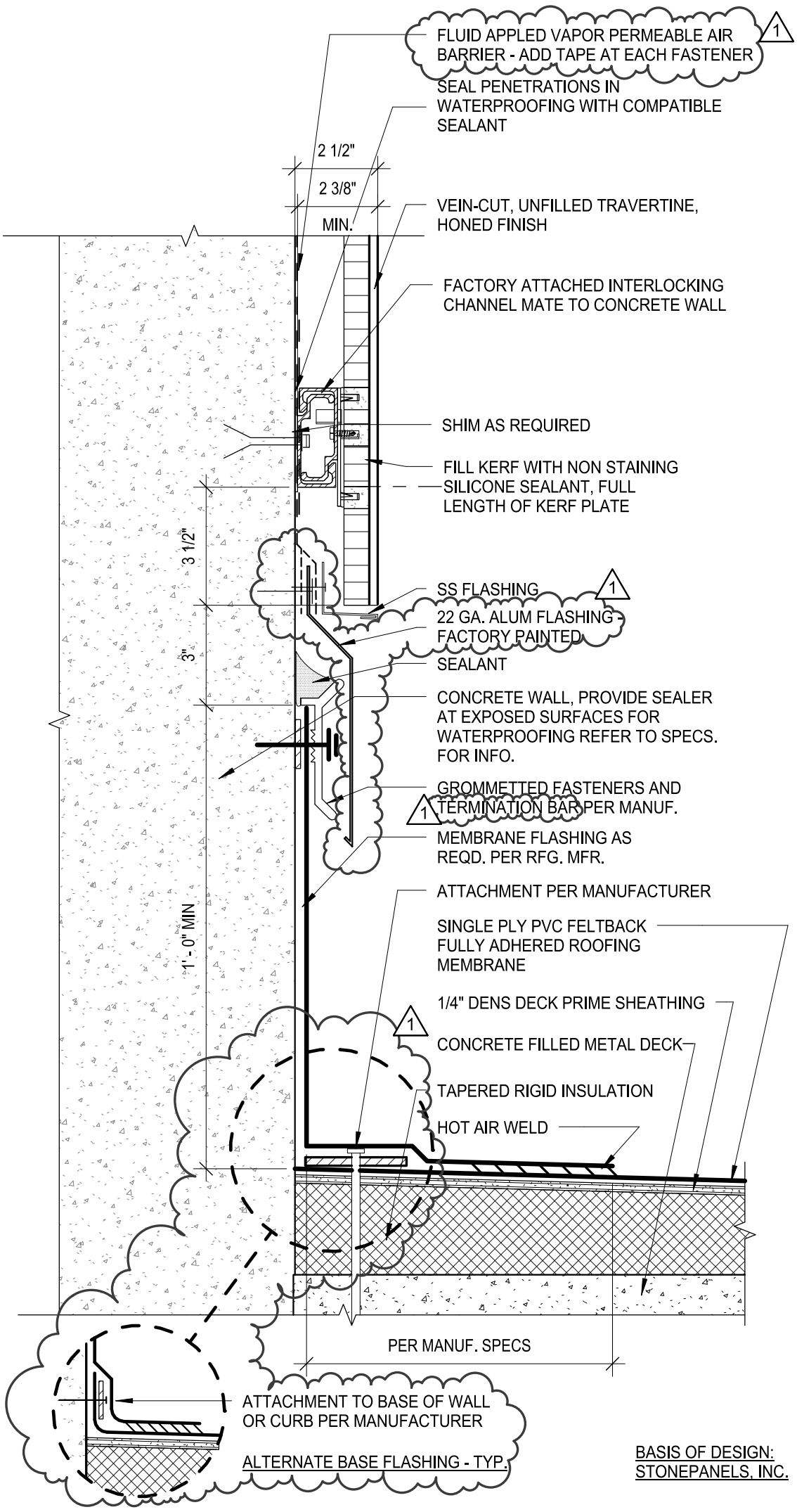
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
FLOOR DIFFUSER DETAIL

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1 1/2" = 1'-0"	SKA-6.2
SHT. REF. NO.: A9.9	DATE: 04/20/16	



BASIS OF DESIGN:
STONEPANELS, INC.

PARAPET ROOF BASE @ STONE VENEER- | SCALE 3" = 1'-0" | 12

LICENSED ARCHITECT
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PROJECT TITLE:
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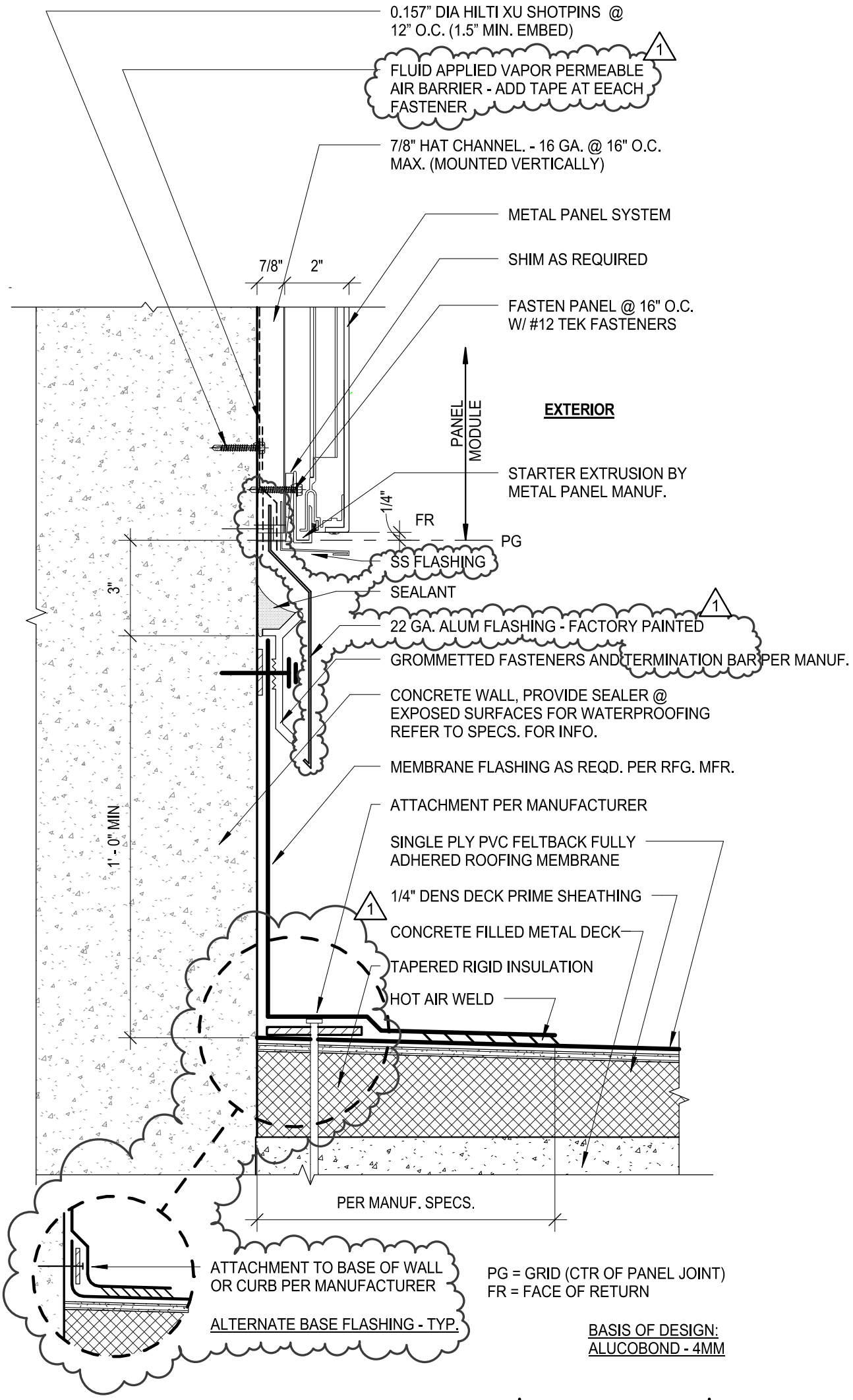
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 12 / A9.24
ISSUED FOR: ADDENDUM 1A
SCALE: 3" = 1'-0"
SK NO. SKA-7
SHT. REF. NO.: A9.24
DATE: 04/20/16



PG = GRID (CTR OF PANEL JOINT)
FR = FACE OF RETURN

BASIS OF DESIGN:
ALUCOBOND - 4MM

PARAPET ROOF BASE @ METAL PANEL-

SCALE
3" = 1'-0"

17

LICENSED ARCHITECT
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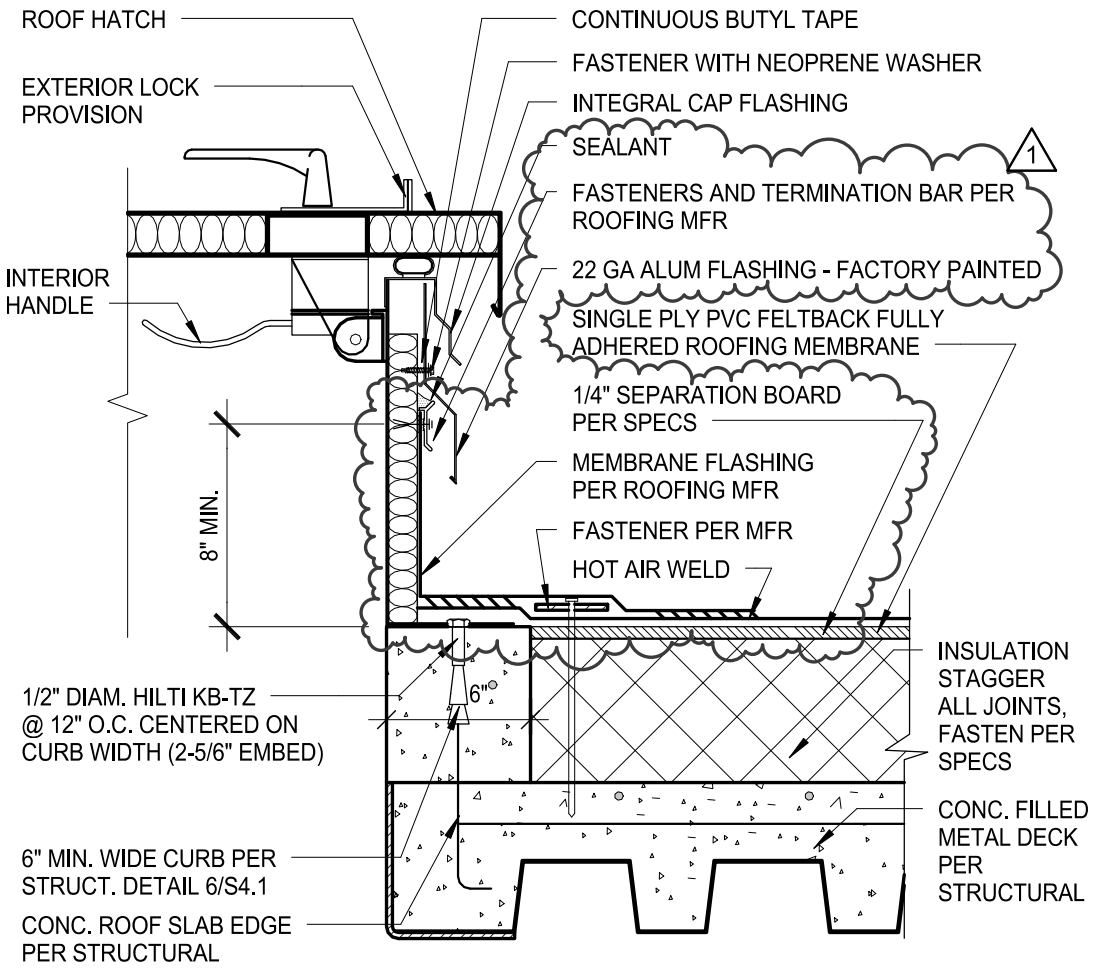
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 17 / A9.24

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-8
SHT. REF. NO.: A9.24	DATE: 04/20/16	



ROOF HATCH | SCALE 1 1/2" = 1'-0" | 13

LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
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Ren. 6-30-17
STATE OF CALIFORNIA

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CONSULTANT:

PROJECT TITLE:
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ORANGE COAST COLLEGE
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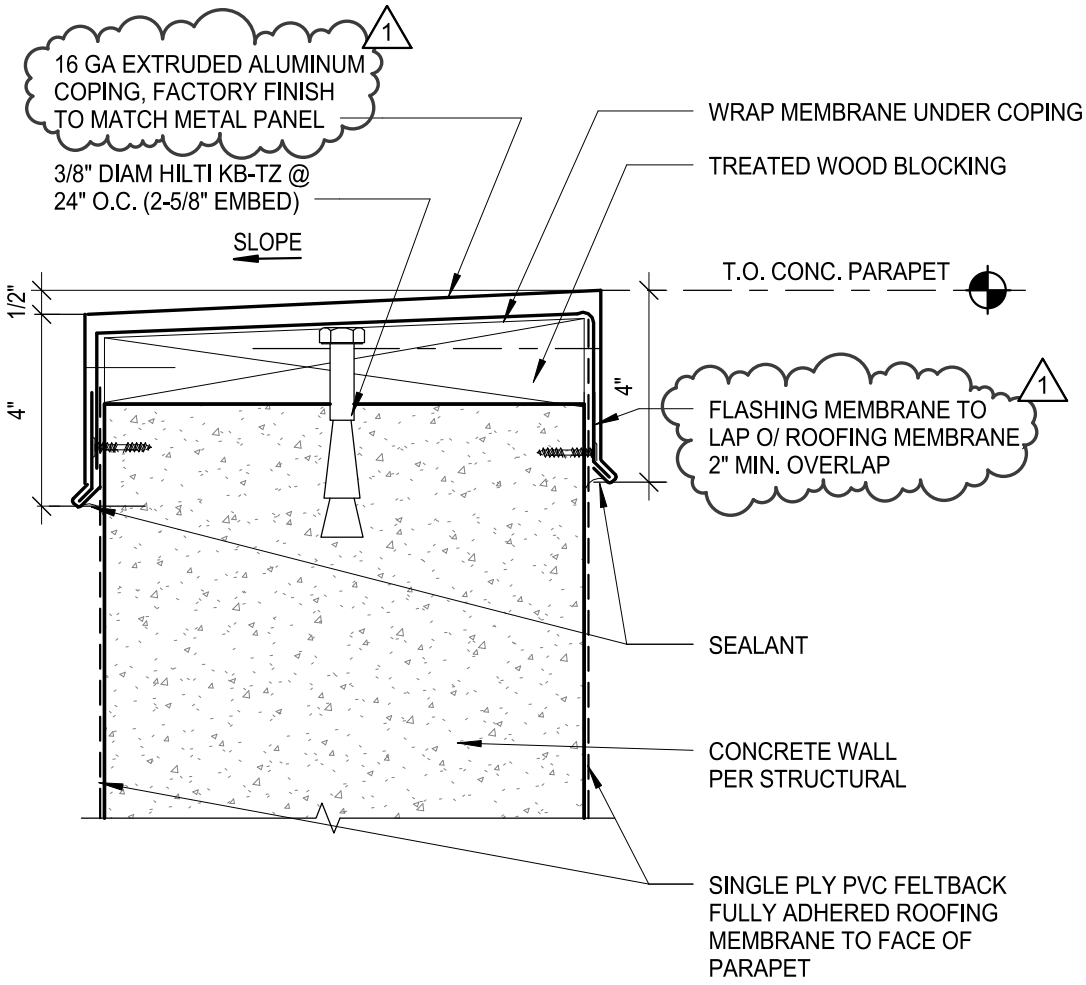
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 13 / A9.24

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1 1/2" = 1'-0"	SKA-9
SHT. REF. NO.: A9.24	DATE: 04/20/2016	



CONCRETE PARAPET- | SCALE 3" = 1'-0" | 3

LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
NO. C 11360
Ren 6-30-17
STATE OF CALIFORNIA

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p. 949.675.6442 f. 949.675.4543
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CONSULTANT:

PROJECT TITLE:
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ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
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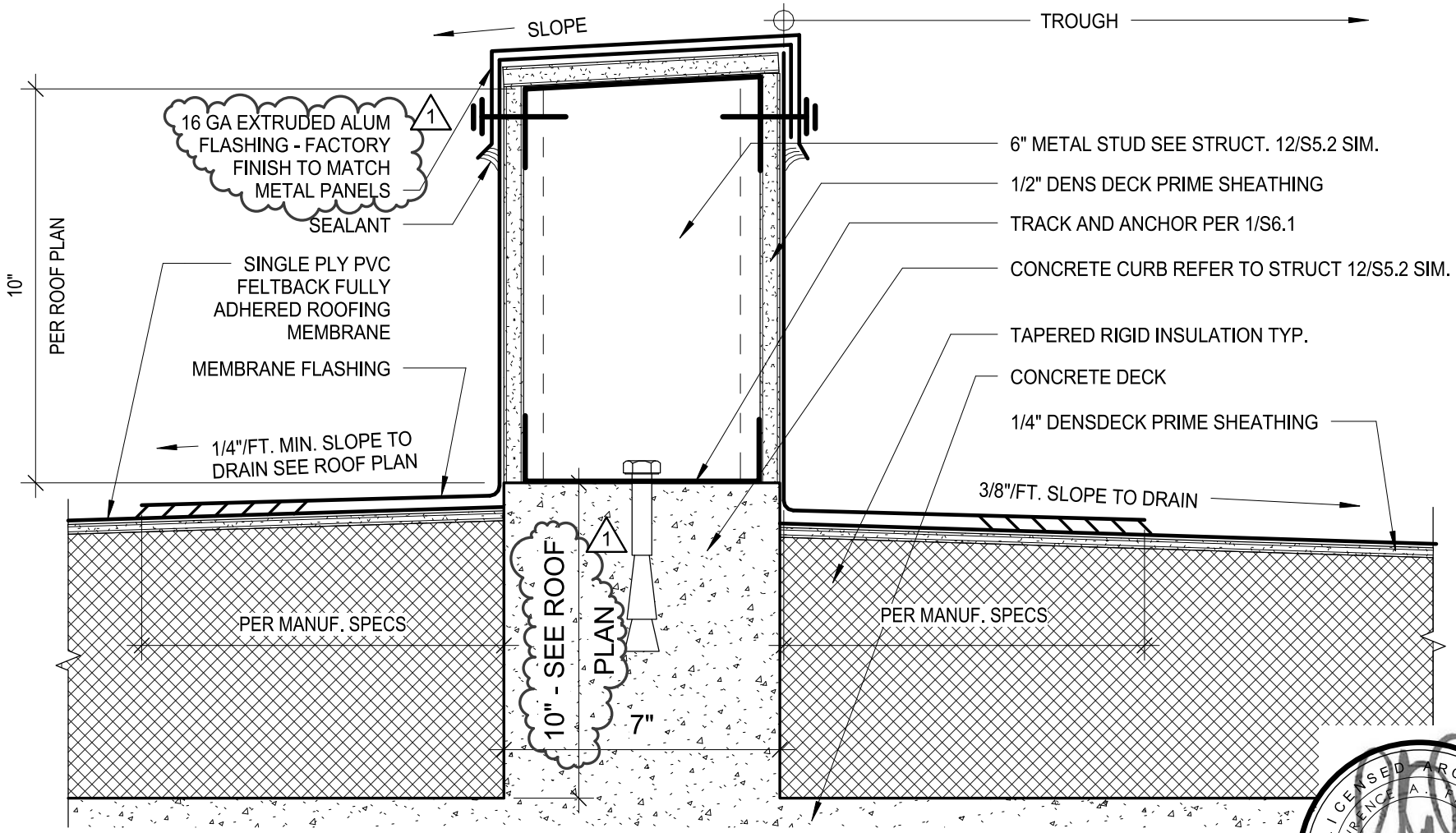
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 3 / A9.24

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-10
SHT. REF. NO.: A9.24	DATE: 04/20/16	



CURB SECTION AT TROUGH-

SCALE
3" = 1'-0"

24

LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
NO. C 11360
Ren. 6-30-17
STATE OF CALIFORNIA

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CONSULTANT:

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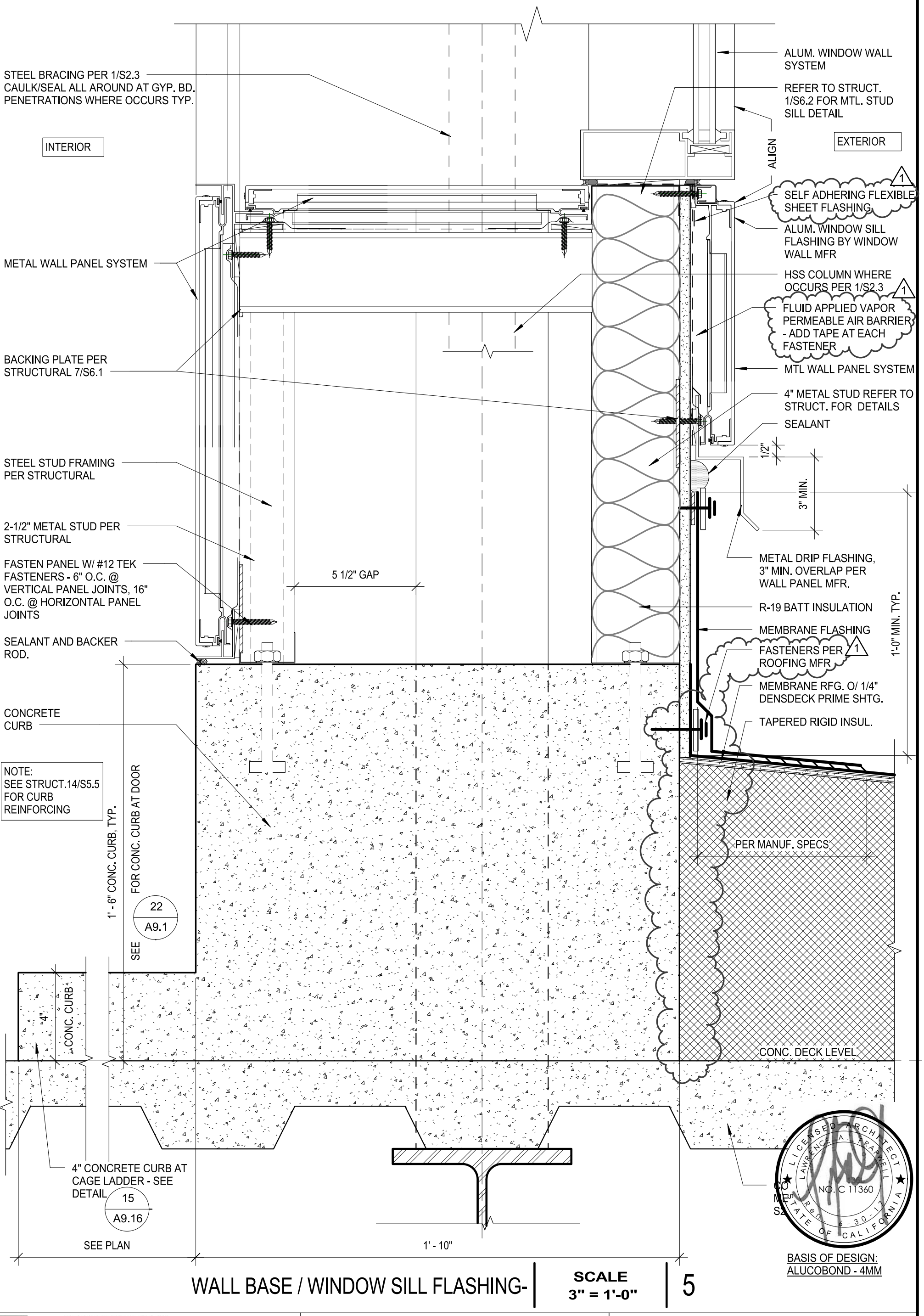
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 24 / A9.24

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-11
SHT. REF. NO.: A9.24	DATE: 04/20/16	



BASIS OF DESIGN:
ALUCOBOND - 4MM

WALL BASE / WINDOW SILL FLASHING-

SCALE
3" = 1'-0"

5

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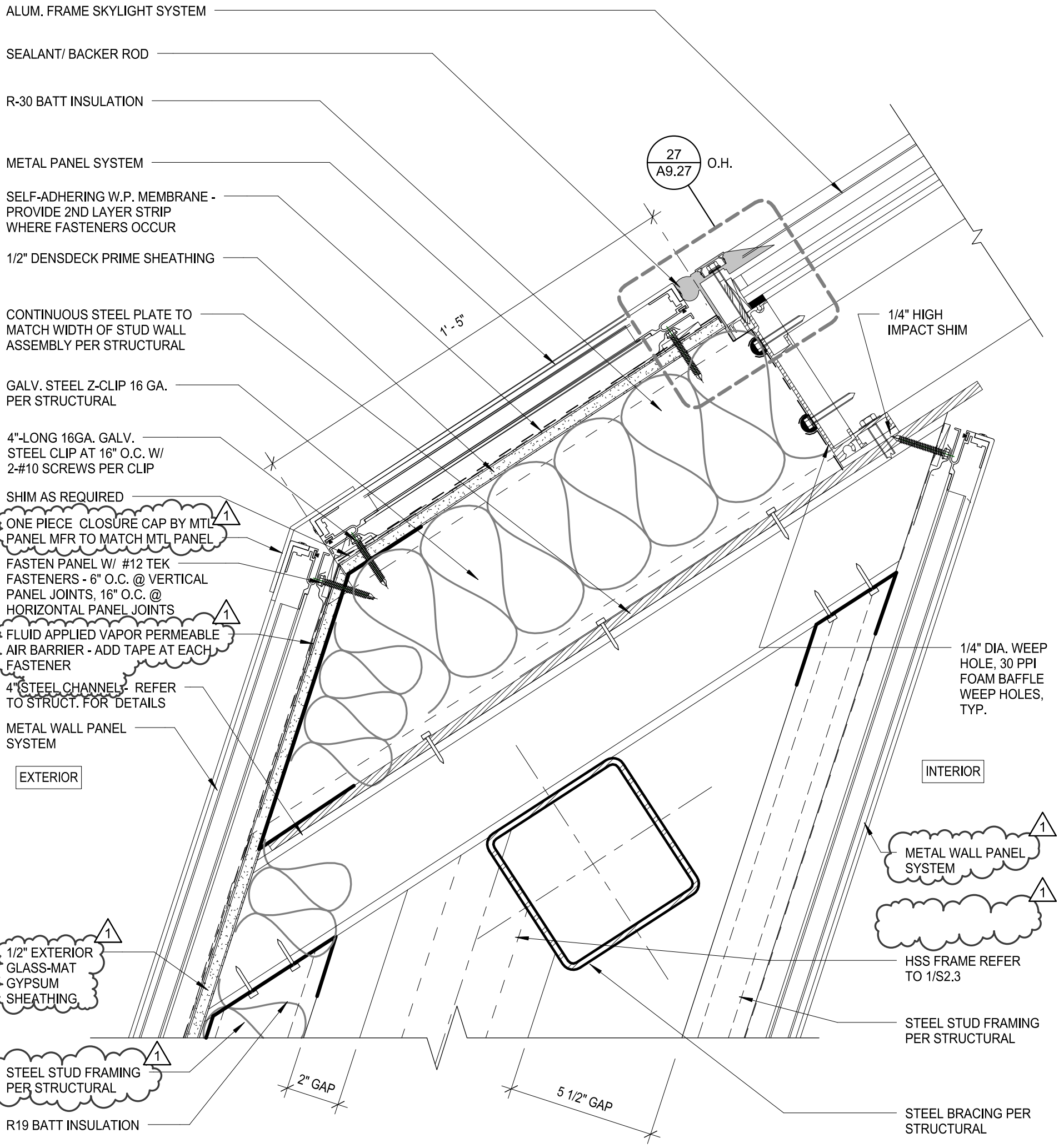
PROJECT TITLE:
COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 5 / A9.27

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-12
SHT. REF. NO.: A9.27	DATE: 04/20/16	



STRUC. DETAIL REF: 10/S6.3

BASIS OF DESIGN:
ALUCOBOND - 4MM
WASCO SKYLIGHT - PINNACLE SYSTEM

PENDULUM TOWER SKYLIGHT @ LOWER END- | **SCALE 3" = 1'-0"** | 12

LICENSED ARCHITECT
LAWRENCE A. FRAMPELL
NO. C 11360
Ren. 6-30-17
STATE OF CALIFORNIA

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PROJECT TITLE:
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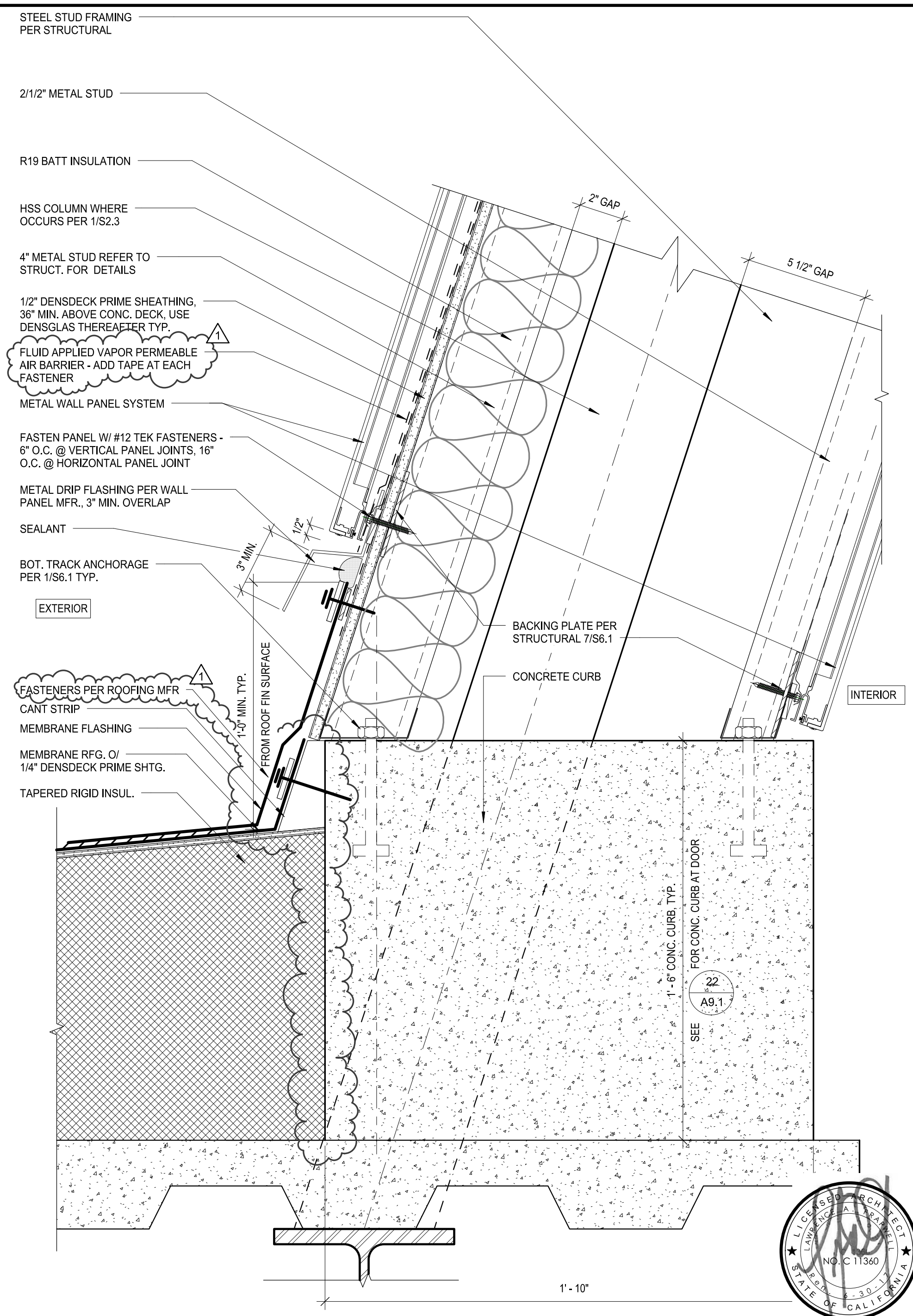
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 12 / A9.27

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-13
SHT. REF. NO.: A9.27	DATE: 04/20/16	



SLOPED WALL BASE FLASHING-

SCALE
3" = 1'-0"

15

BASIS OF DESIGN:
ALUCOBOND - 4MM

LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
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PROJECT TITLE:
COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
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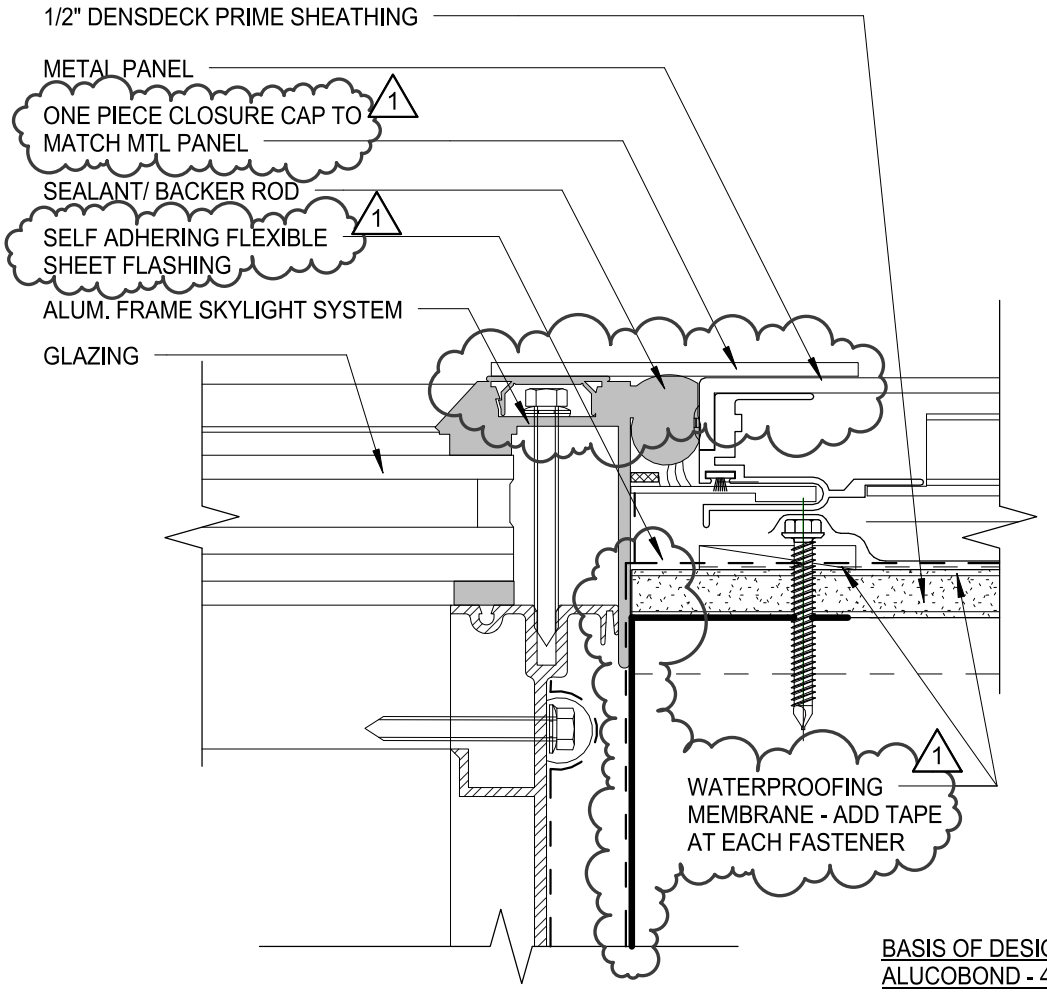
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
DETAIL 15 / A9.27

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3" = 1'-0"	SKA-14
SHT. REF. NO.: A9.27	DATE: 04/20/16	



BASIS OF DESIGN:
ALUCOBOND - 4MM

SKYLIGHT FRAME FLASHING- | SCALE 6" = 1'-0" | 27

LICENSED ARCHITECT
LAWRENCE A. FRAPWELL
NO. C 11360
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PROJECT TITLE:
COMMUNITY PLANETARIUM
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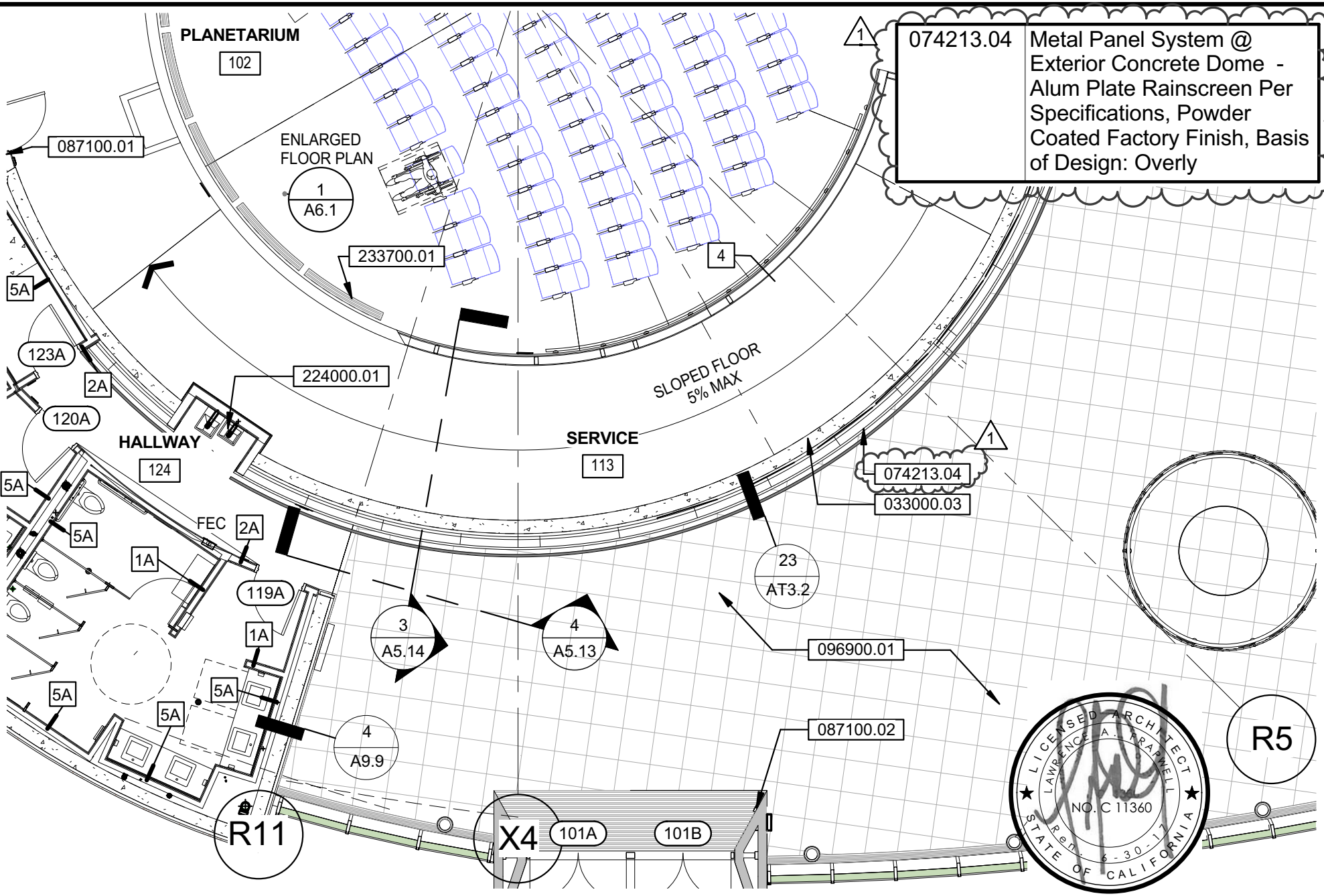
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: DETAIL 27 / A9.27		
ISSUED FOR: ADDENDUM 1A	SCALE: 6" = 1'-0"	SK NO. SKA-15
SHT. REF. NO.: A9.27	DATE: 04/20/16	



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COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
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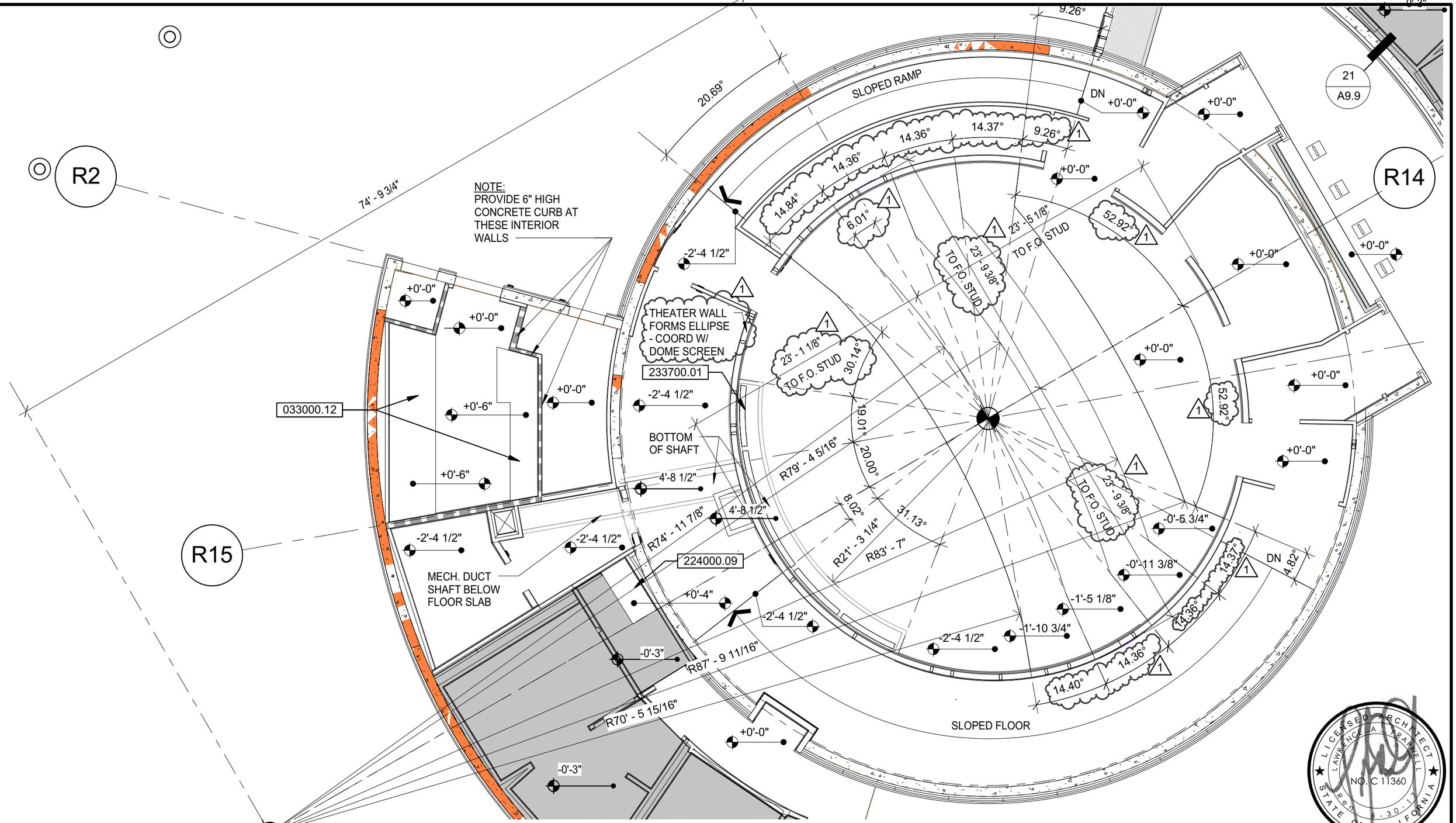
DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT:
GROUND FLOOR PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKA-16
SHT. REF. NO.: A2.1	DATE: 04/20/16	



LICENSED ARCHITECT
LAWRENCE A. TRAMMELL
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DIV. OF THE STATE ARCHITECT
DSA File #: 30-C3 DSA App. #: 04-113620

SUBJECT: SLAB PLAN
ISSUED FOR: ADDENDUM 1
SCALE: 1/8" = 1'-0"
SK NO.: SKA-17
SHT. REF. NO.: A2.3
DATE: 04/20/16

C:\Users\MStuart\Documents\OCC Planetarium_Arch_RVT2014_mstuart.rvt
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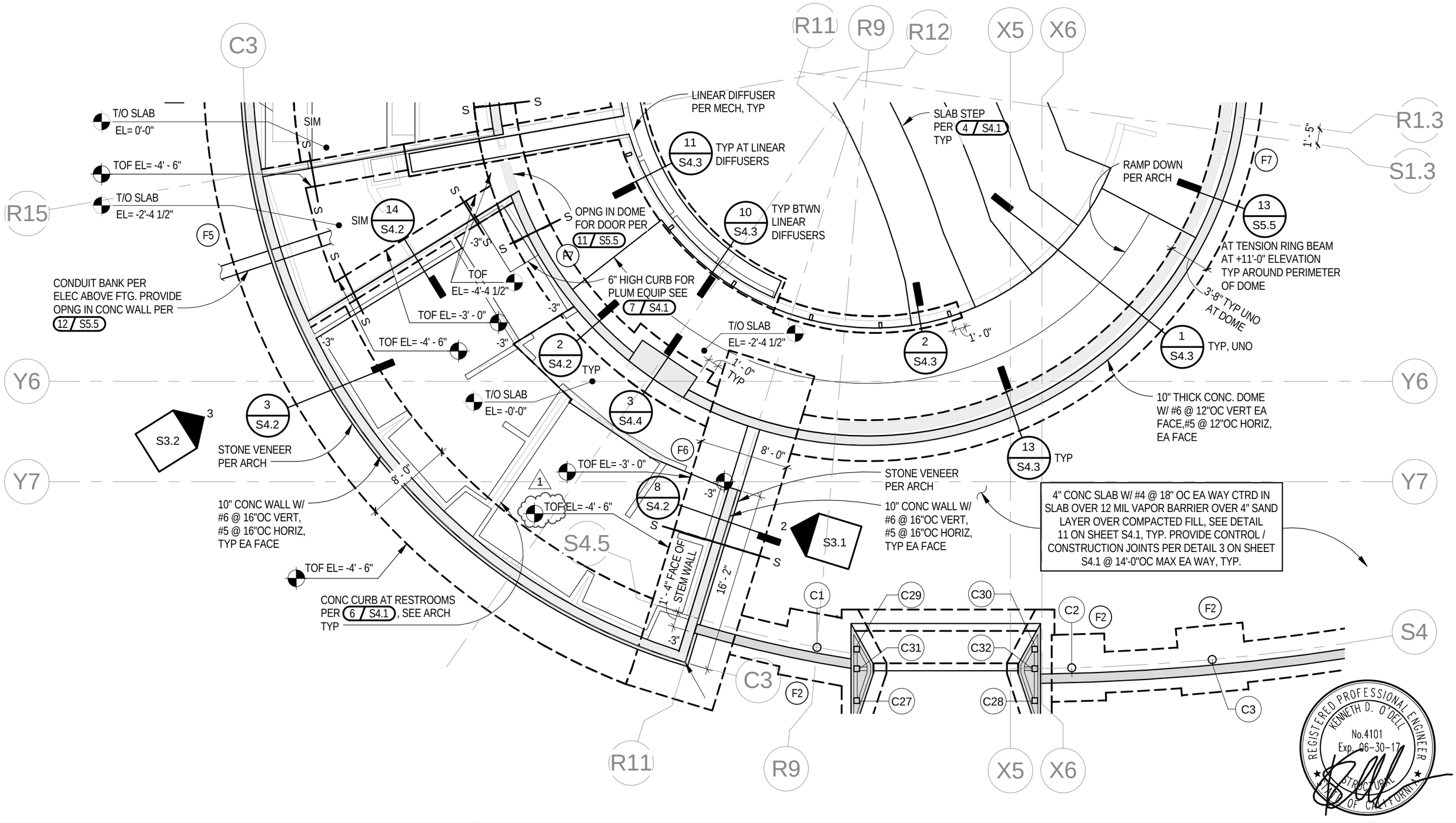

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PROJECT TITLE:

COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
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SUBJECT: PARTIAL FOUNDATION PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKS-1
SHT. REF. NO.: S2.1	DATE: 04/11/16	

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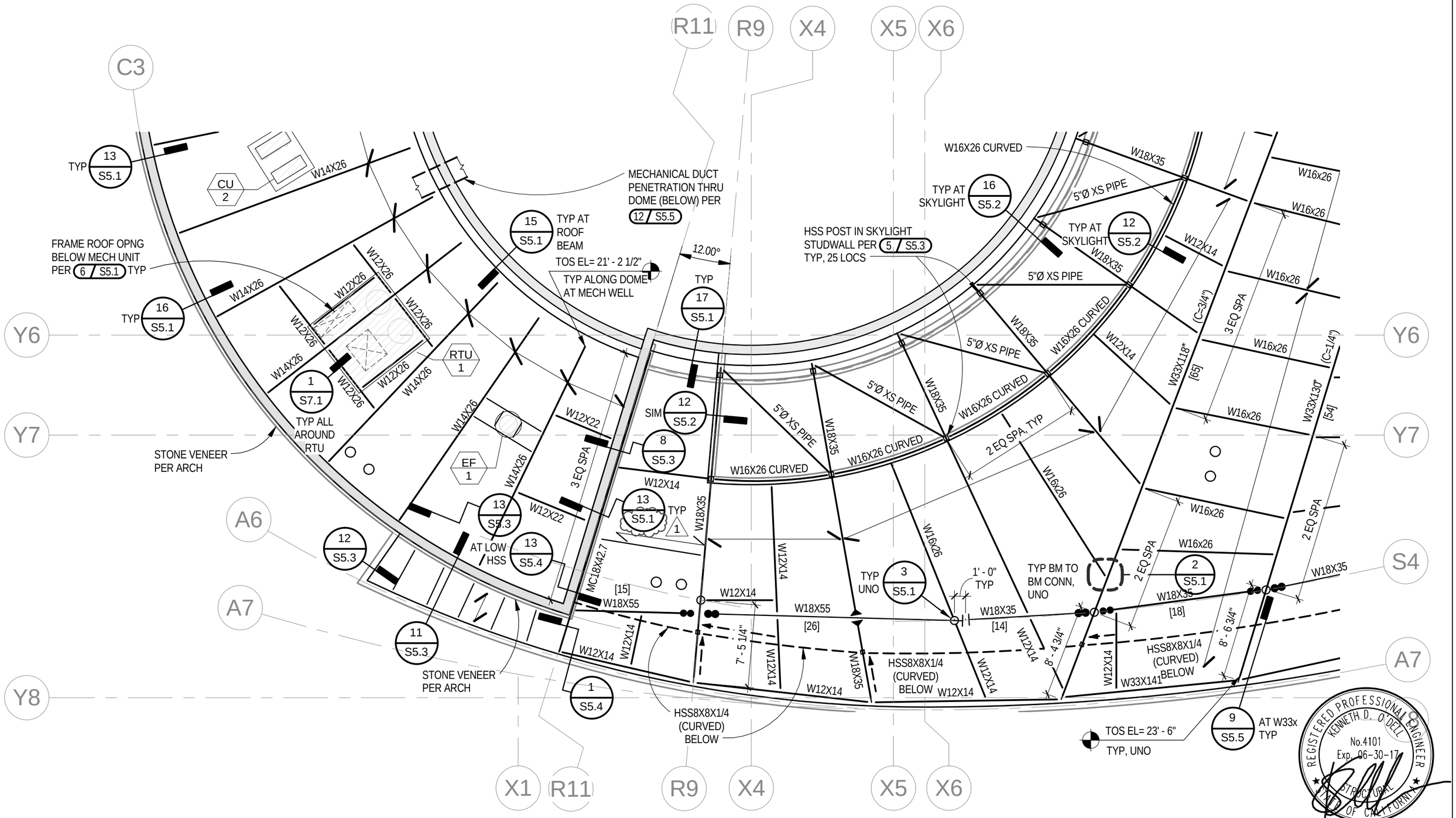

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CONSULTANT:
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PROJECT TITLE:

COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

SUBJECT: PARTIAL ROOF FRAMING PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKS-2
SHT. REF. NO.: S2.2	DATE: 04/11/16	

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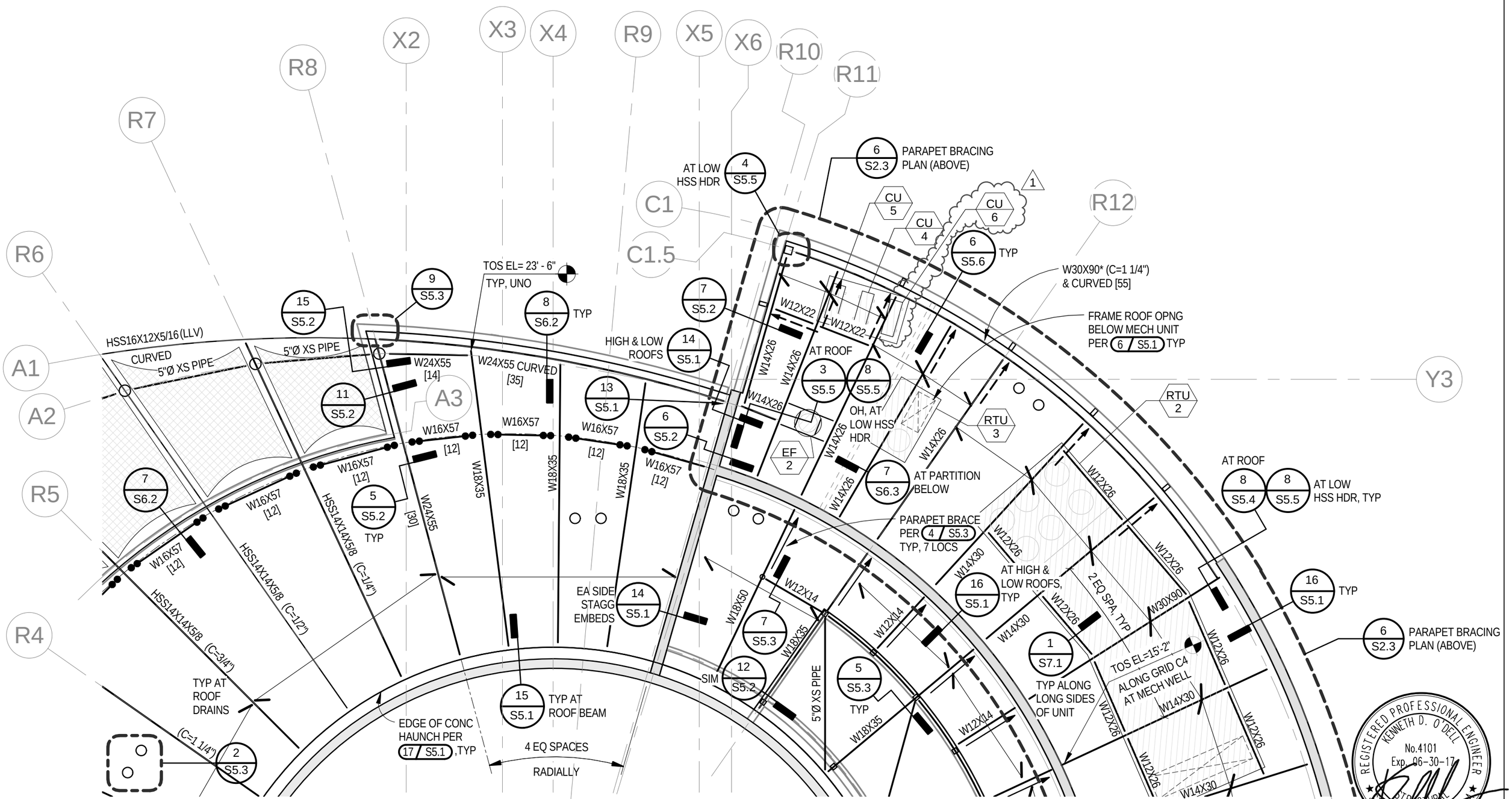

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PROJECT TITLE:

COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD. COSTA MESA, CA 92626

DIV. OF THE STATE ARCHITECT

SUBJECT: PARTIAL FRAMING PLAN

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/8" = 1'-0"	SKS-3
SHT. REF. NO.: S2.2	DATE: 04/12/16	

REGISTERED PROFESSIONAL ENGINEER
KENNETH D. O'DELL
No.4101
Exp. 06-30-17
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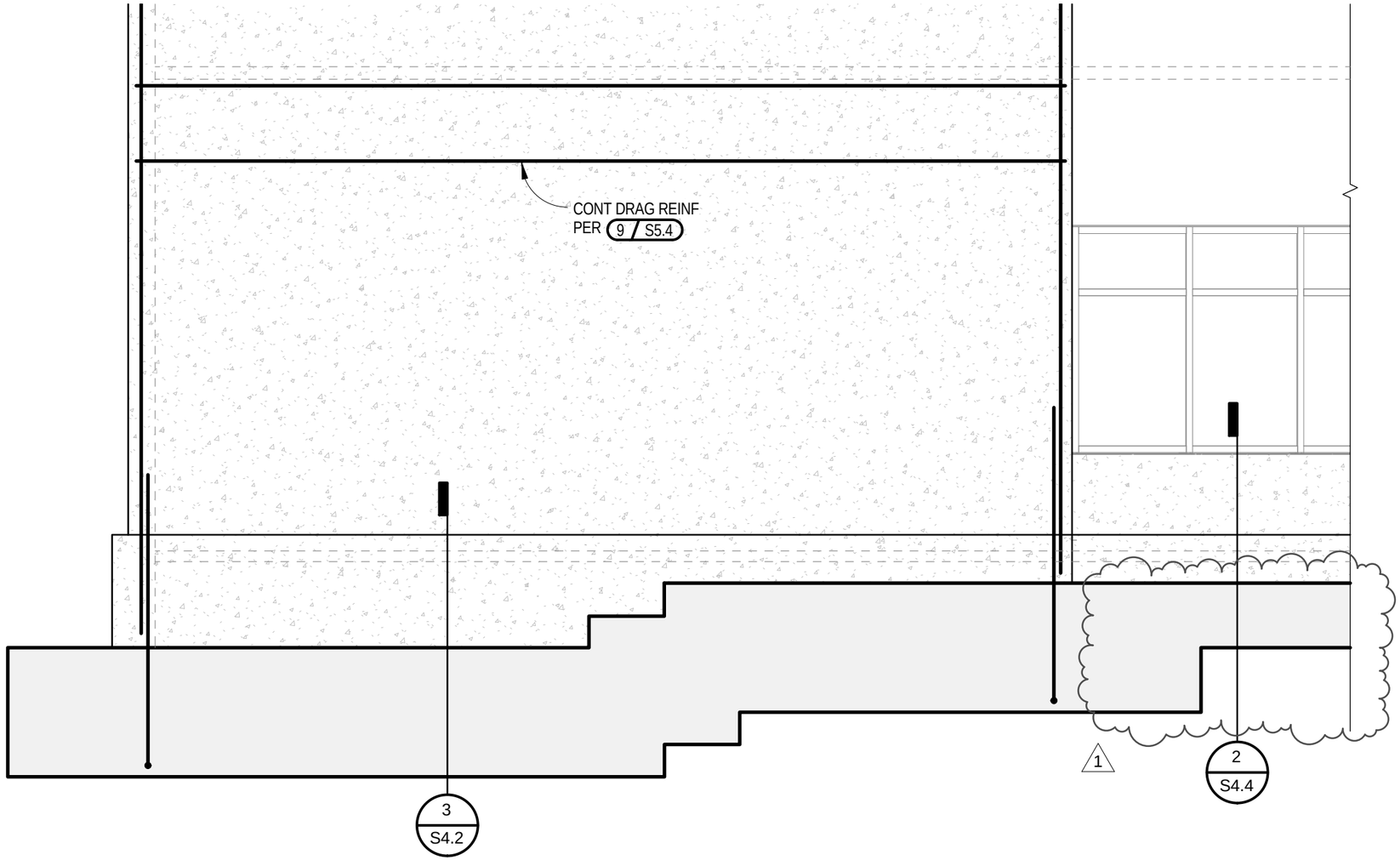
STATE OF CALIFORNIA



GRID C1 WALL ELEVATION.

SCALE: 1/4" = 1'-0"

2 / S3.2

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2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

SUBJECT: GRID C1 WALL ELEVATION

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/4" = 1'-0"	SKS-4
SHT. REF. NO.: S3.2	DATE: 04/11/16	

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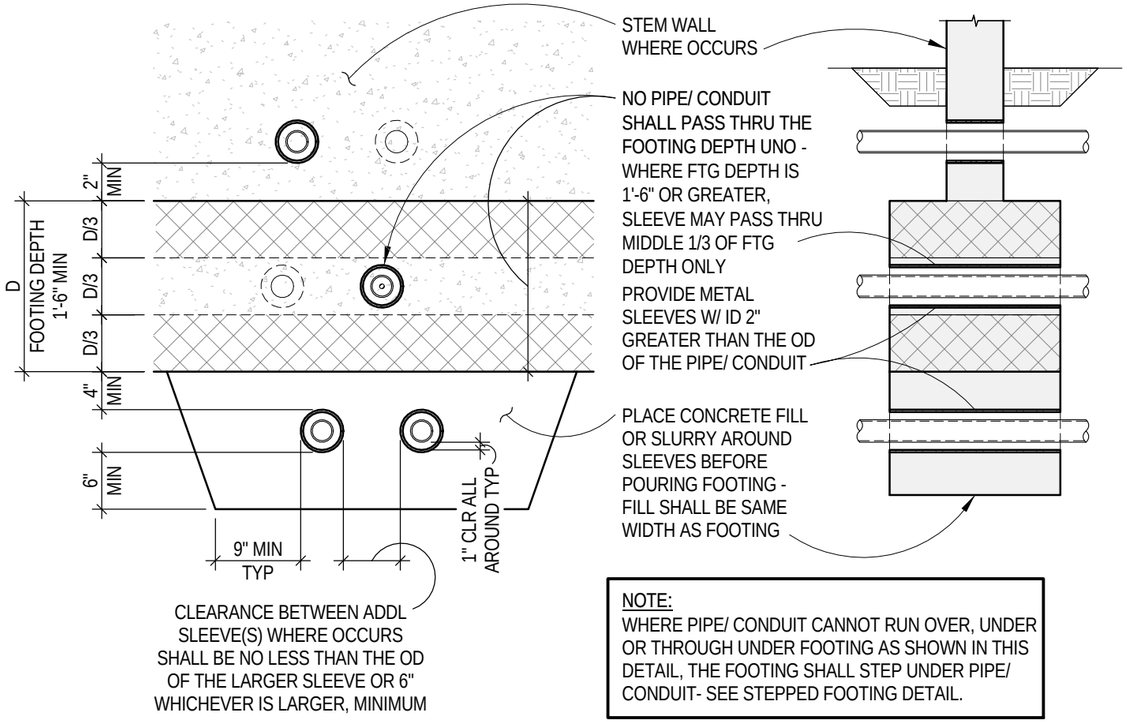


ELEVATION

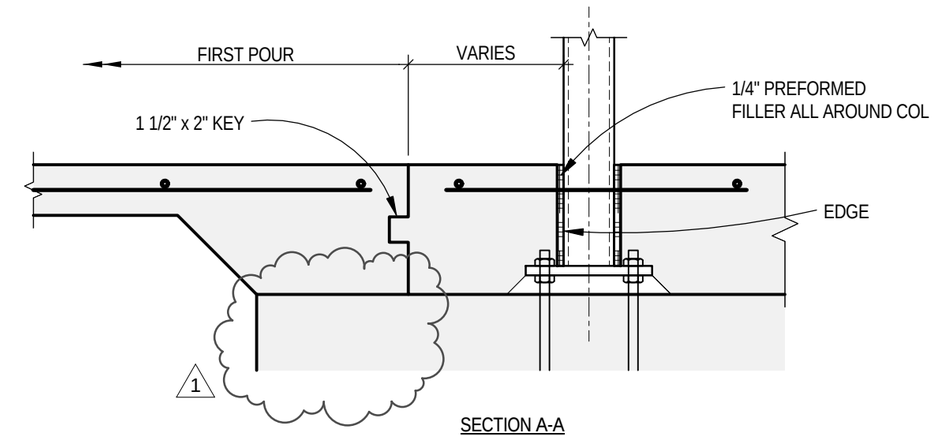
SECTION

NOTE:
WHERE PIPE/ CONDUIT CANNOT RUN OVER, UNDER OR THROUGH UNDER FOOTING AS SHOWN IN THIS DETAIL, THE FOOTING SHALL STEP UNDER PIPE/ CONDUIT- SEE STEPPED FOOTING DETAIL.

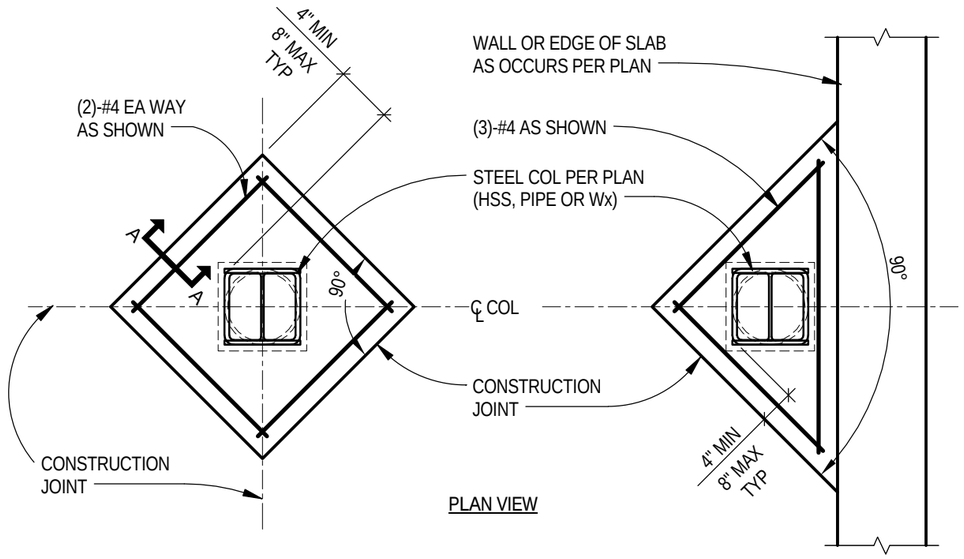
TYPICAL PIPE / CONDUIT SLEEVES ACROSS FOOTINGS

SCALE: 3/4" = 1'-0"

14 / S4.1 / 1



SECTION A-A



PLAN VIEW

CONSTRUCTION JOINT IN SLAB ON GRADE AT STEEL COL

SCALE: 1" = 1'-0"

13 / S4.1

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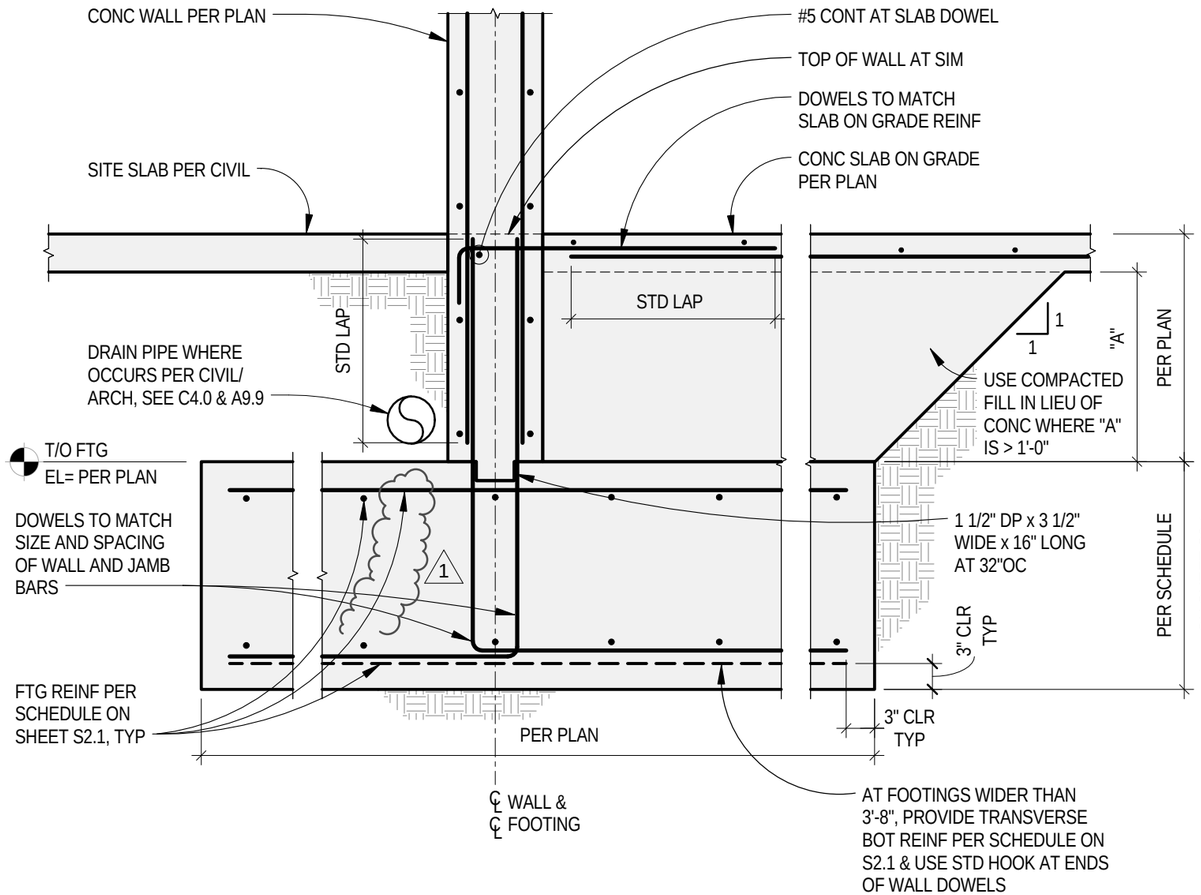
PROJECT TITLE:
COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

SUBJECT: FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	As indicated	SKS-5
SHT. REF. NO.: S4.1	DATE: 04/11/16	



CONCRETE WALL FOOTING

SCALE: 3/4" = 1'-0"

1
S4.2

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PROJECT TITLE:

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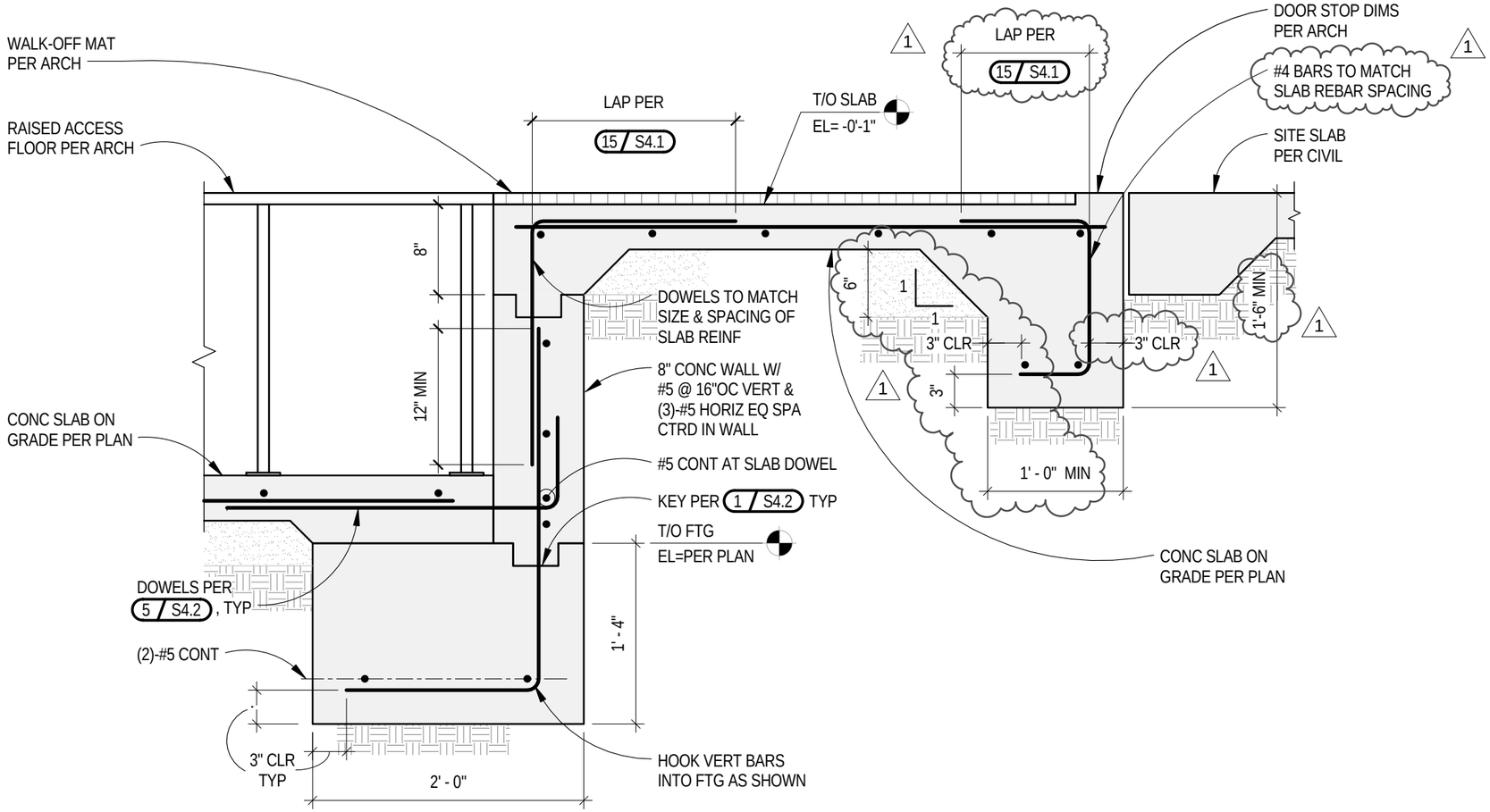
SUBJECT: FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3/4" = 1'-0"	SKS-6
SHT. REF. NO.: S4.2	DATE: 04/11/16	



WALK-OFF MAT

SCALE: 1" = 1'-0"

7
S4.2

REGISTERED PROFESSIONAL ENGINEER
KENNETH D. O'DELL
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Exp. 06-30-17
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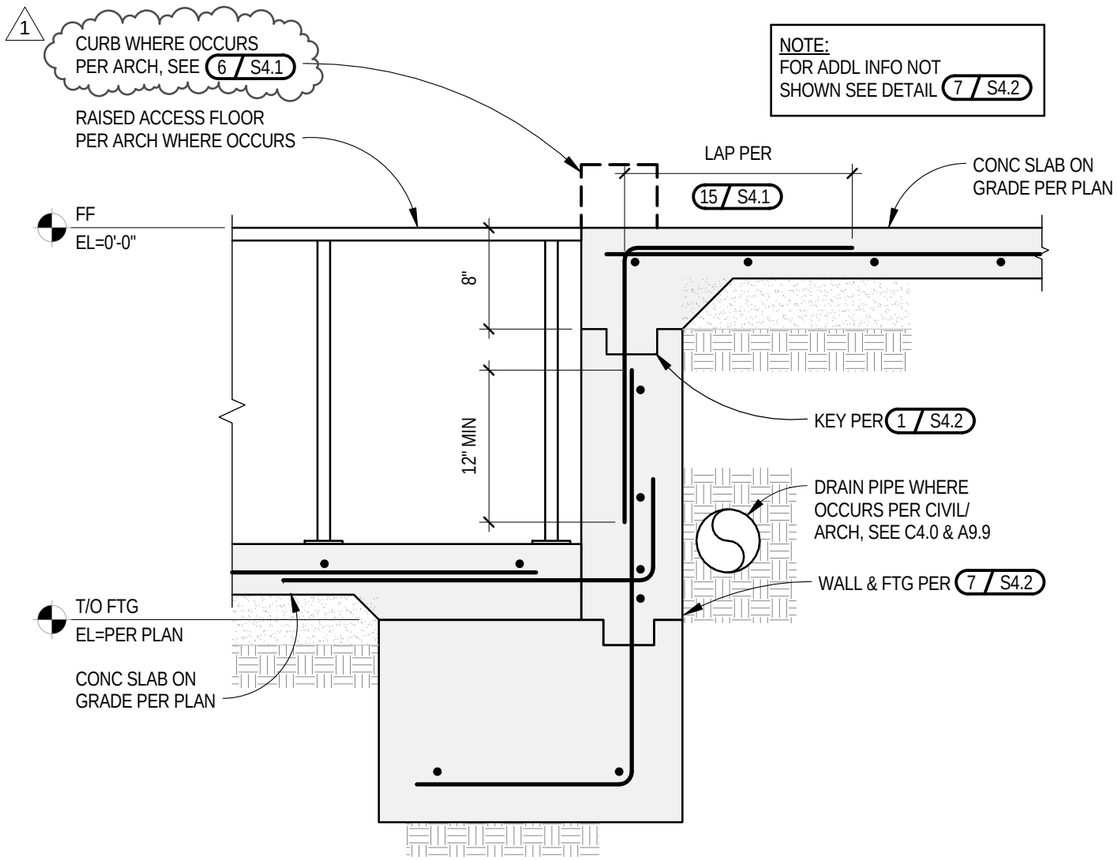
DIV. OF THE STATE ARCHITECT

SUBJECT:
FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-7
SHT. REF. NO.: S4.2	DATE: 04/11/16	



DETAIL

SCALE: 1" = 1'-0"

14 / S4.2

REGISTERED PROFESSIONAL ENGINEER
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Exp. 06-30-17
STRUCTURAL
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SUBJECT: FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-8
SHT. REF. NO.: S4.2	DATE: 04/11/16	

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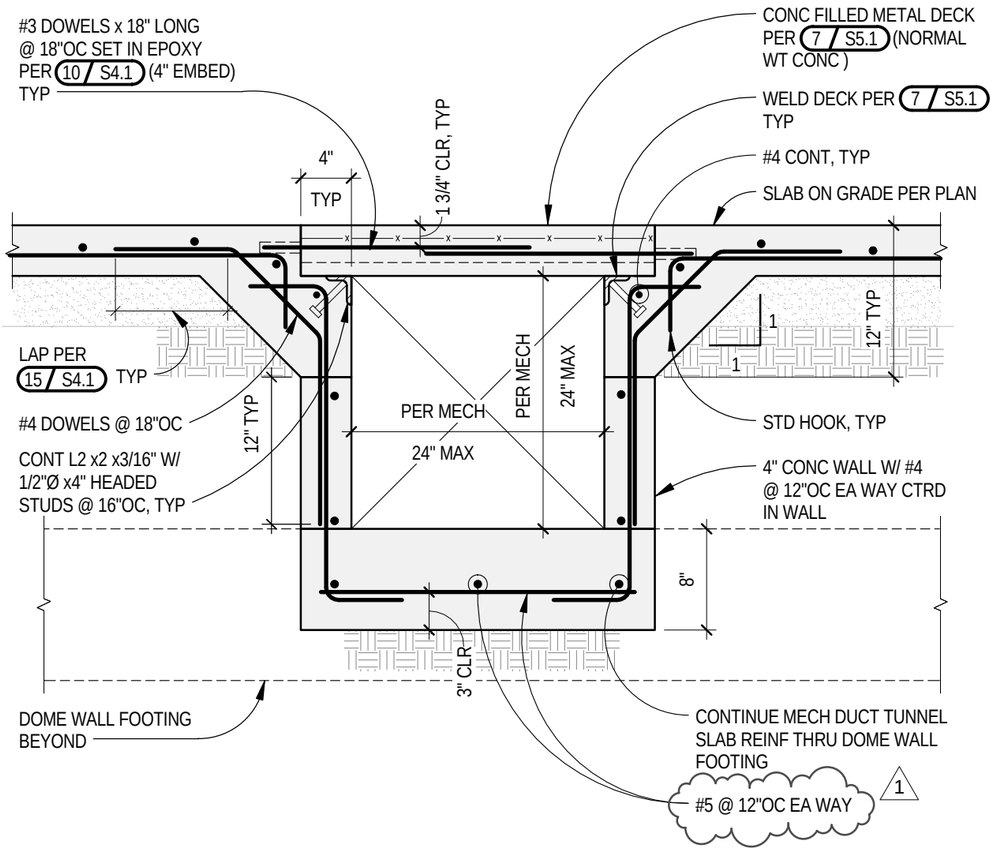

DUCT TUNNEL DETAIL

SCALE: 1" = 1'-0"

8
S4.3

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KENNETH D. O'DELL
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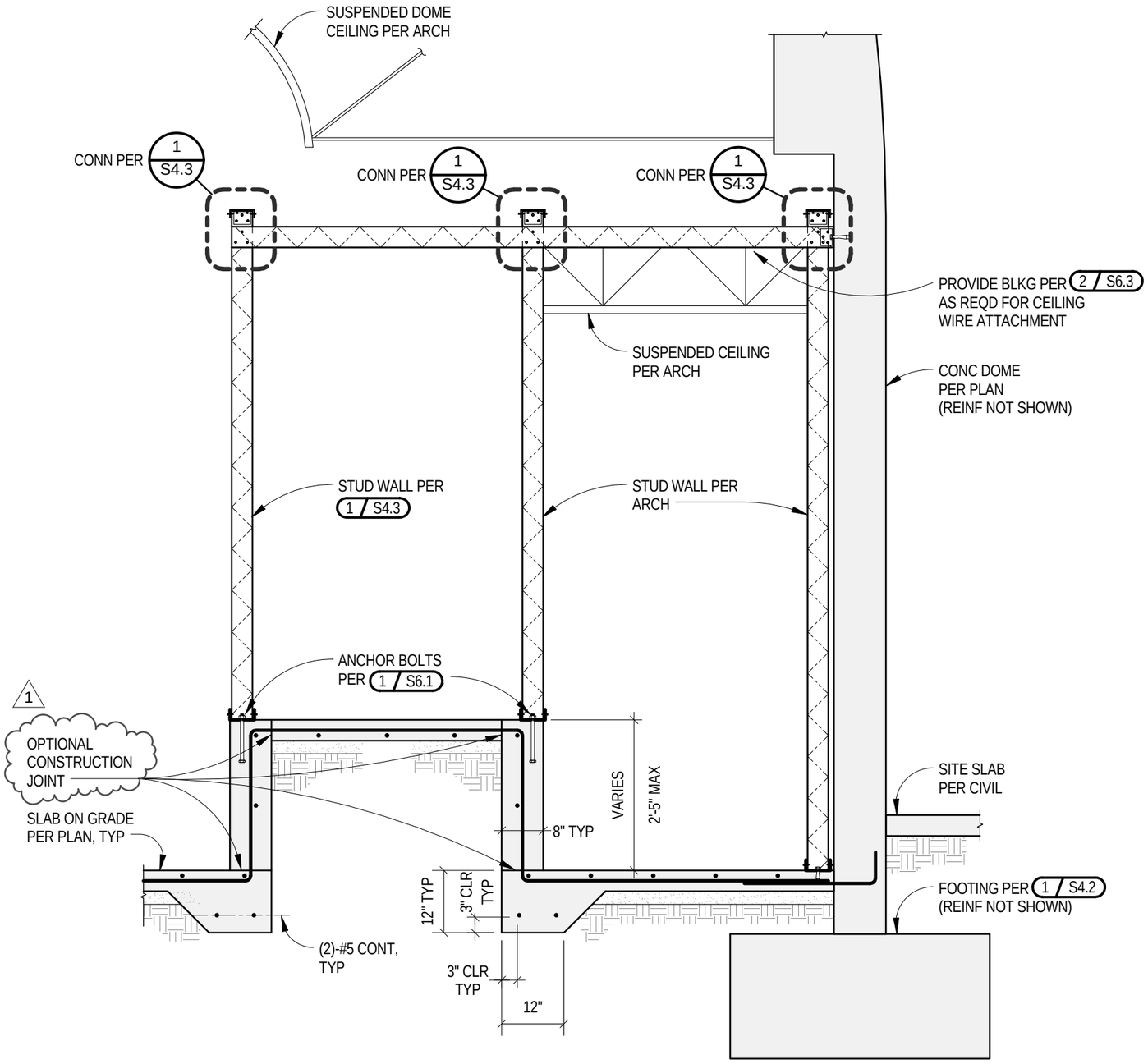
DIV. OF THE STATE ARCHITECT

SUBJECT: FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-9
SHT. REF. NO.: S4.3	DATE: 04/11/16	



SECTION AT RAMP

SCALE: 1/2" = 1'-0"

5 / S4.4

REGISTERED PROFESSIONAL ENGINEER
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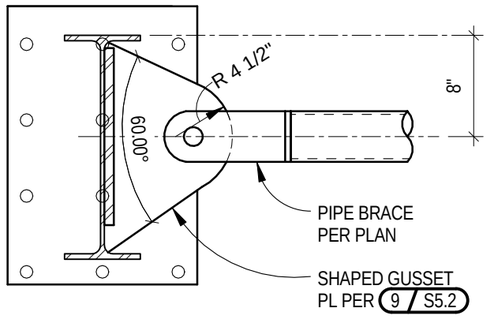
PROJECT TITLE:

COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

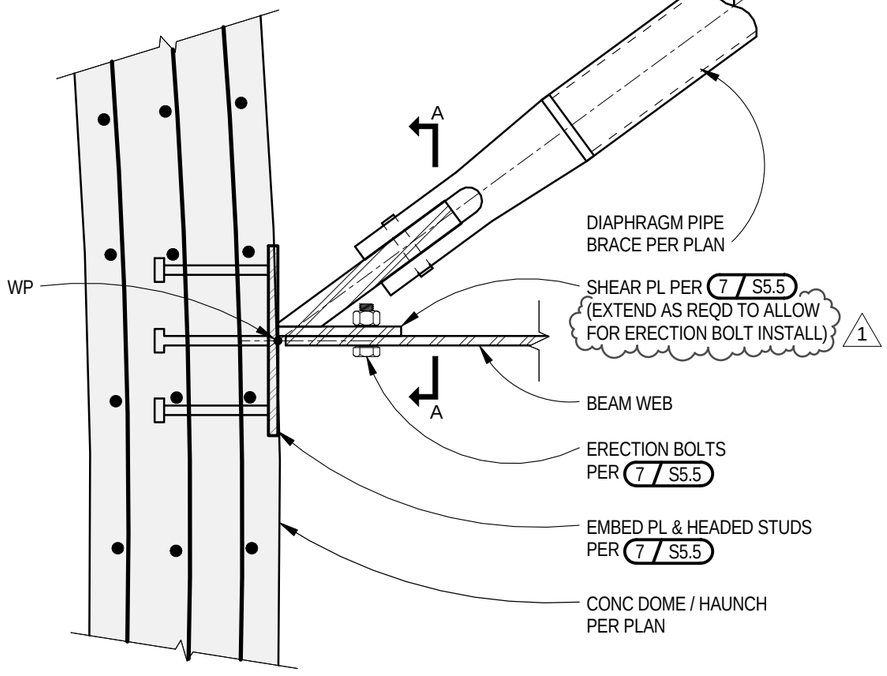
SUBJECT: FOUNDATION DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/2" = 1'-0"	SKS-10
SHT. REF. NO.: S4.4	DATE: 04/11/16	



SECTION A-A

NOTE:
FOR ADDITIONAL INFO
NOT SHOWN, SEE
DETAIL 9 / S5.2

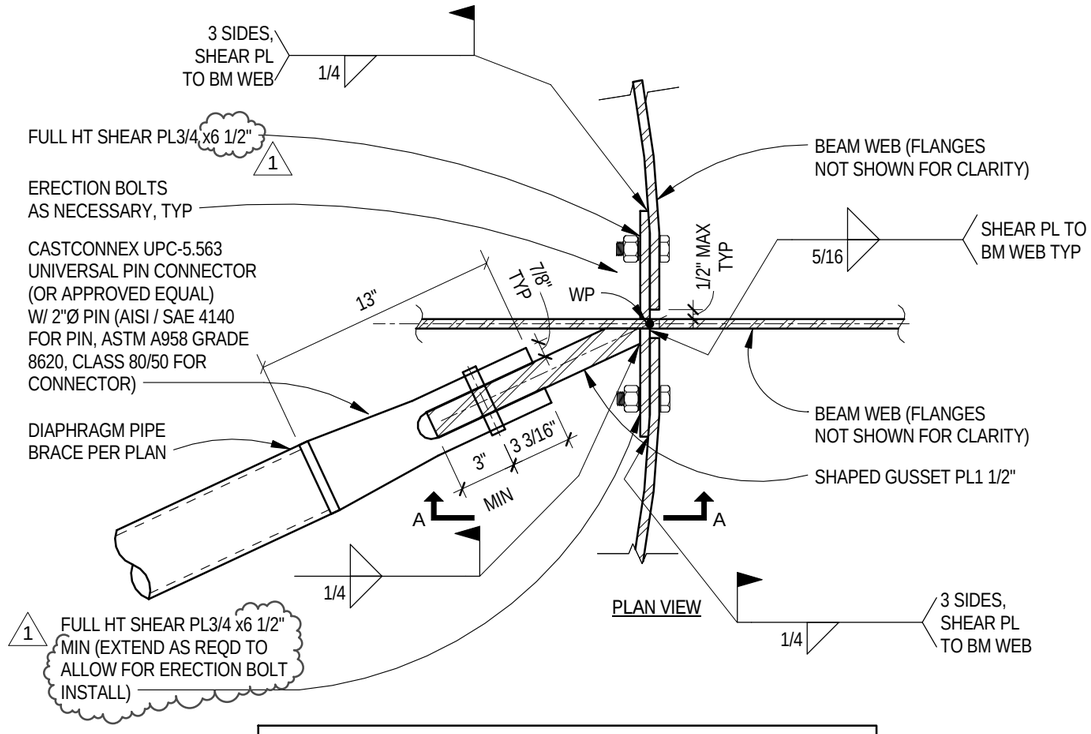


PLAN VIEW

SKYLIGHT DIAPHRAGM BRACE CONN TO DOME

SCALE: 1 1/2" = 1'-0"

10 / S5.2



NOTE:
STEEL FABRICATOR SHALL DEVELOP AND QUALIFY A WELDING PROCEDURE SPECIFICATION (WPS) FOR WELDING TO CAST STEEL, SUPPORTED BY A PROCEDURE QUALIFICATION RECORD (PQR), PER AWS D1.1, D1.8. AWS AND PQR DOCUMENTS SHALL BE SUBMITTED TO SEOR FOR REVIEW.

SKYLIGHT DIAPHRAGM BRACE CONNECTION

SCALE: 1 1/2" = 1'-0"

9 / S5.2

REGISTERED PROFESSIONAL ENGINEER
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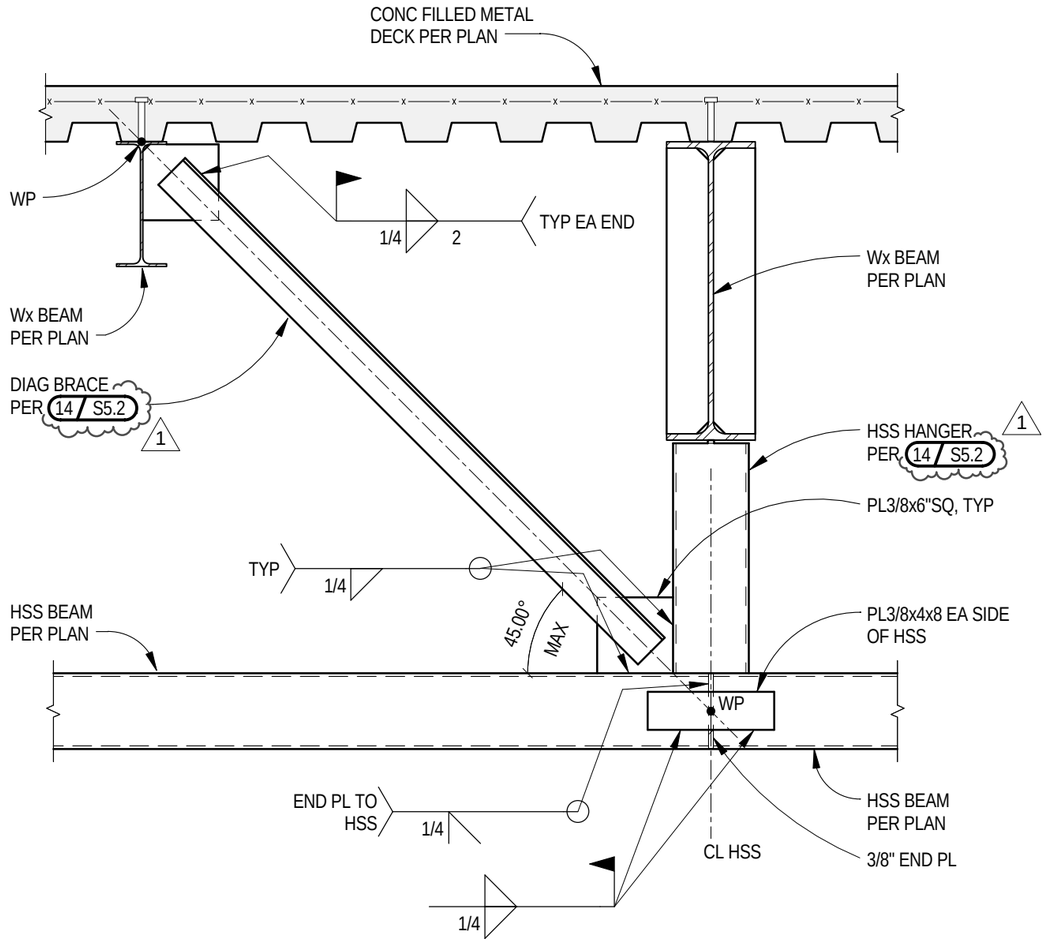
PROJECT TITLE:
COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

SUBJECT: FRAMING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	As indicated	SKS-11
SHT. REF. NO.: S5.2	DATE: 04/11/16	



CURTAIN WALL LONGITUDINAL SECTION

13
S5.2

SCALE: 1" = 1'-0"

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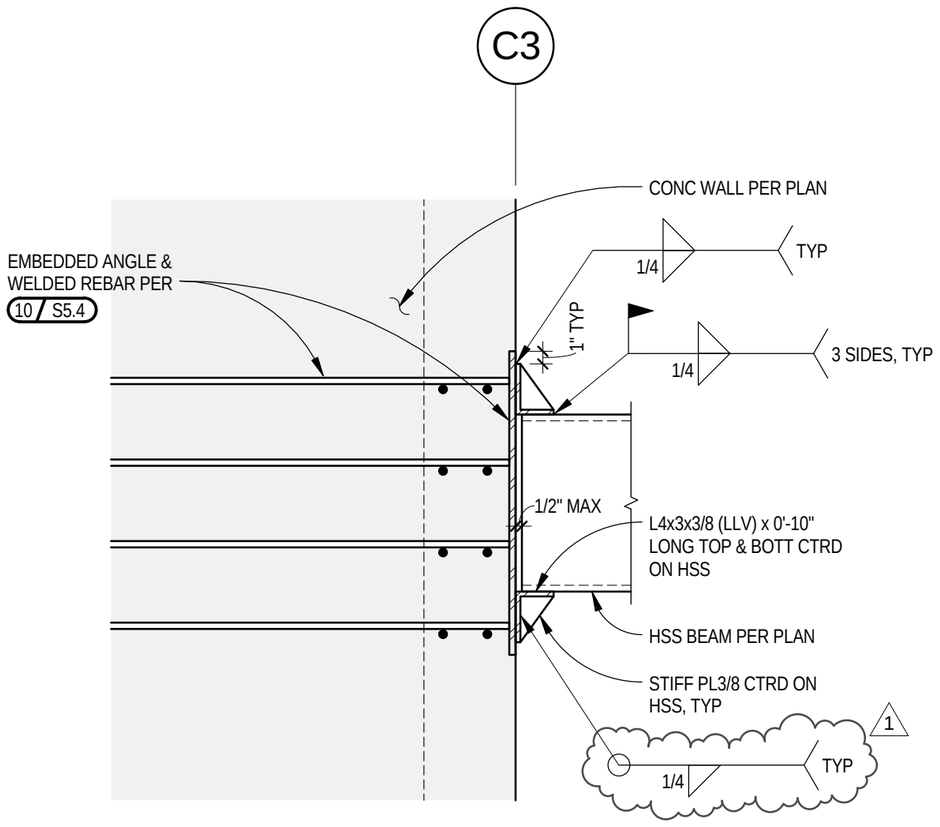
DIV. OF THE STATE ARCHITECT

SUBJECT: FRAMING DETAILS

ISSUED FOR: ADDENDUM 1A
SCALE: 1" = 1'-0"
SK NO.: SKS-12
SHT. REF. NO.: S5.2
DATE: 04/11/16



DRAG CONNECTION SECTION

11
S5.4

SCALE: 1" = 1'-0"

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SUBJECT: FRAMING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-13
SHT. REF. NO.: S5.4	DATE: 04/11/16	

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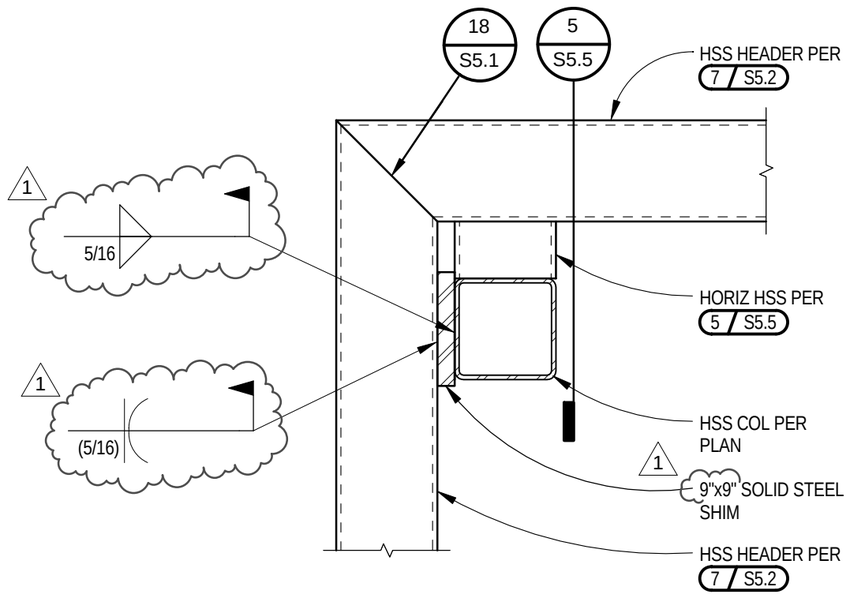

PLAN VIEW

HSS DETAIL

SCALE: 1" = 1'-0"

4
S5.5

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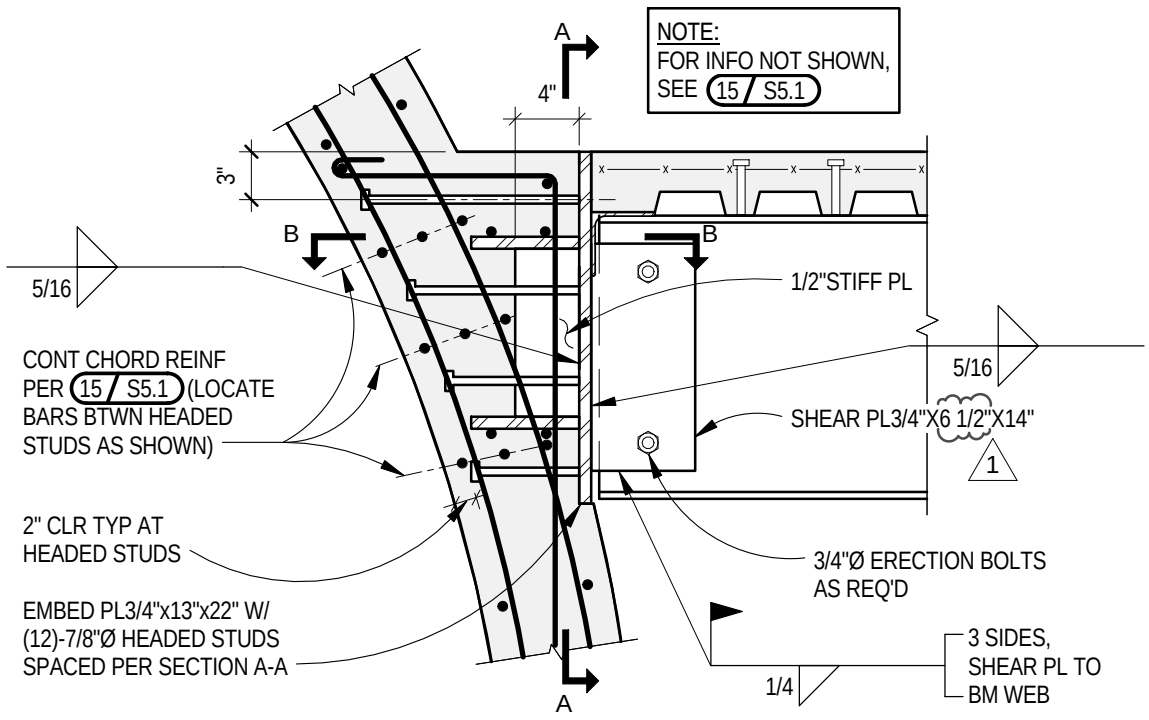
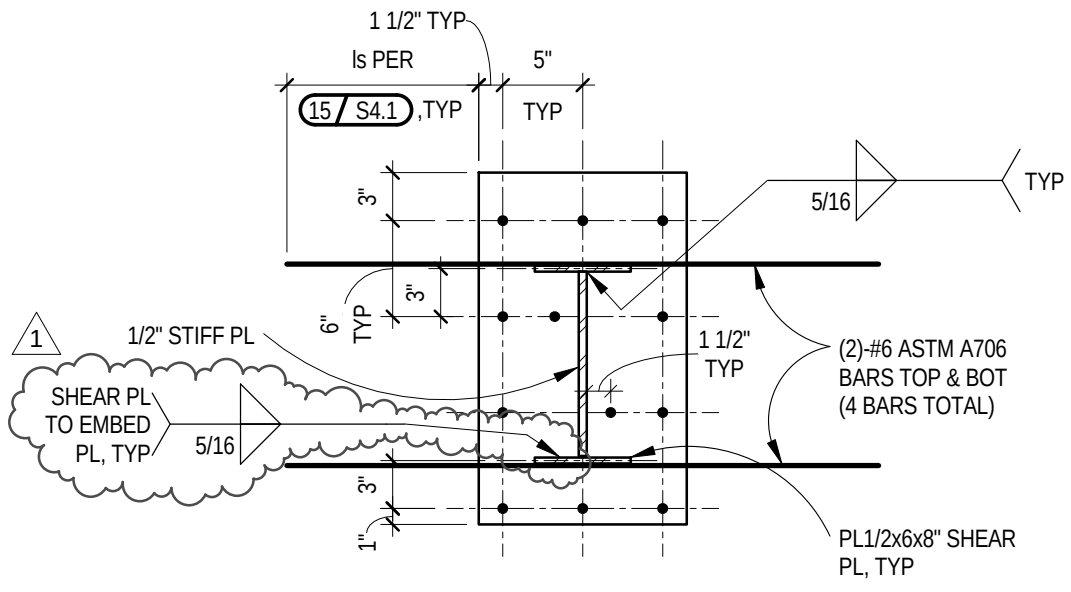
SUBJECT: FRAMING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-14
SHT. REF. NO.: S5.5	DATE: 04/11/16	

NOTE:
WHERE DIAGONAL DIAPHRAGM BRACE OCCURS, SEE DETAIL 10 / S5.2 (BRACE NOT SHOWN FOR CLARITY)

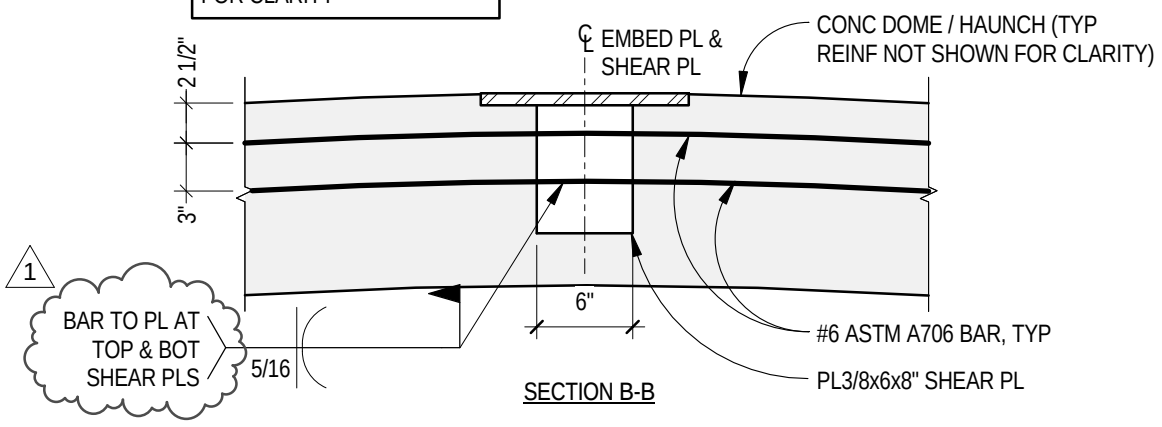
NOTE:
FOR INFO NOT SHOWN, SEE 15 / S5.1





SECTION A-A

NOTE:
HEADED STUDS NOT SHOWN FOR CLARITY



SECTION B-B

BEAM TO CONC DOME CONNECTION DETAIL

7
S5.5

SCALE: 1" = 1'-0"

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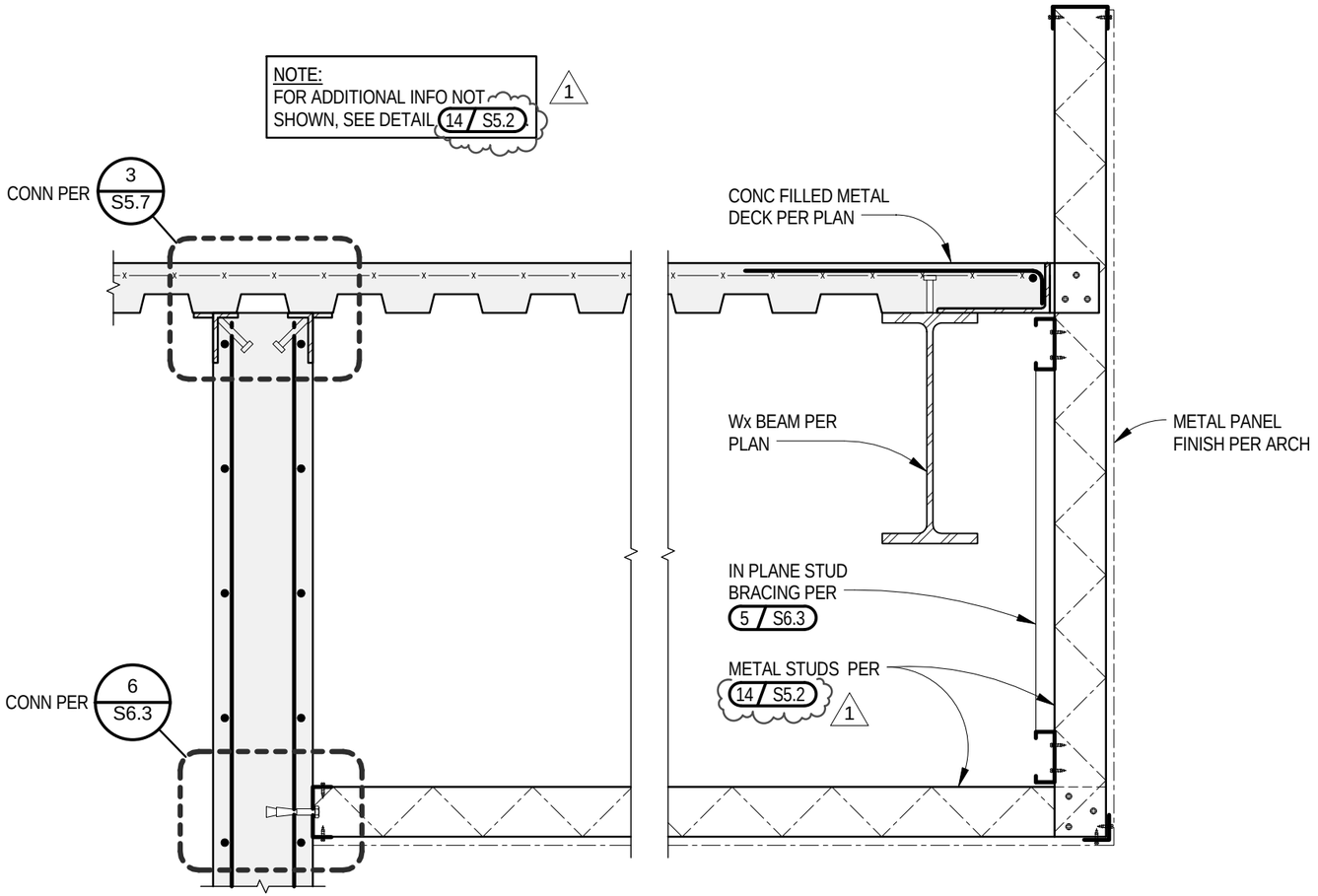
SUBJECT:
FRAMING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-15
SHT. REF. NO.: S5.5	DATE: 04/11/16	



DETAIL

SCALE: 1" = 1'-0"

8 / S5.7

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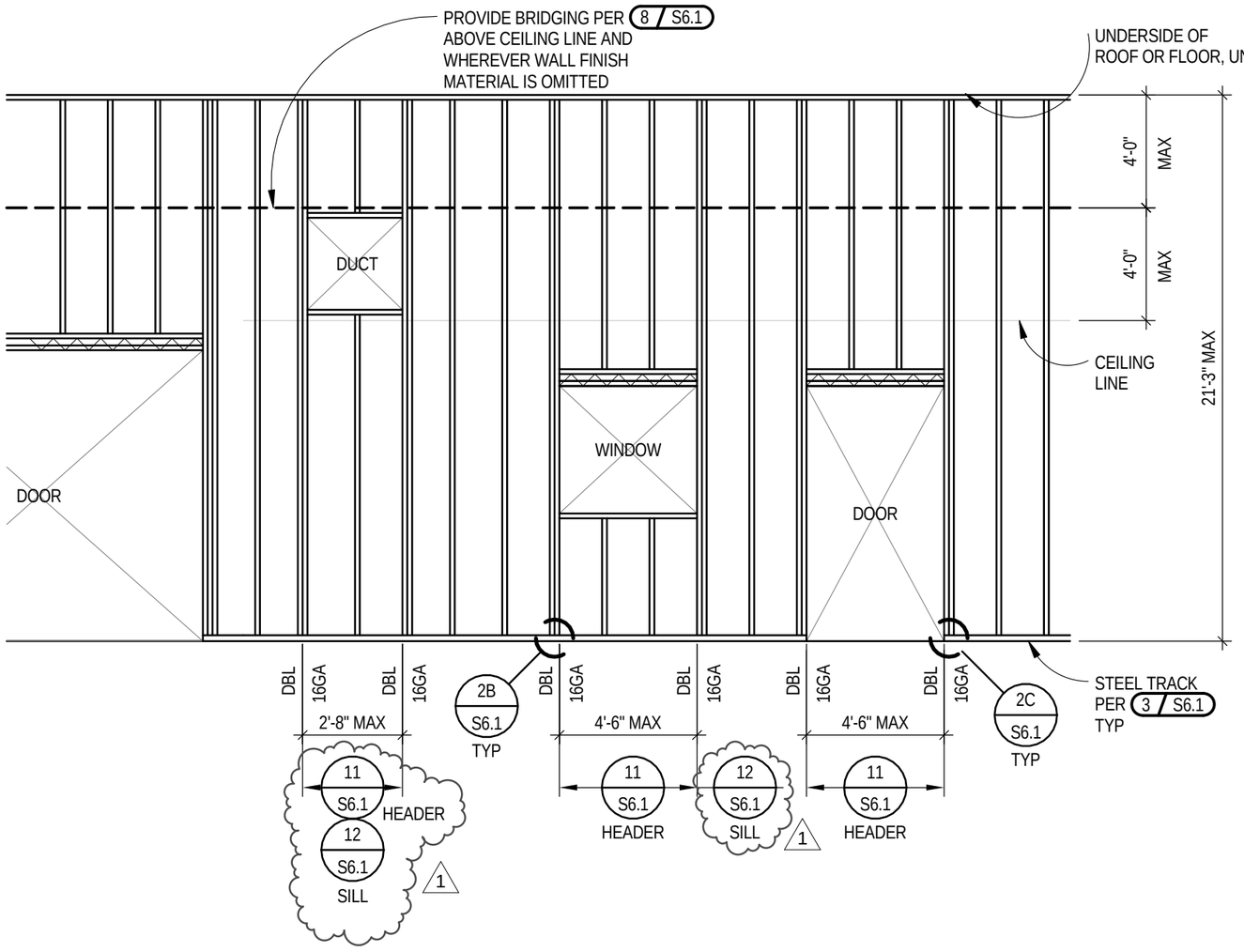
DIV. OF THE STATE ARCHITECT

SUBJECT: FRAMING DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-16
SHT. REF. NO.: S5.7	DATE: 04/11/16	



STEEL STUD FRAMING ELEVATION NOTES:

1. SIZE AND SPACING OF STEEL STUD WALLS ARE PER PLAN. UNLESS NOTED OTHERWISE, STEEL TRACK THICKNESS SHALL BE EQUAL TO OR GREATER THAN STEEL STUD THICKNESS.
2. UNLESS NOTED OTHERWISE, ALL NON-BEARING, NON-SHEAR WALL STEEL STUDS SHALL BE 362S200-54 @ 16"OC, OR 400S200-43 @ 16"OC, OR 600S162-43 @ 16"OC MINIMUM AND STEEL TRACKS SHALL BE PER DETAIL 3 ON SHEET S6.1. SEE ARCH DRAWINGS FOR LOCATIONS WHERE STUD DEPTHS NEED TO BE INCREASED.
3. ALL STEEL STUDS SHALL BE "C" TYPE STUDS WITH FLANGE STIFFENERS AT OPEN SIDE.
4. ▨ DENOTES SHELVING, CABINETRY, EQUIPMENT, ETC; PROVIDE STEEL BACKING AT ALL LOCATIONS WHERE THESE ITEMS ARE ATTACHED TO WALL.
5. IN NO CASE SHALL STUDS (SINGLE OR MULTIPLE) AT SIDES OF OPENINGS (JAMBS) BE CUT FOR DUCTWORK OR FOR ANY OTHER PURPOSE NOT SPECIFICALLY ADDRESSED ON THESE STRUCTURAL DRAWINGS.
6. UNLESS NOTED OTHERWISE, 14GA STEEL STUDS @ 16"OC MINIMUM SHALL BE USED AT ALL LOCATIONS WHERE STEEL BACKING OCCURS AND WHERE SHOWN ON FRAMING ELEVATION.
7. FULL HEIGHT STUD WALLS REQUIRED AT ALL LOCATIONS.
8. PROVIDE (3)-0.157"Ø SHOTPINS MINIMUM AT BOTTOM OF ALL JAMB STUDS, UNLESS NOTED OTHERWISE, SEE DETAIL 2 ON SHEET S6.1.
9. SEE GENERAL NOTES SHEET FOR STEEL STUD NOTES, INCLUDING SSMA STEEL STUD IDENTIFICATION TABLE. FOR SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL STUD AND BRACING REQUIREMENTS.
10. SEE SHEET S6.2 AND S6.3 FOR ADDITIONAL TYPICAL STEEL STUD DETAILS.
11. MAXIMUM HOLE DIAMETER DRILLED IN CENTER OF STUD DEPTH OR STUD MANUFACTURER PUNCHOUTS IN STUDS CANNOT EXCEED d/2 OR 2 1/2", WHICHEVER IS LESS AND CANNOT BE SPACED CLOSER THAN 24"OC.
12. PROVIDE FRAMING AT WALL CORNERS AND INTERSECTIONS PER DETAILS 5 AND 6 ON SHEET S6.1, TYP, UNO.

PARTIAL TYPICAL INTERIOR STEEL STUD WALL FRAMING ELEVATION

SCALE: 1/4" = 1'-0"

A
S6.1

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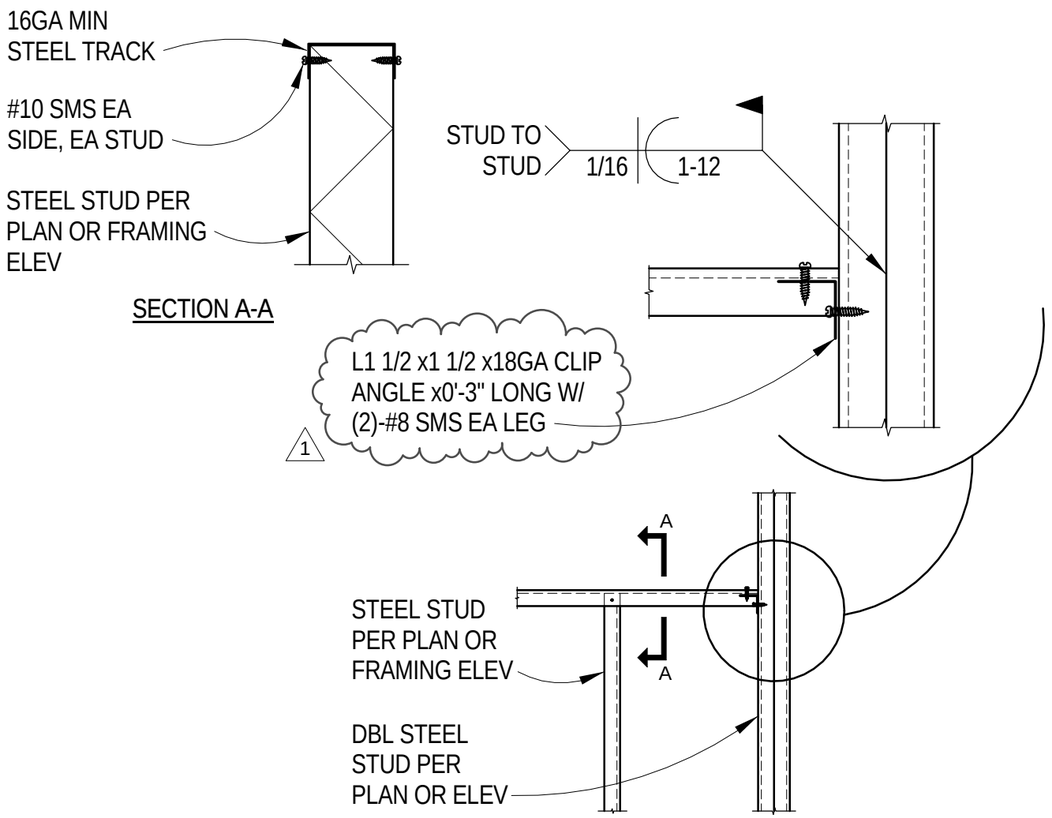
DIV. OF THE STATE ARCHITECT

SUBJECT:
INTERIOR STEEL STUD SECTIONS AND DETAILS

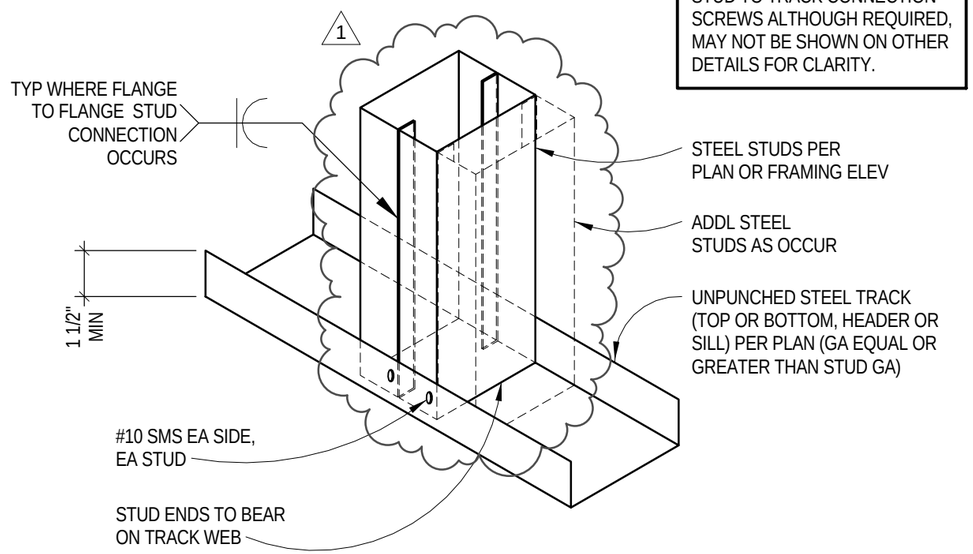
ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1/4" = 1'-0"	SKS-17
SHT. REF. NO.: S6.1	DATE: 04/12/16	



SILL AT 10'-0" MAX OPENING IN NON-BEARING INTERIOR STEEL STUD WALL

SCALE: 1" = 1'-0"

12 / S6.1



TYPICAL MULTIPLE STEEL STUDS TO TRACK CONNECTION

SCALE: 1 1/2" = 1'-0"

4 / S6.1

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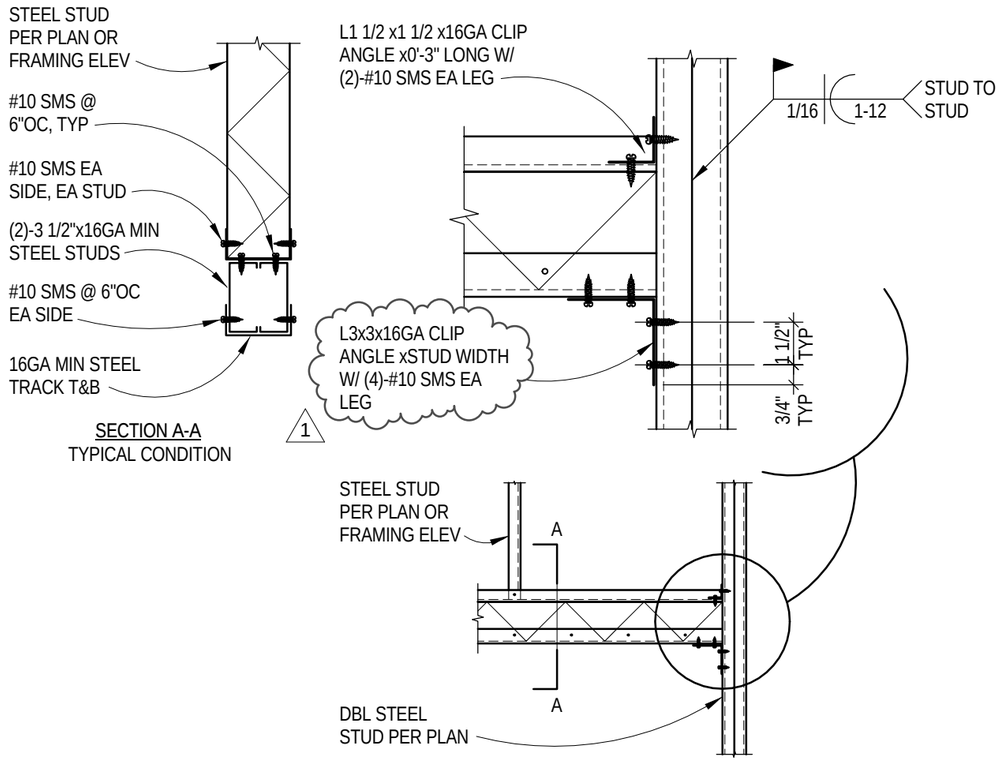
SUBJECT:
INTERIOR STEEL STUD SECTIONS AND DETAILS

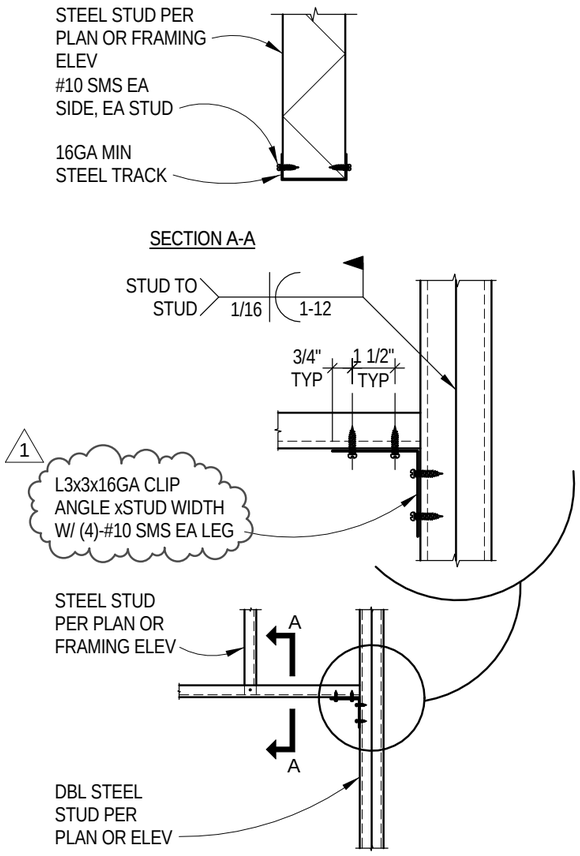
ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	As indicated	SKS-18
SHT. REF. NO.: S6.1	DATE: 04/12/16	



HEADER AT 10'-0" MAX OPENING IN NON-BEARING INTERIOR STEEL STUD WALL

13
S6.1

SCALE: 3/4" = 1'-0"



HEADER AT 4'-6" MAX OPENING IN NON-BEARING INTERIOR STEEL STUD WALL

11
S6.1

SCALE: 3/4" = 1'-0"

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SUBJECT:
INTERIOR STEEL STUD SECTIONS AND DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3/4" = 1'-0"	SKS-19
SHT. REF. NO.: S6.1	DATE: 04/12/16	

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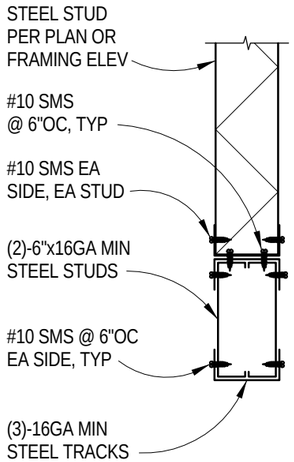
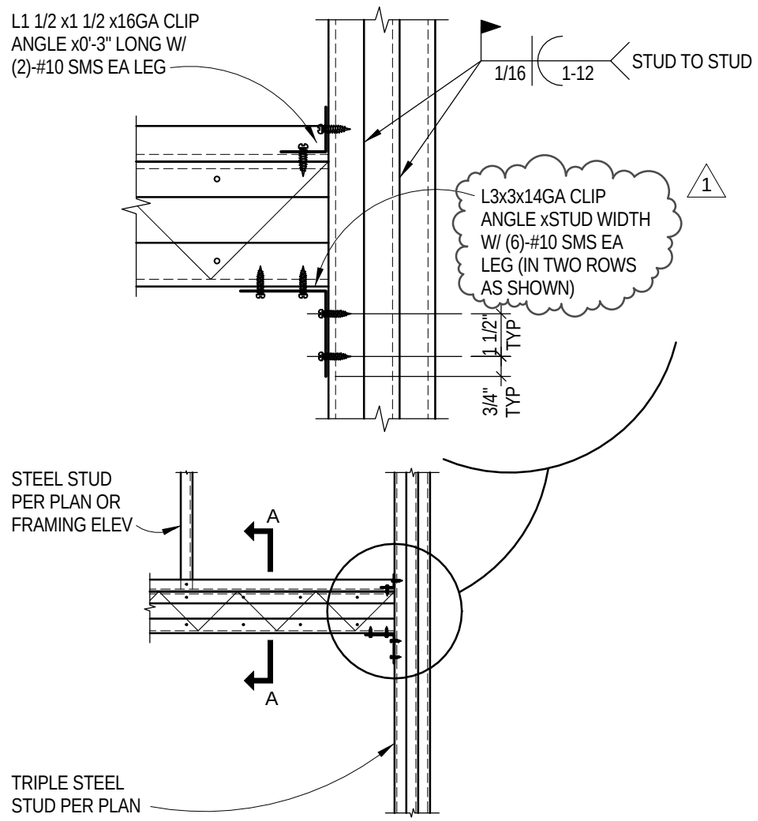


SECTION A-A



HEADER / SILL AT 16'-6" MAX OPENING IN NON-BEARING INTERIOR STEEL STUD WALL

14
S6.1

SCALE: 3/4" = 1'-0"

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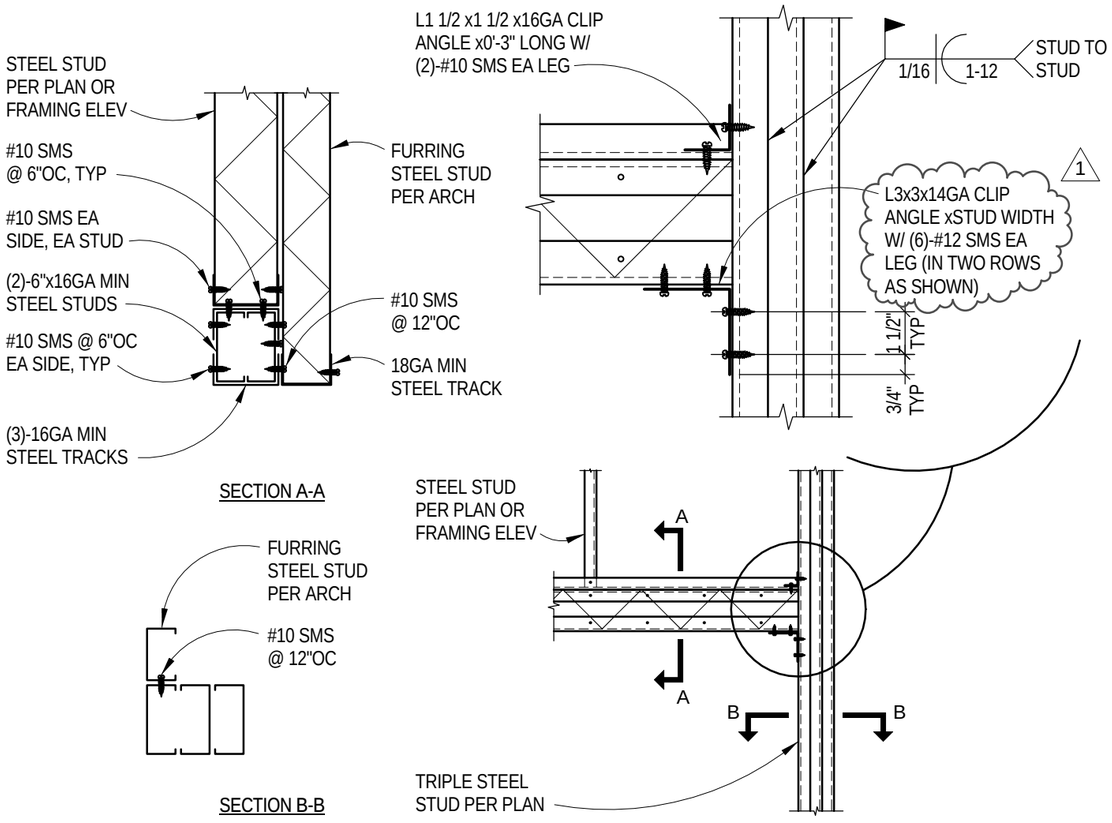
DIV. OF THE STATE ARCHITECT

SUBJECT:
INTERIOR STEEL STUD SECTIONS AND DETAILS

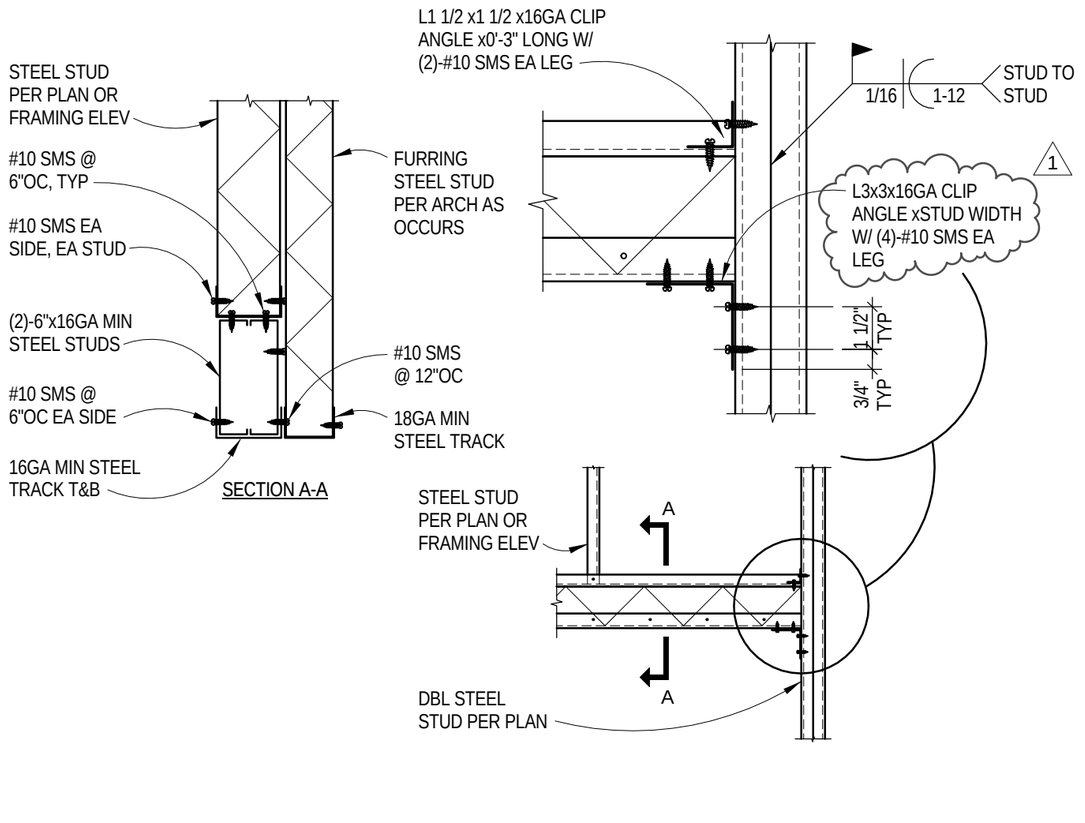
ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3/4" = 1'-0"	SKS-20
SHT. REF. NO.: S6.1	DATE: 04/12/16	



HEADER AT 12'-6" MAX OPENING IN NON-BEARING EXTERIOR STEEL STUD WALL

SCALE: 3/4" = 1'-0"

4 / S6.2



HEADER AT 4'-6" MAX OPENING IN NON-BEARING EXTERIOR STEEL STUD WALL

SCALE: 3/4" = 1'-0"

2 / S6.2

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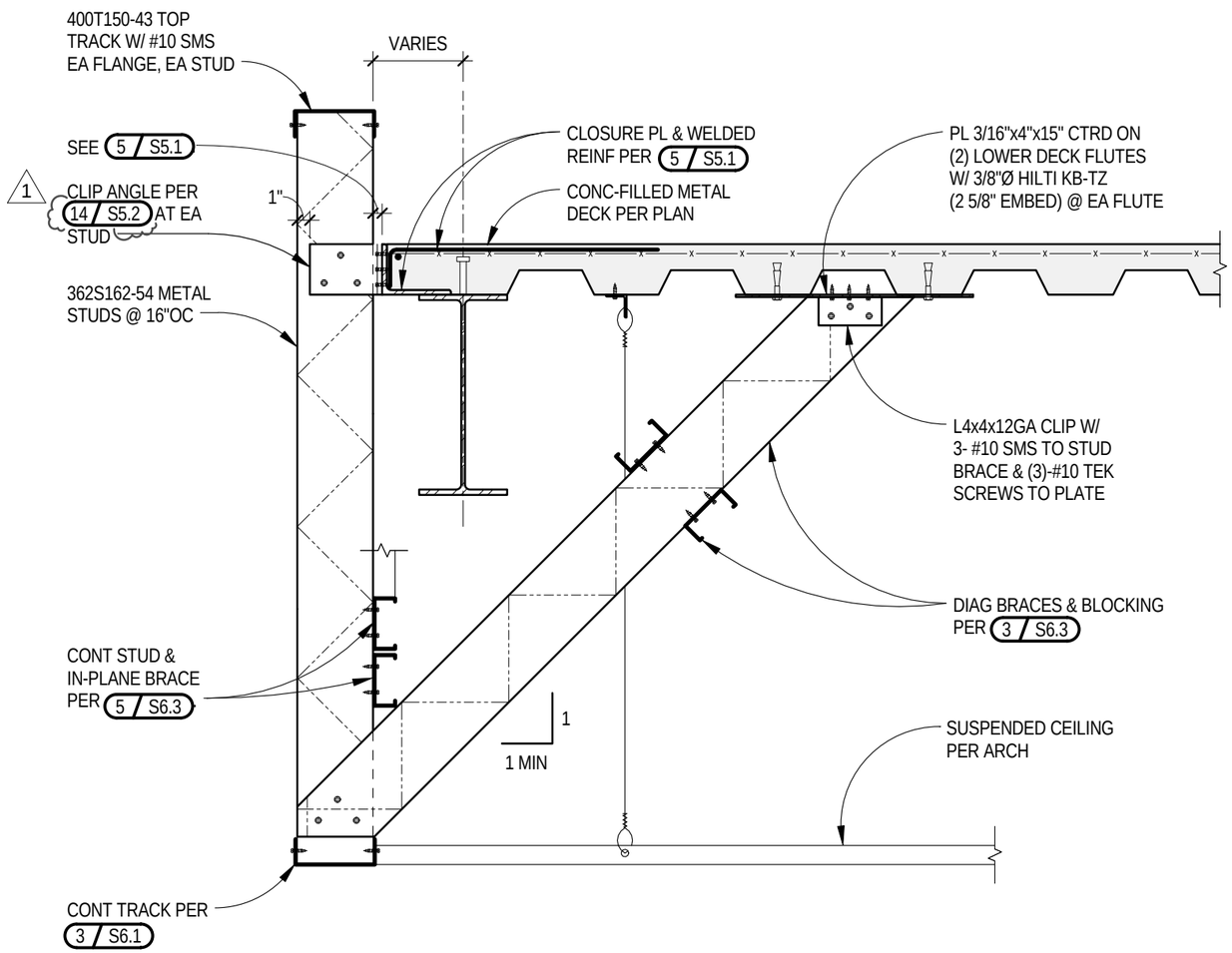
SUBJECT: EXTERIOR STEEL STUD SECTIONS AND DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	3/4" = 1'-0"	SKS-21
SHT. REF. NO.: S6.2	DATE: 04/12/16	



SOFFIT FRAMING DETAIL

SCALE: 1" = 1'-0"

7
S6.2

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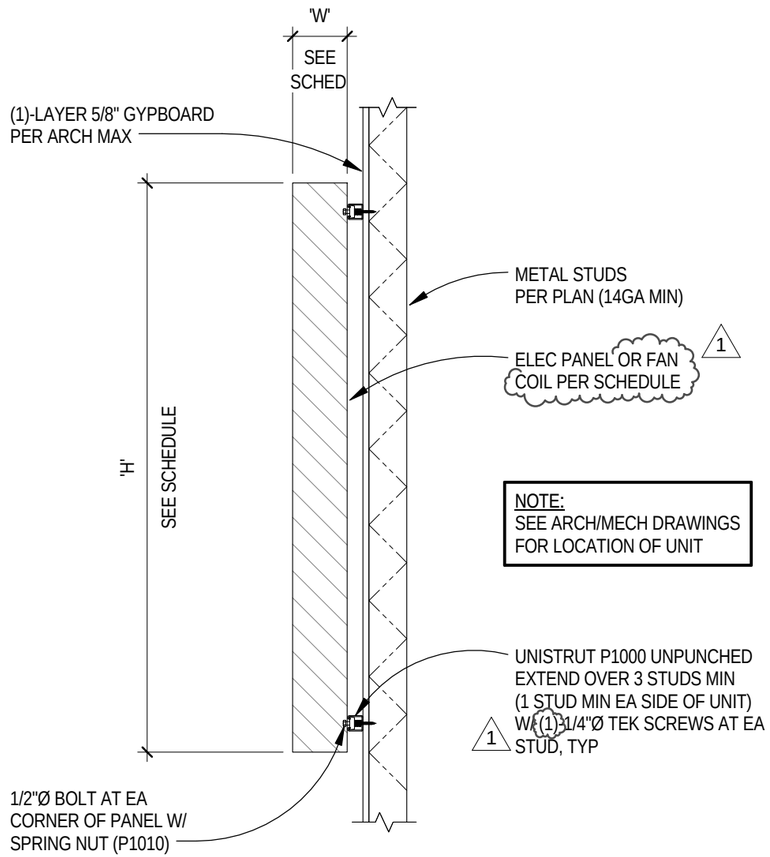
SUBJECT: EXTERIOR STEEL STUD SECTIONS AND DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	1" = 1'-0"	SKS-22
SHT. REF. NO.: S6.2	DATE: 04/11/16	



1 WALL MOUNTED EQUIPMENT DETAIL

SCALE: 3/4" = 1'-0"

9 / S7.1

EQUIPMENT ANCHORAGE SCHEDULE

EQUIPMENT LABEL	LOCATION	MAX OPERATING WEIGHT (INCL. CURB, WHERE OCCURS)	DIMENSIONS (IN, MAX)			A/M/E/P	ANCHORAGE DETAIL
			WIDTH	LENGTH	HEIGHT		
RTU-1	ROOF	4000 LBS	54.4	87.5	73.8	MECH	1/S7.1
RTU-2	ROOF	22,500 LBS	124.0	406.0	138.0	MECH	1/S7.1
RTU-3	ROOF	1000 LBS	46.5	75.5	35.0	MECH	11/S7.1
CU-1	ROOF	300 LBS	34.3	37.3	41.1	MECH	2/S7.1
CU-2	ROOF	1 165 LBS	1 14.4	31.5	23.6	MECH	2/S7.1
CU-3	ROOF	165 LBS	14.4	31.5	23.6	MECH	2/S7.1
1 CU-4	ROOF	165 LBS	14.4	31.5	23.6	MECH	2/S7.1
CU-5	ROOF	165 LBS	14.4	31.5	23.6	MECH	2/S7.1
EF-1	ROOF	100 LBS	19.0	19.0	37.5	MECH	4/S7.1
EF-2	ROOF	100 LBS	19.0	19.0	37.5	MECH	4/S7.1
1 EF-3	ROOF	100 LBS	19.0	19.0	37.5	MECH	4/S7.1
FC-1	CEILING	1 155 LBS	21.0	23.5	57.9	MECH	8/S7.1
FC-2	1 WALL	1 60 LBS	9.8	35.4	11.6	MECH	9/S7.1 1
FC-3	WALL	60 LBS	9.8	35.4	11.6	MECH	9/S7.1
1 FC-4	CEILING	60 LBS	37.4	37.4	12	MECH	8/S7.1
FC-5	CEILING	60 LBS	37.4	37.4	12	MECH	8/S7.1
INV	FLOOR	790 LBS	25.0	48.0	76.0	ELEC	7/S7.1
TDSL	FLOOR	2040 LBS	31.3	24.2	56.2	ELEC	7/S7.1
DSL	FLOOR	650 LBS	18.0	36.0	90.0	ELEC	7/S7.1
MSH	FLOOR	800 LBS	30.0	36.0	90.0	ELEC	7/S7.1
UPC	FLOOR	5250 LBS	38.0	48.0	85.0	ELEC	7/S7.1
MISC ELECTRICAL PANELS	WALL	150 LBS	5.8	20.0	60.0	ELEC	9/S7.1
SCIENCE ON SPHERE EXHIBIT	CEILING	50 LBS	68.0	68.0	68.0	ARCH	5/S7.1
FOUCAULT PENDULUM EQUIP	PENDULUM TOWER	640 LBS	20.0	20.0	29.6	ARCH	10/S7.1
MISC SUSPENDED EQUIP	CEILING	320 LBS	VARIOUS	VARIOUS	VARIOUS	M/E/P	8/S7.1

EQUIPMENT ANCHORAGE SCHEDULE

SCALE: NONE

A / S7.1

REGISTERED PROFESSIONAL ENGINEER
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PROJECT TITLE:

COMMUNITY PLANETARIUM
ORANGE COAST COLLEGE
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD. COSTA MESA, CA 92626
DIV. OF THE STATE ARCHITECT

SUBJECT: EQUIPMENT ANCHORAGE SUPPORT DETAILS

ISSUED FOR:	SCALE:	SK NO.
ADDENDUM 1A	As indicated	SKS-23
SHT. REF. NO.: S7.1	DATE: 04/11/16	

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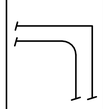
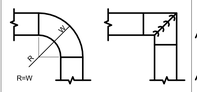
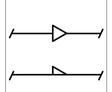
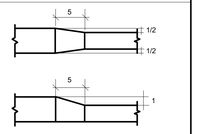
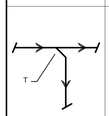
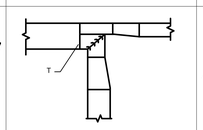
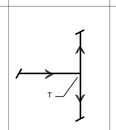
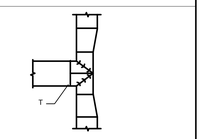
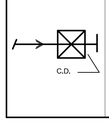
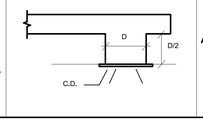
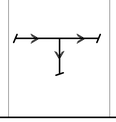
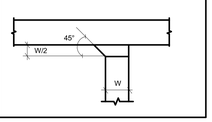
MECHANICAL GENERAL NOTES

1. MECHANICAL CONTRACTOR SHALL PERFORM INSTALLATION, START UP, AND TEST OF ALL AIR CONDITIONING UNITS.
2. FOR FINAL LOCATION OF CEILING DIFFUSERS AND REGISTERS, SEE ARCHITECTURAL REFLECTED CEILING AND FLOOR PLANS.
3. FOR ALL SUPPLY AND RETURN DUCTWORK LINING SEE MECHANICAL PLAN SHEET M2.01.
4. EXISTING CONCRETE REINFORCING SHALL BE LOCATED BY NON-DESTRUCTIVE TESTING PRIOR TO CORING CONCRETE SLABS, WALLS AND ROOF FOR PIPES, CONDUITS, ECT. EXISTING CONCRETE REINFORCING SHALL NOT BE CUT. SHIFT PIPE/CONDUITS, ECT. AS REQUIRED TO MISS EXISTING REINFORCING.
5. LABEL EACH HVAC EQUIPMENT TO IDENTIFY THE AREA IT SERVES.
6. LOW VOLTAGE WIRING EXPOSED TO THE WEATHER SHALL BE INSTALLED IN CONDUIT APPROVED FOR EXTERIOR USE.
7. CONTRACTOR SHALL VISIT JOBSITE AND VERIFY ALL CONDITIONS, LOCATIONS AND DIMENSIONS BEFORE SUBMITTING THE BID AND STARTING WORK.
8. ALL WORK SHALL BE IN FULL ACCORDANCE WITH ALL CODES, RULES, AND REGULATIONS OF GOVERNING AGENCIES AND SHALL COMPLY WITH THE REQUIREMENTS OF THE SERVING UTILITY COMPANIES.
9. EXACT LOCATION OF HVAC EQUIPMENT, SUPPLY AND RETURN REGISTERS, AND DUCT SHALL BE COORDINATED IN THE FIELD BY THE CONTRACTOR. PROVIDE NECESSARY ADJUSTMENTS, OFFSETS, FITTINGS, TRANSITIONS TO MISS BEAMS OR OTHER STRUCTURAL MEMBERS, LIGHT FIXTURES, CONDUITS, ETC,. WITHOUT ANY ADDITIONAL COST TO THE OWNER.
10. CONTRACTOR SHALL INSTALL REQUIRED HVAC COMPONENTS TO FIT ACTUAL JOBSITE CONDITIONS WITHOUT IMPAIRING THE CONCEPT OF THE DESIGN SYSTEM.
11. CONTRACTOR SHALL INCLUDE ANY DUCT OR PIPE TURNS OR ANY ADDITIONAL APPURTENANCE NECESSARY FOR THE PROPER FUNCTION OF THE SYSTEM EVEN IF THEY ARE NOT SHOWN ON THE DRAWINGS OR IN THE SPECIFICATIONS.
12. CONTRACTOR SHALL BE RESPONSIBLE FOR EXACT LOCATION OF ROOF, WALL, AND FLOOR PENETRATIONS BY DUCTS AND PIPES. VERIFY IN FIELD.
13. FRESH AIR INTAKE SHALL BE 10 FT AWAY FROM APPLIANCE VENTS, PLUMBING VENTS OR EXHAUST FAN OUTLETS.
14. ALL DUCT SIZES GIVEN ON THE DRAWINGS ARE NET INSIDE CLEAR DIMENSIONS. DUCT SIZES INDICATED SHALL BE INCREASED TO COMPENSATE FOR THICKNESS OF INSULATION AND/OR ACOUSTICAL LINING.
15. PATCH AND REPAIR ALL EXISTING MATERIALS OR EQUIPMENT DAMAGED OR EXPOSED BY REMOVAL WORK OR BY ANY OTHER CONSTRUCTION WORK. MATCH ADJACENT SIMILAR MATERIALS IN TEXTURE AND COLOR.
16. UPON COMPLETION OF THE WORK, REMOVE ALL WASTE AND DEBRIS AND LEAVE PREMISES IN A CLEAN CONDITION.
17. ALL THERMOSTATS SHALL BE ADJUSTABLE TO PROVIDE A TEMPERATURE RANGE OF UP TO 10 DEGREES FAHRENHEIT BETWEEN FULL HEATING AND FULL COOLING AND SHALL HAVE THE CAPABILITY OF TERMINATING ALL HEATING AT A TEMPERATURE OF NO MORE THAN 72°F AND TERMINATING ALL COOLING AT A TEMPERATURE NOT LESS THAN 72°F. MOUNT ALL THERMOSTATS AND SENSOR DEVICES 48 INCHES ABOVE FLOOR FINISH.
18. PERMANENT ACCESS TO EQUIPMENT SHALL BE PROVIDED FOR MAINTENANCE.
19. INSPECTION, OPERATION AND MAINTENANCE OF ALL CONTROLS, MOTOR BEARINGS, OR OTHER APPARATUS CONCEALED ACCESS DOORS: WHERE NECESSARY IN DUCTWORK OR CASINGS, SUITABLE ACCESS DOORS AND FRAMES TO PERMIT BEHIND THE SHEET METAL WORK SHALL BE PROVIDED, ACCESS DOORS IN DUCTS MAY BE OF SINGLE PANEL CONSTRUCTION OF NOT LESS THAN NO. 18 GAUGE, GALVANIZED, AND SHALL HAVE SPONGE RUBBER GASKETS WITH HINGES AND LATCHES.
20. DUCT:
- 20.1. PROVIDE HANGERS PER CMC CHAPTER 6, TABLE 6-7 AND AS SHOWN ON DRAWINGS.
- 20.2. PROVIDE TURNING VANES AT ALL DIRECTION CHANGES OR AIR STREAM. THE VANES TO BE DOUBLE THICKNESS, SECURELY RIVETED OR WELDED IN FRAMES, AND TO BE OF ADEQUATE THICKNESS TO PREVENT BUCKLING OR VIBRATION DURING OPERATION OF THE SYSTEM.
- 20.3. CONSTRUCTION SHALL BE PER CMC CHAPTER 6, TABLES 6-1, 6-2, AND 6-3; DUCT SUPPORT PER TABLE 6-5.
21. SEE ELECTRICAL DWGS FOR DISCONNECT SWITCHES.
22. CONTRACTOR SHALL BALANCE ALL AIR QUANTITIES TO THOSE SHOWN ON DRAWINGS, AND FOLLOW BALANCING PROCEDURES AS OUTLINED IN THE SPECIFICATIONS, THE CONTRACTOR SHALL DEMONSTRATE TO THE CITY ENGINEER THAT THE SYSTEM IS IN BALANCE AND SHALL SPOT-CHECK DIFFUSERS.
23. ALL LOW VOLTAGE WIRING AND CONDUITS SHALL BE SUPPLIED AND INSTALLED UNDER DIVISION 15.
24. ALL LINE VOLTAGE WIRING AND CONDUITS SHALL BE SUPPLIED AND INSTALLED UNDER DIVISION 16.
25. PROVIDE ISOLATION FOR ALL MOVING EQUIPMENT, AND BETWEEN EQUIPMENT AND DUCTWORK (I.E. ISOLATORS, FLEX CONNECTORS, ETC.).
26. ALL EQUIPMENT SHALL COMPLY WITH THE CALIFORNIA STATE ENERGY COMMISSION STANDARDS.
27. PROVIDE MANUAL VOLUME DAMPER TO FACILITATE PROPER BALANCE OF EACH AIR INLET/OUTLET.
28. SEAL ALL OPENINGS AROUND PIPING AND DUCTWORK PENETRATING FIRE RESISTIVE RATED WALLS AND FLOORS TO MAINTAIN RATING INTEGRITY.
29. INSTALL EQUIPMENT IN ACCESSIBLE LOCATION AND PROVIDE ADEQUATE SERVICE CLEARANCE FOR NORMAL MAINTENANCE WITHOUT REMOVING ARCHITECTURAL, ELECTRICAL OR STRUCTURAL ELEMENTS.
30. FLEXIBLE DUCT LENGTH SHALL NOT EXCEED 6'-0". MINIMUM RADIUS SHALL BE 1-1/2 DIAMETER OF DUCT.
31. PROVIDE ISOLATION VALVES AND UNIONS ON PIPING ADJACENT TO ALL CONTROL VALVES AND OTHER APPURTENANCES OR EQUIPMENTS. LOCATE VALVES SO THE EQUIPMENT CAN BE REMOVED WITHOUT WITHOUT DISMANTLING ANY BRANCH LINES.
32. ALL CURB, ROOF JACKS AND EQUIPMENT SUPPORT PADS SHALL BE COMPATIBLE WITH ROOFING SYSTEM.
33. SEE PLUMBING DRAWINGS FOR CONDENSATE DRAIN PIPING AND DRAINAGE FITTINGS.
34. A MAINTENANCE LABEL SHALL BE AFFIXED TO MECHANICAL EQUIP. A MAINTENANCE MANUAL SHALL BE PROVIDED FOR THE OWNER'S USE.
35. ALL DUCTWORK AND EQUIPMENT WHICH IS EXPOSED SHALL BE APPLIED WITH PRIMER AND ENAMEL PAINT. COLOR SHALL BE SELECTED BY THE OWNER/OWNERS REPRESENTATIVE. ALL DUCTWORK EXPOSED UNDER THE CEILING SHALL BE PAINTED W/PRIMER AND ENAMEL PAINT TO MATCH THE SURROUNDINGS. PAINT DUCTWORK VISIBLE BEHIND AIR OUTLETS AND INLETS MATTE BLACK.
36. ALL MATERIALS USED IN RETURN AIR PLENUMS SHALL BE APPROVED FOR USE IN RETURN AIR PLENUMS.
37. FIELD COORDINATE THE EXACT LOCATION OF ALL TEMPERATURE SENSORS, THERMOSTATS WITH ANY EQUIPMENT, SHELVING, RACKS, CABINETS OR OTHER FACILITY SUPPLIED FURNITURE.
38. PROVIDE SHEET METAL WEATHER HOOD COVER FOR ALL DAMPER ACTUATORS, SMOKE DETECTOR MOTORS LOCATED OUTDOORS.
39. PER CALIFORNIA MECHANICAL CODE SECTION 609, CONTRACTOR SHALL PROVIDE SHUTOFF FOR SMOKE CONTROL FOR ALL ALL AIR-MOVING SYSTEMS SUPPLYING AIR IN EXCESS OF 2,000 CUBIC FEET PER MINUTE TO ENCLOSED SPACES WITHIN BUILDINGS. AUTOMATIC SHUTOFF SHALL BE ACCOMPLISHED BY INTERRUPTING THE POWER SOURCE OF THE AIR-MOVING EQUIPMENT UPON DETECTION OF SMOKE IN THE MAIN SUPPLY-AIR DUCT SERVED BY SUCH EQUIPMENT. SMOKE DETECTORS WHICH WILL DETECT PRODUCTS OF COMBUSTION OTHER THAN HEAT AND WHICH COMPLY WITH THE CALIFORNIA BUILDING CODE, SHALL BE LABELED BY AN APPROVED AGENCY FOR AIR-DUCT INSTALLATION AND SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. SUCH DEVICES SHALL BE COMPATIBLE WITH THE OPERATING VELOCITIES, PRESSURES, TEMPERATURES AND HUMIDITIES OF THE SYSTEM. WHERE FIRE DETECTION OR ALARM SYSTEMS ARE PROVIDED FOR THE BUILDING, THE SMOKE DETECTORS REQUIRED BY THIS SECTION SHALL BE SUPERVISED BY SUCH SYSTEMS AND SHALL ACTIVATE THE FIRE ALARM SYSTEM.
40. AT NO TIME DURING CONSTRUCTION, THE OPERATING IT EQUIPMENT SHALL BE LEFT WITHOUT SUFFICIENT COOLING AND POWER UPS.
41. MECHANICAL CONTRACTOR TO PROVIDE AND CHARGE THE AC EQUIPMENTS WITH REFRIGERANT AT JOBSITE.

MECHANICAL ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	EAG	EXHAUST AIR GRILLE	MIN	MINIMUM
AHU	AIR HANDLING UNIT	EER	ENERGY EFFICIENCY RATIO	NC	NOISE CRITERIA
AMB	AMBIENT	EF	EXHAUST FAN	OA	OUTSIDE AIR
ARCH	ARCHITECT OR ARCHITECTURAL	ENT	ENTERING	OPNG	OPENING
B	BOILER	ESP	EXTERNAL STATIC PRESSURE	P	PUMP
BHP	BRAKE HORSE POWER	EXH	EXHAUST	RA	RETURN AIR
BTUH	BRITISH THERMAL UNIT PER HOUR	°F	DEGREES FAHRENHEIT	RAG	RETURN AIR GRILLE
CAV	CONSTANT AIR VOLUME	FCU	FAN COIL UNIT	RLA	RUNNING LOAD AMP
CD	CEILING DIFFUSER	FLA	FULL LOAD AMP,	RPM	REVOLUTIONS PER MINUTE
CFH	CUBIC FEET PER HOUR	FPI	FINS PER INCH	SA	SUPPLY AIR
CFM	CUBIC FEET PER MINUTE	FPM	FEET PER MINUTE	SAG	SUPPLY AIR GRILLE
CLG	CEILING	GAL.	GALLON	SP	STATIC PRESSURE
COP	COEFFICIENT OF PERFORMANCE	HP	HORSEPOWER	SF	SQUARE FEET
CV	CONSTANT VOLUME	HZ	HERTZ	ST	SOUND TRAP
DB	DRY-BULB	INWC	INCH OF WATER COLUMN	TG	TRANSFER GRILLE
DIFF	DIFFUSER	INWG	INCH OF WATER GAGE	TYP	TYPICAL
DN	DOWN	KBTUH	THOUSAND BTU PER HOUR	UNO	UNLESS NOTED OTHERWISE
DS	DUCT SILENCER	LBS	POUNDS	UTR	UP THROUGH ROOF
DWG	DRAWING	MAX	MAXIMUM	VAV	VARIABLE AIR VOLUME
(E)	EXISTING	MCA	MINIMUM CIRCUIT AMP	VTR	VENT THROUGH ROOF
EA	EXHAUST AIR	MCC	MOTOR CONTROL CENTER		

RECTANGULAR LOW PRESSURE DUCTWORK

SINGLE LINE DIAGRAM	DOUBLE LINE CONFIGURATION	SINGLE LINE DIAGRAM	DOUBLE LINE CONFIGURATION
			
			
			

ROUND LOW PRESSURE DUCTWORK

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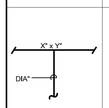	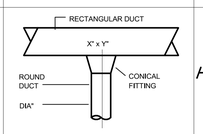	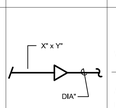	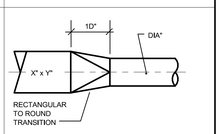
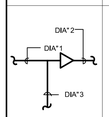	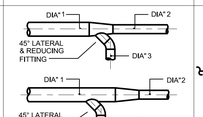	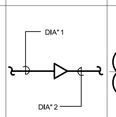	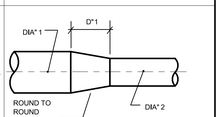

STRUCTURAL DESIGN CRITERIA

1A

MEP COMPONENT ANCHORAGE NOTE

ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2013 CBC, SECTIONS 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

1. ALL PERMANENT EQUIPMENT AND COMPONENTS.
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE ATTACHMENT OF THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.8, 13.6.7, 13.6.5.6, AND 2013 CBC, SECTIONS 1616A.1.23, 1616A.1.24, 1616A.1.25 AND 1616A.1.26.

THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS (OPA #349 OR OPA 485).

COPIES OF THE MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS.

THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

MECHNICAL LEGEND

SYMBOL DOUBLE	SYMBOL SINGLE	ABBREV.	DESCRIPTION
	S	S	COLD SUPPLY AIR DUCT
	E	E	EXHAUST AIR DUCT
	R	R	RETURN AIR DUCT
			ROUND RADIUS ELBOW
48X24(L)	48X24(L)		DUCT WITH INTERNAL LINING
			TRANSITION - RECTANGULAR TO RECTANGULAR OR ROUND TO ROUND
			TRANSITION - RECTANGULAR TO ROUND
			ELBOW WITH TURNING VANE
R	R		RISE IN DIRECTION OF AIRFLOW
D	D		DROP IN DIRECTION OF AIRFLOW
48X24	48X24		48" X 24" DUCT FIRST DIMENSION FACES VIEWER
			FLEXIBLE DUCT
			CEILING DIFFUSER 4-WAY THROW
			CEILING DIFFUSER 3-WAY THROW
			CEILING DIFFUSER 2-WAY THROW
			CEILING DIFFUSER CORNER THROW
		MOD	MAXIMUM OVERLOAD DEVICE
			SUPPLY OR OUTSIDE AIR DUCT - SECTION
			RETURN OR RELIEF AIR DUCT - SECTION
			EXHAUST AIR DUCT - SECTION
			ROUND DUCT OR RISER - SECTION
SFD	SFD		COMBINATION SMOKE & FIRE DAMPER
FD			FIRE DAMPER
	MD	MD	MOTORIZED DAMPER
		VD (QBD)	MANUAL VOLUME DAMPER (QUADRANT BALANCING DAMPER)
BDD		BDD	BACKDRAFT DAMPER
			FLEXIBLE DUCT CONNECTOR
			CAPPED DUCTWORK
			CONICAL TAP W/MANUAL VOLUME DAMPER
		360	CEILING DIFFUSER, ADAPTER FOR ROUND DUCT. 360 CFM
EXHAUST	RETURN		CEILING GRILLE OR REGISTER
		6X6 150	6"X6"WALL REGISTER, 150 CFM
		(4)3/4"X5'-0" LAD 300	NO. & SIZE OF SLOTS, LENGTH, LINEAR AIR DIFFUSER, CFM
P			PRESSURE TRANSMITTER
S			TEMPERATURE SENSOR
T			ROOM THERMOSTAT
H			HUMIDITY TRANSMITTER
H			ROOM HUMIDISTAT
SD			DUCT MOUNTED SMOKE DETECTOR (FURNISH AND WIRE UNDER ELECTRICAL SECTION AND INSTALL UNDER MECHANICAL SECTION)
WL			WALL LOUVER (UNDER ARCH SECTION)
U/C			UNDERCUT DOOR (UNDER ARCH SECTION)
D/L			DOOR LOUVER (UNDER ARCH SECTION)
L/D			LOUVERED DOOR FULL HEIGHT (UNDER ARCH SECTION)
		AP/AD	ACCESS PANEL/ ACCESS DOOR
RL		RL	REFRIGERANT LIQUID
RS		RS	REFRIGERANT SUCTION
D		D	INDIRECT DRAIN
VAV X-Y-ZZ		VAV	VARIABLE AIR VOLUME BOX x - AC SYSTEM Y - FLOOR ZZ - BOX. No.
		VAV OR CAV	VAV OR CAV TERMINAL BOX (ABOVE CEILING)

MECHANICAL LEGEND

SYMBOL	ABBREV.	DESCRIPTION
HWS	HWS	HOT WATER SUPPLY
HWR	HWR	HOT WATER RETURN
		CAPPED PIPE
		PIPE ELBOW UP
		PIPE ELBOW DOWN
		PIPE TEE UP
		PIPE TEE DOWN
		STRAINER
		UNION
		FLANGE
		ECCENTRIC REDUCER
		CONCENTRIC REDUCER
EJ		EXPANSION JOINT
		PRESSURE GAGE WITH COCK
		TEMPERATURE GAGE
PTTP		COMBINATION PRESSURE & TEMPERATURE TEST PLUG
		FLEXIBLE PIPE CONNECTOR
		ANCHOR
		PIPE GUIDE
		FLOW MEASURING STATION
FS	FS	FLOW SWITCH
PS	PS	PRESSURE SWITCH
		PLUG VALVE
		BUTTERFLY VALVE
		BALL VALVE
	GLV	GLOBE VALVE
	CV	CHECK VALVE
	RV	SAFETY OR PRESSURE RELIEF VALVE
	PRV	PRESSURE REDUCING VALVE
		FLOW CONTROL VALVE, AUTOMATIC
		2-WAY CONTROL VALVE
		3-WAY CONTROL VALVE
	AAV	AUTOMATIC AIR VENT TO BE PIPED TO NEAREST APPROVED RECEPTOR
	MAV	MANUAL AIR VENT TO BE PIPED TO NEAREST APPROVED RECEPTOR
DP		DIFFERENTIAL PRESSURE
FS	FS	FLOOR SINK (UNDER PLUMBING SECTION)
CO2		CARBON DIOXIDE SENSOR FOR VENTILATION
	POC	POINT OF CONNECTION
	POD	POINT OF DISCONNECTION
1 / M1		DETAIL DESIGNATION / SHEET NUMBER — DETAIL REFERENCE
1		SHEET NOTE
A / M-2		SECTION DESIGNATION / SHEET NO. WHERE SECTION DRAWN
1		REVISION TAG
		RETURN / EXHAUST AIR FLOW DIRECTION
E-1	E-1	NEW EQUIPMENT DESIGNATION
CAV X-YZZ	CAV	CONSTANT AIR VOLUME BOX x - AC SYSTEM Y - FLOOR ZZ - BOX. No.

MECHANICAL SHEET INDEX

1A

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SHEET TITLE
MECHANICAL COVER SHEET

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CONSTRUCTION DOCUMENTS 12/15/2014

ROOFTOP UNIT SCHEDULE

SYMBOL	MFGR. & MODEL NO.	SERVICE	TYPE	LOCATION	SUPPLY FAN: FAN TYPE/SIZE	SUPPLY FAN: FAN QTY.	SUPPLY FAN: FAN TOTAL CFM	SUPPLY FAN: FAN TOTAL SP (IN WC)	SUPPLY FAN: FAN EXTERNAL SP (IN WC)	SUPPLY FAN: FAN RPM	SUPPLY FAN: MOTOR TOTAL HP	SUPPLY FAN: MOTOR POWER V/PH/HZ	EXHAUST FAN: FAN TYPE/SIZE	EXHAUST FAN: FAN QTY.	EXHAUST FAN: FAN CFM	EXHAUST FAN: FAN TOTAL SP (IN WC)	EXHAUST FAN: FAN EXTERNAL SP (IN WC)	EXHAUST FAN: FAN RPM	EXHAUST FAN: MOTOR BHP	EXHAUST FAN: MOTOR POWER V/PH/HZ	CAPACITY: TOTAL KBTUH	CAPACITY: SENS KBTUH	MIN. AREA SQ. FT.	AIR VELOCITY FPM	ROWS/FPI	COOLING COIL: EAT DB	COOLING COIL: EAT WB	COOLING COIL: LAT DB	COOLING COIL: LAT WB	COOLING COIL: APD IN. WG (MAX)	GAS HEATER: INPUT MBH	GAS HEATER: OUTPUT MBH	GAS HEATER: EFF%	FILTERS	MIN. OSA CFM	MIN. RELIEF AIR CFM	OPER. WEIGHT (LBS)	ANCH. DETAIL	ACCESSORIES	REMARKS
RTU-1	McQUAY DPS015A	PLANETARIUM	PACKAGE	ROOF	AF 22	1	4300	2.7	-	1391	4	460-3-60	AF 16	1	4000	-	0.50	2033	1.3	460-3-60	175.0	122	15.4	279	6 15	80	67	54	54	0.34	200	160	80	2" MERV 8	3200	-	4,000	A/S7.1	2 3 4 5 6 8 9 10	5 6 7 8
RTU-2	SEASON 4 3-ZONE MULTIZONE	LOBBY	CUSTOM	ROOF	AF 24.5	4	22000	5.25	2.0	1748	30	460-3-60	AF 40.25	1	22000	1.0	0.5	618	7.5	460-3-60	598.6	443	40.0	-	4 10	80	67	61.7	58.4	-	650	520	80	2" MERV 8 PRE-FILTER 4" MERV 13	2200	-	22,500	A/S7.1	1 2 3 4 5 6 8 9 10	1 3 5 6 7 8
RTU-3	McQUAY MPSH05B	AUXILIARY AREAS	PACKAGE	ROOF	FC 10	1	1800	-	.75	1258	1.2	460-3-60	- -	-	-	-	-	-	-	-	55.00	47.1	5.1	392	3 15	76	61	55	51	-	135	109	81	1" MERV 8	320	-	1,000	A/S7.1	2 3 5 6 8 9	5 6 7 8

ACCESSORIES:

1 VAPOR PROOF SERVICE LIGHTS TO A SINGLE SWITCH. 2 CONVENIENCE OUTLET. 3 BUILT-IN RETURN, OSA AND RELIEF AIR DAMPER 4 UNIT-MOUNTED VFD'S FOR SUPPLY AND RETURN FANS 5 FAN DOOR SWITCH. 6 WINDOW GLASS AT ACCESS DOORS. 7 (NOT USED)

8 100% FULLY MODULATING ECONOMIZER SYSTEM WITH DIFFERENTIAL ENTHALPY CONTROLS. 9 PROVIDE MAGNAHELIC FILTER GAUGE FOR PRE AND FINAL FILTER SECTIONS. 10 PROVIDE DUCT DETECTOR ON SUPPLY AIR DUCT

REMARKS:

1 AH UNIT MANUFACTURER SHALL PROVIDE AN "AIR FLOW STATION" FACTORY INSTALLED AT OSA INLET. 2 CORROSION PROTECTION COATING ON COILS 3 PROVIDE HIGH PRESSURE CUT-OFF SWITCH FOR SUPPLY AND RETURN FANS. 4 (NOT USED) 5 SINGLE POINT POWER CONNECTION; 6 COPPER FINS COPPER TUBES

7 ZONE 1 - 10,880 CFM, ZONE 2 - 4,480, ZONE 3 - 6,640 CFM 8 PROVIDE PITCHED CURB TO MATCH ROOF SLOPE.

SPLIT SYSTEM INDOOR FAN COIL UNIT SCHEDULE

SYMBOL	SERVICE	LOCATION	MFGR.	MODEL	COOLING CAP. (TOT./SENS.) (KBTUH)	SUPPLY FAN DATA: CFM	SUPPLY FAN DATA: ESP (INWG)	SUPPLY FAN DATA: HP	ELECTRICAL: POWER V-ph-HZ	ELECTRICAL: TOTAL FLA	ELECTRICAL: MCA	ELECTRICAL: MAX FUSE SIZE	WEIGHT (LBS)	ANCHORAGE	ACCESSORIES	REMARKS
FC-1	ELECTRICAL ROOM 117	CEILING MOUNTED	TRANE	4TEC3F60	59.5/42.9	2000	.3	1.0	208-1-60	7.6	9.5	15	155	A/S7.1	1 2 3	2 4
FC-2	IT-114	WALL MOUNTED	MITSUBISHI	PKA-A24FA	24.0/18.72	705	0	(89W)	208V-1 -60	0.43	1	15	60	A/S7.1	1 3 6	1 2
FC-3	THEATRE A/V 122	WALL MOUNTED	MITSUBISHI	PKA-A24FA	24.0/18.72	705	0	(89W)	208V-1 -60	0.43	1	15	60	A/S7.1	1 3 6	1 2
FC-4	CONTROL-2 111-2	CEILING MOUNTED	MITSUBISHI	PLA-A24BA	24.0/18.72	705	0	(89W)	208V-1 -60	0.43	1	15	60	A/S7.1	1 3 6	1 2 3
FC-5	CONTROL-2 111-2	CEILING MOUNTED	MITSUBISHI	PLA-A24BA	24.0/18.72	705	0	(89W)	208V-1 -60	0.43	1	15	60	A/S7.1	1 3 6	1 2 3
FC-6	AV-104	WALL MOUNTED	MITSUBISHI	PKA-A24FA	24.0/18.72	705	0	(89W)	208V-1 -60	0.43	1	15	60	A/S7.1	1 3 6	1 2

ACCESSORIES:

1 PROVIDE FACTORY CONDENSATE PUMP 2 PROVIDE SECONDARY DRAIN PAN BELOW UNIT 3 PROVIDE HARDWIRED THERMOSTAT 4 PROVIDE HARDWIRED THERMOSTAT WITH REMOTE ROOM SENSOR READY INPUT

5 PROVIDE LOCKING COVER 6 INDOOR UNIT RECEIVES POWER FROM OUTDOOR UNIT THROUGH FIELD SUPPLIED INTERCONNECTED WIRING.

REMARKS:

1 FCU SHALL BE WALL MOUNTED IN ROOM SERVED. 2 COPPER FINS COPPER TUBES 3 PROVIDE SPRING ISOLATOR 4 PROVIDE 24 GA 304 SS SECONDARY DRAIN PAN WITH 2" LIP. ROUTE INDEPENDENT SECONDARY CONDENSATE DRAIN AND TERMINATE TO A APPROVED LOCATION. DRAIN SIZE TO COMPLY WITH CMC.

SUPPLY AIR OUTLET SCHEDULE

MARK OR SYMBOL	TYPE	NECK SIZE	FACE DIM	CFM RANGE	DUCT CONN SIZE	REMARKS
SA ONE WAY FLOW	LOUVERED FACE DIFFUSERS WITH DIRECTIONAL AIR PATTERN & VOLUME DAMPER IN BRANCH DUCT. SEE SPECIFICATIONS FOR MANUFACTURER.	8 X 8	IN ACOUSTICAL CEILING, 24X24 OR 12x12 FLUSH MOUNTED. UNLESS OTHERWISE NOTED ON PLANS. IN GYPSUM BOARD CEILING, SURFACE MOUNTED. PRICE AMCOP (U.N.O.)	UP TO 120	7" DIA	UNLESS OTHERWISE NOTED ON DRAWINGS, SELECT OUTLET NECK SIZE AND DUCT CONN SIZE FOR MAX 468 FPM OR NC 25 AT PLANETARIUM, 460 FPM OR NC 25 AT DIRECTOR OFFICE, 540 FPM OR NC 30 AT OPEN LOBBY, AND 640 FPM AND NC 35 AT OPEN OFFICE. TO SUIT CEILING GRID SYSTEMS REFER TO ARCH DRAWINGS FOR ALL CEILING GRID SYSTEMS. 1 2 3
SA TWO WAY FLOW		8 X 8		101-150	8" DIA	
		10 X10		151-200	9" DIA	
SA CORNER FLOW		12X12		201-250	10" DIA	
		14X14		251-350	12" DIA	
		16X16		351-480	14" DIA	
		18X18		481-640	16" DIA	
SA THREE WAY FLOW		8X8		UP TO 120	7" DIA	
		8X8		101-150	8" DIA	
		10X10		151-200	9" DIA	
		12X12		201-250	10" DIA	
		14X14		251-350	12" DIA	
		16X16		351-480	14" DIA	
SA FOUR WAY FLOW		18X18		481-640	16" DIA	

RETURN & EXHAUST INLET SCHEDULE

MARK OR SYMBOL	TYPE	NECK SIZE	FACE DIM	CFM RANGE	DUCT CONN SIZE	REMARKS
EG OR RG	PERFORATED FACE EXHAUST OR RETURN GRILLE WITH DAMPER IN BRANCH DUCT. SEE SPECIFICATIONS FOR MANUFACTURER.	8 X 8	UNLESS OTHERWISE NOTED ON PLANS IN ACOUSTICAL CEILING GRID SYSTEMS. IN GYP BD CLG. & WALLS SURFACE MOUNTED.	UP TO 130	7" DIA	UNLESS OTHERWISE NOTED ON DRAWINGS, SELECT OUTLET NECK SIZE AND DUCT CONN SIZE FOR MAX 468 FPM OR NC 25 AT PLANETARIUM, 652 FPM OR NC 30 AT DIRECTOR OFFICE, 648 FPM OR NC 35 AT OPEN LOBBY, AND 768 FPM AND NC 40 AT OPEN OFFICE. 1 SELECT OUTLET NECK SIZE AND DUCT CONN SIZE FOR MAX 468 FPM OR NC 25 AT PLANETARIUM, 652 FPM OR NC 30 AT DIRECTOR OFFICE, 648 FPM OR NC 35 AT OPEN LOBBY, AND 768 FPM AND NC 40 AT OPEN OFFICE. 2 TO SUIT CEILING GRID SYSTEMS REFER TO ARCH DRAWINGS FOR ALL CEILING GRID SYSTEMS. 3 ALL AIR DISTRIBUTION CORES TO PROVIDE EQUAL AIR FLOW IN EACH DIRECTION. 4 FURNISHED WITH SQUARE TO ROUND TRANSITION INLET COLLAR FOR EASY DUCT CONNECTION.
		10 X 10		131-170	8" DIA	
		12 X 12		171-270	10" DIA	
		12 X 12		-	-	
		14 X 14		271-390	12" DIA	
		16 X 16		391-540	14" DIA	
		18 X 18		541-700	16" DIA	
		20 X 20		701-890	16" DIA	

SPLIT SYSTEM OUTDOOR CONDENSING UNIT SCHEDULE

SYMBOL	SERVICE	LOCATION	MFGR.	MODEL	COOLING CAPACITY (BTUH)	SEER	HEATING CAPACITY (BTUH)	HSPF	ELECTRICAL: POWER V-ph-HZ	ELECTRICAL: TOTAL FLA	ELECTRICAL: MCA	ELECTRICAL: MFS	SUCTION LINE SIZE	LIQUID LINE SIZE	WEIGHT (LBS)	REF TYPE	ANCH. DETAILS	ACCESSORIES	REMARKS
CU-1	FC-1	ROOF	TRANE	4TTA3060A	58,000	13.25	-	-	460-3-60	0.2	12.0	20	2	2	260	R410A	A/S7.1	1 3	1 2 3 4
CU-2	FC-2	ROOF	MITSUBISHI	PUY-A24NHA3	24,000	13.0	-	-	208/230V-1 -60	12.75	18.0	30	2	2	165	R410A	A/S7.1	1 2 3	1 2 3 4
CU-3	FC-3	ROOF	MITSUBISHI	PUY-A24NHA3	24,000	13.0	-	-	208/230V-1 -60	12.75	18.0	30	2	2	165	R410A	A/S7.1	1 2 3	1 2 3 4
CU-4	FC-4	ROOF	MITSUBISHI	PUY-A24NHA3	24,000	13.0	-	-	208/230V-1 -60	12.75	18.0	30	2	2	165	R410A	A/S7.1	1 2 3	1 2 3 4
CU-5	FC-5	ROOF	MITSUBISHI	PUY-A24NHA3	24,000	13.0	-	-	208/230V-1 -60	12.75	18.0	30	2	2	165	R410A	A/S7.1	1 2 3	1 2 3 4
CU-6	FC-6	ROOF	MITSUBISHI	PUY-A24NHA3	24,000	13.0	-	-	208/230V-1 -60	12.75	18.0	30	2	2	165	R410A	A/S7.1	1 2 3	1 2 3 4

ACCESSORIES:

1 COMPLETE WITH HIGH/LOW PRESSURE SWITCH, CRANKCASE HEATER, START CAPACITOR, COMPRESSOR SHORT CYCLE PROTECTOR AND LOW AMBIENT CONTROLLER INCLUDING ALL REQUIRED ACCESSORIES.

2 PROVIDE RUBBER/CORK VIBRATION ISOLATION PADS. 3 PROVIDE MIN. 0.20" DEFLECTION CONSTRAINED NEOPRENE MOUNTS. 4 PROVIDE MIN. 1" DEFLECTION SPRING STEEL AND NEOPRENE VIBRATION ISOLATION MOUNTS.

REMARKS:

1 COOLING CAP @ OUTDOOR COND. SELECTION TEMP. 2 SIZE RL & RS LINES PER MANUFACTURER'S RECOMMENDATION BASED ON TOTAL DEVELOPED LENGTH. 3 COPPER FINS COPPER TUBES 4 SEE 6/M5.01 FOR SPLIT SYSTEM PIPING DIAGRAM

EXHAUST FAN SCHEDULE

SYMBOL	MFGR. AND MODEL NO.	SERVICE	LOCATION	BLOWER: CFM	BLOWER: ESP IN. WG.	BLOWER: RPM	MOTOR: HP	MOTOR: RPM	MOTOR: POWER V-ph-HZ	MOTOR: DRIVE	SONES	OPERATING WEIGHT LBS	SUPPORT DETAIL	ACCESSORIES	REMARKS
EF-1	GREENHECK GB-121-4	RESTROOMS	ROOF	960	0.375	1009	1/4	1725	115-1-60	BELT	6.6	100	A/S7.1	1 2 3	
EF-2	GREENHECK GB-081-06	RESTROOMS	ROOF	200	0.375	959	1/6	1725	115-1-60	BELT	4.1	100	A/S7.1	1 2 3	
EF-3	GREENHECK GB-081-06	RESTROOMS	ROOF	120	0.375	959	1/6	1725	115-1-60	BELT	4.1	100	A/S7.1	1 2 3	

ACCESSORIES:

1 PRE-FAB ALUMINUM SOUND ATTENUATOR ROOF CURB. 2 BACKDRAFT DAMPER.

3 BIRD SCREEN

REMARKS:

1

NOTE: FOR EQUIPMENT ANCHORAGE, SEE A/S7.1 (TYP).

SOUND TRAP SCHEDULE

SYMBOL	MANUFACTURER: MAKE	MANUFACTURER: MODEL	UNIT SERVED	DIMENSIONS: WIDTH (INCH)	DIMENSIONS: HEIGHT (INCH)	DIMENSIONS: LENGTH (INCH)	CFM	MAX. PRESSURE DROP (I.W.G.)	OPERATING WEIGHT (LBS.)	FACE VELOCITY (FPM)	DYNAMIC INSERTION LOSS IN dB AT FACE VELOCITY: 63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	ANCH. DETAILS	NOTES
ST-1	IMI	MVA 1420-180	RTU-2	64	32	23	22,000	0.29	320	-2000	18	26	32	37	46	59	43	42	8/S7.1	
-	NOT USED	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	NOT USED	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
ST-4	IAC	5LFS	RTU-3	12	24	60	1,800	0.61	100	1000	12	19	31	36	40	27	22	16	8/S7.1	
ST-5	IAC	5LFS	RTU-3	24	18	60	1,480	0.18	100	-1000	13	21	35	41	41	28	21	15	8/S7.1	
ST-6	IAC	3LFM	RTU-1	24	24	36	3,380	0.15	75	-1000	6	8	16	21	18	13	12	11	8/S7.1	
ST-7	IAC	5LFM	RTU-1	24	30	60	3,120	0.09	150	1000	8	13	23	29	28	17	14	13	8/S7.1	

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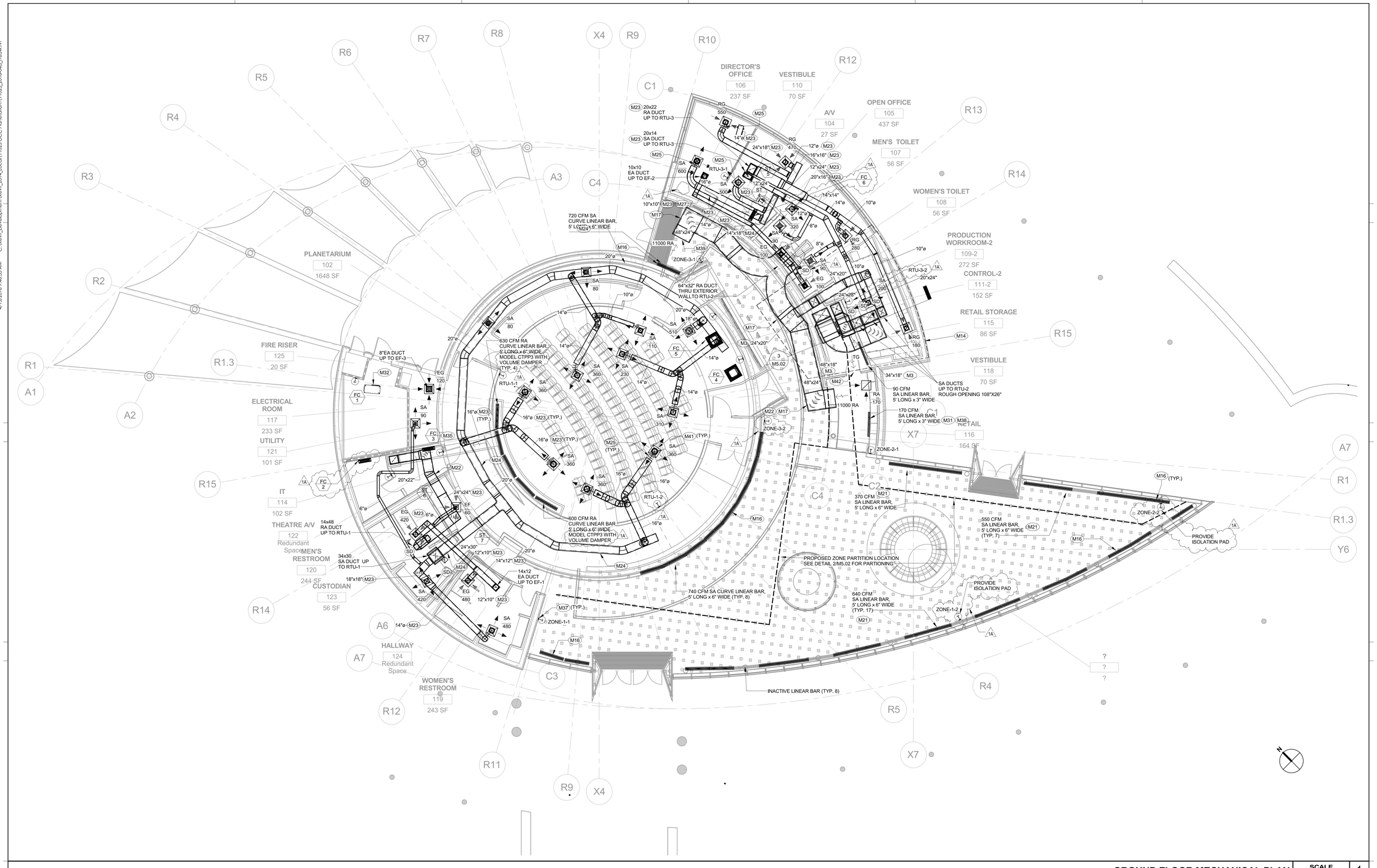
SHEET TITLE
MECHANICAL SCHEDULES

SHEET NUMBER
M0.02

CONSTRUCTION DOCUMENTS 12/15/2014



GROUND FLOOR MECHANICAL PLAN | SCALE 1/8" = 1'-0" | 1

KEYNOTE LEGEND

M3	DUCT BELOW FLOOR.
M14	ALL SA DUCT ASSOCIATED WITH RTU-2 TO BE ACOUSTICALLY LINEd WITH 2" THICK, 3 PCF, DUCT LINER BOARD, IN ADDITION, INSTALL 5/8" GYPSUM BOARD LAGGING DIRECTLY TO THE DUCTWORK SHEET METAL (EXPOSED CONNECTING FLANGES OK). INSTALL LAGGING FROM THE ROOF UNDERSIDE TO THE POINT OF ENTRY INTO THE VERTICAL SHAFT.
M16	COORDINATE FLOOR LINEAR DIFFUSER INSTALLATION WITH FLOOR STEEL BAR SUPPORTS.
M17	INSTALL 2" THICK, 3 PCF. DUCT LINER BOARD ON RETURN AIR.
M21	TITUS LINEAR (OR CURVE AS SHOWN ON PLANS) BAR MODEL CTPP3, 6" WIDE. PROVIDE VOLUME DAMPER WITH MATCHING PLENUM. SEE DETAIL 4/M5.02.
M22	DUCTWORK IN CEILING SPACE.
M23	INSTALL 1" THICK, 1.5 PCF, DUCT LINER. ENTIRE LENGTH BACK TO THE MAIN DUCT. 1A
M24	INSTALL 2" THICK, 3 PCF, DUCT LINER BOARD.
M25	INSTALL 3.5 FT MIN. ACOUSTICAL FLEX DUCT.
M27	INSTALL 1 LAYER OF 5/8" GYPSUM BOARD LAGGING DIRECT TO THE OUTSIDE OF THE DUCT SHEET METAL WITHIN THE DIRECTOR'S OFFICE 106.
M31	TITUS LINEAR BAR MODEL CTPP3, 3" WIDE. PROVIDE VOLUME DAMPER SUPPORTED BY RAISED FLOOR SYSTEM.
M32	INSTALL AT 12 FT ABOVE FINISH FLOOR. COORDINATE FINAL FC UNIT HEIGHT AND LOCATION WITH ELECTRICAL EQUIPMENT AND LIGHTING.
M35	INSTALL AT 9 FT ABOVE FINISH FLOOR. COORDINATE FINAL FC UNIT HEIGHT AND LOCATION WITH ELECTRICAL EQUIPMENT.
M37	SEE DETAIL 8/M5.01 FOR MOUNTING INSTALLATION.
M38	COORDINATE CASEWORK WITH UNDERFLOOR LINEAR DIFFUSERS.
M39	RA DUCT OPENING ABOVE CEILING WITH WIRE MESH SCREEN.
M41	MIN. 36" FROM REGISTER TO DOME SURFACE.
M42	PROVIDE 18"LX12"H TRANSFER GRILLE OVER DOOR.

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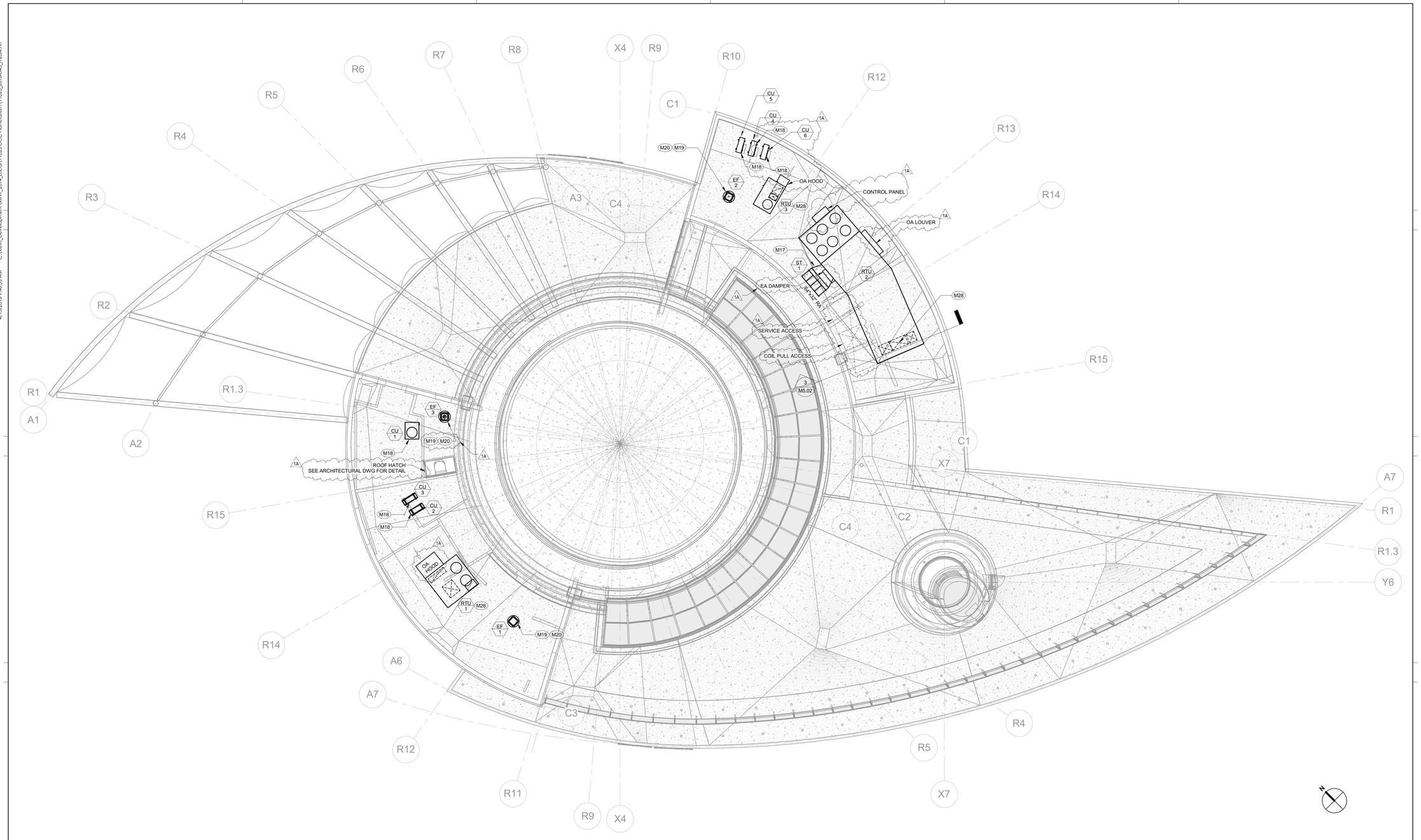
GROUND FLOOR MECHANICAL PLAN

SHEET NUMBER
M2.01

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

M17	INSTALL 2" THICK, 3 PCF, DUCT LINER BOARD ON RETURN AIR.
M18	CONDENSING UNIT MOUNTED ON ROOF CURB TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS AND IN ACCORDANCE WITH ALL APPLICABLE BUILDING CODES. INSTALL REFRIGERANT LINE SET PER MANUFACTURER'S RECOMMENDATIONS. SEE DETAIL 4/M5.01 FOR LINE FLASHING AT ROOF AND 2/M5.03 FOR PIPE ROOF SUPPORTS.
M19	PROVIDE 10' CLEARANCE FROM OPENINGS INTO THE BUILDING.
M20	EXHAUST FAN MOUNTED ON ROOF CURB. FOR MOUNTING DETAIL SEE 5/M5.01.
M28	PROVIDE 2 LAYERS 5/8" CEMENT BOARD WITHIN THE ROOF CURB AT THE PLANE OF THE ROOF WHERE DUCTS PENETRATE THAT PLANE. PLACE R30 INSULATION IN THE CAVITY BETWEEN THE MEMBRANE AND THE RTU UNIT UNDERSIDE.

ROOF MECHANICAL PLAN | SCALE 1/8" = 1'-0" | 1

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DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023

DATE 12/15/2014

DRAWN BY Author

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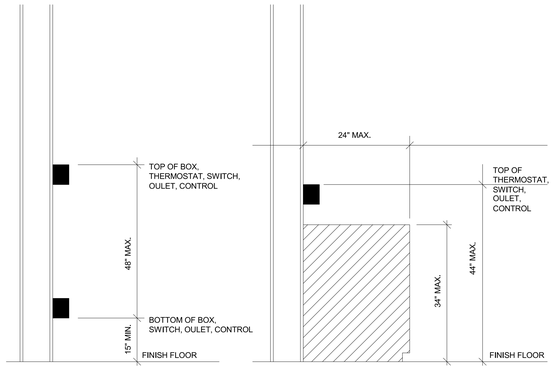
SHEET TITLE
ROOF MECHANICAL PLAN

SHEET NUMBER
M2.02

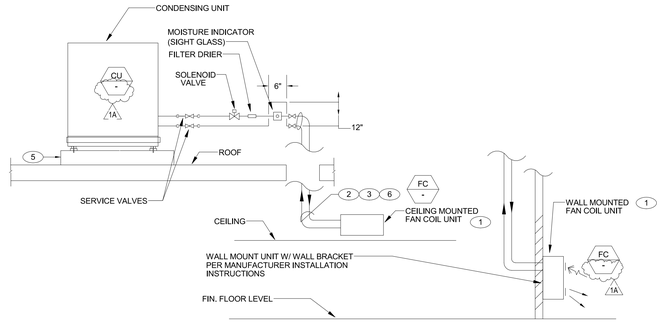
CONSTRUCTION DOCUMENTS 12/15/2014



NOTES:
PROVIDE PLASTIC LOCKING COVER.

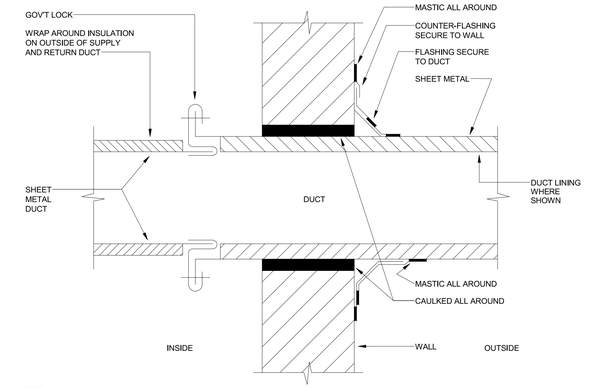
WOOD BASES WITH PIPE CLAMPS AND/OR PLUMBERS TAPE IS NOT ALLOWED.

THERMOSTAT MOUNTING DETAIL | SCALE N.T.S | 8



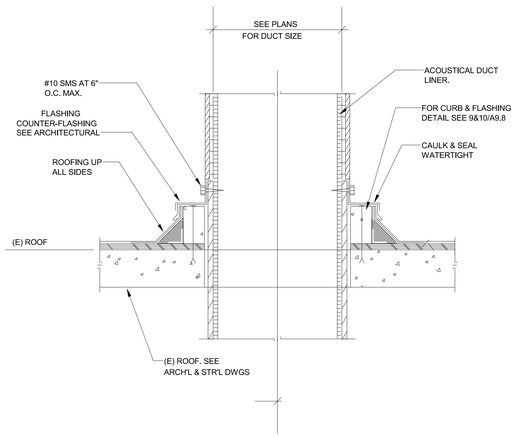
NOTES:
1. FAN COIL UNITS SHALL BE LOCATED SUCH THAT UNIT CAN BE SERVICED AND REMOVED WITHOUT REMOVAL OF PERMANENT CONSTRUCTION, LOCATION SHALL ALSO CONFIRM TO MANUFACTURER'S RECOMMENDATION.
2. INSULATE BOTH REFRIGERANT PIPES SUCTION LINES & LIQUID ON HEAT PUMP UNITS NO PIPE INSULATION IS REQUIRED FOR LIQUID LINE ON COOLING UNITS ONLY, IF APPLICABLE.
3. INSTALL PIPES IN STUD WALL WITH TRISOLATOR PIPE SUPPORT.
4. NOT USED
5. EQUIPMENT PLATFORM. SEE STRUCTURAL AND ARCHITECTURAL DRAWINGS.
6. INSTALL AND SIZE REFRIGERANT PIPING PER MF'R RECOMMENDATIONS. APPLY LONG LINE APPLICATION DATA IF VERTICAL LINES ARE ABOVE 50 FT.

SPLIT AIR CONDITIONING PIPING SYSTEM DETAIL | SCALE N.T.S | 6

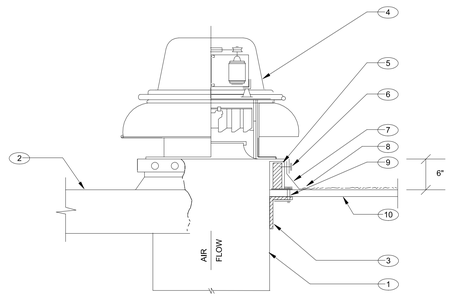


NOTES:
1. FOR DESIGN #, SEE ARCH. DWGS.

DUCT THRU WALL | SCALE N.T.S. | 3

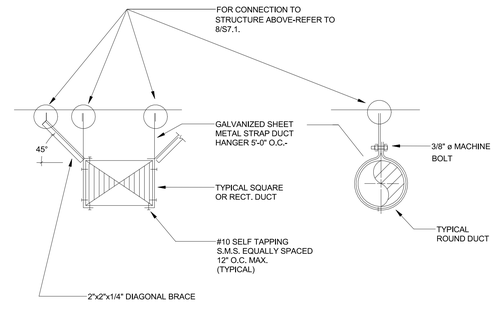


DUCT UP THRU ROOF DETAIL | SCALE N.T.S | 9



1. EXHAUST DUCT. (SEE PLANS FOR SIZES)
2. ROOF CONSTRUCTION.
3. STRUCTURAL SUPPORT, SEE STRUCTURAL DRAWINGS.
4. EXHAUST FAN.
5. FACTORY CURB .
6. SECURE FAN TO CURB WITH A #12 S.M.S. MIN. (2) EACH SIDE.
7. CANT STRIP.
8. ROOFING. RUN UP CANT STRIP TO UNDER FACTORY CURB.
9. SECURE FACTORY CURB, SEE STRUCTURAL DRAWINGS.
10. ROOF STRUCTURE. (SEE STRUCTURAL AND ARCHITECTURAL DWG'S.)

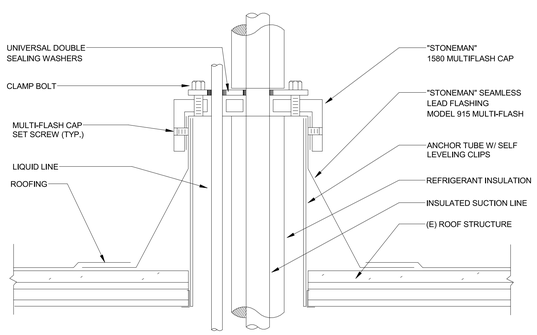
ROOF EXHAUST FAN | SCALE N.T.S | 5



NOTES:
1. FOR HANGER AND LATERAL BRACE, REFER TO SMACNA APPROVED DETAILS AND HANGER BRACE LOCATION OSHPD OPA-0010.

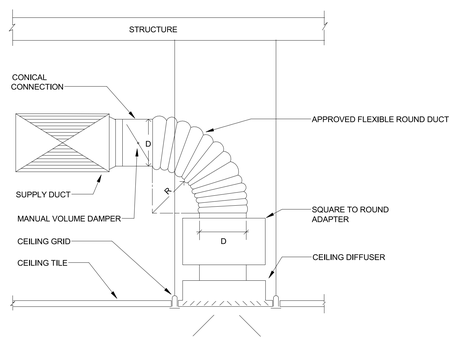
DUCT SUPPORT DETAIL | SCALE N.T.S | 2

NOT USED | SCALE N.T.S | 7



NOTE:
1. INSTALL MULTIFLASH ASSEMBLY PER MANUFACTURER'S INSTRUCTIONS
2. CONTROL & POWER WIRING/CONDUIT MAY RUN THRU FLASHING ASSEMBLY (VERIFY).
3. MUTLI-FLASH ASSY.

REFRIGERANT PIPING THRU DETAIL | SCALE N.T.S | 4



NOTES:
1. WHERE HEADROOM PERMITTED (R=D) CONNECTION TO DIFFUSER SHALL BE MADE AS SHOWN.
2. FLEXIBLE DUCTS 6'-0" MAXIMUM IN LENGTH.

DIFFUSER CONNECTION | SCALE N.T.S | 1

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Long Beach, California 90804
P: 562-985-3200 F: 562-985-1011
Job No. 120006

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PROJECT IDENTIFICATION 11023
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SHEET TITLE
MECHANICAL DETAILS

SHEET NUMBER
M5.01

CONSTRUCTION DOCUMENTS 12/15/2014

MULTI-ZONE UNIT SEQUENCE OF OPERATION:

RUN CONDITIONS - CONTINUOUS:
THE UNIT SHALL RUN CONTINUOUSLY.

HIGH STATIC SHUTDOWN:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING AN HIGH STATIC SHUTDOWN SIGNAL.

LOW STATIC SHUTDOWN:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A LOW STATIC SHUTDOWN SIGNAL.

SUPPLY AIR SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SUPPLY AIR SMOKE DETECTOR STATUS.

RETURN AIR SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A RETURN AIR SMOKE DETECTOR STATUS.

SUPPLY FAN:
THE SUPPLY FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

SUPPLY AIR DUCT STATIC PRESSURE CONTROL:
THE CONTROLLER SHALL TAKE THE LOWEST OF THE TWO DUCT STATIC PRESSURE READINGS FROM THE COLD AND HOT DUCTS AND SHALL MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF 1.5IN H2O (ADJ.), THE SUPPLY FAN VFD SPEED SHALL NOT DROP BELOW 30% (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- SUPPLY FAN VFD FAULT.

RETURN FAN:
THE RETURN FAN SHALL RUN WHENEVER THE SUPPLY FAN RUNS.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- RETURN FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RETURN FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RETURN FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

RETURN FAN TRACKING:
THE RETURN FAN VFD SHALL MODULATE IN UNISON WITH THE SUPPLY AIR FAN. THE RETURN FAN VFD SHALL TRACK THE SUPPLY FAN VFD AT 80% (ADJ.) OF THE SUPPLY FAN VFD SPEED. THE RETURN FAN VFD SPEED SHALL NOT DROP BELOW 20% (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- RETURN FAN VFD FAULT.

COLD DECK - COOLING SUPPLY AIR TEMPERATURE SETPOINT - FIXED:
THE UNIT SHALL MAINTAIN A FIXED COOLING SUPPLY AIR TEMPERATURE SETPOINT OF 55°F (ADJ.).

COLD DECK - COOLING COIL VALVE:
THE CONTROLLER SHALL MEASURE THE COOLING SUPPLY AIR TEMPERATURE AND AND MODULATE THE COOLING COIL VALVE TO MAINTAIN ITS COOLING SETPOINT.

THE COOLING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.).
- AND THE ECONOMIZER IS DISABLED OR FULLY OPEN.
- AND THE SUPPLY FAN STATUS IS ON.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH COOLING SUPPLY AIR TEMP: IF THE COOLING SUPPLY AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SETPOINT

HOT DECK - HEATING SUPPLY AIR TEMPERATURE SETPOINT - FIXED:
THE UNIT SHALL MAINTAIN A FIXED HEATING SUPPLY AIR TEMPERATURE SETPOINT OF 82°F (ADJ.).

HOT DECK - HEATING COIL VALVE:
THE CONTROLLER SHALL MEASURE THE HEATING SUPPLY AIR TEMPERATURE AND MODULATE THE HEATING COIL VALVE TO MAINTAIN ITS SETPOINT.

THE HEATING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).
- AND THE SUPPLY FAN STATUS IS ON.

THE HEATING COIL VALVE SHALL OPEN WHENEVER:
- HEATING SUPPLY AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH HEATING SUPPLY AIR TEMP: IF THE HEATING SUPPLY AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.).
- LOW HEATING SUPPLY AIR TEMP: IF THE HEATING SUPPLY AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SETPOINT.

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT 2°F LESS THAN THE COOLING SUPPLY AIR TEMPERATURE SETPOINT. THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.

THE ECONOMIZER SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).
- AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.
- AND THE SUPPLY FAN STATUS IS ON.

THE ECONOMIZER SHALL CLOSE WHENEVER:
- MIXED AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.).
- OR ON LOSS OF SUPPLY FAN STATUS.

THE OUTSIDE AND EXHAUST AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF.

FILTER STATUS:
THE CONTROLLER SHALL MONITOR THE FILTER STATUS.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FINAL FILTER CHANGE REQUIRED: FINAL FILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

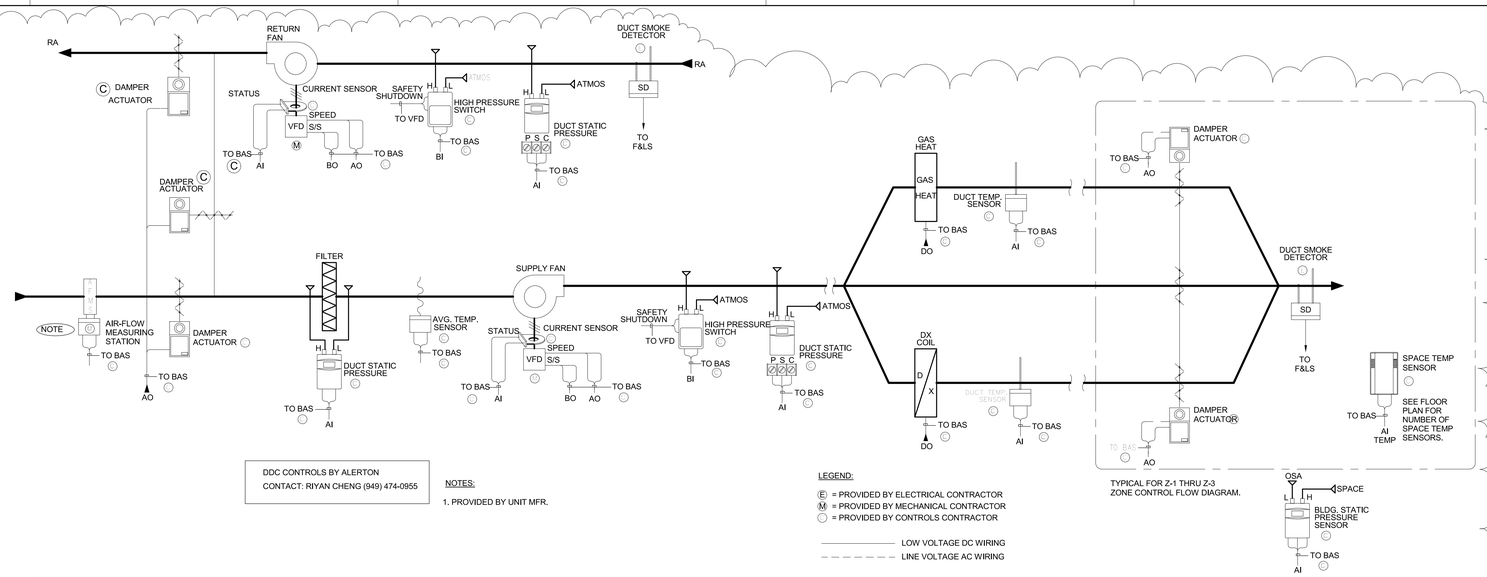
MIXED AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

RETURN AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

SAGE GLASS CONTROL:
IF COOLING EFFORTS ARE MAXIMIZED THROUGH THE SEQUENCES ABOVE AND THE SPACE TEMPERATURE CONTINUES TO RISE STAGE THE SAGE GLASS FROM TRANSLUCENT TO DARKER. AFTER ROOM TEMPERATURE HAS STABILIZED, AND IF OUTSIDE AIR TEMPERATURE BEGINS TO DROP, STAGE SAGE GLASS BACK TOWARDS TRANSLUCENCY.



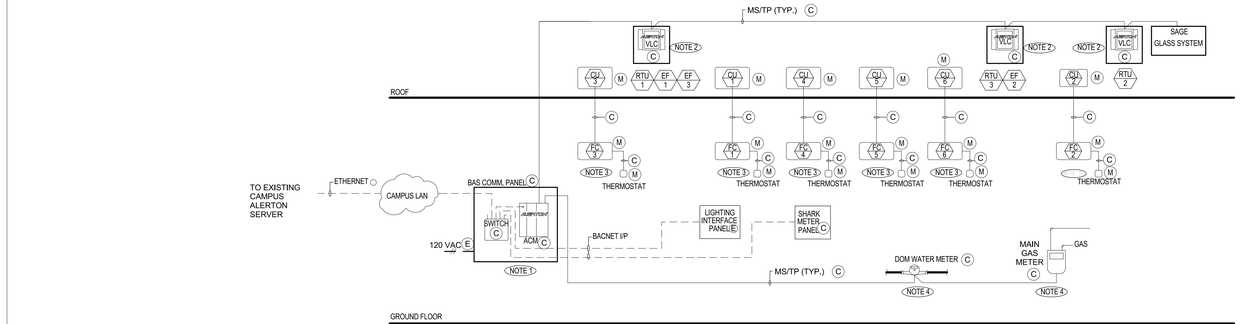
DDC CONTROLS BY ALERTON
CONTACT: RIYAN CHENG (949) 474-0955

NOTES:
1. PROVIDED BY UNIT MFR.

LEGEND:
(E) = PROVIDED BY ELECTRICAL CONTRACTOR
(M) = PROVIDED BY MECHANICAL CONTRACTOR
(C) = PROVIDED BY CONTROLS CONTRACTOR
LOW VOLTAGE DC WIRING
LINE VOLTAGE AC WIRING

TYPICAL FOR Z-1 THRU Z-3 ZONE CONTROL FLOW DIAGRAM.

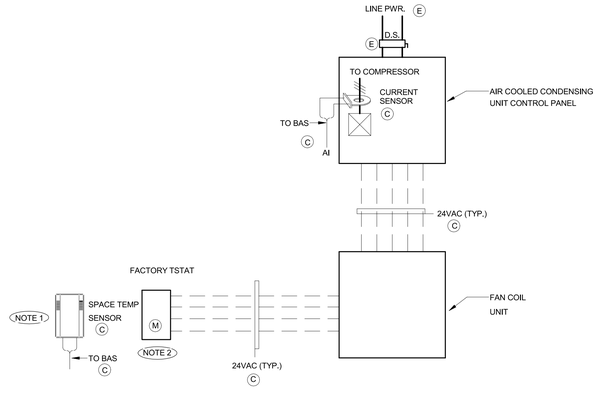
MULTI-ZONE UNIT CONTROL DIAGRAM (RTU-2) | SCALE N.T.S. | 3



NOTES:
1. DDC CONTROLS BY CLIMATEC. CONTACT RYAN CHENG (949) 394-1865
2. CONTROL POWER FROM UNIT POWER- PROVIDE MULT-TAP TRANSFORMER.
3. PROVIDE DDC HIGH TEMPERATURE ALARM. FURNISH AND INSTALL SPACE TEMPERATURE SENSOR, REQUIRED DDC POINTS, WIRING AND
4. DOMESTIC FLOW METER AND GAS METER PROVIDED BY CLIMATEC TO BE INSTALLED BY PIPING CONTRACTOR.

LEGEND:
(E) = PROVIDED BY ELECTRICAL CONTRACTOR
(M) = PROVIDED BY MECHANICAL CONTRACTOR
(C) = PROVIDED BY CONTROLS CONTRACTOR
LOW VOLTAGE WIRING
LINE VOLTAGE WIRING
CAT-5 CABLING

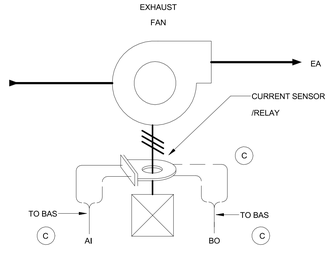
NETWORK RISER DIAGRAM | SCALE N.T.S. | 2



NOTES:
1. SPACE TEMP SENSOR TO BE CONNECTED TO NEAREST DDC CONTROLLER SPARE POINT. ALARM ON HIGH TEMPERATURE.
2. SPACE THERMOSTAT FURNISHED BY UNIT MANUFACTURER.

LEGEND:
(E) = PROVIDED BY ELECTRICAL CONTRACTOR
(M) = PROVIDED BY MECHANICAL CONTRACTOR
(C) = PROVIDED BY CONTROLS CONTRACTOR
LOW VOLTAGE DC WIRING
LINE VOLTAGE AC WIRING
CAT-5 CABLING

SPLIT AC UNIT CONTROL DIAGRAM | SCALE N.T.S. | 4



EXHAUST FAN FLOW CONTROL | SCALE N.T.S. | 1

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4500 East Pacific Coast Highway, Suite 100
Long Beach, California 90804
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Job No. 120006

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SHEET TITLE
MECHANICAL CONTROLS

SHEET NUMBER
M6.01

CONSTRUCTION DOCUMENTS 12/15/2014

RTU-3 ROOFTOP PACKAGE A/C UNIT CONTROL

RTU-3:

RUN CONDITIONS - SCHEDULED:
THE RTU WILL BE ACTIVATED BY AN OCCUPIED COMMAND FROM A USER DEFINED SCHEDULE OR AN AFTER HOUR OVERRIDE INITIATED AT THE SPACE SENSOR.

SUPPLY FAN:
THE SUPPLY FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. THE SUPPLY FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED HOURS. TO PREVENT SHORT CYCLING, THE SUPPLY FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

SPACE TEMPERATURE SETPOINT CONTROL - SCHEDULED:

THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL MAINTAIN
- A 74°F (ADJ.) COOLING SETPOINT
- A 70°F (ADJ.) HEATING SETPOINT.

UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN
- A 85°F (ADJ.) COOLING SETPOINT,
- A 55°F (ADJ.) HEATING SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH SPACE TEMP: IF THE SPACE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT, 4°F (ADJ.),
- LOW SPACE TEMP: IF THE SPACE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT, 4°F (ADJ.),

SPACE SETPOINT ADJUST:
THE OCCUPANT SHALL BE ABLE TO ADJUST THE SPACE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE SPACE SENSOR.

ECONOMIZER:
THE ECONOMIZER IS CONTROLLED BY PACKAGE UNIT INTERNAL CONTROLS. ECONOMIZER SHALL ACT AS THE FIRST STAGE OF COOLING IF CONDITIONS PERMIT.

THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.

THE OUTSIDE AND EXHAUST AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF.

DX COOLING CONTROL:

THE COOLING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.),
- AND THE SPACE TEMPERATURE IS ABOVE COOLING SETPOINT.
- AND HEATING IS NOT ACTIVE
- AND THE FAN IS ON,

THE CONTROLLER SHALL STAGE THE DX COMPRESSOR(S) ON TO MAINTAIN COOLING SETPOINT IF THE ECONOMIZER IS DISABLED OR UNABLE TO MEET COOLING SETPOINT.

GAS HEATING CONTROL:

THE HEATING SHALL BE ENABLED WHENEVER:
- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.),
- AND THE SPACE TEMPERATURE IS BELOW HEATING SETPOINT.
- AND COOLING IS NOT ACTIVE
- AND THE FAN IS ON.

THE CONTROLLER SHALL STAGE THE HEATING ON TO MAINTAIN HEATING SETPOINT.

FILTER DIFFERENTIAL PRESSURE MONITOR:
THE CONTROLLER SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FILTER.

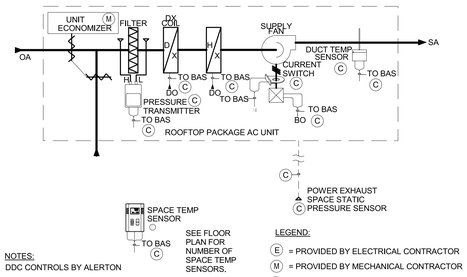
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FILTER CHANGE REQUIRED: FILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.),

DISCHARGE AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.),
- LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 40°F (ADJ.),

FAN STATUS:
THE CONTROLLER SHALL MONITOR THE FAN STATUS.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- FAN RUNTIME EXCEEDED: FAN STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.),



PACKAGE GAS/ELECT. AC UNIT CONTROL DIAGRAM (RTU-3) | SCALE N.T.S. | 2

RTU-1 ROOFTOP PACKAGE A/C UNIT CONTROL

VARIABLE SPEED SINGLE ZONE UNIT CONTROL
RTU-1:

SAME AS ABOVE BUT WITH SUPPLY FAN AND RETURN FAN VFD CONTROLS.

SUPPLY AIR DUCT STATIC PRESSURE CONTROL:
THE CONTROLLER WILL MEASURE DUCT STATIC PRESSURE AND WILL MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF 1.5"WC (ADJ.), THE SUPPLY FAN VFD SPEED WILL NOT DROP BELOW 30% (ADJ.),

ALARMS WILL BE PROVIDED AS FOLLOWS:
HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25 % (ADJ.) LESS THAN SETPOINT.

RETURN FAN:
THE RETURN FAN WILL RUN WHENEVER THE SUPPLY FAN RUNS.

BUILDING STATIC PRESSURE CONTROL:
THE CONTROLLER WILL MEASURE BUILDING STATIC PRESSURE AND MODULATE THE RETURN FAN VFD SPEED TO MAINTAIN A BUILDING STATIC PRESSURE SETPOINT OF 0.05"WC (ADJ.), THE RETURN FAN VFD SPEED WILL NOT DROP BELOW 30% (ADJ.),

ALARMS WILL BE PROVIDED AS FOLLOWS:
HIGH BUILDING STATIC PRESSURE: IF THE BUILDING AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
LOW BUILDING STATIC PRESSURE: IF THE BUILDING AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.

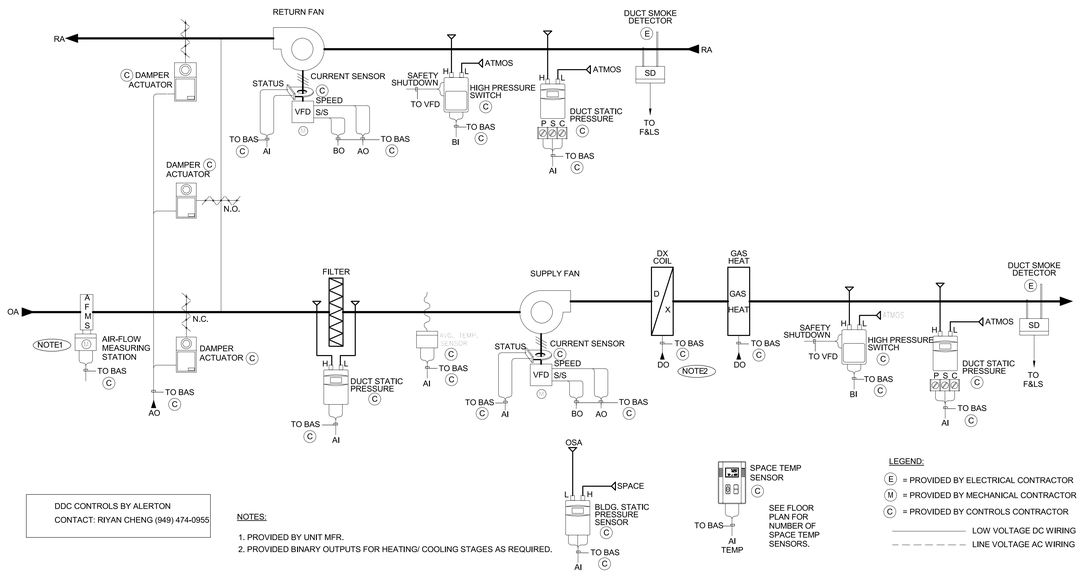
SUPPLY AIR TEMPERATURE SETPOINT - OPTIMIZED:
THE CONTROLLER WILL MONITOR THE SUPPLY AIR TEMPERATURE AND WILL MAINTAIN A SUPPLY AIR TEMPERATURE SETPOINT RESET BASED ON ZONE COOLING AND HEATING REQUIREMENTS.

ECONOMIZER:
THE CONTROLLER WILL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SETPOINT. THE OUTSIDE AIR DAMPERS WILL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.

THE ECONOMIZER WILL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.),
AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE,
AND THE SUPPLY FAN STATUS IS ON.

THE ECONOMIZER WILL CLOSE WHENEVER:
MIXED AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.),
OR ON LOSS OF SUPPLY FAN STATUS.
THE OUTSIDE AND EXHAUST AIR DAMPERS WILL CLOSE AND THE RETURN AIR DAMPER WILL OPEN WHEN THE UNIT IS OFF.

MINIMUM OUTSIDE AIR VENTILATION:
WHEN IN THE OCCUPIED MODE, THE CONTROLLER WILL MEASURE THE OUTSIDE AIRFLOW AND MODULATE THE OUTSIDE AIR DAMPERS TO MAINTAIN THE PROPER MINIMUM OUTSIDE AIR VENTILATION, OVERRIDDING NORMAL DAMPER CONTROL. ON DROPPING OUTSIDE AIRFLOW, THE CONTROLLER WILL MODULATE THE OUTSIDE AIR DAMPERS OPEN TO MAINTAIN THE OUTSIDE AIRFLOW SETPOINT (ADJ.),
RETURN AND MIXED AIR TEMPERATURE: THE CONTROLLER WILL MONITOR THE RETURN AND MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL.



VARIABLE SPEED SINGLE ZONE UNIT CONTROL DIAGRAM (RTU-1) | SCALE N.T.S. | 1

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SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS		
#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY Author
CHECKED BY Checker

SHEET TITLE
MECHANICAL CONTROLS

SHEET NUMBER
1A
M6.02

CONSTRUCTION DOCUMENTS 12/15/2014

PLUMBING GENERAL NOTES

1	PRIOR TO THE BID THE CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS, ELEVATIONS, POINTS OF CONNECTIONS AND CHARACTERISTICS OF ALL UTILITY PIPING AND SHALL IMMEDIATELY NOTIFY THE ARCHITECT OF ANY DISCREPANCIES.
2	EXACT LOCATION AND MOUNTING HEIGHTS OF PLUMBING FIXTURES SHALL BE OBTAINED FROM THE ARCHITECTURAL DRAWINGS.
3	SEE ARCHITECTURAL DRAWINGS FOR ALL DISABLED ACCESS FIXTURE LOCATIONS AND MOUNTING HEIGHTS. INSULATE ALL EXPOSED EDGES, INCLUDING WATER SUPPLY PIPING, LOOSE KEY STOPS, AND DRAIN PIPING BELOW DISABLED ACCESS FIXTURES. ALL DESIGNATED FIXTURES SHALL BE ACCESSIBLE TO INDIVIDUALS WITH DISABILITIES IN ACCORDANCE WITH THE "AMERICANS WITH DISABILITIES ACT OF 2010 - FIXTURES AND THEIR INSTALLATION ANSI A117.1".
4	ALL PLUMBING WORK SHALL BE INSTALLED SO AS TO AVOID INTERFERENCE WITH OTHER TRADES.
5	CLEANOUTS SHALL BE PROVIDED AS REQUIRED BY CODE AND SHALL BE READILY ACCESSIBLE. THE CONTRACTOR SHALL COORDINATE ALL LOCATIONS WITH EQUIPMENT, CABINETS, ETC., WITH THE ARCHITECT PRIOR TO ANY INSTALLATION. ALL CLEANOUTS SHALL BE SIZED PER CODE.
6	EQUIPMENT ANCHORAGE ANCHORAGE DETAILS FOR EQUIPMENT ARE SUBJECT TO APPROVAL OF THE DSA STRUCTURAL ENGINEER PRIOR TO INSTALLATION AND INSPECTION, UNLESS SPECIFICALLY SHOWN ON THESE PLANS. NO STRUCTURAL MEMBER SHALL BE CUT, DRILLED NOR NOTCHED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE STRUCTURAL ENGINEER.
7	ALL PLUMBING FIXTURES, EQUIPMENT, TRIM AND FITTINGS SHALL COMPLY WITH LOCAL, STATE, AND FEDERAL REGULATIONS AND CODES, INCLUDING, BUT NOT LIMITED TO WATER AND ENERGY CONSERVATION CODES. THE SCHEDULED AND/OR SPECIFIED PLUMBING FIXTURES AND EQUIPMENT REPRESENT THE MINIMUM CRITERIA AND SHALL BE THE BASIS FOR THE CONTRACTOR'S BASE BID.
8	ALL WASTE PIPING 3" & SMALLER SHALL SLOPE AT 2% UNLESS OTHERWISE INDICATED OR REQUIRED DUE TO STRUCTURAL CONDITIONS.
9	PROVIDE DIELECTRIC ISOLATION FITTINGS AT POINT OF CONNECTION OF ALL COPPER TUBING AND ANY DISSIMILAR METALS.
10	ALL NEW PIPING, INCLUDING WATER, WASTE, STORM, OVERFLOW AND GAS, SHALL BE TESTED IN ACCORDANCE WITH THE CALIFORNIA PLUMBING CODE.
11	ALL HOT WATER PIPING SHALL BE INSULATED WITH MINIMUM THERMAL RESISTANCE OF R=4.0 PER INCH. THE INSULATION SHALL HAVE A FLAME SPREAD RATING OF NOT MORE THAN 25 AND SMOKE DEVELOPED RATING OF NOT MORE THAN 50, TYPE AND THICKNESS PER SPECIFICATIONS.
12	PROVIDE LOOSE KEY STOPS AT ALL FIXTURES.
13	EACH PLUMBING VENT SHALL TERMINATE NOT LESS THAN TEN (10) FEET FROM TO THREE (3) FEET ABOVE ANY WINDOW, DOOR, AIR INTAKE, OR VENT SHAFT, AND SHALL HAVE A VANDAL RESISTANT VENT CAP.
14	ALL HOSE BIBBS HAVE A NON-REMOVABLE VACUUM BREAKER.
15	CONTRACTOR SHALL PAY ALL FEES REQUIRED TO COMPLETELY INSTALL ALL EQUIPMENT, MATERIALS AND PIPING INDICATED IN CONTRACT DRAWINGS.
16	CONTRACTOR SHALL COORDINATE LOCATIONS OF ALL EXPOSED PIPING ON ROOF WITH ALL EQUIPMENT, CRICKETS AND RIDGE LINES AS SHOWN ON MECHANICAL, ELECTRICAL, AND ARCHITECTURAL DRAWINGS.
17	CONTRACTOR SHALL PROVIDE WATER HAMMERS, THREADED OR SOLDERED, UPSTREAM OF ALL FIXTURE STOPS ON HW & CW SUPPLY PIPING.
18	ALL BURRED ENDS OF WATER PIPING AND TUBING SHALL BE REAMED TO THE FULL BORE OF THE PIPE OR TUBE AND ALL CHIPS SHALL BE REMOVED (SEE CALIFORNIA PLUMBING CODE, 2013 EDITION, SECTION 310.3), ADDITIONALLY, TOOLS USED IN CUTTING OR REAMING SHALL BE KEPT FREE FROM OIL OR GREASE AND WHERE SUCH CONTAMINATION HAS OCCURRED, THE ITEMS AFFECTED SHALL BE REWORKED AND RINSED.
19	FOR PIPE PENETRATIONS THROUGH FIRE RATED FLOOR, WALL AND PARTITIONS, PROVIDE FIRE STOP DEVICES AND PACKING IN COMPLIANCE WITH U.L. FIRE RESISTANCE DIRECTORY FOR THROUGH-PENETRATION FIRE STOPS DEVICES (XHCR), SYSTEMS WL1001, WL1002, WL5001, WL5002 OR CAJ1001, CAJ5001, CAJ5002, CAJ5003 AS APPLICABLE.

PIPE MATERIAL

UTILITY	ABOVE GRADE	BELOW GRADE
SANITARY SOIL, WASTE, VENT, STORM & OVERFLOW DRAIN	NO-HUB CAST IRON & COUPLINGS W/STAINLESS STEEL BAND FITTINGS	NO-HUB CAST IRON W/M.G. COUPLINGS, IF SOIL CORROSIVE PROVIDE CORROSION RESISTANT WRAP FOR BURRIED PIPING.
DOMESTIC WATER	TYPE "L" COPPER W/ WROUGHT COPPER SOLDERED JOINT FITTINGS	TYPE "K" COPPER W/WROUGHT COPPER BRAZED JOINT FITTINGS
NATURAL GAS	SCHEDULE 40 BLACK STEEL W/THREADED & WELDED FITTINGS, EXPOSED EXTERIOR PIPING SHALL BE PROTECTED WITH ZINC COATING OR WRAP AGAINST CORROSION.	MEDIUM DENSITY POLYETHELENE, PE2406 WITH HEAT FUSION FITTINGS BEYOND MAT FOUNDATION, SECONDARY CONTAINMENT & VENTED PIPING SYSTEM BELOW MAT FOUNDATION
CONDENSATE DRAIN	TYPE "M" COPPER W/ WROUGHT COPPER SOLDER JOINT FITTINGS.	N/A

1A

* NOTES:

1. FOR ALL PLUMBING PIPING RUNNING IN THE RAISED ACCESS FLOOR PIPING MATERIAL TO BE NON-COMBUSTIBLE AND PLENUM RATED.

PLUMBING LEGEND

SYMBOL	ABBREV	DESCRIPTION
—SW—	S OR W	SEWER OR WASTE BEL. FLR. OR GRD.
—SW—	S OR W	SEWER OR WASTE ABV. FLR. OR GRD.
— — V — —	V	VENT LINE
—CD—	CD	CONDENSATE DRAIN
—CW—	CW	COLD WATER
—HW—	HW	HOT WATER
—HWR—	HWR	HOT WATER RETURN
—MPG—	MPG	MEDIUM PRESSURE GAS (5 PSIG)
—G—	G	GAS LINE (9" WC)
—SD—	SD	STORM DRAIN BELOW GRADE
—OD—	OD	OVERFLOW DRAIN ABOVE GRADE
—SD—	SD	STORM DRAIN BELOW GRADE
—OD—	OD	OVERFLOW DRAIN BELOW GRADE
—TP—	TP	TRAP PRIMER LINE
	FD	FLOOR DRAIN
	FS	FLOOR SINK
	FCO	FLOOR CLEANOUT
	COYB	CLEANOUT IN YARD BOX
	WCO	WALL CLEANOUT BEHIND ACCESS PANEL
	IWR	INDIRECRT WASTE RECEPTOR
	CO	CLEANOUT
	TP	TRAP PRIMER
	SOVYB	SHUT-OFF VALVE IN YARD BOX (BALL TYPE)
	SOV	SHUT-OFF VALVE (BALL TYPE)
	SOV	SHUT-OFF VALVE (BUTTERFLY TYPE)
	HB	HOSE BIBB
	GV	GAS VALVE
	GPR	GAS PRESSURE REGULATOR
	-	UNION
	CV	CHECK VALVE
	PG	PRESSURE GAUGE
	TH	THERMOMETER
	-	DIRECTION OF FLOW IN LINE
	–	CAP OR PLUG
	–	KEYNOTE
		DETAIL NUMBER DRAWING NUMBER WHERE DRAWN
	POC	POINT OF CONNECTION BETWEEN NEW & EXISTING WORK
	POD	POINT OF DISCONNECTION

1A

PLUMBING ABBREVIATIONS

&	AND
(E)	EXISTING
@	AT
ABV	ABOVE
AD	AREA DRAIN
ADA	AMERICAN WITH DISABILITY ACT
AFF	ABOVE FINISH FLOOR
AP	ACCESS PANEL
ARCH	ARCHITECT/ARCHITECTURAL
BEH	BEHIND
BEL	BELOW
BLDG	BUILDING
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CLG	CEILING
CM	COFFEE MAKER
CONC	CONCRETE
CONN	CONNECT/CONNECTION
CONT	CONTINUED/CONTINUTATION
CP	CIRCULATING PUMP
DF	DRINKING FOUNTAIN
DIA	DIAMETER
DN	DOWN
DS	DOWNSPOUT
DWG(S)	DRAWING(S)
EA	EACH
EQUIP	EQUIPMENT
FD	FLOOR DRAIN
FFE	FINISH FLOOR ELEVATION
FIN	FINISH
FLR	FLOOR
FR	FROM
FS	FLOOR SINK
FTG(S)	FITTINGS
GAL	GALLONS
GPF	GALLONS PER FLUSH
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE
HB	HOSE BIBB
HDR	HEADER
HP	HORSE POWER
HTR	HEATER
IE	INVERT ELEVATION
IWR	INDIRECT WASTE RECEPTOR
L	LAVATORY
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
OD	OVERFLOW DRAIN
PP	POLYPROPYLENE
PRESS	PRESSURE
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	REFRIGERATOR
RD	ROOF DRAIN
RI & C	ROUGH-IN AND CONNECT
S	SINK
SHT	SHEET
T	TANK
TEMP	TEMPERATURE
THRU	THROUGH
TP	TRAP PRIMER
TYP	TYPICAL
UL	UNDERWRITERS' LABRATORIES
UR	URINAL
VTR	VENT THRU ROOF
W/	WITH
WC	WATER CLOSET
WH	WATER HEATER

PLUMBING FIXTURE SCHEDULE

TAG	FIXTURE	WASTE	TRAP	VENT	COLD	HOT	DESCRIPTION *
TP-1	TRAP PRIMER				1/2"		PPP INC. #PR-500: WITH DISTRIBUTION BOX AS REQUIRED 1/2" TP CONN. TO FD-1 & FS-1
WC-1	WATER CLOSET	4"	INTEGRAL	2"	1 1/2"	0"	KOHLER "KINGSTON" #K-4325: VITREOUS CHINA, ELONGATED BOWL, SIPHON JET, WALL MOUNT, TOP SPUD, 1.28 GPF, DIM: 26 1/2" L X 16 1/2" W X 13 1/4" H, COLOR: WHITE; FLUSH VALVE: SLOAN OPTIMA #111-1.28 SMO EXPOSED BATTERY OPERATED, SIDE MOUNT SENSOR HIGH EFFICIENCY FLUSHOMETER; J.R. SMITH 200 OR 400 SERIES SUPPORT CARRIER; SEAT: CHURCH #9500CT, OPEN FRONT
WC-2	WATER CLOSET - ADA	4"	INTEGRAL	2"	1 1/2"	0"	SAME AS WC-1, EXCEPT INSTALL AT ADA APPROVED HEIGHT.
UR-1	URINAL	2"	INTEGRAL	1 1/2"	1 1/4"		KOHLER "BARDON HIGH EFFICIENCY, #K-4904-ET: VITREOUS CHINA WITH 3/4" TOP SPUD, WALL MOUNTED, 0.5 GPF; COLOR: WHITE; FLUSH VALVE: SLOAN #186-0.5 SMO, 0.5 GPF, HIGH EFFICIENCY, EXPOSED BATTERY POWERED, SIDE MOUNT SENSOR, DUAL FILTERED BYPASS DIAPHRAGM; J.R. SMITH 600 CARRIER
UR-2	URINAL - ADA	2"	INTEGRAL	1 1/2"	1 1/4"		SAME AS UR-1, EXCEPT INSTALL AT ADA APPROVED HEIGHT.
L-1	LAVATORY - ADA	2"	1 1/4" x 1 1/2"	1 1/2"	1/2"	1/2"	KOHLER "KATHRYN" #K-2330: VITREOUS CHINA, UNDERMOUNT, WITH OVERFLOW, DIM: 19 3/4"L x 15 5/8" W x 6 1/4"H, COLOR: THUNDER GREY-58, SINGLE HOLE; CHICAGO FAUCET: E-TRONIC #116.606.AB,1, DECK MOUNTED, FAUCET SHALL BE METERED NOT MORE THEN 0.2 GAL. PER CYCLE, BATTERY OPERATED FAUCET MODIFIED WITH E39JKABCP, 0.35 GPM FLOW CONTROL, NON-AERATING, CHROME PLATED FINISH; #131-ABNF MIXING VALVE, #1017-ABCP LOOSE KEY ANGLE STOPS & SUPPLIES, #327-XCP GRID DRAIN, 1 1/4"x1 1/2" P-TRAP. INSULATE TRAP, TRAP ARM & SUPPLIES. INSTALL AT ADA APPROVED HEIGHT
L-2	LAVATORY - ADA	2"	1 1/4" x 1 1/2"	1 1/2"	1/2"	1/2"	KOHLER "KINGSTON" #K-2007: WALL HUNG, 21"x18"x5", SINGLE HOLE; CHICAGO FAUCET: E-TRONIC #116.606.AB,1, FAUCET SHALL BE METERED NOT MORE THEM 0.2 GAL/CYCLE, BATTERY OPERATED FAUCET MODIFIED WITH E39JKABCP, 0.35 GPM FLOW CONTROL, #131-ABNF MIXING VALVE, #1017-ABCP LOOSE KEY ANGLE STOPS & SUPPLIES, #327-XCP GRID DRAIN, 1 1/4"x1 1/2" P-TRAP. INSULATE TRAP, TRAP ARM & SUPPLIES. INSTALL AT ADA APPROVED HEIGHT
SS-1	SERVICE SINK	3"	3"	2"	3/4"	3/4"	CECO #871: FLOOR MOUNTED, CORNER TYPE WITH #871-3" DRAIN #B-872 RIM GUARD; CHICAGO FAUCET #956-RCP; VACUUM BREAKER & VINYL HOSE
DF-1	DRINKING FOUNTAIN - ADA	2"	(2) 1 1/2"	1 1/2"	1/2"		HAWS #1119.14: DUAL HEIGHT, 14 GA., TYPE 304 STAINLESS STEEL WITH #6700.4 MOUTING PLATE; CHICAGO FAUCET #45-LKCABCP, LOOSE KEY STOP, INSTALL AT ADA APPROVED HEIGHT
FD-1	FLOOR DRAIN	2"	2"	1 1/2"			J.R. SMITH #2005-A: DUCO CAST IRON WITH 5"Ø OR 8"Ø NICKEL BRONZE GRATE & TP CONN. WITH 1/2" MAX. GRATE OPENING'S IN ALL DIRECTIONS.
FS-1	FLOOR SINK	2"	2"	1 1/2"	1/2"		J.R. SMITH #3100-Y, DUCO CAST IRON, ACID RESISTANT COATED INTERIOR, NICKEL BRONZE 8 1/2" TOP WITH 3/4 SECURED GRATE & 1/2" TP CONN.
OD-1	OVERFLOW DRAIN						J.R. SMITH #1080-YRC: DUCO CAST IRON, SUMP RECEIVER, UNDERDECK CLAMP, SOLID WATER DAM. SEE PLANS FOR SIZE
RD-1	ROOF DRAIN						J.R. SMITH #1010-YRC: DUCO CAST IRON, SUMP RECEIVER, UNDERDECK CLAMP, SEE PLANS FOR SIZE
OD-2	SCUPPER OVERFLOW DRAIN						J.R. SMITH # 1530T WITH DOWNSPOUT ADAPTOR #1550: DUCO CAST IRON, FLASHING CLAMP AND ANGLE GRATE. SEE PLANS FOR SIZE
RD-2	SCUPPER ROOF DRAIN						J.R. SMITH # 1530T WITH DOWNSPOUT ADAPTOR #1550 : DUCO CAST IRON, FLASHING CLAMP AND ANGLE GRATE. SEE PLANS FOR SIZE
DN-1	DOWNSPOUT NOZZLE				1/2"		J.R. SMITH #1770T, SEE FLOOR PLAN FOR SIZES; REFER TO ARCHITECTURAL DETAIL 20/A9.21

* PLUMBING FIXTURES NOTES:

1. ACCESSIBLE PLUMBING FIXTURES SHALL COMPLY WITH ALL OF THE REQUIREMENTS IN CBC DIVISION 6.
2. HEIGHTS AND LOCATION OF ALL ACCESSIBLE FIXTURES SHALL BE MOUNTED ACCORDING TO CBC SECTIONS 11B-602 THROUGH 11B-612.
3. FIXTURE CONTROLS SHALL COMPLY WITH CBC SECTION 11B-601.3 FOR DRINKING FOUNTAINS, 11B-604.6 FOR WATER CLOSETS, 11B-604.9,5 FOR CHILDREN'S WATER CLOSETS, 11B-605.4 FOR URINALS, 11B-606.4 FOR LAVATORIES AND SINKS, 11B-607.5 FOR BATHTUBS, 11B-608.5 FOR SHOWERS, AND 11B-611.3 FOR WASHING MACHINES AND CLOTHES DRYERS.
4. EACH ACCESSIBLE SINK SHALL BE A MAXIMUM OF 6 1/2" DEEP. SINKS SHALL BE MOUNTED WITH THE FRONT OF THE HIGHER OF THE RIM AND COUNTER SURFACE NO HIGHER THAN 34" ABOVE THE FINISHED FLOOR OR GROUND .
5. WATER SUPPLY AND DRAIN PIPES UNDER LAVATORIES AND SINKS SHALL BE INSULATED OR OTHERWISE CONFIGURED TO PROTECT AGAINST CONTACT. THERE SHALL BE NO SHARP OR ABRASIVE SURFACE UNDER LAVATORIES AND SINKS. CBC SECTION 11B-606.

WATER HEATER SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	BTU INPUT	RECOVERY @ 60°F RISE	WATER TEMP °F IN	WATER TEMP °F OUT	OPER. WT. (LBS)	ANCHORAGE	REMARKS
WH 1	CUSTODIAN ROOM 123	DOMESTIC HOT WATER	BRADFORD WHITE U-50T-55FR-3N	55,000	88	60 °F	120 °F	575	SEE 9/P5.01	LO NOX, 48 GALLONS

PUMP SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	PUMP CAPACITY GPM	PUMP CAPACITY HEAD	SUCTION HEAD/FT.	HP	RPM	V	PH	HZ	REMARKS
CP-1	CUSTODIAN ROOM 123	DOMEESTIC HOT WATER	BELL & GOSSETT SERIES 100	2	14	-	1/12	1725	115	1	60	3/4" INLINE PUMP

TANK SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	TYPE	STORAGE CAPACITY (GAL.)	SIZE	OPER. PRESS. (PSIG)	OPER WT. (LBS.)	ANCHORAGE	REMARKS
T 1	CUSTODIAN ROOM #123	DOMESTIC HOT WATER	AMTROL ST-5-C	DIAPHRAM TYPE	2.1	10"Ø x 10 3/8"	150	37.5	SEE DETAIL 9/P5.01	ASME RATED
T 2	WATER HEATER ROOM #126	DOMESTIC HOT WATER	AMTROL ST-5-C	DIAPHRAM TYPE	2.1	10"Ø x 10 3/8"	150	37.5	SEE DETAIL 2/P5.02	ASME RATED

ELECTRIC WATER HEATER SCHEDULE

SYMBOL	LOCATION	SERVICE	MANUFACTURER & MODEL NO.	STORAGE CAPACITY	RECOVERY @ 100°F RISE	WATER TEMP °F IN	WATER TEMP °F OUT	V	PH	HZ	KW	OPER. WEIGHT (LBS)	ANCHORAGE	REMARKS
EWH-1	STORAGE ROOM	DOMESTIC HOT WATER	BRADFORD WHITE CORPORATION, #LD-10U3-1	10 GPM	6 GPH	60 °F	120 °F	120 V	1	60 Hz	1500 W	132.00 lb/ft³	SEE DETAIL 2/P5.02	LIGHT DUTY COMMERCIAL UTILITY ENERGY SAVER ELECTRIC WATER HEATER, HIGH SILICA VITRAGLAS LINING, ALL WATER & ELECTRIC CONNECTIONS ARE 3/4", SINGLE PHASE ONLY, ONE ELEMENT, 150 PSI WORKING PRESSURE.

APPLICABLE CODES

2013	CALIFORNIA BUILDING STANDARDS ADMINISTRATIVE CODE, PART 1, TITLE 24 C.C.R.
2013	CALIFORNIA BUILDING CODE, PART 2, TITLE 24 C.C.R. (2012 INTERNATIONAL BUILDING CODE WITH 2012 CALIFORNIA AMENDMENTS).
2013	CALIFORNIA ELECTRICAL CODE, PART 3, TITLE 24 C.C.R. (2012 NATIONAL ELECTRICAL CODE WITH 2012 CALIFORNIA AMENDTMENTS).
2013	CALIFORNIA MECHANICAL CODE, PART 4, TITLE 24 C.C.R. (2012 UNIFORM MECHANICAL CODE WITH 2012 CALIFORNIA AMENDTMENTS).
2013	CALIFORNIA PLUMBING CODE, PART 5, TITLE 24 C.C.R. (2012 UNIFORM PLUMBING CODE WITH 2012 CALIFORNIA AMENDMENTS).
2013	CALIFORNIA ENERGY CODE, PART 6, TITLE 24 C.C.R.
2013	CALIFORNIA FIRE CODE, PART 9, TITLE 24 C.C.R. (2012 INTERNATIONAL FIRE CODE).
2013	CALIFORNIA GREEN BUILDING STANDARD CODE, TITLE 24, PART II C.C.R.
2013	CALIFORNIA REFERENCE STANDARDS CODE, PART 12, TITLE 24 C.C.R.

SEISMIC DESIGN CRITERIA

MEP COMPONENT ANCHORAGE NOTE

ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PRE THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2013 CBC, SECTIONS 1616A.1,18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

1. ALL PERMANENT EQUIPMENT AND COMPONENTS.
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVIAL OF THE STRUCTURAL ENGINEER OF RECORD AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING, DUCTWORK, ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.8, 13.6.7, 13.6.5.6, AND 2013 CBC, SECTIONS 1616A.1.23, 1616A.1.24, 1616A.1.25 AND 1616A.1.26.

THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS (OPA#).

COPIES OF THEBRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS.

THE STRCUTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

CALIFORNIA GREEN BUILDING STANDARD FLOW RATES

FIXTURE	BASELINE FLOW RATE	ACTUAL FLOW RATE	% OF REDUCTION
WATER CLOSET	1.6 GPF	1.28 GPF	20%
LAVATORY	0.5 GPM	0.35 GPM	30%
URINAL	1.0 GPF	0.5 GPF	50%

NOTE:
1. GPF - GALLONS PER FLUSH
2. GPM - GALLONS PER MINUTE

DOMESTIC WATER CALCULATIONS

A. CAMPUS WATER PRESSURE @ BUILDING ..... 60 PSI
B. PRESSURE LOSSES
1. LOSS DUE TO BUILDING HEIGHT 50 FT. x .433, PSI 2.17
2. PRESSURE REQ. AT MOST REMOTE OUTLET, PSI 35
3. TOTAL PRESSURE LOSSES, PSI 37.17
C. PRESSURE LEFT TO OVERCOME FRICTION, PSI 22.83
D. TOTAL DEVELOPED LENGTH ..... 100 FT
E. 100 FT. x 50% FITTINGS, FEET ..... 150 FT
F. AVAILABLE FRICTION HEAD LOSS PER 100 FT. 22.83 PSI x 100 FT., PSI / 150 FT. ..... 15.22 PSI

PIPE SIZE	FV FU	FT FU	VEL FPS
1/2"	-	.75	2.3
3/4"	-	6	3.2
1"	-	13	3.9
1-1/4"	-	24	4.6
1-1/2"	11	49	5.1
2"	69	165	6
2-1/2"	186	315	6
3"	396	506	6
4"	1091	1091	6

NOTE: USE 3 PSI/100 FT.
MAX. VELOCITY = 6 FEET PER SECOND

GAS CALCULATIONS

A. WATER HEATER (1 @ 55) ..... 55 CFH
B. HVAC (RTU 1 @ 200, RTU 2 @ 650 & RTU 3 @ 135) ..... 985 CFH
GRAND TOTAL CONNECTED LOAD ..... 1040 CFH

PIPE SIZE	CFH
1/2"	34
3/4"	71
1"	134
1-1/4"	275
1-1/2"	412
2"	794
3"	1270
4"	2240

NOTE: SYSTEM LENGTH = 200 FT., 0.5" WC

PLUMBING SHEET INDEX

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Job No. 120006

SEALS / APPROVALS

REGISTERED PROFESSIONAL ENGINEER — RAYMOND J. KOO — No. M17360 — CIVIL — STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER — No. M31713 — Exp. 6/30/2017 — MECHANICAL — STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

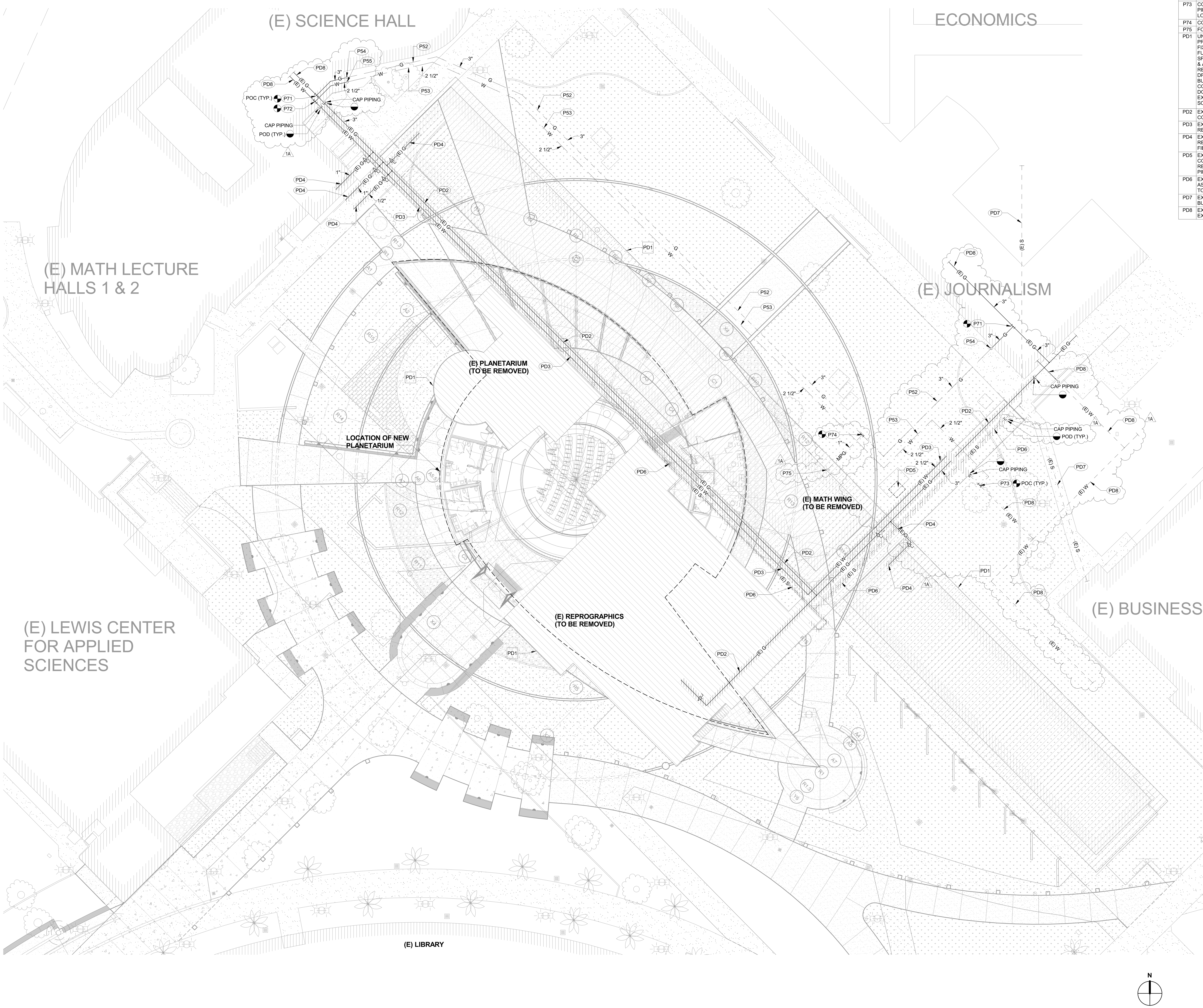
#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY LA
CHECKED BY RV

SHEET TITLE
PLUMBING COVER SHEET

SHEET NUMBER
P0.01

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

P52	NEW 3" GAS, RUN PIPING UNDERGROUND.
P53	NEW 2 1/2" WATER, RUN PIPING UNDERGROUND.
P54	3" GAS RISE AND RUN PIPING UP TO ROOF, UTILIZE (E) GAS REGULATOR.
P55	2 1/2" WATER SUPPLY RISE AND RUN PIPING UP TO ROOF.
P71	CONNECT NEW 3" GAS TO (E) 3" GAS SUPPLY ON THE ROOF. CONTRACTOR TO VERIFY EXACT LOCATION IN FIELD AND UTILIZE (E) GAS REGULATOR.
P72	CONNECT NEW 2 1/2" WATER SUPPLY TO (E) WATER SUPPLY ON THE ROOF. CONTRACTOR TO VERIFY EXACT LOCATION IN FIELD.
P73	CONNECT NEW 2 1/2" UNDERGROUND TO EXISTING WATER PIPING ON SITE. CONTRACTOR TO VERIFY EXISTING LOCATION IN FIELD.
P74	CONNECT NEW 1" MPG TO NEW 3" GAS UNDERGROUND.
P75	FOR CONTINUATION REFER TO PLUMBING SITE PLAN P1.00.
PD1	UNLESS OTHERWISE NOTED, ALL PLUMBING & FIRE PROTECTION SYSTEMS INCLUDING BUT NOT LIMITED TO FIXTURES, TRIM, SUPPORTS, WASTE, VENT, WATER, GAS, FUEL OIL, SPRINKLER, AND STORM DRAIN PIPING, VALVES, SPRINKLER HEADS, FIRE HOSE CABINETS, PIPE SUPPORTS & ALL ASSOCIATED SYSTEM EQUIPMENT SHALL BE REMOVED. SEAL & CAP WATER, GAS, WASTE AND STORM DRAIN PIPING AT 5 FT. FROM THE EXTERIOR WALL OF THE BUILDING. PRIOR TO ANY DEMOLITION WORK, CONTRACTOR SHALL REFER TO ALL REFERENCED DOCUMENTS PROVIDED IN THE BID PACKAGE & VERIFY ALL EXISTING CONDITIONS AT THE SITE FOR THE EXTENT & SCOPE OF DEMOLITION WORK.
PD2	EXISTING 3" GAS PIPING ON THE ROOF TO BE REMOVED. CONTRACTOR TO VERIFY EXISTING LOCATION IN FIELD.
PD3	EXISTING 2 1/2" WATER PIPING ON THE ROOF TO BE REMOVED.
PD4	EXISTING GAS PIPING ON THE ROOF TO BE REMOVED.CONTRACTOR TO VERIFY EXISTING LOCATION IN FIELD.
PD5	EXISTING CHEMICAL RETENTION TANK TO BE REMOVED. CONTRACTOR TO VERIFY EXISTING LOCATION IN FIELD. REMOVE ALL EXISTING WASTE AND ALL ASSOCIATED PIPING CONNECTION, CAP PIPING.
PD6	EXISTING SANITARY/SEWER PIPING TO BE REMOVED. ALL ASSOCIATED CLEAN-OUTS TO BE REMOVED. CONTRACTOR TO VERIFY EXISTING LOCATION IN FIELD. CAP PIPING.
PD7	EXISTING SANITARY/SEWER PIPING SERVICING EXISTING BUILDING ON SITE TO REMAIN.
PD8	EXISTING PIPING TO REMAIN. CONTRACTOR TO VIRIFY EXACT LOCATIONS IN FIELD.

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SEALS / APPROVALS

LICENSED ARCHITECT LAWRENCE A. FRAPWELL NO. C 11360 Ren. 6-30-17 STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER NIKOLAOS J. KOURAKIS No. M31713 Exp. 6/30/2017 MECHANICAL STATE OF CALIFORNIA

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1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023

DATE 12/15/2014

DRAWN BY MG

CHECKED BY RV

SHEET TITLE

PLUMBING DEMOLITION SITE PLAN

SHEET NUMBER

PD.01

PLUMBING DEMOLITION SITE PLAN | SCALE 1/16" = 1'-0" | 1

CONSTRUCTION DOCUMENTS 12/15/2014

4/19/2016 4:42:37 PM

KEYNOTE LEGEND

P1	3" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE CIVIL SITE PLAN DWG.
P2	4" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE CIVIL SITE PLAN DWG.
P3	5" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE CIVIL SITE PLAN DWG.
P4	6" F. FOR CONT. REFER TO FIRE/SPRINKLER SITE PLAN DWG
P5	2" CW. FOR CONT. REFER TO CIVIL SITE PLAN DWG.
P6	1" MPG. FOR CONT. REFER TO PLUMBING DEMOLITION SITE PLAN PD.01
P32	4" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE CIVIL SITE PLAN DWG.
P51	3" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE CIVIL SITE PLAN DWG

(E) SCIENCE HALL

(E) SCIENCE HALL

(E) MATH LECTURE HALLS 1 & 2

(E) LEWIS CENTER FOR APPLIED SCIENCES

(E) JOURNALISM

(E) BUSINESS

NEW PLANETARIUM F.F.=68.40'

LIMIT OF WORK LINE

CANE DETECTABLE NON WALKING SURFACE - DECORATIVE AGGREGATE PER LANDSCAPE DRAWINGS

BUILDING EXIT

BUILDING MAIN ENTRY

FOUCAULT PENDULUM

CANE DETECTABLE RAIL AT DOME WALL - PER DETAIL 23 / AT3.2

ROOF OVERHANG

LINE OF EXTERIOR WALL

NO PARKING

SEE AT1.3 FOR ACCESSIBLE PARKING AND LOADING ZONE

R5 Y4 X4

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PROJECT IDENTIFICATION	11023
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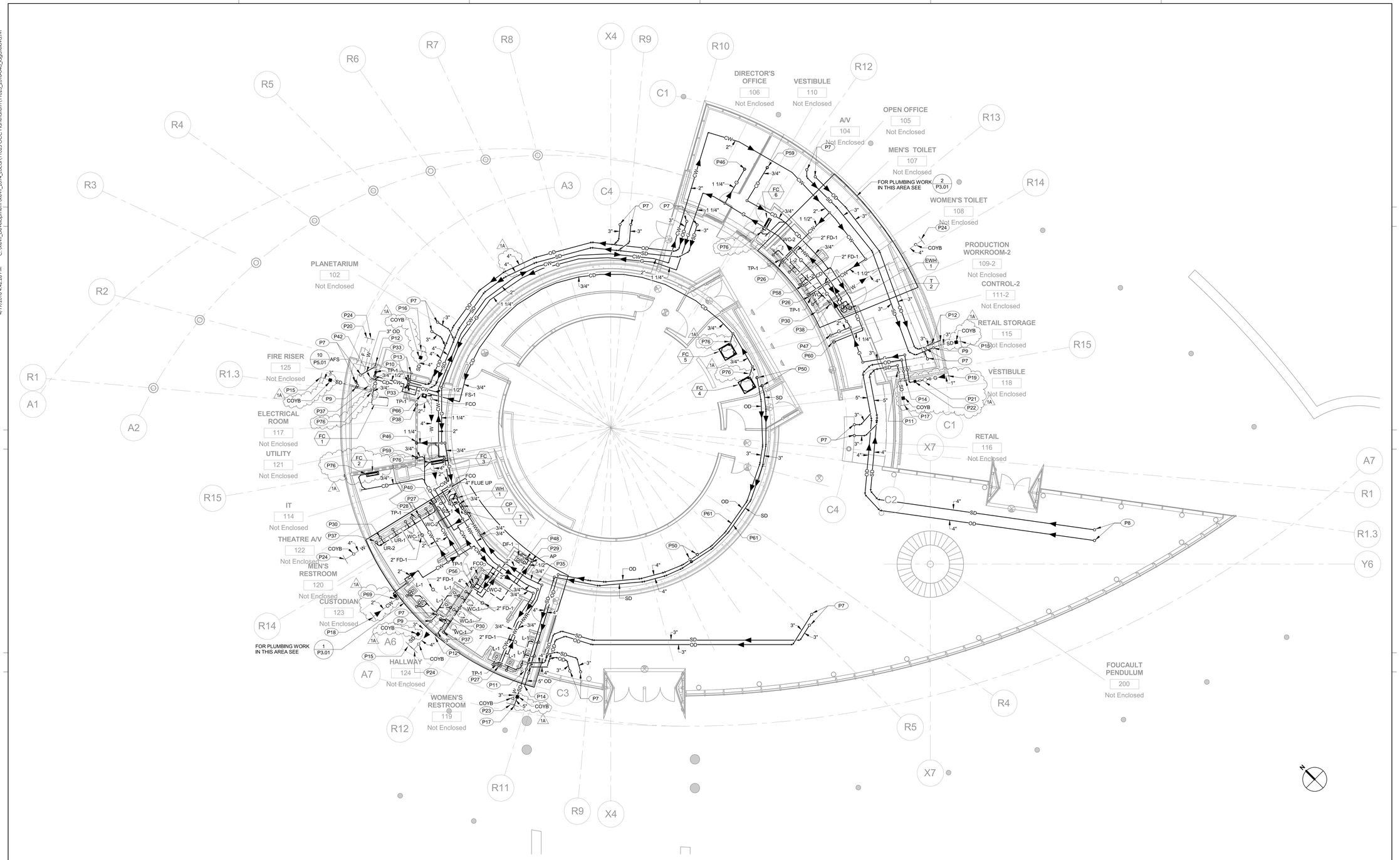
SHEET TITLE
PLUMBING SITE PLAN

SHEET NUMBER
P1.00

PLUMBING SITE PLAN | SCALE 1/16" = 1'-0" | 1

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

P7	3" SD & OD UP TO RD-1 & OD-1
P8	4" SD & OD UP TO RD-1 & OD-1
P9	3" SD DN.
P10	4" SD DN.
P11	5" SD DN.
P12	3" OD DROP. SPILL OVER GRADE W/ DOWNSPOUT NOZZLE (DN-1) J.R. SMITH # 1770T; REFER TO ARCH. DETAIL 20/A9.21
P13	4" OD DROP. SPILL OVER GRADE W/ DOWNSPOUT NOZZLE (DN-1) J.R. SMITH # 1770T; REFER TO ARCH. DETAIL 20/A9.21
P14	5" OD DROP. SPILL OVER GRADE W/ DOWNSPOUT NOZZLE (DN-1) J.R. SMITH # 1770T; REFER TO ARCH. DETAIL 20/A9.21
P15	3" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P16	4" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P17	5" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P18	2" CW; FOR CONT. SEE P1.00
P19	1" MPG; FOR CONT. SEE P1.00
P20	6" F. FOR CONT. SEE P1.00
P21	PROVIDE GAS PRESSURE REGULATOR TO DELIVER 1040 CFH, 5 PSI INLET, 9" WC OUTLET W/1" WC DROP AND SEISMIC SHUT OFF VALVE: PACIFIC SEISMIC PRODUCTS 3" MODEL #315F FLANGED HORIZONTAL, 60 PSI
P22	PROVIDE GAS METER; REFER TO SPEC. SECTION 230923. GAS METER TO BE SENSUS SONIX 600 OR 880 ULTRASONIC TECHNOLOGY.
P23	3" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00

KEYNOTE LEGEND

P24	4" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P26	1-1/2" CW & 1/2" HW DROPS TO SOV BEHIND AP. PROVIDE ROUGH-IN PIPING AS SCHEDULED
P27	3/4" CW & HW DROPS TO SOV BEHIND AP. PROVIDE ROUGH-IN PIPING AS SCHEDULED
P28	2" CW DROP TO SOV BEHIND AP. RUN 2" CW HEADER IN WALL & ROUGH-IN PIPING AS SCHEDULED
P29	1/2" CW DROP TO SOV BEHIND AP. PROVIDE ROUGH-IN PIPING AS SCHEDULED
P30	4" W DN.
P33	1/2" CW DROP TO SOV & TP-1 ON WALL.
P35	FLOW CONTROL VALVE ASSEMBLY. REFER TO THE PLUMBING DETAIL 6/P5.01, PROVIDE ACCESS PANEL (AP) IN THE CLG.
P37	4" V UP THROUGH ROOF.
P38	2" V UP
P40	3/4" CD DROP TO SERVICE SINK.
P42	3/4" CD DROP OVER HOPPER DRAIN; REFER TO DETAIL 10/P5.01
P46	1 1/4" G UP TO MECH. UNIT.
P47	2" G UP TO MECH.UNIT.
P48	2" W DN. & 1 1/2" V RISE
P50	3" SD & OD UP TO RD-2 & OD-2
P56	2" CW & 3/4" HW DROPS TO SOV BEHIND AP. RUN 2" CW & 3/4" HW HEADER IN WALL & ROUGH-IN PIPING AS SCHEDULED
P58	1 1/4" CD DROP. CONN. TO LAVATORY TAILPIECE
P59	3/4" CD UP TO MECH. UNIT.
P60	1 1/4" CD UP TO MECH. UNIT

KEYNOTE LEGEND

P61	RUN SD & OD PIPING IN SOFFIT OUTSIDE OF THE DOME. REFER TO ARCH. DETAIL 4/A9.25
P66	1 1/4" DRAIN FROM DELUGE VALVE SYSTEM. DROP & SPILL 1 1/4" DRAIN INTO FLOOR SINK.
P69	2" DOMESTIC CW RISE AT BUILDING. PROVIDE DOMESTIC WATER FLOW METER. REFER TO SPEC. SECTION 230923 AND MECH CONTROLS DWG. M6.01. METER SHALL BE ONICON ELECTROMAGNETIC FLOW METER MODEL F-3100 SERIES, 1 1/2" METER SIZE
P76	3/4" CD CONN. AT MECH UNIT.

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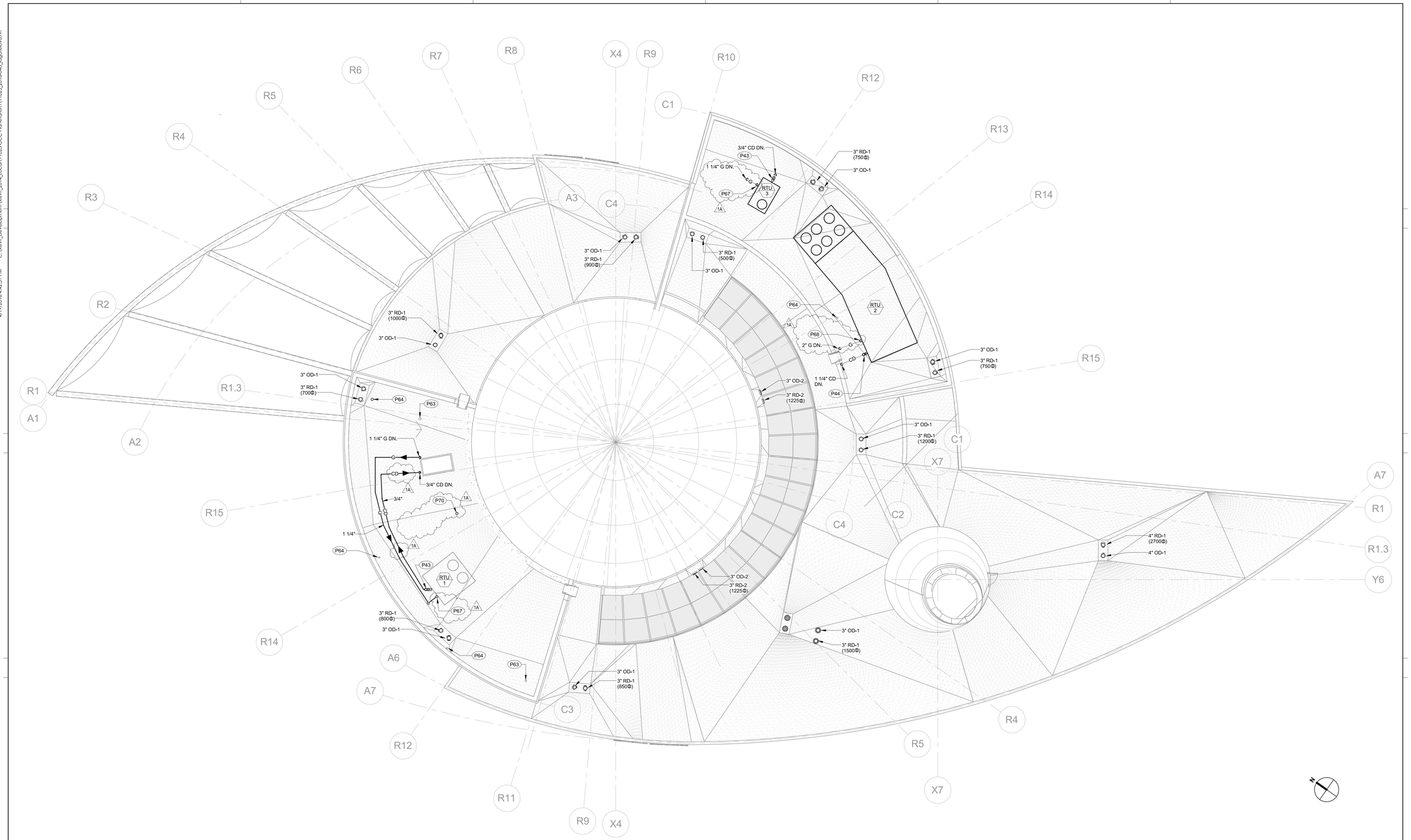
CHECKED BY RV

SHEET TITLE
GROUND FLOOR PLUMBING PLAN

SHEET NUMBER
P2.01

CONSTRUCTION DOCUMENTS 12/15/2014



ROOF PLUMBING PLAN

SCALE 1/8" = 1'-0"

1

KEYNOTE LEGEND

P43	TRAP & VENT 3/4" CD @ MECH. UNIT; REFER TO DETAIL 7/P5.01
P44	TRAP & VENT 1-1/4" CD @ MECH. UNIT; REFER TO DETAIL 7/P5.01
P63	2" VTR; REFER TO PLUMBING DETAIL 4/P5.01
P64	4" VTR; REFER TO PLUMBING DETAIL 4/P5.01
P67	1 1/4" GAS CONNECTION AT MECH UNIT.
P68	2" GAS CONNECTION AT MECH UNIT.
P70	4" FLUE THROUGH ROOF. 1A

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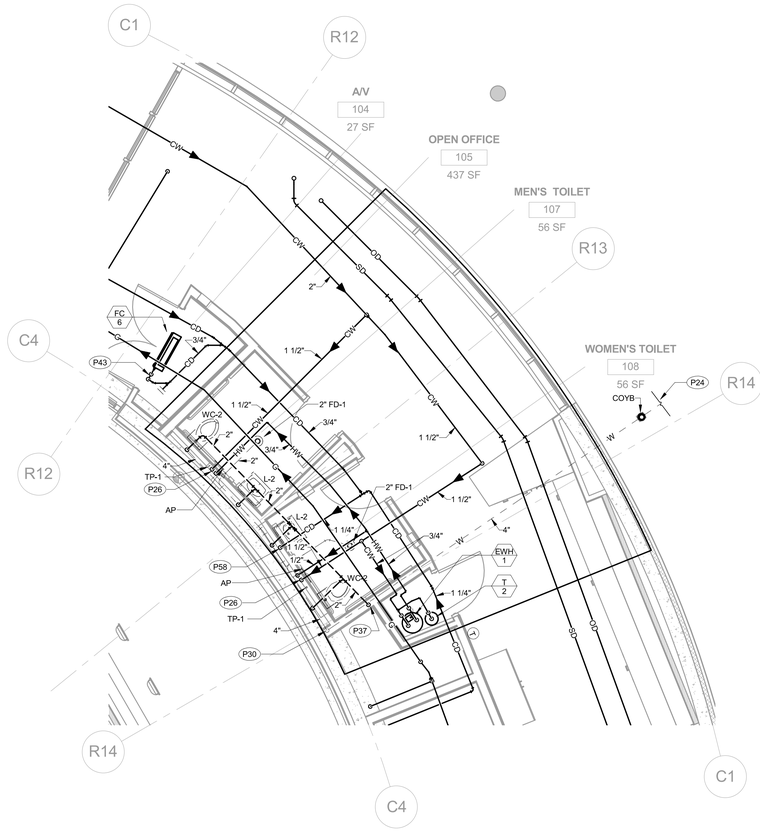
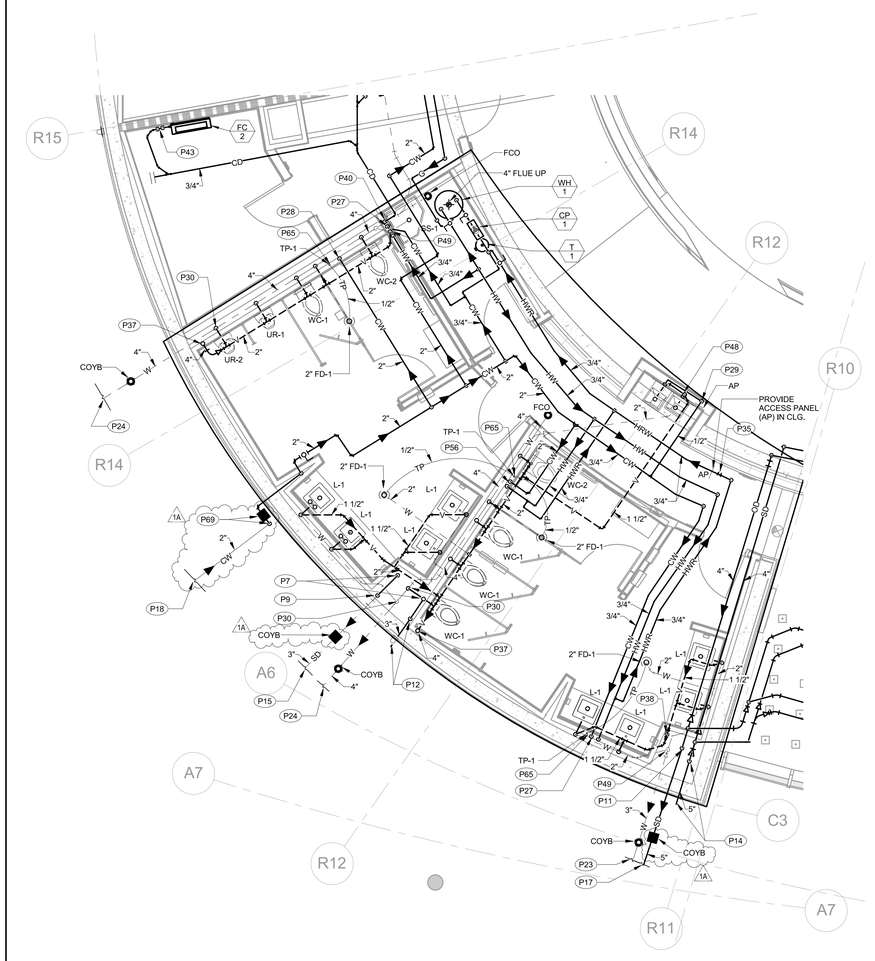
SHEET TITLE
ROOF PLUMBING PLAN

SHEET NUMBER
P2.02

CONSTRUCTION DOCUMENTS 12/15/2014



STAFF RESTROOMS 107 & 108 | SCALE 1/4" = 1'-0" | 2



MEN'S RESTROOM 120, WOMEN'S RESTROOM 119 | SCALE 1/4" = 1'-0" | 1

KEYNOTE LEGEND

P7	3" SD & OD UP TO RD-1 & OD-1
P9	3" SD DN.
P11	5" SD DN.
P12	3" OD DROP. SPILL OVER GRADE W/ DOWNSPOUT NOZZLE (DN-1) J.R. SMITH # 1770T; REFER TO ARCH. DETAIL 20/A9.21
P14	5" OD DROP. SPILL OVER GRADE W/ DOWNSPOUT NOZZLE (DN-1) J.R. SMITH # 1770T, REFER TO ARCH. DETAIL 20/A9.21
P15	3" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P17	5" UNDERGROUND SD PIPING POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P18	2" CW; FOR CONT. SEE P1.00
P23	3" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
P24	4" UNDERGROUND WASTE (W) POC ON SITE @ 5' OUTSUDE THE BUILDING; FOR CONT. SEE P1.00
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P35	FLOW CONTROL VALVE ASSEMBLY. REFER TO THE PLUMBING DETAIL 6/P5.01, PROVIDE ACCESS PANEL (AP) IN THE CLG.
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P40	3/4" CD DROP TO SERVICE SINK.
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P48	2" W DN. & 1 1/2" V RISE
P49	3" W DN.
P56	2" CW & 3/4" HW DROPS TO SOV BEHIND AP. RUN 2" CW & 3/4" HW HEADER IN WALL & ROUGH-IN PIPING AS SCHEDULED
P58	1 1/4" CD DROP. CONN. TO LAVATORY TAILPIECE
P65	1/2" CW DROP W/SOV TO TP-1 IN WALL BEHIND ACCESS PANEL (AP).
P69	2" DOMESTIC CW RISE AT BUILDING. PROVIDE DOMESTIC WATER FLOW METER, REFER TO SPEC. SECTION 230923 AND MECH CONTROLS DWG. M6.01. FLOW METER SHALL BE ONICON MODEL F-3100 SERIES.

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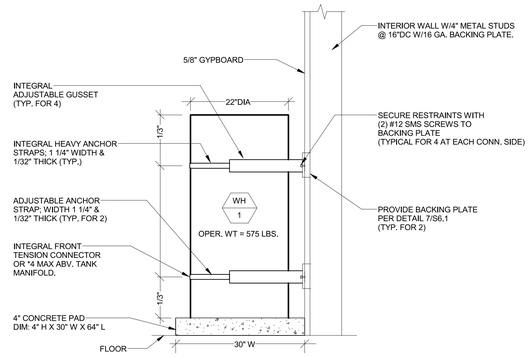
ENLARGED PLUMBING PLANS

SHEET NUMBER
P3.01

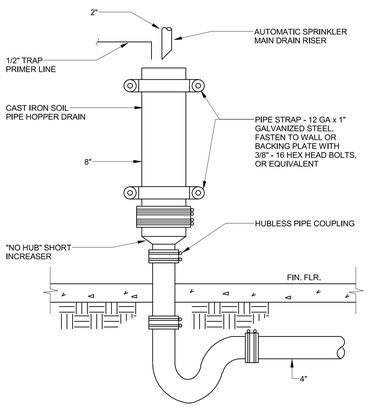
CONSTRUCTION DOCUMENTS 12/15/2014



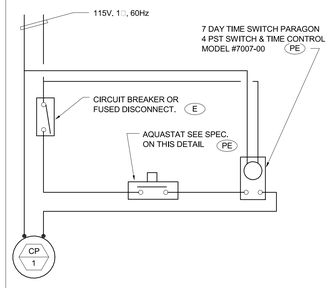
NOTES:

1. GAS WATER HEATER (WH-1) RESTRAINT SYSTEM: "SPACE MAKER #E-100 FOR UP TO 100 GAL CAP. STORAGE TANK. (TWO STRAPS PROVIDED). GAS WATER HEATER SHOWN.

WATER HEATER ANCHORING | SCALE NONE | 9



AUTO SPRINKLER HOPPER DRAIN | SCALE NONE | 10



SPECIFICATION
AQUASTAT: HONEYWELL NO. L4006A
40 TO 180 DEGREE F RANGE, 5-30 DEGREE F ADJUSTABLE DIFFERENTIAL

PE FURNISHED BY PLUMBER INSTALLED BY ELECTRICAL CONTR.

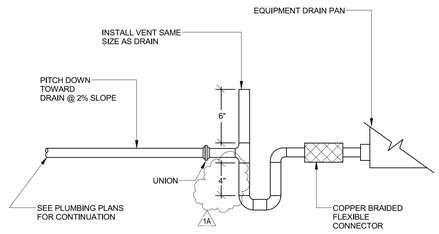
E FURNISHED AND INSTALLED BY ELECTRICAL CONTR.

ALL WIRING BY ELECTRICAL CONTR.

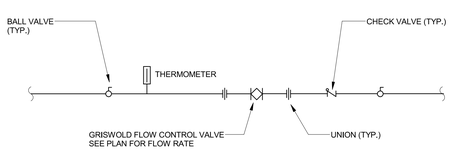
PUMP START/STOP AQUASTAT SETTINGS (DEGREES F) :

PUMP #	START	STOP
CP-1	110	120

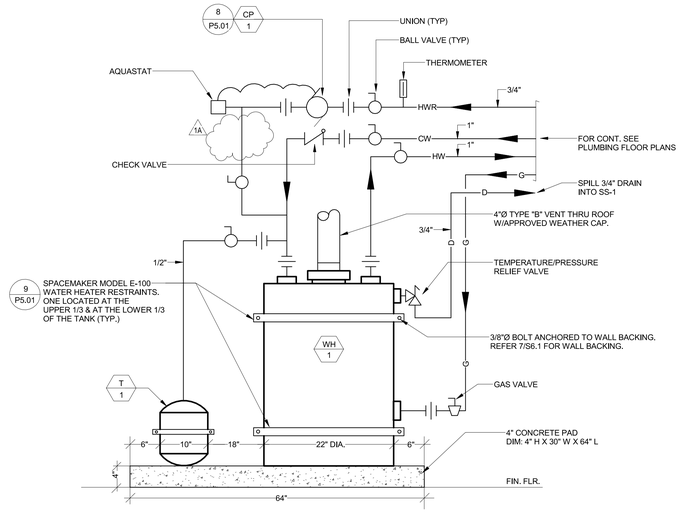
HW CIRCULATING PUMP AND WIRING DIAGRAM | SCALE NONE | 8



TYPICAL CONDENSATE DRAIN CONNECTION | SCALE NONE | 7



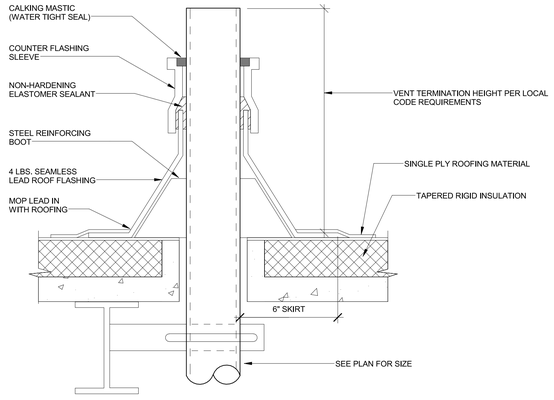
DOMESTIC HOT WATER FLOW CONTROL VALVE ASSEMBLY | SCALE NONE | 6



NOTES:

1. GAS WATER HEATER (WH-1) SHOWN.

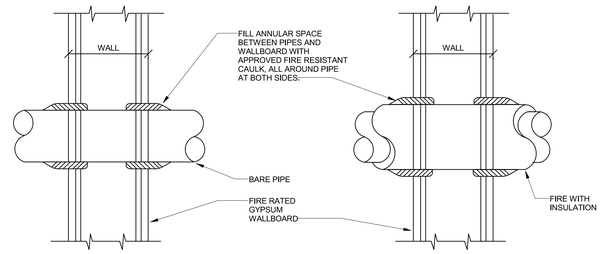
DOMESTIC HOT WATER DIAGRAM | SCALE NONE | 5



NOTES:

1. REFER TO ARCH. DWG 9/7.01

TYPICAL VENT OR PIPE THRU ROOF | SCALE NONE | 4

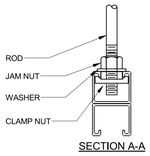


WALL PENETRATION DETAIL | SCALE NONE | 3

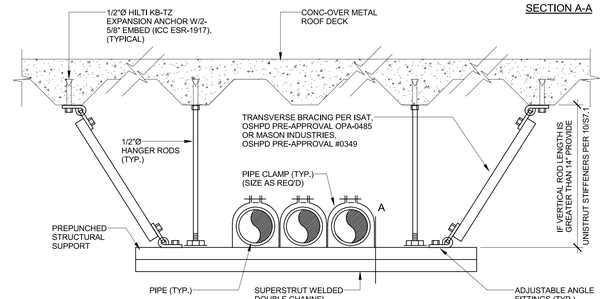
NOTE

1. SEISMIC ANCHORAGE AND BRACING OF ALL PIPING AND EQUIPMENT SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL SEISMIC APPLICATION TECHNOLOGY (ISAT) DESIGN STANDARDS, OSHPD PRE-APPROVAL OPA-0485, OR MASON INDUSTRIES, OSHPD PRE-APPROVAL #0349

2. SPACING OF TRAPEZE HANGERS SHALL BE BASED ON THE CLOSEST SPACING REQUIRED BY THE APPLICABLE PRODUCT TRANSPORTED.



SECTION A-A

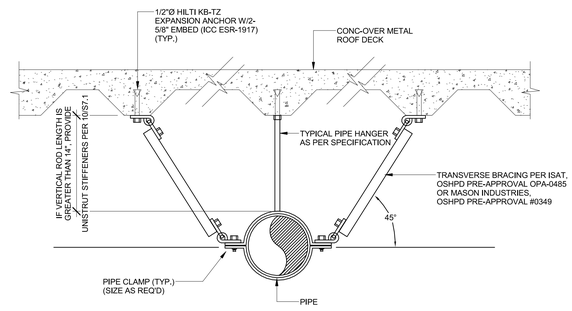


NOTE: MAX. SUPPORT & PIPE WEIGHT = 100 LBS.

MULTIPLE PIPE SUPPORT/SWAY BRACING | SCALE NONE | 2

NOTE

1. SEISMIC ANCHORAGE AND BRACING OF ALL PIPING AND EQUIPMENT SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL SEISMIC APPLICATION TECHNOLOGY (ISAT) DESIGN STANDARDS, OSHPD PRE-APPROVAL OPA-0485, OR MASON INDUSTRIES, OSHPD PRE-APPROVAL #0349



NOTE: MAX. SUPPORT & PIPE WEIGHT = 100 LBS.

SINGLE PIPE SUPPORT/SWAY BRACING | SCALE NONE | 1

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4500 East Pacific Coast Highway, Suite 100
Long Beach, California 90804
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Job No. 120006

SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY LA
CHECKED BY RV

SHEET TITLE
PLUMBING DETAILS

SHEET NUMBER
P5.01

CONSTRUCTION DOCUMENTS 12/15/2014

ELECTRICAL ABBREVIATIONS

@	AT
A	AMPERES
A.F.F.	ABOVE FINISHED FLOOR
A/C	AIR CONDITIONING
ABV	ABOVE
AF	AMP FUSE OR AMP FRAME
AFC	AVAILABLE FAULT CURRENT (SYMMETRICAL)
ARCH.	ARCHITECT
AS	AMP SWITCH
AUTO	AUTOMATIC
AWG	AMERICAN WIRE GUAGE
BKBD	BACKBOARD
C	CONDUIT
C.O.	CONDUIT ONLY
C.W.	COLD WATER
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CLG.	CEILING
CLR.	CLEAR
CONC.	CONCRETE
CONN.	CONNECT OR CONNECTION
CONT.	CONTINUED/CONTINUATION
D	DEPTH
D.E.F.	DUAL ELEMENT FUSE
DET.	DETAIL
DIA.	DIAMETER
DISC.	DISCONNECT
DN	DOWN
DWG	DRAWING
E	EXISTING OR EMERGENCY
EA	EACH
EDF	ELECTRIC DRINKING FOUNTAIN
ELEC	ELECTRIC OR ELECTRICAL
ELEV	ELEVATION
EMERG.	EMERGENCY
EQUIP.	EQUIPMENT
EXT.	EXTERIOR
FA	FIRE ALARM
FIXT.	FIXTURE
FLA	FULL LOAD AMPERES
FLR	FLOOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
H	HIGH OR HEIGHT
HORIZ.	HORIZONTAL
HP	HORSEPOWER
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
I.G.	ISOLATED GROUND
INT.	INTERIOR
JB	JUNCTION BOX
K.O.	KNOCK OUT
KVA	KILOVOLT AMPERES
KW	KILOWATT
KWH	KILLOWATT HOUR
L	LENGTH
L.V.	LOW VOLTAGE
LCL	LONG CONTINUOUS LOAD
LOC.	LOCATION
LTG	LIGHTING
MAX	MAXIMUM
MECH	MECHANICAL
MFR.	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM OR MINUTES
MTD	MOUNTED
MTG	MOUNTING
MTG. HT.	MOUNTING HEIGHT
N.I.C.	NOT IN CONTRACT
N.L.	NIGHT LIGHT
NA	NOT APPLICABLE
NF	NON FUSIBLE
NTS	NOT TO SCALE
O.C.	ON CENTER
P	POLE
P.C.	PHOTOCELL
P.O.C.	POINT OF CONNECTION
PB	PULBOX
PNL	PANEL
PR	PAIR
PWR.	POWER
RECPT	RECEPTACLE
REQ'D	REQUIRED
RM	ROOM
S	SIGNAL
SCHED.	SCHEDULE
SHT	SHEET
SPKR	SPEAKER
SQ. FT.	SQUARE FEET
SURF.	SURFACE
SW.	SWITCH
SWBD	SWITCHBOARD
SYS.	SYSTEM
TEL	TELEPHONE
TEMP.	TEMPORARY OR TEMPERATURE
TGB	TELECOM GROUNDING BUS BAR
TRANSF.	TRANSFORMER
TTB	TELEPHONE TERMINAL BACKBOARD
TV	TELEVISION
TYP	TYPICAL
U.G.	UNDERGROUND
U.O.N.	UNLESS OTHERWISE NOTED
V	VOLT
V.D.	VOLTAGE DROP
V.L.	VERIFY LOCATION
VA	VOLT AMPERES
VERT.	VERTICAL
W	WATTS OR WIRE OR WIDE
W.P.	WEATHERPROOF
W/	WITH
W/O	WITHOUT

ELECTRICAL LEGEND

GENERAL POWER

- FLUSH WITH CEILING RECEPTACLE, DUPLEX; NEMA 5-20R,
- DUPLEX FLUSH FLOOR RECEPTACLE; NEMA 5-20R.
- RECEPTACLE, DUPLEX; NEMA 5-20R, +18" A.F.F (U.O.N.)
- GFI RECEPTACLE, DUPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER; NEMA 5-20R, 18" A.F.F
- RECEPTACLE, QUADRAPLEX; NEMA 5-20R, 18" A.F.F. (U.O.N.)
- RECEPTACLE, SINGLE; NEMA 5-20R, 18" A.F.F. (U.O.N.)
- S RECEPTACLE, SINGLE WITH SWITCH; NEMA 5-20R, 18" A.F.F. (U.O.N.)
- RECEPTACLE, SPECIAL PURPOSE
  A = 120V, 20A, 1 PHASE, 2-POLE, 3W, NEMA 5-20R.
  B = 208V, 20A, 1 PHASE, 2-POLE, 3W, NEMA 6-20R.
  C = 120V, 30A, 1 PHASE, 2-POLE, 3W, NEMA 5-30R.
  D = 208V, 30A, 1 PHASE, 2-POLE, 3W, NEMA 6-30R.
  E = 208V, 60A, 1 PHASE, 3-POLE, 4W, NEMA 14-60R.
  F = 208V, 30A, 3 PHASE, 3-POLE, 4W, NEMA L21-30R.
  G = 208V, 50A, 3 PHASE, 3 POLE, 4W, NEMA 15-30R.
  H = 208V, 60A, 3 PHASE, 3 POLE, 4W, NEMA 15-60R.
- J J JUNCTION BOX
  CIRCLE DESIGNATED JUNCTION BOX CEILING MOUNTED, BRACKET DESIGNATES JUNCTION BOX, WALL MOUNTED AT + 18" A.F.F (U.O.N)

POWER AND WIRING DISTRIBUTION

- MOTOR
- Sm Sm_3 SINGLE POLE MOTOR SWITCH - THREE POLE MOTOR SWITCH
- T TRANSFORMER
- EARTH GROUND
- 100AS 100AF 3P DISCONNECT SWITCH, "AS" INDICATES SWITCH AMPERE RATING "AF" INDICATES FUSE AMPERE RATING, +48" A.F.F (U.O.N)
- STARTER, COMBINATION WITH DISCONNECT SWITCH, +48" A.F.F (U.O.N)
- STARTER OR MOTOR CONTROLLER
- VFD VARIABLE FREQUENCY DRIVE WITH INTEGRAL DISCONNECT SWITCH.(PROVIDED BY DIV. 22 OR 23)
- PUSH BUTTON; +48" A.F.F (U.O.N.)
- DISTRIBUTION SWITCHBOARD - FLOOR STANDING
- PANELBOARD CABINET, FLUSH MOUNTED
- PANELBOARD CABINET, SURFACE MOUNTED
- FUSE WITH RATING
- S SHUNT TRIP CIRCUIT BREAKER
- GF CIRCUIT BREAKER WITH GROUND FAULT PROTECTION
- 100AS 3P MOLDED CASE CIRCUIT BREAKER, AMPERE TRIP RATING AND NUMBER OF POLE AS INDICATED.
- SWITCH AND FUSE UNIT
- PB PULL BOX
- BRANCH CIRCUIT HOMERUN. LINES INDICATE NUMBER OF CIRCUITS, NEUTRAL, AND SWITCH LEG CONDUCTORS. ONE SEPARATE GREEN GROUNDING CONDUCTOR SHALL BE PROVIDED FOR EACH HOMERUN; NOT SHOWN
- CONDUIT RUN IN OR BELOW FLOOR SLAB OR UNDERGROUND. 3/4"C. MIN.
- CONDUIT RUN CONCEALED IN WALL OR ABOVE CEILING SPACE. 3/4"C. MIN. (U.O.N)
- E EMERGENCY SYSTEM CONDUIT
- CONDUIT STUBBED OUT AND CAPPED.
- PANEL ELECTRICAL EQUIPMENT
- MS-1 FEEDER SYMBOL
- 1 AN OVAL WITH A NUMBER INSIDE REFERS TO A KEY NOTE ON THE DRAWING WHERE IT IS INDICATED.

GENERAL LIGHTING

- A INDICATES A REFERENCE TO THE FIXTURE SCHEDULE, TYPE "A" FIXTURE INDICATED.
- OV KEY ENABLED OVERRIDE SWITCH, WALL MOUNTED
- DL DAYLIGHT SENSOR
- D LED DRIVER
- OS CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR
- OS WALL MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR
- $\$_2$ SWITCH ; +48" A.F.F. (U.O.N.)
  BLANK = SINGLE POLE
  3 = THREE-WAY
  D = DIMMER
  LV = LOW VOLTAGE
  2 = DOUBLE POLE
  4 = FOUR-WAY
  K = KEY OPERATED
  L = LOCK
  T = 0-2HR SPRING WOUND TIMER

GENERAL COMMUNICATION

- MULTI-GANG BOX IN FLOOR FOR TELEPHONE, DATA & RECEPTACLE.
- FLUSH FLOOR OUTLET, DATA/COMMUNICATION
- CEILING MOUNTED OUTLET, DATA /COMMUNICATION
- WALL MOUNTED DATA OUTLET, +18" A.F.F (U.O.N)
- WALL MOUNTED COMBINATION VOICE/DATA OUTLET, +18" A.F.F (U.O.N)
- FLUSH FLOOR COMBINATION OUTLET, VOICE/DATA
- AV A/V EQUIPMENT ENCLOSURE
- P WALL MOUNTED TELEPHONE
- W WALL MOUNTED WIRELESS ACCESS POINT
- 2 WALL MOUNTED 2-PORT PLATE
- 4 WALL MOUNTED 4-PORT PLATE
- 2 FLOOR BOX 2-PORT PLATE
- 4 FLOOR BOX 4-PORT PLATE
- W CEILING MOUNTED WIRELESS ACCESS POINT

LIGHT FIXTURE

- 2'x4' LIGHTING FIXTURE, CEILING RECESSED MOUNTED
- RECESSED DOWN LIGHT
- PENDANT DIRECT/INDIRECT LIGHT FIXTURE
- INDUSTRIAL LIGHT FIXTURE
- COVE LIGHT FIXTURE
- EXIT SIGN, WALL MOUNTED WITH DIRECTIONAL ARROWS AND FACES AS SHOWN
- EXIT SIGN, CEILING MOUNTED WITH DIRECTIONAL ARROWS AND FACES AS SHOWN

ELECTRICAL GENERAL NOTES

1	FOR PURPOSES OF CLARITY AND LEGIBILITY, THE ELECTRICAL DRAWINGS ARE ESSENTIALLY DIAGRAMMATIC. THE SIZE AND LOCATION OF EQUIPMENT IS SHOWN TO SCALE WHEREVER POSSIBLE. VERIFY ALL CONDITIONS.
2	THE SYMBOLS DESIGNATING CONDUIT SIZES AND QUANTITIES OF BRANCH CIRCUIT WIRING DO NOT NECESSARILY INCLUDE THE EQUIPMENT GROUNDING CONDUCTOR REQUIRED.
3	REFER TO ALL DRAWINGS FOR ADDITIONAL INFORMATION, EXACT EQUIPMENT LOCATION, MOUNTING HEIGHTS, MOUNTING REQUIREMENTS AND MAKE FINAL ELECTRICAL CONNECTIONS WHETHER SHOWN ON THE ELECTRICAL DRAWINGS OR NOT.
4	LOCATIONS SHOWN ON THE ARCHITECTURAL DRAWINGS TAKE PRECEDENCE OVER THOSE SHOWN ON THE ELECTRICAL DRAWINGS. COORDINATE WITH OTHER TRADES FOR ADDITIONAL INFORMATION, EQUIPMENT LOCATION, MOUNTING HEIGHTS, MOUNTING REQUIREMENTS AND MAKE FINAL CONNECTIONS TO ALL ELECTRICAL EQUIPMENT. PROVIDE TEMPORARY ELECTRICAL SERVICE SUITABLE TO CONDUCT CONSTRUCTION. OPERATIONS AND OWNER'S NEEDS FOR CONTINUOUS SERVICE AND OPERATIONS.
5	SEAL ALL PENETRATIONS THROUGH FIRE RATED WALLS, CEILINGS, FLOORS, ETC., TO MAINTAIN THE FIRE RATING. FURNISH AND INSTALL FIRE RATED ENCLOSURES FOR ALL EQUIPMENT PENETRATING INTO FIRE RATED ENVELOPES, SPACES, ETC.
6	PAINT ALL EXPOSED ELECTRICAL RACEWAYS, CABINETS, ENCLOSURES AND FITTINGS TO MATCH ADJACENT SURFACES IN FINISHED AREAS.
7	PROVIDE WEATHERPROOF GROUND FAULT INTERRUPTER (GFI) RECEPTACLES ON ROOF WITHIN 25 FEET OF "HVAC" EQUIPMENT, MOUNT RECEPTACLE ON UNISTRUT SUPPORT.
8	MANUAL MOTOR STARTERS FOR FRACTIONAL HORSEPOWER MOTORS SHALL HAVE OVERLOAD PROTECTION. PROVIDE OVERLOAD PROTECTION IN EACH PHASE FOR 3-PHASE MOTORS.
9	ROUTE CONDUIT AND PROVIDE ALL NECESSARY PULL BOXES AND FITTINGS TO AVOID OBSTACLES IN ROOMS OR BUILDINGS.
10	IN ADDITION TO JUNCTION BOXES INDICATED ON DRAWINGS, INSTALL JUNCTION BOXES AND PULL BOXES FOR CABLE SPLICES, CABLE PULLING AND CONNECTIONS NECESSARY FOR THE INSTALLATION OF A COMPLETE OPERATING SYSTEM.
11	OUTLET BOXES AND PANELS INSTALLED IN FIRE RATED WALLS AND CEILINGS SHALL NOT EXCEED 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL OR CEILING AREA. INDIVIDUAL OUTLET BOXES OR FIXTURES SHALL BE STEEL AND NOT GREATER THAN 16 SQUARE INCHES.
12	ALL UTILITIES HOOK-UPS REQUIRED DURING OFF HOURS WILL BE PERFORMED BY THE CONTRACTOR AT NO ADDITIONAL COST.
13	CONTRACTOR TO OBTAIN AND PAY FOR ALL PERMITS NECESSARY AND INSPECTION FEE AS REQUIRED BY LOCAL AGENCIES HAVING JURISDICTION.
14	ALL ELECTRICAL PREFABRICATED EQUIPMENT SHALL BE DESIGNED AND CONSTRUCTED IN SUCH A MANNER THAT ALL PORTIONS, ELEMENTS, SUB-ASSEMBLIES AND/OR PARTS OF SAID EQUIPMENT, AND THE EQUIPMENT AS A WHOLE INCLUDING ITS ATTACHMENTS, WILL RESIST A LOAD WHICH EXCEEDS THE FORCE LEVEL USED TO RESTRAIN AND ANCHOR THE EQUIPMENT TO THE SUPPORTING STRUCTURE.
15	ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE NEW AND SHALL BE LISTED BY UNDERWRITER'S LABORATORIES (UL) AND BEAR THEIR LABEL, OR LISTED AND CERTIFIED BY A NATIONALLY RECOGNIZED TESTING AUTHORITY WHERE UL DOES NOT HAVE A LISTING. CUSTOM MADE EQUIPMENT SHALL HAVE COMPLETE TEST DATA SUBMITTED BY THE MANUFACTURER ATTESTING TO ITS SAFETY. IN ADDITION, THE MATERIALS, EQUIPMENT, AND INSTALLATION SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING: AMERICAN SOCIETY OF TESTING MATERIALS (ASTM) INSULATED POWER CABLE ENGINEERS ASSOCIATION (IPCEA) NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) AMERICAN STANDARD ASSOCIATION (ASA) NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) AMERICAN NATIONAL STANDARD INSTITUTE (ANSI) CALIFORNIA ELECTRICAL CODE (CEC) - 2013 EDITION CALIFORNIA CODE OF REGULATIONS TITLE 24 (CCR) INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) ALL LOCAL CODES HAVING JURISDICTION.
16	WHERE THE CODES HAVE DIFFERENT LEVELS OF REQUIREMENTS, THE MOST STRINGENT RULE SHALL APPLY.
17	THE CONTRACTOR SHALL VISIT THE SITE INCLUDING ALL AREAS INDICATED ON THE DRAWINGS. THE CONTRACTOR SHALL THOROUGHLY FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS, AND BY SUBMITTING HIS BID, ACCEPTS THE CONDITIONS UNDER WHICH HE SHALL BE REQUIRED TO PERFORM HIS WORK.
18	IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN A COMPLETE SET OF CONTRACT DOCUMENTS, ADDENDA, DRAWINGS AND SPECIFICATIONS. HE SHALL CHECK THE DRAWINGS OF THE OTHER TRADES FOR DUCTS, LINES AND EQUIPMENT AND SHALL CAREFULLY READ THE ENTIRE SPECIFICATIONS AND DETERMINE HIS RESPONSIBILITIES. FAILURE TO DO SO SHALL NOT RELEASE THE CONTRACTOR FROM DOING THE WORK IN COMPLETE ACCORDANCE WITH THE CONTRACT DOCUMENTS.
19	THE CONTRACTOR SHALL COORDINATE HIS WORK WITH OTHER TRADES. ANY COSTS TO INSTALL WORK TO ACCOMPLISH SAID COORDINATION WHICH DIFFERS FROM THE WORK AS SHOWN ON THE CONTRACT DOCUMENTS SHALL BE INCURRED BY THE CONTRACTOR. ANY DISCREPANCIES, AMBIGUITIES OR CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT DURING BID TIME FOR CLARIFICATION. ANY SUCH CONFLICTS NOT CLARIFIED PRIOR TO BID SHALL BE SUBJECT TO THE INTERPRETATION OF THE ARCHITECT AT NO ADDITIONAL COST TO THE OWNER.
20	EXACT ROUTING METHOD AND LOCATION OF CONDUIT PENETRATION AND OPENINGS IN CONCRETE WALLS OR FLOORS OR STRUCTURAL STEEL MEMBERS SHALL BE DETERMINED BY THE CONTRACTOR IN THE FIELD. PERFORM CORING, SAWCUTTING, PATCHING, AND REFINISHING OF EXISTING WALLS AND SURFACES WHEREVER IT IS NECESSARY TO PENETRATE. OPENINGS SHALL BE SEALED IN AN APPROVED METHOD TO MEET THE FIRE RATING AND WATER PROOFING REQUIREMENTS OF THE PARTICULAR WALL, FLOOR OR CEILING. ALL FIRE SEALS SHALL BE UL APPROVED
21	THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SAWCUTTING, TRENCHING, BACKFILLING, COMPACTION AND PATCHING OF CONCRETE AND ASPHALT AS REQUIRED TO PERFORM HIS WORK. ATTENTION IS CALLED TO THE FACT THAT THERE MAY BE EXISTING UNDERGROUND UTILITIES. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN TRENCHING FOR HIS WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER AND APPROVED REPAIR OF ANY AND ALL DAMAGES CAUSED BY HIM OR HIS WORK.
22	WHENEVER A DISCREPANCY ARISES ON THE DRAWINGS OR IN THE SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL MATERIAL AND SERVICES REQUIRED BY THE STRICTEST CONDITIONS NOTED ON THE DRAWINGS OR IN THE SPECIFICATIONS TO ENSURE COMPLETE AND OPERABLE SYSTEMS AS REQUIRED BY THE OWNER'S REPRESENTATIVE.
23	DRAWINGS ARE DIAGRAMMATIC ONLY. ROUTING OF RACEWAYS SHALL BE AT THE OPTION OF THE CONTRACTOR WITH THE ARCHITECT'S APPROVAL AND SHALL BE COORDINATED WITH OTHER SECTIONS. DO NOT SCALE THE ELECTRICAL DRAWINGS FOR LOCATIONS OF ANY ARCHITECTURAL, STRUCTURAL, CIVIL, OR MECHANICAL ITEMS OR FEATURES.
24	WHEN 5KV DEMOLITION IS PERFORMED AT ANY BUILDING WHICH SERVE AS A LOOP TO 5 KV SYSTEM, MAINTAIN POWER CONTINUITY TO ALL BUILDINGS PRIOR TO THE DEMOLITION OF ANY 5KV LOOP EQUIPMENT AT INDIVIDUAL BUILDINGS, AT THE END OF THE PROJECT REMOVE ALL EXISTING 5KV CONDUCTORS FROM EXISTING DUCT BANKS AND CONDUITS. PROVIDE CONDUIT CAPS OR PLUGS IN ALL ABANDONED CONDUITS.
25	NO PVC OR NON-METALLIC ELECTRICAL CONDUIT BENEATH RAISED FLOOR TO BE USE.

MEP COMPONENT ANCHORAGE NOTES:

ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER DETAIL ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2013 CBC, SECTION 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

1. ALL PERMANENT EQUIPMENTS AND COMPONENTS .
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT THE ATTACHMENT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS,LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF STRUCTURAL ENGINEER OF RECORD AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING. DUCTWORK AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTES:

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.8. 13.6.7, 13.6.5.6, AND 2013 CBC, SECTIONS 1616A.1.23, 1616A.1.24, 1616A.1.25 AND 1616A.1.26.

THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS (OPM #).

COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS.

THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

SEISMIC BRACING OF ELECTRICAL SYSTEMS NOTES:

BRACING OF CONDUITS OR OTHER ELECTRICAL EQUIPMENT SHALL MEET CBC AND TITLE 24 REQUIRMENTS.

SYSTEMS SHALL BE BRACED IN ACCORDANCE WITH THE LATEST ISSUE OF THE INTERNATIONAL SEISMIC APPLICATION TECHNOLOGY (ISAT) DESIGN STANDARD, OSHPD PRE-APPROVAL #OPA-0485 OR MASON INDUSTRIES, OSHPD PRE-APPROVAL #OPA-0349.

THE DESIGN FORCE FOR THE BRACING SYSTEM SHALL BE PER THE STRUCTURAL GENERAL NOTES ON SHEET S1.1, TYPICAL.

SHOP DRAWINGS SHOWING ALL BRACING LOCATIONS AND DETAILS OF CONNECTIONS ARE REQUIRED FOR ALL SYSTEMS INCLUDING PRE-APPROVED SYSTEMS, SUBMITTAL SHALL INCLUDE:

A. LOADING CONDITIONS OF SUPPORTS
B. LOADING CONDITIONS OF BRACES
C. DETAILING ASSEMBLY OF PRE-APPROVED SYSTEM
D. SHOW DRAWINGS TO BE SUBMITTED AS A DEFFERED APPROVAL.

CONTRACTOR SHALL NOT MIX COMPONENTS OF TWO OR MORE PRE-APPROVED BRACING SYSTEMS, ONLY ONE PRE-APPROVED BRACING SYSTEM SHALL BE USE FOR RUN OF PIPE, DUCT OR CONDUIT. ANY SUBSTITUTION OF A COMPONENT OF A PRE-APPROVED BRACING SYSTEM REQUIRED OSHPD REVIEW AND APPROVAL.

LIGHTING CONSULTANT FIXTURE SCHEDULE

TYPE	DESCRIPTION	INPUT VA	LAMPS NO.	LAMPS WATTS	LAMPS TYPE	MOUNTING	MANUFACTURER & CATALOG NO. BASIS OF DESIGN	MANUFACTURER & CATALOG NO. ALTERNATE	REMARKS	NOTES
A	2'X4' LED TROFFER LIGHT FIXTURE	49	1	49	LED 5350 LUMEN	RECESSED	COLUMBIA LIGHTING LJT24-40HLGFSA12125-LUTHU	FINELITE, INC. HPR-F-2X4-DCO-LED-HO-4000K-277V-SC-CXX-DIM		1 2 4 8
A1	4' INDUSTRIAL LINEAR LED LIGHT FIXTURE WITH REFLECTOR.	56	1	56	LED	SURFACE/ PENDANT	COLUMBIA LIGHTING LCR-4-40HL-LUTHU-EL114	HE WILLIAMS 80-4-L60/840-RA-80-DIM-277V-EM/BSL310		1 2 4 8
B	4" DIA. OPEN LED DOWN LIGHT SUITABLE FOR WET LOCATION	14	1	14	LED 1000 LUMEN	RECESSED	LITE FRAME LF4LED5G4277HDM 4LFLED5G440KWT	LITON LIGHTING LHALD425C070UE-D10-C260-LRALD471SSF-101-T40		1 2 4 8
B1	2" DIA. ADJUSTABLE LED DOWN LIGHT	22	1	22	LED 1200 LUMEN	RECESSED	ARCHITEKTUR A2LED277HDM2A9LED12L30K8FL3 5SSWT D2FRM	AMERLUX E2.9RA-G2-HP-20-LED-277-FL-HILUME E2.9RA-G2-HP-SDW	1	1 2 4 8
C	LED LIGHT FIXTURE	1320	DRIVER 10	132	LED	COVE	CROMACOVE #NANO COVE -RB	CROMACOVE #NANO COVE -RB	14 FIXTURE PER DRIVER	
D	6" DIA. LED OPEN DOWNLIGHT	19	1	19	LED	RECESSED	LITE FRAME LF6LED6G4277HDM 6LFLED6G440KWT	LITON LIGHTING LHALD625C071UE-D10-C260-LRALDSSF-101-B60-T40		1 2 4 8
E1	LED EXIT SIGN, RED LETTERS ON WHITE FACE WITH 90 MINUTES BATTERY BACK UP.	3	1	3	LED	RECESSED	SOVEREIGN SOV-EM-R-1W-BA-RC-ARROW	EMERGI-LITE TA-PE-1/2-RC/GC		1 2 3 8
F	PENDANT-MOUNTED LED INDIRECT/DIRECT WITH INDEPENDENTLY-ADJUSTABLE UPLIGHT & DOWNLIGHT LEVELS. HOUSING LENGTHS: 4' AND 8'.	53	1	53	LED	PENDANT	LITECONTROL P-ID-L12-04-SOF-STD-40K-I10/D35-CWM-LHI-1CWQ-VOLT. LITECONTROL P-ID-L12-08-SOF-STD-40K-I10/D35-CWM-LHI-1CWQ-VOLT.	METALUMEN RMEP-6-L40K-4'-ODC-M-XX-L3-1-PX-2 20 UP/ 80 DOWN	SEE MOUNTING/SUPPORT DETAILS 6, 12 & 20 / A9.8	1 2 4 8
G	2' LINEAR LED LIGHT FIXTURE	17W	1	17W	LED	RECESSED	JLC-TECH TBSL-MN-2-15-D-U-W	JLC-TECH TBSL-T-BAR LED SMART LIGHT FOR 9/16"-277V	T-BAR 96W POWER SUPPLY 24VDC LED DRIVER DIMMING 0-10V	1 2 6 8
H	LED LINEAR LED STRIP LIGHT FIXTURE	40	1	40	LED	SURFACE	BOCA FLASHER HPNLS-L08-4000K-STD OPTIC-VOLT-STD FINISH-I-S-C	ACCLAIM LIGHTING DGB.141.APEU-CA-CBF-00305-MF CA-CBL-00000-MF CA-CBE-00000	SEE 15/A9.27 FOR FIXTURE LOCATION	1 2 5 8
I	LED FLOOD LIGHT WITH EW BURST POWER CORE WITH 10X41 DEGREE SPREAD LENS	25	1	25	LED	SURFACE	BEACON FL-1/12NB-25/4K/5X3/UNV/YK/ 12NA/DBT	COLOR KINETICS 523-000038-910503700743		1 2 4 8
J	LED STEP LIGHT FIXTURE	6	1	6	LED	RECESSED	MP LIGHTING L47-6-W30S-DC-MA	GHIDINI 820-8717-FINISH-RIH-5409	MOUNT AT PLANETARIUM 102 ABOVE RAMP	1 2 8
K	LED STRIP LIGHT FIXTURE	20	1	20	LED	SURFACE	PRUDENTIAL S1-LED4LO-04-WA-TMW-UNV-SUR-ND	HE WILLIAMS LLMS-4-LED-UT34/840-SQ-ED-UT		1 2 8
L	RECESSED LINEAR LED LIGHT FIXTURE, NOMINAL LENGTHS: 2' AND 4'.	12W/FT	1	12W/FT	LED	RECESSED	PRUDENTIAL P43-LED35HO-02-TMW-SAL-D1-SC -UNV-X1-DML. PRUDENTIAL P43-LED35HO-04-TMW-SAL-D1-SC -UNV-X1-DML.	FINELITE HP4-R-XX-SO-4000K-277V-SC-XX		1 2
P	PENDANT WITH 3 ANGLED AIRCRAFT CABLES AND A WHITE POWER CORD TO CANOPY. SIZE 48" AND 72" DIA.	117	1	117	LED	PENDANT	OCL L01-P1EC-48-MW-STD-PTD-1LD117/35K -VOLT-48-DMO. OCL L01-P1EC-72-MW-STD-PTD-1LD194/35K -VOLT-48-DMO.	BETA CALCO 95-0021-S2-WH	SEE MOUNTING/SUPPORT DETAILS 6, 12 & 20 / A9.8 AND A3.1 FOR MOUNTING HEIGHT	1 2 7 8
P1	11.75 DIA. LED PENDANT LIGHT FIXTURE	7.7	1	7.7	LED	PENDANT	SKAN 0270-03	VIBIA SKAN	SEE MOUNTING/SUPPORT DETAILS 6, 12 & 20 / A9.8 AND A3.1 FOR MOUNTING HEIGHT	1 2 8
P2	23.5 DIA. LED PENDANT LIGHT FIXTURE	12	1	12	LED	PENDANT	SKAN 0275-03	VIBIA SKAN	SEE MOUNTING/SUPPORT DETAILS 6, 12 & 20 / A9.8 AND A3.1 FOR MOUNTING HEIGHT	1 2 8
S1	LINEAR LIGHTING FIXTURE	38W/4'	AS REQUIRED	38W/4'	LED	SURFACE	LIGHT EDGE VRAP1-4-38-40-DM (LUTRON HI LUME)	IGUZZINI LIGHTING LINEALUCE-I.BB72-277V-10		1 2 4 8
S2	LINEAR LIGHTING FIXTURE	38W/4'	AS REQUIRED	38W/4'	LED	SURFACE	LIGHT EDGE VRAP1-4-38-40-MV	IGUZZINI LIGHTING LINEALUCE-I.BB72-277V-10		1 2 4 8
T	2' X 2' LOW VOLTAGE LIGHT PANEL WITH 24 LAMPS PER PANEL	12	1	12	5V-T1	RECESSED	TUBE LIGHTING STAR PANEL CS-9SP-"X"-"Y"-"Z"	TUBE LIGHTING STAR PANEL #CS9SP WITH TRANSFORMER SEBCO #T-1106-277-24-1 (500W)		1 2 8
V	VANITY LIGHTING FIXTURE	9	1	9	LED 3500K	SURFACE	SOLAVANTI LIGHTING B65.104.81	AAMSCO LIGHTING ALINEA-LED-100NG-35K-15W		1 2 8
X	LED SCONCE LIGHT	34	1	34	LED 3000K	SURFACE WALL	SPAULDING LIGHTING TRP-30L3K035-3-U-DB-BBU	PHILLIPS GARDCO #121-EP1-26-WW-UNV		1 2 8
X1	FASTUBE 360° LIGHT TUBING. POWER SUPPLIES ADNM SERIES.	0.24W PER LED	LENGTH AS REQUIRED	0.24W PER LED	LED	SURFACE	TIVOLI LIGHTING: FTL-03-02-BL-12 TIVOLI LIGHTING: ADNM-240-3-5-12-D	GE LIGHTING TETRA CONTOUR	10 METERS PER POWER SUPPLY MT. HT. 0'-4", SEE DETAIL 10/A9.4	1 2 8
X2	ROUND, DOMED TOP LED BOLLARD WITH CONCRETE SHAFT.	28	-	25	LED	SURFACE	KIM #VRB1C/20L4KUV/SG/NGC/1		MT. HT. 42", SEE DETAIL 10/A9.4	1 2 8
X3	RECESSED STEP LIGHT	12	1	12	LED	RECESSED	INSIGHT LIGHTING QD/12/40K/CW/15/VOLT/STANDARD FINISH	FC LIGHTING FCSL1502-120V-LED-4K-SS	MAX. HT. 4'-0", SEE DETAIL I&J/L4.1 SIM	1 2
X6	ROUND POST TOP AREA LUMINAIRE FIXT. ON 12' 4" ROUND STRAIGHT .125" THICK ALUM. POLE. POLE # HADCO RSA1284-4	73	-	66	LED	POLE	CREE EDGE SERIES # ARE-EDR-5M-R5-06-E-UL-SV-350-40K	NO SUBSTITUTION	NO SUBSTITUTION, SEE DETAIL K/L4.2	1 8
X8	LINEAR LED LIGHT FIXTURE	64	1	64	LED 4000K	SURFACE	BOCA FLASHER HPNLS-HO-4000K-30-VOLT-A-W-S-C	ACCLAIM LIGHTING DGB.141.APEU-CA-CBF-00305-MF CA-CBL-00000-MF CA-CBE-00000	MT. HT. 20'-0", SEE A5.15	1 2 8
X9	LED FLOOD LIGHT	170	1	170	LED	SURFACE	BEACON AL-D/72NB-170/4K/5X3/UNV/SF3/BBT	AMERLUX FL1-MFL-BLK	MAX. HT. 25'-0"	1 2
E2	COMPACT CONCEALED SELF-CONTAINED EMERGENCY LIGHT				LED	RECESSED	EVEN LITE APL-NC-UI-TLRT	CONCEALITE F5-LED45-90-FMS-IR-NC	WITH ADJUSTABLE LAMP PACKAGE	1 2

1A

1. ALL LIGHTING FIXTURES ARE TO BE FURNISHED COMPLETE WITH ALL NECESSARY MOUNTING HARDWARE, LAMPS, ETC.
2. SEE ARCHITECTURAL REFLECTED CEILING PLANS/LANDSCAPE LIGHTING PLAN FOR EXACT LOCATIONS/MOUNTING HEIGHT OF LIGHTING FIXTURES.
3. SEE LIGHTING PLANS FOR EXIT SIGN ARROWS DIRECTION AND NUMBER OF ILLUMINATED FACES.
4. PROVIDE LUTRON HI-LUME, A SERIES LED DRIVER
5. PROVIDE LUTRON HI-LUME, DIMMING LED DRIVER
6. PROVIDE LUTRON ECOSYSTEM 0-10V INTERFACE DEVICE AT EACH LED DRIVER.
7. PROVIDE MANUFACTURERS 0-10V DIMMING DRIVER WITH LUTRON ECOSYSTEM 0-10V INTERFACE DEVICE PER LED DRIVER.
8. DARK DOT IN THE CENTER INDICATE LIGHT FIXTURE ON EMERGENCY CIRCUIT.

ELECTRICAL SHEET INDEX

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SEALS / APPROVALS

LICENSED ARCHITECT LAWRENCE A. FRAPWELL NO. C 11360 REN. 6-30-17 STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER LESTER S. JUNG NO. E10979 6/30/2017 ELECTRICAL STATE OF CALIFORNIA

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC ________ FLS ________ SS ________
DATE ________________

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS		
#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY Author
CHECKED BY Checker

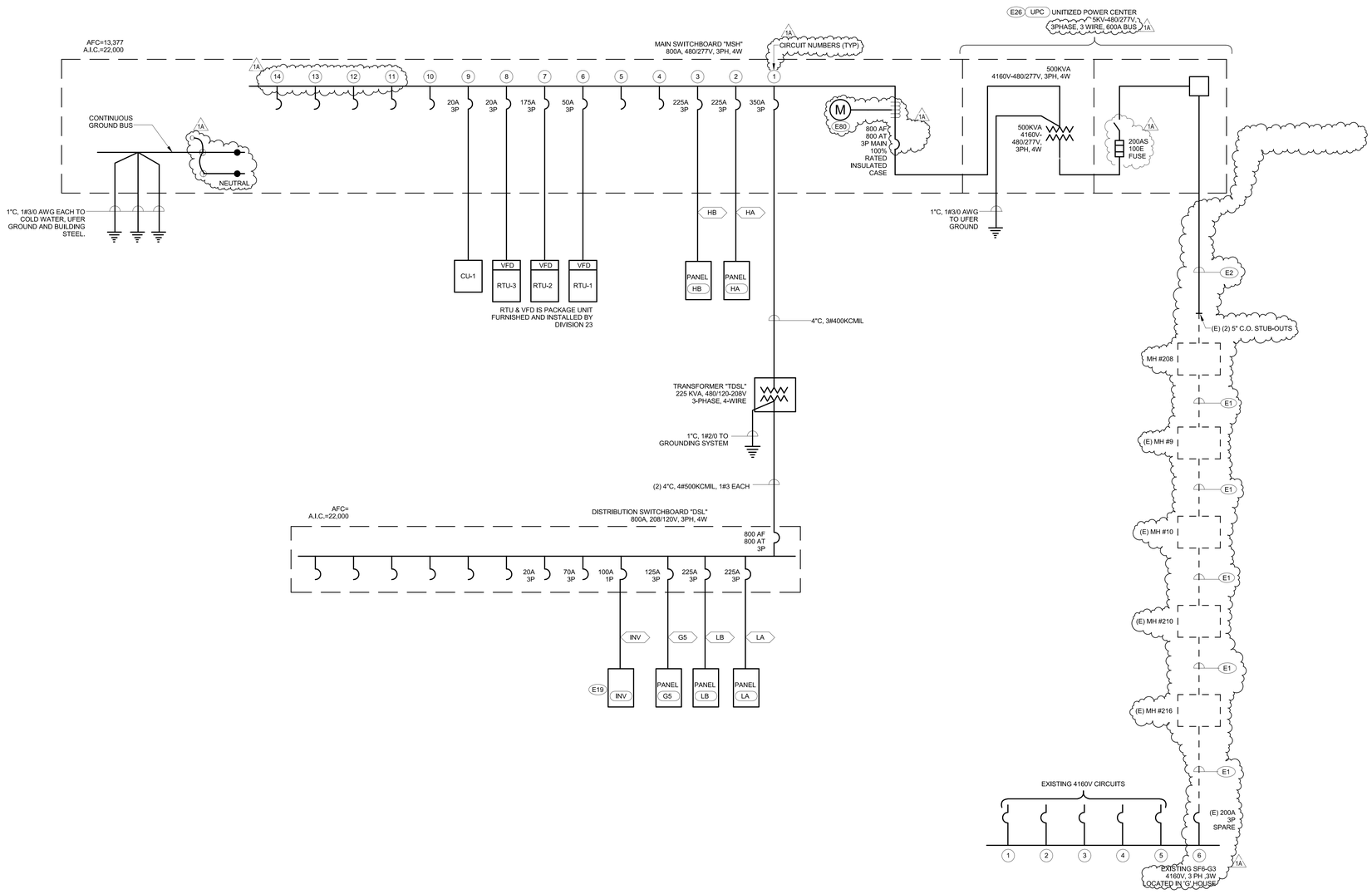
SHEET TITLE
COVER SHEET & LTG CONSULTANT FIXTURE SCHEDULE

SHEET NUMBER
E0.01

CONSTRUCTION DOCUMENTS 12/15/2014

KEYNOTE LEGEND

E1	3 #4/0 CU, 15KV EDP & 1 #1GRND IN EXISTING 5"C.
E2	LOCATE EXISTING 5"C.O. STUB-OUTS & EXTEND ONE WITH 3#4/0 CU, 15KV EDP, & 1 #1,15KV GRND TO NEW UPC AT NEW PLANETARIUM.
E19	16 KVA INVERTER 208/120V, MYERS # 3-IE-8-G-V-BA12012-C-Z-5YP.
E26	MEDIUM VOLTAGE SPLICING MUST BE PERFORMED BY INDUSTRIAL HIGH VOLTAGE, OR HAMPTON TEDDER.
E80	SHARK 200 MULTI-FUNCTION POWER METER.



NOTE
REFER TO SHEET E0.03 FOR MSH4 DSL FEEDER SCHDULES.

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1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY Author
CHECKED BY Checker

SHEET TITLE
SINGLE LINE DIAGRAM

SHEET NUMBER
E0.02

CONSTRUCTION DOCUMENTS 12/15/2014

LOCATION ELECTRICAL ROOM — **PANEL** LA — NEMA TYPE
120/208 VOLTS — SURFACE MOUNTING — 225 MAIN CIRCUIT BREAKER
3 PHASE 4 WIRE — 225 BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE A	WATTAGE B	WATTAGE C	LTS	REC	MSC	CB SZ A	CB P	CKT NO	PHASE A	PHASE B	PHASE C	CKT NO	CB SZ A	CB P	LTS	REC	MSC	WATTAGE A	WATTAGE B	WATTAGE C	LOAD DESCRIPTION
SPARE							20	1	1	○			2	20	1			3	540			RECEPT ROOF
RECEPT IT		540			2		20	1	3		○		4	20	1			3		540		RECEPT ROOF
RECEPT THEATRE AV			1080		6		20	1	5			○	6	20	1			6			1080	RECEPT CONTROL RM VEST.
RECEPT A/V	180				1		20	1	7	○			8	20	1			3	540			RECEPT RETAIL
RECEPT		540			3		20	1	9		○		10	20	1			3		540		RECEPT RETAIL
RECEPT RESTROOMS, CORR.			720		4		20	1	11			○	12	20	1			8			1440	RECEPT
RECEPT RESTROOMS, CORR.	360				2		20	1	13	○			14	20	1			8	1440			RECEPT
* RECEPT EXHIBIT		360					20	1	15		○		16	20	1			2		360		RECEPT EXHIBIT
* RECEPT EXHIBIT	360						20	1	17	○			18	20	1			8			1440	RECEPT
* RECEPT EXHIBIT		360					20	1	19		○		20	20	1					360		RECEPT EXHIBIT
* RECEPT EXHIBIT			360				20	1	21			○	22	20	1						360	RECEPT EXHIBIT
* RECEPT EXHIBIT	360						20	1	23	○			24	20	1				360			RECEPT EXHIBIT
* RECEPT EXHIBIT		360					20	1	25		○		26	20	1					360		RECEPT EXHIBIT
* RECEPT EXHIBIT			360				20	1	27			○	28	20	1						360	RECEPT EXHIBIT
* RECEPT EXHIBIT	360						20	1	29	○			30	20	1				360			RECEPT EXHIBIT
* SPARE EXHIBIT							20	1	31		○		32	20	1					360		RECEPT EXHIBIT
* SPARE EXHIBIT							20	1	33			○	34	20	1						360	RECEPT EXHIBIT
* SPARE EXHIBIT							20	1	35	○			36	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	37		○		38	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	39			○	40	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	41	○			42	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	43		○		44	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	45			○	46	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	47	○			48	20	1							SPARE EXHIBIT
* SPARE EXHIBIT							20	1	49		○		50	20	1							SPARE EXHIBIT
OVERHEAD AUTOMATIC CLOSER		1920					20	1	51			○	52	20	1			2	600			RECEPT EXHIBIT
OVERHEAD AUTOMATIC CLOSER			1920				20	1	53	○			54	20	1			2			600	FLAT SCREEN MONITOR
IT LADDER RACK	3120						30	2	55		○		56	20	1							SPARE EXHIBIT
IT LADDER RACK		3120					20	1	57			○	58	20	1							SPARE EXHIBIT
IT LADDER RACK			2400				20	1	59	○			60	20	1							SPARE EXHIBIT
IT LADDER RACK	2400						20	1	61		○		62	20	1			4	720			KIOSK TOUCH SCREEN
OVERHEAD AUTOMATIC CLOSER		1920					20	1	63			○	64	20	1							SPARE
CENTER, DEATING FLOORBOX			1500		1		20	1	65	○			66	20	1							
BUSSED SPACE							20	1	67		○		68	20	1							
							20	1	69			○	70	20	1							
							20	1	71	○			72	20	1							
							20	1	73		○		74									
									75			○	76									
									77	○			78									
									79		○		80									
									81			○	82									
									83	○			84	20	1			6			1080	EXTERIOR WP WITH USB

CONTINUOUS LOAD				VA
NON-CONTINUOUS LOAD	12060	12240	13120	VA
ADJUSTED TOTAL	12060	12240	15120	VA
(1.25 X CONT. + NON CONT.)				

TOTAL ADJUSTED 39 KVA
TOTAL ADJUSTED 110 AMPS

1A 1A 1A 1A

* PROVIDE LUGS FOR #8 CONDUCTORS
** PROVIDE GFI CIRCUIT BREAKER

LOCATION ELECTRICAL ROOM — **PANEL** LB — NEMA TYPE
120/208 VOLTS — SURFACE MOUNTING — 225 MAIN CIRCUIT BREAKER
3 PHASE 4 WIRE — 225 BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE A	WATTAGE B	WATTAGE C	LTS	REC	MSC	CB SZ A	CB P	CKT NO	PHASE A	PHASE B	PHASE C	CKT NO	CB SZ A	CB P	LTS	REC	MSC	WATTAGE A	WATTAGE B	WATTAGE C	LOAD DESCRIPTION
CP-1 PUMP	500						1	20	1	○			2	20	1			1	685			EF-1
								20	1	3		○	4	20	1			1		580		EF-2
								20	1	5			6	20	1			1			1000	FACP
CU-3	1326					1	20	2	7	○			8	20	1			1	300			BPS 1
---		1326					-	-	9		○		10	20	1			1		300		BPS 2
SPARE							20	1	11			○	12	20	1							SPARE
FC-1	790					1	20	2	13	○			14	20	1			1	1575			SAGE GLASS CONTROL PANEL 1
---		790					-	-	15		○		16	20	1			1		1575		SAGE GLASS CONTROL PANEL 2
* RECEPT EXHIBIT			360				20	1	17			○	18	20	1			1			1575	SAGE GLASS CONTROL PANEL 3
* RECEPT EXHIBIT	360						20	1	19	○			20	20	1			1	1200			SIGN LIGHTING
* RECEPT EXHIBIT		360					20	1	21		○		22	20	1					165		LIGHTING EXTERIOR
* RECEPT EXHIBIT			360				20	1	23			○	24	20	1						640	LIGHTING EXTERIOR
* RECEPT EXHIBIT	360						20	1	25	○			26	20	1				320			LIGHTING EXTERIOR
* RECEPT EXHIBIT		360					20	1	27		○		28	20	1				640			LIGHTING EXTERIOR
* RECEPT EXHIBIT			360				20	1	29			○	30	20	1						320	LIGHTING EXTERIOR
* RECEPT EXHIBIT	360						20	1	31	○			32	20	1				1575			SAGE GLASS CONTROL PANEL 4
* RECEPT EXHIBIT		360					20	1	33		○		34	20	1					1500		EVAH-1
* SPARE EXHIBIT							20	1	35			○	36	20	1						180	DISPLAY CASE
* SPARE EXHIBIT							20	1	37	○			38	20	1			2	1920			STAR II PANEL
* SPARE EXHIBIT							20	1	39		○		40	20	1					1800		LUTRON LIGHT MGMT HUB
* SPARE EXHIBIT							20	1	41			○	42	20	1						200	LUTRON GRAFIK EYE QS
* SPARE EXHIBIT							20	1	43	○			44	20	1				200			LUTRON ESN
* SPARE EXHIBIT							20	1	45		○		46	20	1					200		LUTRON ESN
* SPARE EXHIBIT							20	1	47			○	48	20	1						320	LIGHTING EXTERIOR
* SPARE EXHIBIT							20	1	49	○			50	20	1	11			165			LIGHTING EXTERIOR
* SPARE EXHIBIT							20	1	51		○		52	20	1					500		LUTRON PANEL LP
SPARE							20	1	53			○	54	20	1						100	IRRIGATION CONTROLLER
RECEPT PENDULUM	360				2		20	1	55	○			56	20	1				100			CONTROL PANEL FOUCAULT PENDULUM
CU-2		1326					20	2	57		○		58	20	1					580		EF-3
---			1326				-	-	59			○	60	20	1							
CU-4	1326						20	1	61	○			62	20	1							
---		1326					-	-	63		○		64	20	1							
CU-5			1326				20	1	65			○	66	20	1							
---	1326						-	-	67	○			68	20	1							
SPARE							20	1	69		○		70	20	1							
							20	1	71			○	72	20	1							
							20	1	73	○			74									
							20	1	75		○		76									
							20	1	77			○	78									
							20	1	79	○			80									
							20	1	81		○		82									
							20	1	83			○	84									

CONTINUOUS LOAD	1685	805	1280	VA
NON-CONTINUOUS LOAD	13063	12883	6787	VA
ADJUSTED TOTAL	15169	13889	8387	VA
(1.25 X CONT. + NON CONT.)				

TOTAL ADJUSTED 37 KVA
TOTAL ADJUSTED 104 AMPS

* PROVIDE LUGS FOR #8 CONDUCTORS
** PROVIDE LOCK-ON DEVICE

LOCATION ELECTRICAL ROOM — **PANEL** HA — 1 NEMA TYPE
277/480 VOLTS — SURFACE MOUNTING — 225A MAIN CIRCUIT BREAKER
3 PHASE 4 WIRE — 225 BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE A	WATTAGE B	WATTAGE C	LTS	REC	MSC	CB SZ A	CB P	CKT NO	PHASE A	PHASE B	PHASE C	CKT NO	CB SZ A	CB P	LTS	REC	MSC	WATTAGE A	WATTAGE B	WATTAGE C	LOAD DESCRIPTION
LIGHTING CORR., VEST 110, 118	508			19			20	1	1	○			2	20	1	17			1288			LIGHTING 104-109, 111, 115,116
LIGHTING EXHIBIT 101		182		17			20	1	3		○		4	20	1	19				432		LIGHTING 114, 119, 120-123
LIGHTING CANOPY			462	33			20	1	5			○	6	20	1	11					330	LIGHTING EXHIBIT 101
LIGHTING EXHIBIT 101	750			10			20	1	7	○			8	20	1	6			84			LIGHTING EXHIBIT 101
LIGHTING EXHIBIT 101		1049		52			20	1	9		○		10	20	1	8				288		LIGHTING ROOF
LIGHTING 113			349	21			20	1	11			○	12	20	1							SPARE
LIGHTING CANOPY	252			18			20	1	13	○			14	20	1							
SPARE							20	1	15		○		16	20	1							
							20	1	17			○	18	20	1							
							20	1	19	○			20	20	1							
							20	1	21		○		22	20	1							
							20	1	23			○	24	20	1							
							20	1	25	○			26	20	1							
							20	1	27		○		28	20	1							
									29			○	30									
									31	○			32									
									33		○		34									
									35			○	36									
									37	○			38									
									39		○		40									
									41			○	42									

CONTINUOUS LOAD	2882	1951	1141	VA
NON-CONTINUOUS LOAD	0	0	0	VA
ADJUSTED TOTAL	3603	2439	1426	VA
(1.25 X CONT. + NON CONT.)				

TOTAL ADJUSTED 7 KVA
TOTAL ADJUSTED 9 AMPS

LOCATION ELECTRICAL ROOM — **PANEL** HB — 1 NEMA TYPE
277/480 VOLTS — SURFACE MOUNTING — 225A MAIN CIRCUIT BREAKER
3 PHASE 4 WIRE — 225 BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE A	WATTAGE B	WATTAGE C	LTS	REC	MSC	CB SZ A	CB P	CKT NO	PHASE A	PHASE B	PHASE C	CKT NO	CB SZ A	CB P	LTS	REC	MSC	WATTAGE A	WATTAGE B	WATTAGE C	LOAD DESCRIPTION
SPARE							20	1	1	○			2	20	1							SPARE
							20	1	3		○		4	20	1							
							20	1	5			○	6	20	1							
							20	1	7	○			8	20	1							
							20	1	9		○		10	20	1							
							20	1	11			○	12	20	1							
							20	1	13	○			14	20	1							
							20	1	15		○		16	20	1							
							20	1	17			○	18	20	1							
SPACE							20	1	19	○			20	20	1							
									21		○		22									SPACE
									23			○	24									
									25	○			26									
									27		○		28									
									29			○	30									
									31	○			32									
									33		○		34									
									35			○	36									
									37	○			38									
									39		○		40									
									41			○	42									

CONTINUOUS LOAD				VA
NON-CONTINUOUS LOAD	0	0	0	VA
ADJUSTED TOTAL	0	0	0	VA
(1.25 X CONT. + NON CONT.)				

TOTAL ADJUSTED 0 KVA
TOTAL ADJUSTED 0 AMPS

LOCATION CONTROL ROOM — **PANEL** G5 — NEMA TYPE
120/208 VOLTS — SURFACE MOUNTING — 125A MAIN CIRCUIT BREAKER
3 PHASE 4 WIRE — 125A BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE A	WATTAGE B	WATTAGE C	LTS	REC	MSC	CB SZ A	CB P	CKT NO	BUS A	BUS B	BUS C	CKT NO	CB SZ A	CB P	LTS	REC	MSC	WATTAGE A	WATTAGE B	WATTAGE C	LOAD DESCRIPTION
REC: FLOOR BOX	1250						20	1	1	○			2	20	1				1250			REC: FLOOR BOX
REC: FLOOR BOX		1250					20	1	3		○		4	20	1					1250		REC: FLOOR BOX
04 LED COVE BOX			200				20	1	5			○	6	20	1						1250	REC: FLOOR BOX
PROJECTOR	1240						20	1	7	○			8	20	1				1250			REC: FLOOR BOX
PROJECTOR		1240					20	1	9		○		10	20	1					1250		REC: FLOOR BOX
PROJECTOR			1240				20	1	11			○	12	20	1						1250	REC: FLOOR BOX
PROJECTOR	1240						20	1	13	○			14	20	1				1250			REC: FLOOR BOX
PROJECTOR		1240					20	1	15		○		16	20	1					1250		REC: FLOOR BOX
PROJECTOR			1240				20	1	17			○	18	20	1						1250	REC: FLOOR BOX
INSET PROJECTOR	800						20	1	19	○			20	20	1				1320			COVE LIGHTS
STEP LIGHTS		115					20	1	21		○		22	20	1							
SPARE							20	1	23			○	24	20	1							
							20	1	25	○			26	20	1							
							20	1	27		○		28	20	1							
							20	1	29			○	30	20	1							
							20	1	31	○			32	20	1							
							20	1	33		○		34	20	1							
							20	1	35			○	36	20	1							
							20	1	37	○			38	20	1							
							20	1	39		○		40	20	1							
							20	1	41			○	42	20	1							

CONTINUOUS LOAD	1320	115		VA
NON-CONTINUOUS LOAD	8280	7480	6430	VA
ADJUSTED TOTAL	9930	7624	6430	VA
(1.25 X CONT. + NON CONT.)				

TOTAL ADJUSTED 24 KVA
TOTAL ADJUSTED 67 AMPS

LOCATION ELECTRICAL ROOM — **PANEL** INV (INVERTER) — 16 KVA INVERTER 100% RATED
120 VOLTS — SURFACE MOUNTING — 100A MAIN CIRCUIT BREAKER
1 PHASE 2 WIRE — 100A BUS — MAIN LUG SIZE

LOAD DESCRIPTION	WATTAGE L1	LTS	RECC	MSC	CB SZ A	CB P	CKT NO	PHASE L1	CKT NO	CB SZ A	CB P	LTS	RECC	MSC	WATTAGE L1	LOAD DESCRIPTION
PROJECTOR	840			1	20	1	1	○	2	20	1	11			270	LIGHTING: ROOMS 117,119,120
PROJECTOR	840			1	20	1	3	○	4	20	1	5			95	LIGHTING ROOM 102
PRE-ACTION FIRELOCK	700			1	20	1	5	○	6	20	1	24			247	LIGHTING ROOMS 109, 101
SPARE					20	1	7	○	8	20	1				468	LANDSCAPE S.E. POST TOPS
SPARE					20	1	9	○	10	20	1				468	LANDSCAPE W. POSTS TOPS
SPARE					20	1	11	○	12	20	1				180	LANDSCAPE N. STEP LTS
SPARE					20	1	13	○	14	20	1				180	LANDSCAPE S. STEP LTS
					20	1	15	○	16	20	1				604	LANDSCAPE N. BOLLARDS & POST TOP
					20	1	17	○	18	20	1				476	LANDSCAPE E. BOLARDS
					20	1	19	○	21	20	1					SPARE
							21	○	22							
							23	○	24							

CONTINUOUS LOAD	1728		VA
NON-CONTINUOUS LOAD	5368	0	VA
ADJUSTED TOTAL	7528	0	VA
(1.25 X CONT. + NON CONT.)			

TOTAL ADJUSTED 7.5 KVA
TOTAL ADJUSTED 27 AMPS

1A

MSH FEEDER SCHEDULE

FEEDER DESIGNATION	SERVING	FEEDER SIZE	* LENGTH (FT)	KVA	AMPS	VOLTAGE DROP %
MSH-6	RTU-1	1"C-3#6 & 1#10 GND	40	37.2	45	0.27
MSH-7	RTU-2	2"C-3#3/0 & 1#6 GND	210	116.5	140.4	0.86
MSH-8	RTU-3	1"C-3# 12 & 1# 12 GND	260	2.09	2.52	0.78
MSH-9	CU-1	3/4"C-3#12 & 1#12 GND	55	6.5	7.8	0.24
1A		1A		1A	1A	
MSH-2	HA	2 1/2"C-4#4/0 & 1# 4GND	10	0	0	0
MSH-3	HB	2 1/2"C-4#4/0 & 1# 4GND	10	7	9	0.5
MSH-1	TDSL	3# 400 KCMIL & 1# 1/0 GND)	20	109.35	135.46	0.09
		1A				
TOTAL				299.59	364.73	

* ESTIMATED LENGTH (FT) IS FOR VOLTAGE DROP CALCULATION PURPOSE ONLY

DSL FEEDER SCHEDULE

FEEDER DESIGNATION	SERVING	FEEDER SIZE	* LENGTH (FT)	KVA	AMPS	VOLTAGE DROP %
LB	LB	2 1/2"C-4#4/0 & 1#4GND	20	38.0	105	0.09
LA	LA	2 1/2"C-4#4/0 & 1#4GND	20	36.8	102	0.78
INV	INV	1 1/2"C-4#1 & 1#8GND	10	10.6	38	0.01
G5	G5	1 1/2"C-4#1/0 & 1#6GND	150	23.9	67	1.76
TOTAL				109.35	312.59	

* ESTIMATED LENGTH (FT) IS FOR VOLTAGE DROP CALCULATION PURPOSE ONLY

LA | HA | INV | HB | LB | G5

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SEALS / APPROVALS

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DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
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PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION 11023
DATE 12/15/2014
DRAWN BY Author
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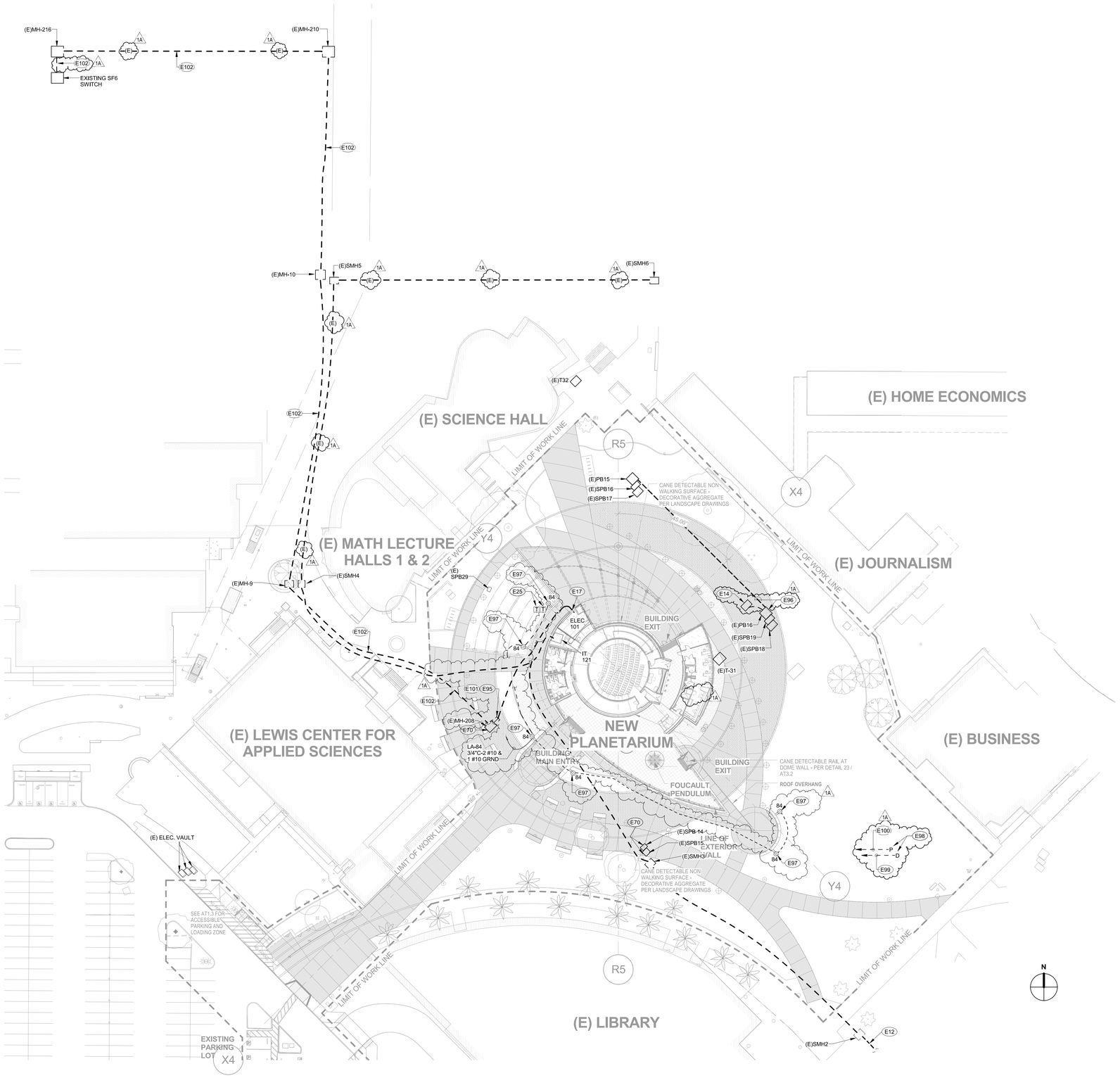
SHEET TITLE
PANEL SCHEDULES & FEEDER SCHEDULES

SHEET NUMBER
E0.03

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

1A	E12	EXISTING FEEDER FROM SMH24 TO REMAIN.
	E14	APPROXIMATE LOCATION FOR INSTALLATION OF TEMPORARY POWER SUBSTATION & PAD. NEMA 3R SUBSTATION & CONCRETE PAD PROVIDED BY COLLEGE. INSTALLED BY CONTRACTOR.LOCATE EXACT LOCATION WITH RANDY KEY
	E17	SEE DETAIL 1/E4.01 FOR CONTINUATION.
	E25	TAMPER SWITCHES FOR DETECTOR CHECK ASSEMBLY, COORDINATE WITH CIVIL DRAWINGS FOR EXACT LOCATION. TO INTERFACE WITH FIRE ALARM SYSTEM, SEE F2.01 FOR CONTINUATION.
	E70	PROVIDE GRADE RINGS AND ADJUST HEIGHT TO MATCH NEW GRADE.
	E95	LOCATE (E) 5"C.O. STUB-OUT & EXTEND TO PLANETARIUM UPC WITH 3# 4/0 CU. 15KV, EDP 4.1# 1 15KV, EDP GORUND.
	E96	REUSE REPROGRAPHIC BUILDING FEEDER TO SERVE TEMPORARY POWER SUBSTATION. REPROGRAPHIC FEEDER IS SF6-G2-5 (VERIFY IN FIELD) 4"C. 3#2
	E97	PROVIDE COMBINATION DUPLEX/USB CHARGER RECEPTACLE. HUBBELL #USB 20X2LA TAMPER RESISTANT RECEPTACLE WITH HUBBELL #RW5040 WEATHER PROOF COVER. MOUNT VERTICALLY. PROVIDE CFI CIRCUIT BREAKER IN PANEL
	E98	JENSEN PRECAST #HN1222 12"x22"x12"D CONCRETE HANDHOLE WITH #HN1222-LO1 BOLT-DOWN CONCRETE LID FOR FUTURE TELESCOPE POWER AND DATA.
	E99	(2) 1" C.O. STUB ONE UP IN IT ROOM #144, STUB ONE UP IN AV ROOM #104
	E100	1"C.O. STUB UP IN PANEL "LB"
	E101	EXERCISE CAUTION AS MANY UNDERGROUND UTILITIES ARE IN THIS AREA (DEF. KEYNOTE E95)
	E102	NEW (1) 5"C-3#4/0 & 1#1, 15KV GROUND IN EXISTING 5" CONDUIT, 15KV EDP.

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DATE	12/15/2014
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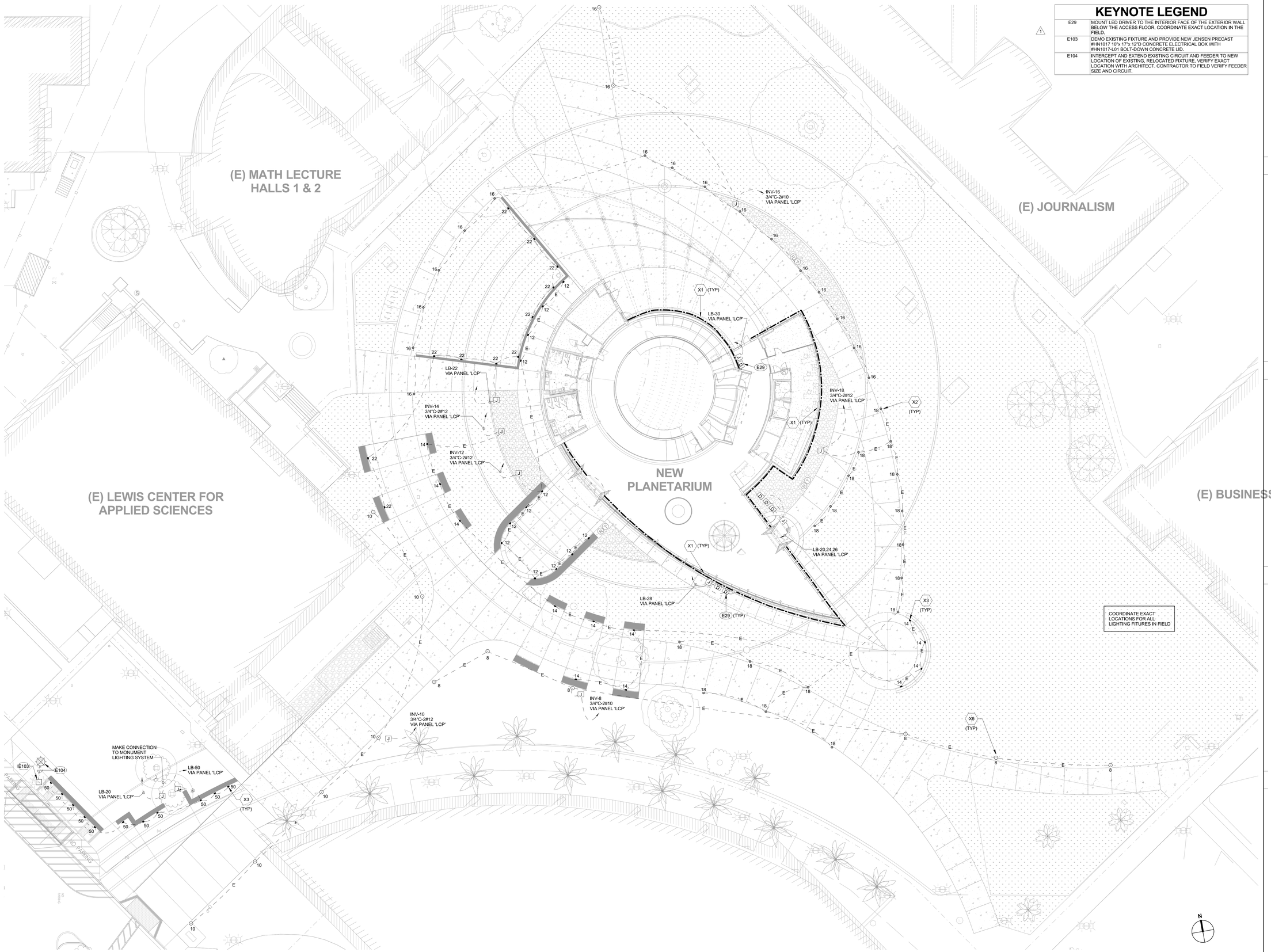
SHEET TITLE
ELECTRICAL SITE PLAN

SHEET NUMBER
E1.00



KEYNOTE LEGEND	
E29	MOUNT LED DRIVER TO THE INTERIOR FACE OF THE EXTERIOR WALL BELOW THE ACCESS FLOOR, COORDINATE EXACT LOCATION IN THE FIELD.
E103	DEMO EXISTING FIXTURE AND PROVIDE NEW JENSEN PRECAST #HN1017 10"x 17"x 12"D CONCRETE ELECTRICAL BOX WITH #HN1017-L01 BOLT-DOWN CONCRETE LID.
E104	INTERCEPT AND EXTEND EXISTING CIRCUIT AND FEEDER TO NEW LOCATION OF EXISTING, RELOCATED FIXTURE. VERIFY EXACT LOCATION WITH ARCHITECT. CONTRACTOR TO FIELD VERIFY FEEDER SIZE AND CIRCUIT.

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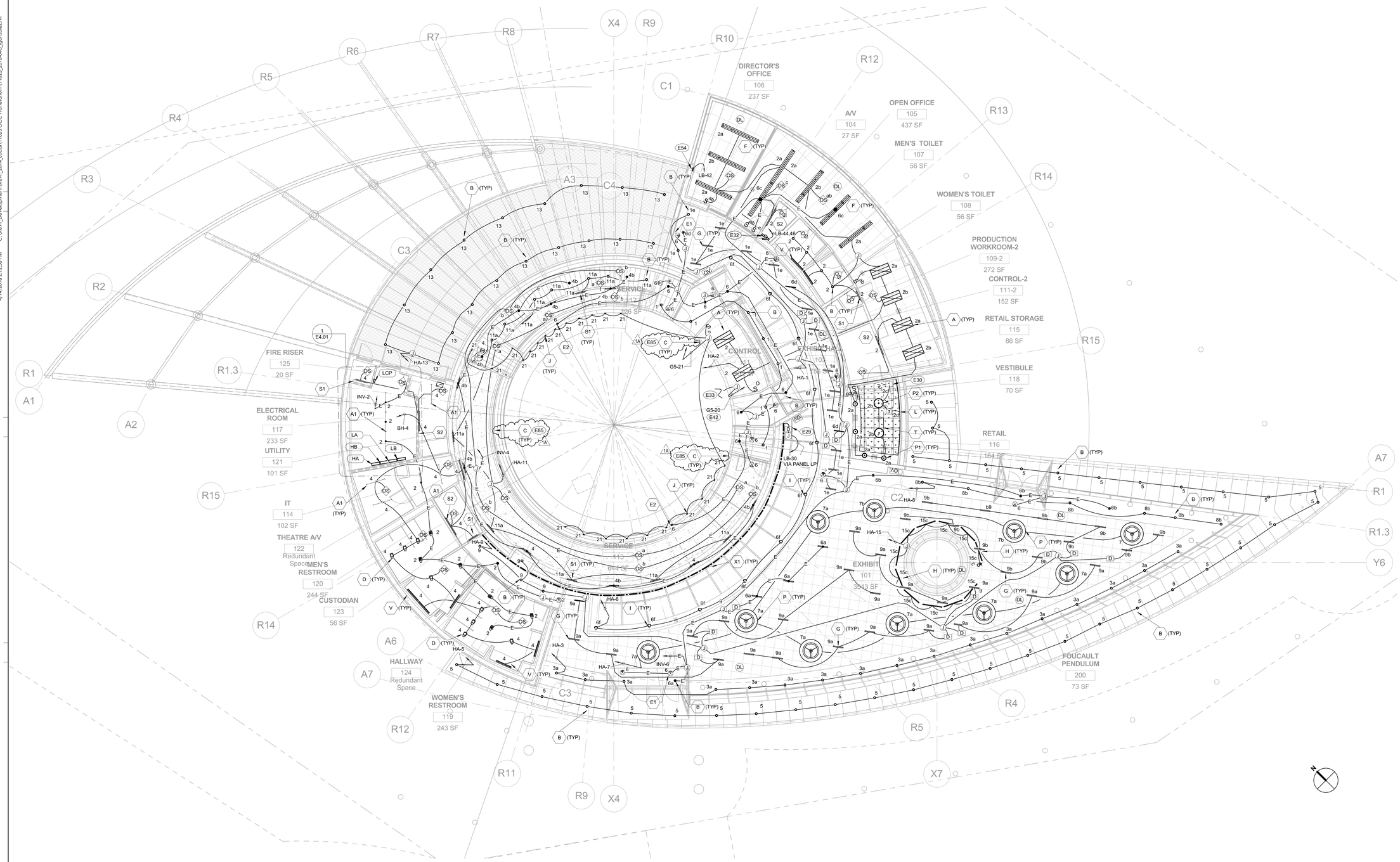
SHEET TITLE
LIGHTING SITE PLAN

SHEET NUMBER
1A
E1.01

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

	E29	MOUNT LED DRIVER TO THE INTERIOR FACE OF THE EXTERIOR WALL BELOW THE ACCESS FLOOR, COORDINATE EXACT LOCATION IN THE FIELD.
	E30	500W LOW VOLTAGE TRANSFORMER FOR STARPANEL LIGHTING SYSTEM CONNECTION, SEBCO-1106-24-277V-1, MOUNT TRANSFORMER IN AN ACCESSIBLE LOCATION.
	E32	LUTRON ENERGI SAVR NODE QS, SEE DIAGRAM ON SHEET E4.02. COORDINATE EXACT LOCATION WITH LUTRON.
	E33	MAKE CONNECTION TO LIGHT FIXTURE TYPE C (PLANETARIUM COVE LIGHTS) PROVIDE 14 LIGHT FIXTURE PER ONE POWER SUPPLY. FOR COVE LIGHT EXACT LOCATION SEE DETAIL 5/TH1.6.
	E42	VIA COVE LIGHT CONTROL. LIGHTING CONTROL BY THEATER CONSULTANT.
	E54	GRAFIK EYE QS, SEE DIAGRAM ON SHEET E4.02. COORDINATE EXACT LOCATION WITH LUTRON.
1A	E85	PROVIDE TYPE "C" FIXTURES IN COVE TROUGH CONTINUOUS AROUND ENTIRE CIRCUMFERENCE OF DOME. REFERENCE KEYNOTES E33 & E42.

GROUND FLOOR LIGHTING PLAN | SCALE 1/8" = 1'-0" | 1

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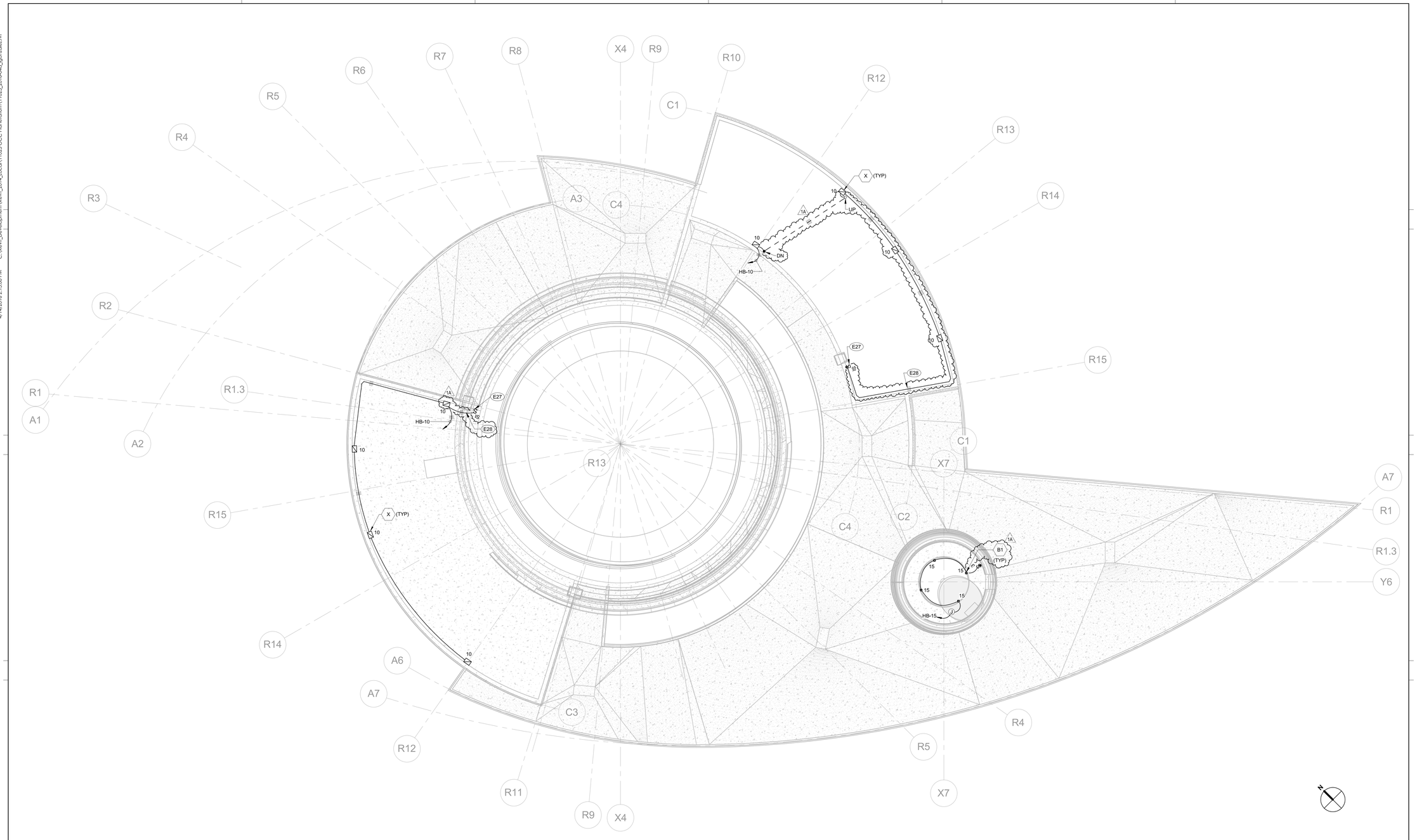
SHEET TITLE
GROUND FLOOR LIGHTING PLAN

SHEET NUMBER
E2.01

CONSTRUCTION DOCUMENTS 12/15/2014



KEYNOTE LEGEND

E27	0-2HR SPRING WOUND TIMER INTERMATIC #FF2H (NO HOLD FEATURE) IN W.P. ENCLOSURE.
E28	INSTALL UNSWITCHED HOT LEG TO BATTERY.

ROOF LIGHTING PLAN | **SCALE 1/8" = 1'-0"** | 1

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SHEET TITLE
ROOF LIGHTING PLAN

SHEET NUMBER
E2.02

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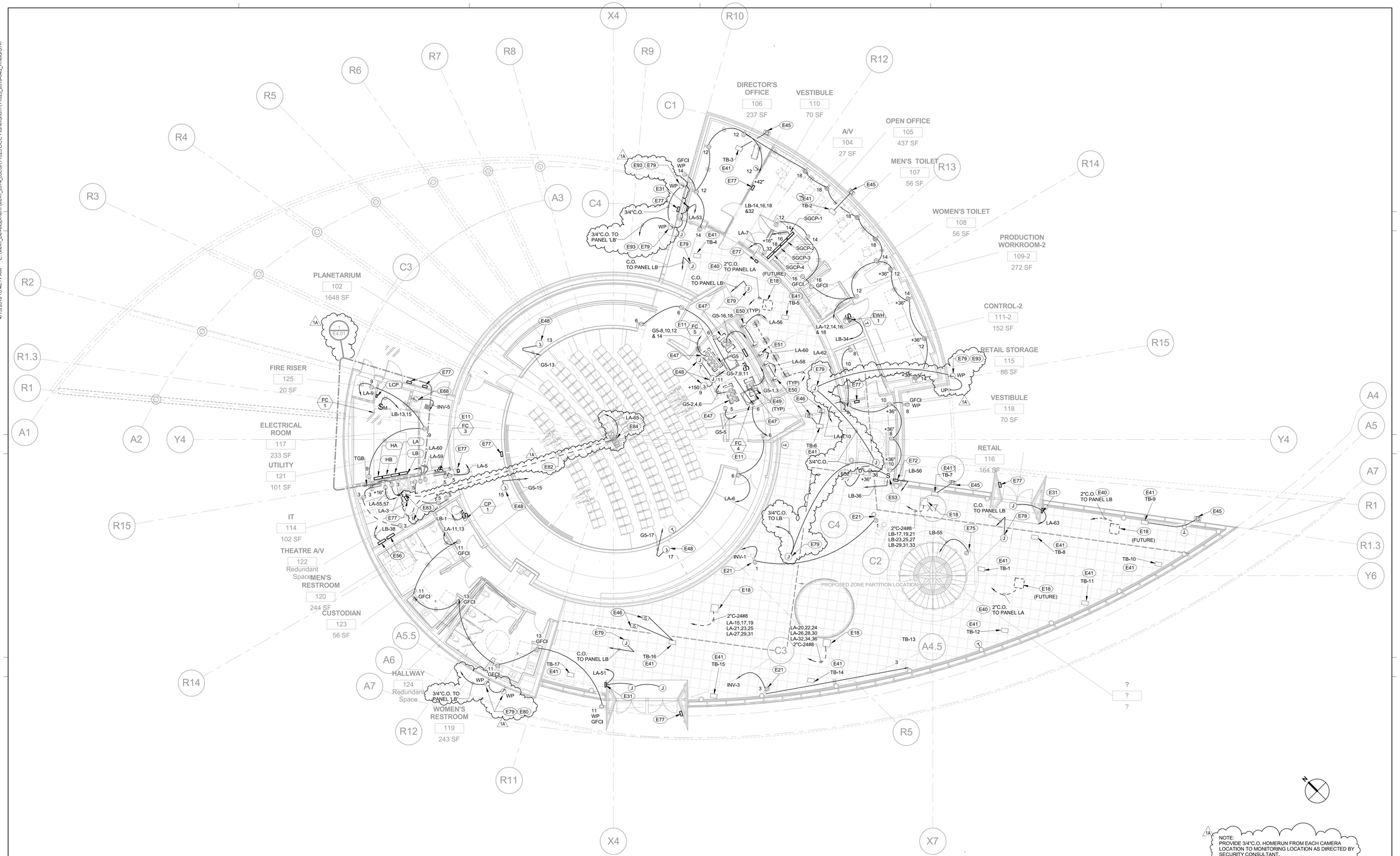

NOTE:
PROVIDE 3/4"C.O. HOMERUN FROM EACH CAMERA LOCATION TO MONITORING LOCATION AS DIRECTED BY SECURITY CONSULTANT.

KEYNOTE LEGEND

E11	POWER FOR FAN COIL UNIT IS DERIVED FROM CONDENSING UNIT AND INSTALLED BY DIV. 23 ALONG WITH REFRIGERATION PIPING.
E18	3 PORT, FIELD WIRED, ZONE DISTRIBUTION BOX. HAWORTH #FBEZ-3000-33 AT THE RAISED FLOOR. SEE DETAIL 3 & 4/E4.01.
E21	POWER FOR PROJECTOR COLUMN MOUNT BENEATH RAISED FLOOR.
E31	CONTROL PANEL FOR OVERHEAD AUTOMATIC DOOR OPERATOR.
E40	STUB-UP CONDUITS FOR FUTURE ZONE DISTRIBUTION BOXES, SEE DETAIL 4/E4.01.
E41	TERMINAL BOX FOR ELECTROCHROMIC GLASS. SEE TERMINAL BOX SCHEDULE ON SHEET E4.03. MOUNT TERMINAL BOXES ABOVE ACCESSIBLE CEILING.
E45	SAGE GLASS EXTERIOR SENSOR, VERIFY EXACT LOCATION IN THE FIELD. SEE DETAIL ON SHEET E4.03.
E46	SAGE GLASS INTERIOR SENSOR, VERIFY EXACT LOCATION IN THE FIELD. SEE DETAIL ON SHEET E4.03.
E47	FSR-FR-500-6 BOX FLUSH FLOOR MOUNTED.
E48	FOR PROJECTOR SYSTEM, COORDINATE EXACT MOUNTING LOCATION WITH TH (THEATER) DRAWINGS.
E49	RECEPTACLE MOUNTED IN BOX (TYPICAL).
E50	PROVIDE POWER FOR FLAT SCREEN MONITOR, COORDINATE EXACT LOCATION WITH DIRTT MANUFACTURER.
E51	PROVIDE POWER FOR FAN KITS AT INTERACTIVE DISPLAY WALL, COORDINATE EXACT LOCATION WITH DIRTT MANUFACTURER.
E52	MAKE CONNECTION TO DISPLAY CASE LIGHT FIXTURE.
E53	DISPLAY CASE LIGHT SWITCH, COORDINATE EXACT LOCATION WITH DIRTT MANUFACTURER.
E56	STAR II PANELS FOR ACCESS CONTROL, COORDINATE EXACT LOCATION.
E68	PROVIDE POWER 120V FOR PRE-ACTION SYSTEM FIRELOCK FIRE-PAC SERIES, SEE FIRE PROTECTION DRAWINGS FOR EXACT LOCATION.
E72	FOUCAULT PENDULUM CONTROL PANEL, PROVIDE (1) 1/2"C- #14 & (1) 1/2"C - W/(1) PAIR #20 SHIELDED TO LOGIC PANEL AT UP ABOVE HIGH ROOF, VERIFY EXACT LOCATION.
E75	FOUCAULT PENDULUM RECEPTACLE MOUNT AT +18" ABOVE HIGH ROOF LEVEL.
E77	PROXIMITY CARD READER, RUN 3/4"C TO STAR II PANEL ACCESS CONTROL IN IT ROOM, SEE SHEET A9.2 FOR ENTRY DOOR DETAILS.
E79	PROVISION FOR FUTURE SECURITY CAMERA.
E80	SHARK 200 MULTI-FUNCTION POWER METER.
E82	(2) 1"C.O. STUB-UP (1) 1"C.O. IN IT ROOM (114) AND THEATRE A/V ROOM (122)
E83	(1) 1" C.O. STUB-UP FOR FUTURE SHOW CONTROLS.
E84	3-GANG FLOOR BOX WITH (1) DUPLEX OUTLET AND (2) DATA OUTLETS FOR FUTURE SHOW CONTROLS.
E93	FIELD VERIFY MOUNTING HEIGHT.

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SEALS / APPROVALS

IDENTIFICATION STAMP
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A#: 04-113620
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DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS		
#	DATE	DESCRIPTION
1A	04/22/16	ADDENDUM 1A

PROJECT IDENTIFICATION	11023
DATE	12/15/2014
DRAWN BY	Author
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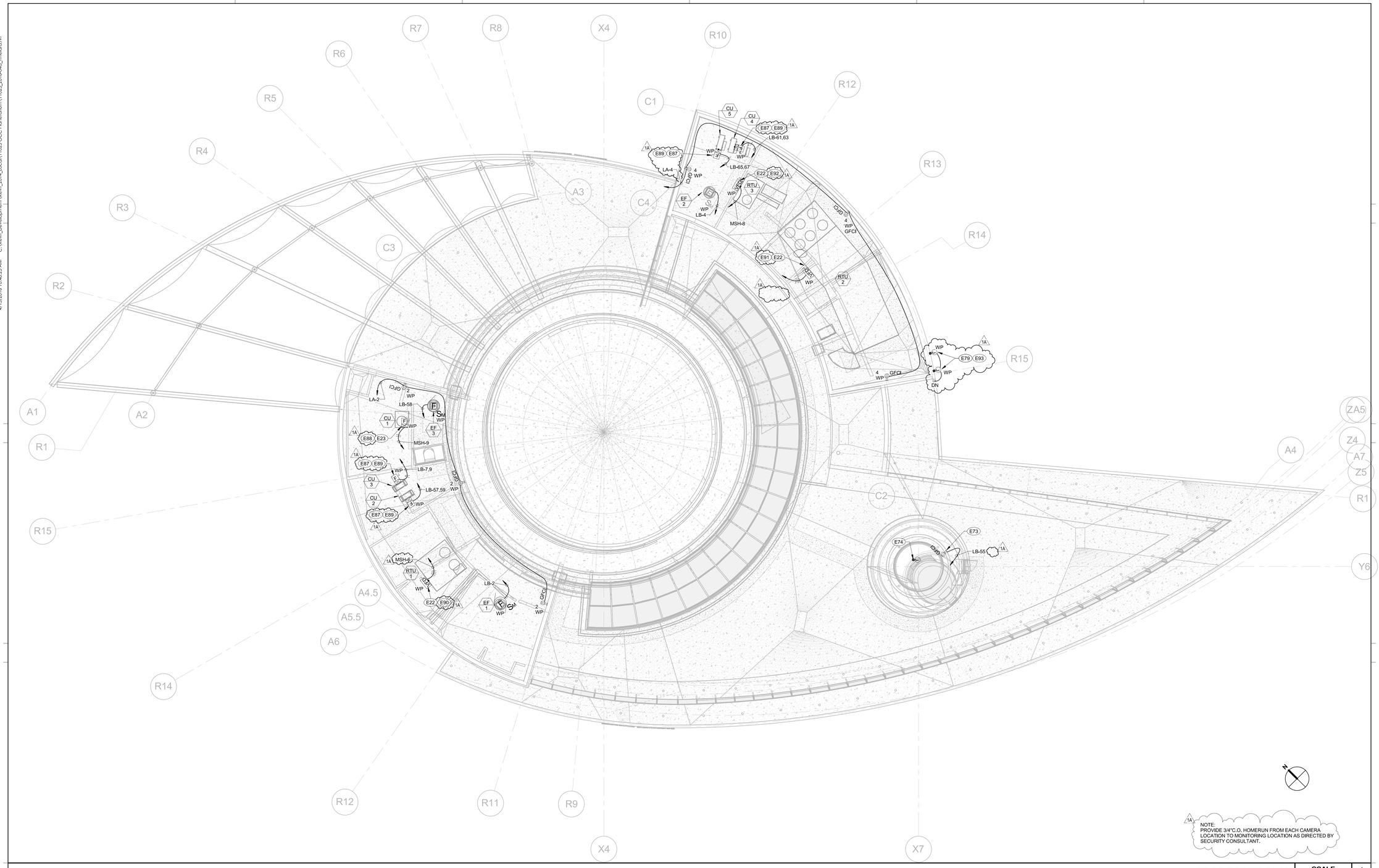
SHEET TITLE
GROUND FLOOR POWER PLAN

SHEET NUMBER
E3.01

CONSTRUCTION DOCUMENTS 12/15/2014



NOTE:
PROVIDE 3/4"C.O. HOMERUN FROM EACH CAMERA LOCATION TO MONITORING LOCATION AS DIRECTED BY SECURITY CONSULTANT.

ROOF POWER PLAN

SCALE 1/8" = 1'-0"

1

KEYNOTE LEGEND

1A	E22	VARIABLE FREQUENCY DRIVE (VFD) WITH INTEGRAL DISCONNECT SWITCH. PROVIDED BY DIVISION 23.
	E23	600V, 3P,30A FUSIBLE DISCONNECT SWITCH.
	E73	RECEPTACLE MOUNT AT +18" ABOVE CATWALK TOWER PLATFORM.
	E74	JUNCTION BOX FOR MAGNETIC TOWER ASSEMBLY AT TOWER PLATFORM LEVEL, PROVIDE (1) 1/2"C- 4#14 & (1) 1/2"C - W/(1) PAIR #20 SHIELDED TO LOGIC PANEL AT HIGH ROOF LEVEL, VERIFY EXACT LOCATION.
	E79	PROVISION FOR FUTURE SECURITY CAMERA.
	E87	FUSE SIZE WITH 20A D.E.F.
	E88	FUSE WITH 10A D.E.F.
1A	E89	PROVIDE 250V, 2P, 30A FUSIBLE SIZE "1" COMBINATION STARTER.
	E90	PROVIDE 60A D.E.F.
	E91	PROVIDE 175A D.E.F.
	E92	PROVIDE 4A D.E.F.
	E93	FIELD VERIFY MOUNTING HEIGHT.

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PROJECT IDENTIFICATION 11023
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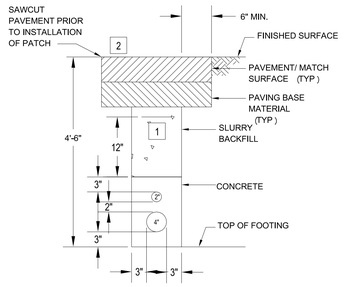
SHEET TITLE
ROOF POWER PLAN

SHEET NUMBER
E3.02

CONSTRUCTION DOCUMENTS 12/15/2014

1 INSTALL RED DETECTABLE WARNING TAPE IN ACCORDANCE WITH SECTION 26 0553.

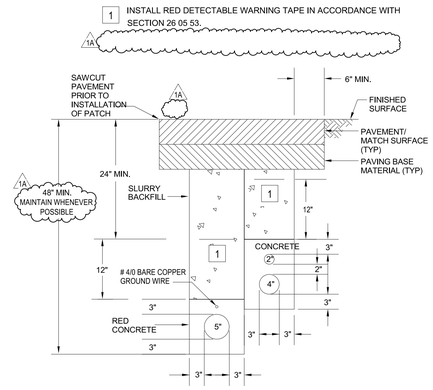
2 INSTALL ELECTRICAL DUCTBANK IN ACCORDANCE WITH SECTION 26 0543.



COMMUNICATION DUCTBANK DETAIL

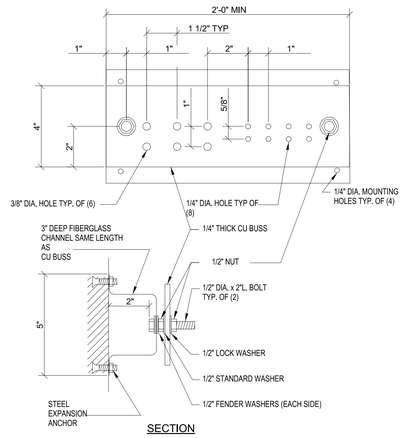
SCALE NONE | 8

1 INSTALL RED DETECTABLE WARNING TAPE IN ACCORDANCE WITH SECTION 26 05 53.



COMMUNICATION / POWER DUCTBANK DETAIL

SCALE NONE | 5



SECTION

GENERAL NOTES

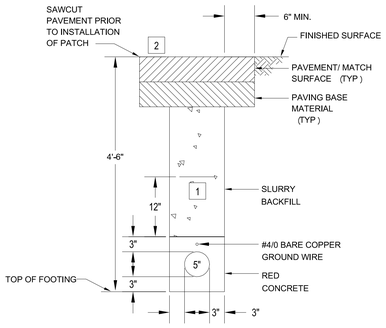
1. ALL HARDWARE SHOWN SHALL BE STAINLESS STEEL.
2. HOLES MAY BE ADDED IF REQUIRED.

GROUND BAR DETAIL

SCALE 1/4" = 1'-0" | 2

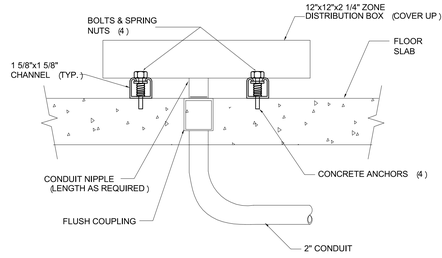
1 INSTALL RED DETECTABLE WARNING TAPE IN ACCORDANCE WITH SECTION 26 0553.

2 INSTALL ELECTRICAL DUCTBANK IN ACCORDANCE WITH SECTION 26 0543.



POWER DUCTBANK DETAIL

SCALE NONE | 7



ZONE DISTRIBUTION BOX MOUNTING DETAIL

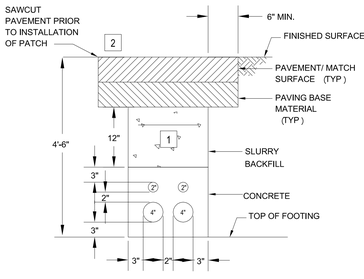
SCALE NONE | 4

KEYNOTE LEGEND

E3	LINE OF 6"H HOUSE KEEPING PAD EXTENDING 6" BEYOND, ALL AROUND. SEE A/S7.1 FOR ANCHORAGE DETAIL.
E15	CLEARANCE FOR ACCESS TO SEISMIC ANCHORS
E16	SEE SITE PLAN E1.00 FOR CONTINUATION.
E37	SEE SINGLE LINE DIAGRAM FOR FEEDER SIZE.
E43	EXOTHERMIC WELD TO #4 RE-BAR IN FOOTING (UFER GROUND).
E44	#4 RE-BAR 20' LONG (MIN.) IN THE FOOTING TO BE USED AS UFER GROUND.
E55	QUANTUM LIGHT MANAGEMENT HUB, SEE DIAGRAM ON SHEET E4.02, COORDINATE EXACT LOCATION WITH LUTRON.
E58	XP SOFTSWITCH PANEL FOR EXTERIOR LIGHTING CONTROL, SEE DIAGRAM ON SHEET E4.02, COORDINATE EXACT LOCATION WITH LUTRON.
E71	IRRIGATION CONTROLLER, VERIFY EXACT LOCATION.

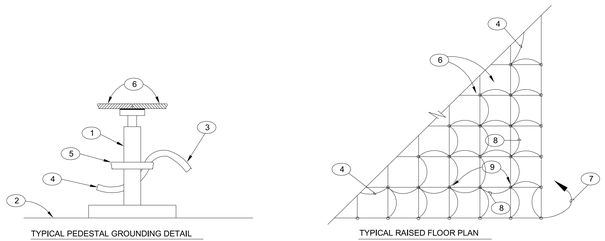
1 INSTALL RED DETECTABLE WARNING TAPE IN ACCORDANCE WITH SECTION 26 0553.

2 INSTALL ELECTRICAL DUCTBANK IN ACCORDANCE WITH SECTION 26 0543.



COMMUNICATION DUCTBANK DETAIL

SCALE NONE | 6



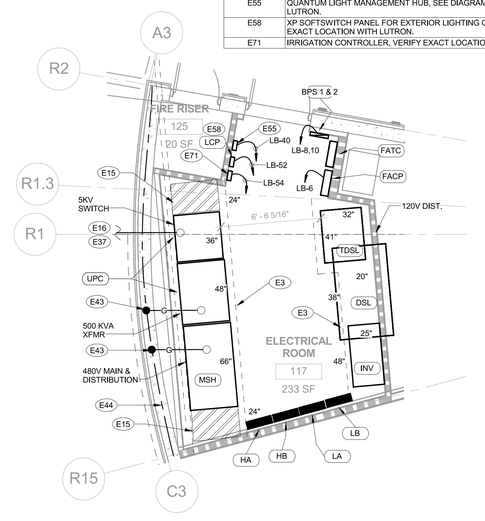
TYPICAL PEDESTAL GROUNDING DETAIL

TYPICAL RAISED FLOOR PLAN

1. RAISED FLOOR PEDESTAL.
2. BUILDING FLOOR.
3. CONTINUOUS #6 AWG, STRANDED GROUND WIRE TO PREVIOUS PEDESTAL.
4. CONTINUOUS #6 AWG, STRANDED GROUND WIRE TO NEXT PEDESTAL.
5. MALLABLE IRON GROUND CLAMP. COAT THE PEDESTAL UNDER THE GROUND CLAMP WITH COPPER SHIELD COMPOUND.
6. RAISED FLOOR.
7. #6 AWG TO COPPER EQUIPMENT GROUND BUS (TYPICAL ALL CORNERS) .
8. #6 AWG FLEXIBLE GROUND WIRE AROUND ENTIRE PERIMETER (CONTINUOUS) .
9. MALLABLE IRON 3 CONDUCTOR #6 AWG GROUND CLAMP. SEE NOTE #5 FOR COATING.

RAISED FLOOR PEDESTAL GROUNDING DETAIL

SCALE 1" = 0'-1" | 3



ENLARGED ELECTRICAL ROOM

SCALE 1/4" = 1'-0" | 1

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DRAWN BY Author

CHECKED BY Checker

SHEET TITLE
ENLARGED PLANS AND ELECTRICAL DETAILS

SHEET NUMBER
E4.01

CONSTRUCTION DOCUMENTS 12/15/2014

TELECOMMUNICATIONS OVERVIEW AND GENERAL NOTES

1. DESIGN INTENT: IT SHALL BE UNDERSTOOD THAT THIS DRAWING PACKAGE IS DIAGRAMMATIC AND SHALL BE USED TO SHOW THE INTENT OF "TELECOMMUNICATIONS CABLING INFRASTRUCTURE" FOR THE PROJECT. CONTRACTOR AGREES TO PERFORM THE INSTALLATION IN CONFORMANCE WITH THE INSTALLATION PRACTICES AND METHODS OUTLINED IN THE PROJECT SPECIFICATIONS, DEPICTED ON THE DRAWINGS, AND IN CONJUNCTION WITH THE PROJECT CONSTRUCTION GUIDELINES. THE CONTRACTOR IS RESPONSIBLE FOR REQUESTING AND OBTAINING A COPY OF THE SPECIFICATIONS AND ANCILLARY DOCUMENTS NECESSARY TO PERFORM THE INSTALLATION TASKS.

2. RESPONSIBILITY: THE TELECOMMUNICATIONS CABLING CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, TOOLS AND SUPPLIES NECESSARY TO INSTALL A COMPLETE STRUCTURED CABLING INFRASTRUCTURE SYSTEM IN COMPLIANCE WITH THE AFORE MENTIONED CONSTRUCTION DOCUMENTS WHETHER SPECIFICALLY ADDRESSED OR NOT. IF THE CONSTRUCTION DRAWINGS OR SPECIFICATION ARE IN CONFLICT, THE CONTRACTOR WILL REQUEST CLARIFICATION FROM THE OWNER'S REPRESENTATIVE IN A MANNER CONSISTENT WITH THE CONTRACT DOCUMENTS.

3. SUBMITTAL DOCUMENTS: SPECIFICATION SHEETS IDENTIFYING TYPE, MANUFACTURER, MODEL, COLOR, ETC. ARE REQUIRED FOR ALL TELECOMMUNICATIONS MATERIAL COMPONENTS AND MUST BE SUBMITTED TO CUSTOMER REPRESENTATIVE PRIOR TO INSTALLATION. THE PROCESS WILL BE PERFORMED UNDER THE TERMS OF CONTRACT DOCUMENTS. IF THIS PROCESS IS NOT STIPULATED IN THE CONTRACT DOCUMENTS, THE TELECOMMUNICATIONS CONTRACTOR MUST SUBMIT A REQUEST IN WRITING TO THE APPROPRIATE REPRESENTATIVE REQUESTING INSTRUCTIONS ON SUBMITTAL PROCEDURES.

4. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL BUILDING PERMITS, WORKING PERMITS, INSPECTIONS AND ANY ADDITIONAL FEES REQUIRED FOR THE PROJECT.

5. EXISTING CONDITIONS: THE CONTRACTOR SHALL VISIT THE PROJECT SITE AND FAMILIARIZE ITSELF WITH ALL EXISTING AND PROPOSED CONDITIONS WHICH MAY AFFECT THE COURSE OF WORK PRIOR TO SUBMITTING A PROPOSAL ON THE PROJECT.

6. REQUEST FOR INFORMATION: QUESTIONS THAT ARISE AND/OR CONFLICTS THAT ARE ENCOUNTERED DURING THE INSTALLATION MUST BE SUBMITTED IN WRITING TO THE APPROPRIATE CUSTOMER REPRESENTATIVE. THIS REQUEST FOR INFORMATION (R.F.I.) PROCESS WILL BE PERFORMED UNDER THE TERMS OF THE CONTRACT DOCUMENTS. IF THIS PROCESS IS NOT STIPULATED IN THE CONTRACT DOCUMENTS, THE CONTRACTOR MUST SUBMIT A REQUEST IN WRITING TO THE APPROPRIATE REPRESENTATIVE REQUESTING INSTRUCTIONS ON R.F.I. PROCEDURES.

7. CHANGE IN SCOPE OF WORK: CHANGE ORDERS THAT ALTER THE DESIGN, IMPACT THE CONSTRUCTION SCHEDULE, AND/OR IMPACT THE BUDGET SHALL NOT BE EXECUTED WITHOUT "AUTHORIZATION TO PROCEED" AS DEFINED BY THE TERMS AND CONDITIONS OF THE CONTRACT DOCUMENTS.

8. CODES AND STANDARDS: THE TELECOMMUNICATIONS CONTRACTOR WILL ADHERE TO ALL LOCAL, STATE, AND FEDERAL CODES AS APPLICABLE. IN THE CASE WHERE THE SPECIFICATIONS OR DRAWINGS PROVIDED ARE MORE STRINGENT THEY WILL SUPERCEDE THE AFORE MENTIONED CODES. MINIMUM CODE COMPLIANCE MATTERS ARE DETERMINED BY THE AUTHORITY HAVING LOCAL JURISDICTION.

9. PLENUM SPACES: WHEN INSTALLING TELECOMMUNICATIONS COMPONENTS IN A PLENUM RATED CEILING OR FLOOR SPACE, THE CONTRACTOR WILL ADHERE TO IMC CODE 602.2.1 TO ENSURE THAT ALL MATERIALS WITHIN PLENUMS ARE NONCOMBUSTIBLE OR HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE-DEVELOPED INDEX OF NOT MORE THAN 50 WHEN TESTED IN ACCORDANCE WITH ASTM E84 OR UL 723.

10. GENERAL WORKMANSHIP: THE CONTRACTOR SHALL EXECUTE AND COMPLETE ALL WORK IN A NEAT, PRACTICAL AND PROFESSIONAL MANNER. WORKMANSHIP QUALITY SHALL MEET OR EXCEED INDUSTRY STANDARDS AND MANUFACTURERS INSTALLATION GUIDELINES.

11. WARRANTY: THE TELECOMMUNICATIONS CONTRACTOR SHALL BE RESPONSIBLE TO FACILITATE A PERFORMANCE WARRANTY OFFERED BY THE PRODUCT MANUFACTURER OF NO LESS THAN 25-YEARS. THE TELECOMMUNICATIONS CONTRACTOR SHALL ALSO EXTEND A LIFETIME WARRANTY AGAINST WORKMANSHIP DEFECTS.

12. TELECOMMUNICATIONS INFRASTRUCTURE COMPONENTS: THE INSTALLATION CONTRACTOR WILL ENSURE THAT ALL TELECOMMUNICATIONS CABLES AND COMPONENTS ARE INSTALLED IN A MANNER CONSISTENT WITH NEC ARTICLE 800 AND PROJECT GUIDELINES. AT A MINIMUM CATEGORY 6A JACKS, CAT 6E PATCH PANELS, AND CAT 6E CABLE WILL BE UTILIZED FOR ALL WORKSTATION, VOICE, ACCESS CONTROL, EMS AND LIGHTING CONNECTIONS U.N.O. FACEPLATE AND JACK COLOR SCHEMES SHOULD BE COORDINATED WITH OWNER'S REPRESENTATIVE. TWO PATCH CABLES ARE TO BE PROVIDED FOR EACH DATA DROP. CABLE JACKET FOR INTERIOR SPACES SHOULD BE PLENUM AND BLUE IN COLOR U.N.O. REFER TO SPECIFICATION AND DRAWING TELECOMMUNICATIONS COMPONENT SHEET FOR A MORE COMPREHENSIVE LIST OF ITEMS. ⚠1

13. COORDINATION OF DISCIPLINES: THE TELECOMMUNICATIONS CONTRACTOR IS REQUIRED TO OBTAIN AUTOCAD BUILDING PLANS FROM THE OWNER'S REPRESENTATIVE AND COORDINATE WITH ALL OTHER APPLICABLE TRADES PRIOR TO ANY INSTALLATION. ELECTRICAL COMPONENTS OR SYMBOLS DEPICTED OR IDENTIFIED ON TELECOMMUNICATIONS PLANS ARE PLACED THERE FOR COORDINATION PURPOSES ONLY. THE ELECTRICAL CONTRACTOR SHALL REFER TO ELECTRICAL PLANS AND SPECIFICATIONS FOR ALL TELECOMMUNICATIONS RELATED ELECTRICAL POWER, LIGHTING, AND GROUNDING INSTALLATION REQUIREMENTS.

14. EMI CLEARANCES: ALL ELECTRICAL CIRCUITS SHALL MAINTAIN A MINIMUM SEPARATION OF 6" FROM ALL COMMUNICATIONS CONDUITS AND CABLES U.O.N.

15. STRUCTURAL REQUIREMENTS: ALL CLAMPS, BRACKETS, THREADED ROD, ETC. REQUIRED FOR SUPPORT OF CABLE PATHWAYS, RACKS AND OTHER COMPONENTS ARE NOT NECESSARILY SHOWN IN THE TELECOMMUNICATIONS PLANS. THE QUANTITY, TYPE, AND RATING OF SUPPORT MUST BE PREAPPROVED BY THE PROJECT STRUCTURAL ENGINEER PRIOR TO INSTALLATION. THE INSTALLING CONTRACTOR IS RESPONSIBLE FOR OBTAINING WRITTEN APPROVAL OF THE STRUCTURAL SUPPORT PLAN BY THE PROJECT STRUCTURAL ENGINEER.

16. PATHWAY RESPONSIBILITY: TELECOMMUNICATIONS CABLE PATHWAY COMPONENTS INCLUDING CONDUIT, BACK BOXES, FLOOR BOXES, JUNCTION BOXES, ENCLOSURES, SLEEVES, TELECOMMUNICATIONS MOUNTING BOARDS AND CABLE TRAYS ARE FURNISHED AND INSTALLED BY GENERAL CONTRACTOR U.N.O.

17. TELECOMMUNICATIONS OUTLET BOXES: SHALL CONSIST OF A DOUBLE GANG STEEL BOX THAT HAS A MINIMUM DEPTH OF 2-1/8" WITH A SINGLE GANG REDUCER. TELECOMMUNICATIONS OUTLET BOXES SHALL MATCH THE HEIGHT OF THE ELECTRICAL OUTLETS U.N.O. THE OUTLET BOX MUST BE SERVICED BY A MINIMUM 1" DIAMETER EMT CONDUIT STUBBED TO THE CABLE TRAY, TELECOMMUNICATIONS ROOM OR AN ACCESSIBLE SPACE WHICH PROVIDES A CONTINUOUS PATHWAY TO THE TELECOMMUNICATIONS ROOM. METAL-CLAD CABLE ASSEMBLIES AND THE LOOPING CONDUIT IN SERIES BETWEEN OUTLET LOCATIONS IS STRICTLY PROHIBITED.

18. BELOW GRADE RACEWAYS: ALL CONDUIT/RACEWAYS BELOW-GRADE SHALL BE A MINIMUM SCHEDULE 40 PVC, INSTALLED AT A MINIMUM DEPTH OF 36" TO TOP OF CONDUIT U.N.O. CONDUIT ELBOWS, THROUGH-GRADE TRANSITIONS, AND STUB-UPS WILL REQUIRE WRAPPED RIGID STEEL CONDUIT. RGS OR IC THREADED FITTINGS SHALL BE USED IN ALL LOCATIONS WHERE EXPOSED TO THE ELEMENTS OR SUBJECT TO PHYSICAL DAMAGE.

19. IN SLAB RACEWAYS: ALL CONDUIT RACEWAYS IN SLAB SHALL BE SCHEDULE 40 PVC WITH A MINIMUM DIAMETER OF 1-1/4" U.N.O.

20. RACEWAY BEND AND BEND RADIUS: ALL BENDS IN TELECOMMUNICATIONS CONDUIT SHALL BE LONG, SWEEPING BANDS WITH A RADIUS NOT LESS THAN SIX TIMES THE INTERNAL DIAMETER OF CONDUITS 2 INCHES OR SMALLER; TEN TIMES THE INTERNAL DIAMETER OF CONDUITS LARGER THAN 2 INCHES; NO MORE THAN 180 DEGREES OF BEND BETWEEN TERMINATION POINTS. ⚠1

21. INTERIOR SPACE JUNCTION AND PULL BOXES: CONDUIT JUNCTION AND PULL BOXES SHALL BE INSTALLED EVERY 98 FEET, OR IF MORE THAN TWO 90 DEGREE BENDS OCCUR. ELECTRICAL CONDUITS (LBs) SHALL NOT BE PERMITTED.

22. CABLE TRAYS: THE CONTRACTOR SHALL INSTALL TELECOMMUNICATIONS CABLE TRAY AS A COMPLETE SYSTEM IN ACCORDANCE WITH NEC 392.6 AND ONLY IN SPACES PERMITTED AS SPECIFIED IN NEC CODE 392.4.

23. PUBLIC ACCESSIBILITY: ALL RACEWAY JUNCTIONS, PULL BOXES AND OUTLETS ACCESSIBLE BY THE PUBLIC SHALL BE SECURED WITH TAMPER PROOF SCREWS AND/OR KEY LOCK MECHANISM.

24. CONDUIT TERMINATIONS: ALL TERMINATED CONDUIT SHALL BE FITTED WITH INSULATED PLASTIC BUSHINGS. USE ORANGE BUSHING FOR TELECOMMUNICATIONS.

25. VERTICAL CABLE RUNS: THE TELECOMMUNICATION CONTRACTOR SHALL INSTALL VERTICAL CABLE RUNWAY WHERE CABLES, EXITING SLEEVES OR CONDUITS ARE VERTICALLY UNSUPPORTED FOR 18" OR MORE. THE LOCATION OF VERTICAL CABLE RUNWAY SHALL BE ADJUSTED AS REQUIRED TO ALIGN WITH SLEEVES OR CONDUITS.

26. WIRELESS ACCESS POINTS: ENCLOSURES MUST BE PROVIDED FOR ALL WIRELESS ACCESS POINT (WAP) LOCATIONS DEPICTED ON TELECOMMUNICATIONS PLANS U.N.O. SPECIFIC MANUFACTURER AND PART NUMBERS FOR THE WAP ENCLOSURE MUST BE CONFIRMED WITH THE CUSTOMER REPRESENTATIVE PRIOR TO ORDERING.

27. PULL-TAPE: ALL EMPTY CONDUIT OR RACEWAY SYSTEMS THAT EXTEND OVER 8'-0" SHALL HAVE A PRE-LUBRICATED POLYESTER PULL-TAPE WITH A TEST RATING OF NOT LESS THAN 200LBS, INSTALLED WITHIN AND SECURED AT EACH END.

28. FIRE STOPPING: THE TELECOMMUNICATIONS CONTRACTOR SHALL INSTALL FIRESTOP MATERIALS FOR ALL TELECOMMUNICATIONS CONDUIT/RACEWAY PENETRATIONS, OCCUPIED OR UNOCCUPIED, UTILIZING UL APPROVED METHODS AS REQUIRED BY CODE AND IN ACCORDANCE WITH PROJECT FIRESTOPPING GUIDELINES. THE TELECOMMUNICATIONS CONTRACTOR WILL COORDINATE FIRESTOP INSTALLATION WITH GENERAL CONTRACTOR TO MEET SCHEDULE AND TO ENSURE CONSISTENT METHODS ARE UTILIZED ON THE PROJECT. FIRE STOP INSTALLATION MUST BE PERFORMED BY A LEVEL II CERTIFIED FIRESTOP TECHNICIAN. ALL FIRESTOP INSTALLATION METHODS MUST MEET THE RATING OF THE BARRIER OR WALL THAT IS PENETRATED AND MUST BE MARKED IN ACCORDANCE WITH PROJECT FIRESTOP GUIDELINES.

29. FIRE SLEEVES: THE CONTRACTOR SHALL INSTALL UL APPROVED FIRE SLEEVE ASSEMBLIES WHEN PENETRATING A RATED WALL. WALL RATINGS ARE DEPICTED ON ARCHITECTURAL SHEETS A9.11.

30. TELECOMMUNICATION ROOM LIGHTING: CEILING LIGHT FIXTURES SHALL BE INSTALLED BY THE ELECTRICAL CONTRACTOR TO PROVIDE A MINIMUM 50 FOOTCANDLES MEASURED AT (1) ONE METER A.F.F. THE INSTALLATION OF LIGHTING SHALL BE COORDINATED TO ENSURE THAT LIGHT FIXTURES ARE NOT PLACED ABOVE EQUIPMENT RACKS/CABINETS, CABLE RUNWAYS, TERMINATION FRAMES AND OTHER SUCH OBSTRUCTIONS. ALL LIGHTING SHOULD BE CONTROL BY AN OCCUPANCY SENSOR WHICH WILL ACTIVATE IMMEDIATELY UPON ENTERING THE ROOM. REFER TO ELECTRICAL PLANS FOR SPECIFIC LIGHTING AND EMERGENCY LIGHTING REQUIREMENTS.

31. LABELING: ALL CONDUITS SHALL BE CLEARLY AND PERMANENTLY LABELED ON BOTH ENDS WITH THE DESTINATION ROOM NUMBER OR MANHOLE. IN SMHs, CONDUIT SHALL BE LABELED WITH BUILDING AND ROOM NUMBER. PRINTED LABELS ARE TO BE ATTACHED WITHIN (1) ONE FOOT OF PATCH PANEL AND WITHIN (1) ONE FOOT OF CONDUIT. CABLE IT TO BE LABELED EVERY 15 FEET WHEN NOT IN CONDUIT. AN ADDITIONAL LABEL WILL BE ADDED TO ANY SERVICE LOOP. LABELS WILL BE OF THE LAMINATED TYPE, ORANGE IN COLOR, WITH BLACK LETTERING. ⚠1

32. TELECOMMUNICATION ROOM GROUNDING AND BONDING: THE TELECOMMUNICATION ROOMS (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM) SHALL BE EQUIPPED WITH A GROUNDING BUSBAR WHICH IS PART OF A DEDICATED TELECOMMUNICATIONS GROUNDING SYSTEM. ALL GROUNDING & BONDING COMPONENTS INCLUDING CABLE/WIRE, BONDING STRAPS, BUSBARS, LUGS AND TERMINALS ARE FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR U.N.O. THE SYSTEM MUST BE DEDICATED AND ORIGINATE FROM THE ELECTRICAL SERVICE OR DESIGNATED BUILDING GROUND AS DEPICTED ON THE ELECTRICAL/TELECOM GROUNDING PLAN. THE ELECTRICAL CONTRACTOR WILL ENSURE THAT THE GROUNDING SYSTEM IS IN ACCORDANCE WITH NEC ARTICLE 250, ANSI-J-STD-607-A AND THE LOW VOLTAGE SPECIFICATIONS AT MINIMUM.

33. ADDITIONAL GROUNDING CRITERIA: THE TELECOMMUNICATIONS CONTRACTOR IS RESPONSIBLE FOR EXTENDING THE GROUND FROM THE TMGB/TGB TO ALL TELECOMMUNICATIONS OVERHEAD RUNWAY, CABLE TRAY INSTALLED WITHIN THE ROOM, PANELS, RACKS, CABINETS, SURGE PROTECTION BLOCKS, AND OWNER FURNISHED EQUIPMENT AS DESIGNATED OR AS REQUIRED BY BICSI STANDARDS.

34. TELECOMMUNICATION ROOM CONDUITS: ALL CONDUIT ENTERING ANY TELECOMMUNICATION ROOM (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM) SHALL EXTEND A MINIMUM OF SIX INCHES INTO THE SPACE AND WILL BE INCORPORATED INTO THE STRUCTURE (I.E. CONCRETE SLAB) OR SECURED TO THE STRUCTURE WITH STRUTS, CLAMPS, OR OTHER HARDWARE TO PROVIDE A RIGID AND STABLE PATH FOR CABLES TO PASS THROUGH.

35. TELECOMMUNICATION ROOM WALLS: THE WALLS OF THE TELECOMMUNICATION ROOM (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM) MUST BE LINED WITH 8'-0" HIGH ¾" ACX PLYWOOD. THE BOTTOM OF THE PLYWOOD MUST BE MOUNTED ABOVE TYPICAL ELECTRICAL WALL OUTLETS IN ROOM. NO PAINT OR OTHER MARKINGS WILL BE APPLIED EXCEPT THOSE INTENDED TO IDENTIFY THE RATING OF THE INSTALLED BOARD AS REQUIRED BY CODE.

36. TELECOMMUNICATION ROOM OVERHEAD RUNWAY: THE TELECOMMUNICATION CONTRACTOR IS RESPONSIBLE FOR FURNISHING AND INSTALLING THE OVERHEAD RUNWAY AND/OR BASKET TRAY IN THE TELECOMMUNICATIONS ROOMS (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM).

37. TELECOMMUNICATION ROOM CEILING: THERE SHOULD BE NO CEILING IN THE TELECOMMUNICATIONS ROOMS (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM).

38. TELECOMMUNICATION ROOMS COOLING: HVAC SERVICES TO BE PROVIDED BY THE MECHANICAL CONTRACTOR SUFFICIENT TO MAINTAIN ROOM ENVIRONMENTALS IN A TEMPERATURE RANGE OF 64 TO 78 DEGREES FAHRENHEIT ON A 24 HOUR, 7 DAY WEEK BASIS, PER BICSI STANDARDS. THE HVAC DESIGN DOES NOT HAVE TO ACCOMMODATE AND SPECIFIC RELATIVE HUMIDITY OR MINIMUM ROOM TEMPERATURES.

39. TELECOMMUNICATION ROOM SECURITY: CARD READERS FOR TELECOMMUNICATION ROOMS DOORS (MDF, IDF, MPOE/MPOP OR EQUIPMENT ROOM) SHALL BE PROVIDED BY THE GENERAL CONTRACTOR TO RESTRICT ACCESS TO THE ROOMS. GENERAL CONTRACTOR WILL COORDINATE WITH THE ARCHITECT AND THE OWNER'S DOOR ACCESS CONTROL INSTALLATION CONTRACTOR FOR SPECIFIC DOOR HARDWARE DESCRIPTIONS AND MANUFACTURER'S DETAILS.

40. ADMINISTRATION: ALL TELECOMMUNICATION ROOMS (MDF, IDF, MPOP/MPOE OR EQUIPMENT ROOM), HARDWARE AND EQUIPMENT INCLUDING ENTRANCE FACILITIES, DEMARCATION POINTS, MAIN AND INTERMEDIATE AND HORIZONTAL CROSS-CONNECTS, TELECOMMUNICATIONS RACEWAYS, PATHWAYS & SPACES, BACKBONE AND HORIZONTAL CABLING, PLYWOOD BACKBOARDS, GROUNDING, BONDING AND FIRE-STOPPING, ETC. SHALL COMPLY WITH THE ANSI/TIA/EIA-606-A STANDARDS.

41. FIELD TESTING: FIELD TESTING: ALL TELECOMMUNICATION CABLING INFRASTRUCTURE SHALL BE TESTED IN ACCORDANCE WITH TIA-526-7, TIA-526-14-A, ANSI/TIA/EIA-568-B.1 THRU ANSI/TIA/EIA-568-B.1-4 AND ALL APPLICABLE TELECOMMUNICATIONS SYSTEMS BULLETINS (TSBs) AND THE COMMUNICATIONS SPECIFICATIONS. ALL FIBER STRANDS SHALL BE TESTED IN ACCORDANCE WITH TIER 1 SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS FOR OPTICAL POWER LOSS MEASUREMENTS OF INSTALLED MULTIMODE AND SINGLEMODE FIBER STRANDS, RESPECTIVELY. FURTHERMORE EACH STRAND WILL BE TESTED IN ACCORDANCE WITH TIER 2 TESTING SPECIFICATIONS USING AN OTDR, AS A SUPPLEMENT TO TIER 1. THE OTDR TRACE SHALL BE SAVED AS TO PROVIDE A GRAPHICAL SIGNATURE OF EACH INDIVIDUAL FIBER LINK FOR THE OWNER'S REFERENCE. IF THE CLOSE OUT PACKAGE IS NOT COVERED IN THE CONTRACT DOCUMENTS, THE TELECOMMUNICATIONS CONTRACTOR SHALL REQUEST INFORMATION FOR THE OWNER'S REPRESENTATIVE FOR WRITTEN INSTRUCTIONS.

42. CLEAN UP: ALL COMPLETED INSTALLATION AREAS OF THE PROJECT SHALL BE LEFT CLEAN AND AS NEW. THE CONTRACTOR IS REQUIRED TO DISPOSE OF MATERIAL DEEMED UNUSABLE UPON COMPLETION OF THE PROJECT. ANY USABLE SURPLUS MATERIAL SHALL BE TURNED OVER TO THE BUILDING OWNER.

PROJECT WORK SCOPE

ITEMS TO BE PROVIDED AND INSTALLED	ELECTRICAL CONTRACTOR		TELECOMMUNICATIONS CONTRACTOR	
	PROVIDES	INSTALLS	PROVIDES	INSTALLS
TELECOMMUNICATIONS CONDUIT RISER DIAGRAM			X	
TELECOMMUNICATIONS EQUIPMENT RACKS AND DEVICES			X	X
■ METALLIC CONDUIT BETWEEN TELECOMMUNICATIONS DEVICES AND TELECOMMUNICATIONS EQUIPMENT RACKS	X	X+		
■ CONDUIT INSULATION BUSHINGS BETWEEN METALLIC CONDUIT AND TELECOMMUNICATIONS EQUIPMENT RACKS	X	X		
■ TELECOMMUNICATIONS EQUIPMENT RACK CABLING			X	X
■ TELECOMMUNICATIONS EQUIPMENT RACK TERMINATIONS				X
■ TELECOMMUNICATIONS DEVICE SPECIALTY BACK BOXES		X◊	X	
■ TELECOMMUNICATIONS DEVICE STANDARD NEMA BACKBOXES	X	X		
■ TELECOMMUNICATIONS DEVICE SPECIALTY FLOOR BOXES	X	X+		
■ TELECOMMUNICATIONS DEVICE METALLIC CONDUIT	X	X+		
■ TELECOMMUNICATIONS DEVICE CABLING			X	X
■ TELECOMMUNICATIONS DEVICE TERMINATION				X
EMPTY CONDUIT (FOR FUTURE USE)	X	X		
CABLE TRAYS FOR TELECOMMUNICATIONS USE	X	X+		
CABLE SLEEVES FOR TELECOMMUNICATIONS USE	X	X+		
PULL BOXES FOR TELECOMMUNICATIONS USE	X	X		

◊ = INSTALLATION CRITERIA TO BE PROVIDED BY TELECOM. CONTRACTOR
+ = INSTALLATION CRITERIA TO BE PROVIDED BY TELECOM. CONSULTANT

TELECOMMUNICATIONS SYMBOL LEGEND

SYMBOL	DESCRIPTION
	A/V EQUIPMENT ENCLOSURE. PROVIDE 2 CAT6E CABLES.
	PHONE. MOUNTED AT SAME HEIGHT AS ELECTRICAL. PROVIDE (1) CAT6E CABLE.
	WALL-MOUNTED WIRELESS ACCESS POINT. PROVIDE (2) CAT6A CABLES.
	WALL-MOUNTED 2-PORT PLATE. MOUNTED AT SAME HEIGHT AS ELECTRICAL UNLESS OTHERWISE NOTED. PROVIDE (2) CAT6E CABLES. ⚠1
	WALL-MOUNTED 4-PORT PLATE. MOUNTED AT SAME HEIGHT AS ELECTRICAL UNLESS OTHERWISE NOTED. PROVIDE (4) CAT6E CABLES.
	FLOOR-BOX 2-PORT PLATE MOUNTED WITHIN FLOOR BOX PROVIDE 2 CAT6E CABLES.
	FLOOR-BOX 4-PORT PLATE MOUNTED WITHIN FLOOR BOX PROVIDE 4 CAT6E CABLES.
	CEILING-MOUNTED IP CAMERA. PROVIDE 2 CAT6E CABLE UNLESS OTHERWISE NOTED. TERMINATION SHALL BE AN INLINE FEMALE JACK WITH AN 8-FOOT SERVICE LOOP, UNLESS OTHERWISE NOTED.
	CEILING-MOUNTED WIRELESS ACCESS POINT. IF SHOWN IN AREA WITH NON-ACCESSIBLE CEILING OR OPEN CEILING, PROVIDE 1-INCH CONDUIT TO NEAREST ACCESSIBLE CEILING AREA. IF NO ACCESSIBLE CEILING AREA IS AVAILABLE, ROUTE CONDUIT TO NEAREST IDF ROOM. TERMINATION SHALL BE AN INLINE FEMALE JACK WITH AN 8-FOOT SERVICE LOOP PROVIDE (2) CAT6A CABLES.
	7'Hx19"W 2-POST RACK, CPI #55053-703.
UF	12" WIRE MESH TRAY, CPI #34811-612, UNDER FLOOR TO SUPPORT TELECOMMUNICATIONS CABLING BACK TO NEAREST IDF ROOM. FINAL PATH AND ELEVATION OF CABLE TRAY WILL BE COORDINATED IN THE FIELD TO AVOID CONFLICTS WITH OTHER TRADES. REFER TO TE1.1 KEYNOTES FOR LOCATIONS.
UF	6" WIRE MESH TRAY, CPI #34811-606, UNDER FLOOR TO SUPPORT TELECOMMUNICATIONS CABLING BACK TO NEAREST IDF ROOM. FINAL PATH AND ELEVATION OF CABLE TRAY WILL BE COORDINATED IN THE FIELD TO AVOID CONFLICTS WITH OTHER TRADES. REFER TO TE1.1 KEYNOTES FOR LOCATIONS.
	12" CABLE TRAY, CPI #10250-712.

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CONSULTANTS

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SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

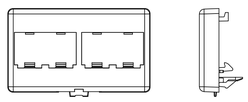
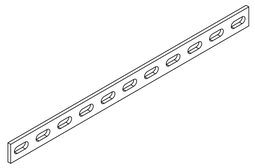
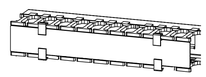
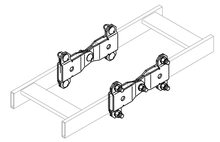
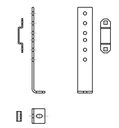
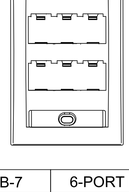
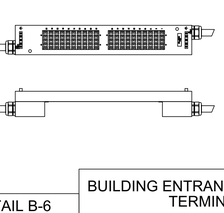
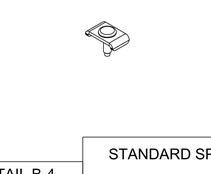
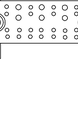
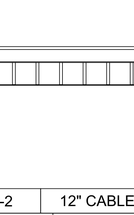
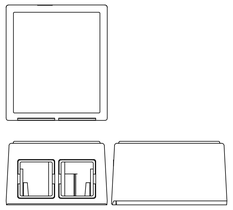
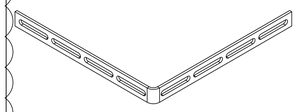
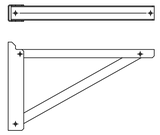
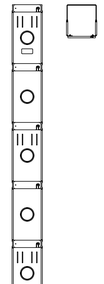
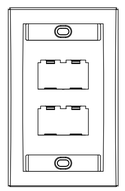
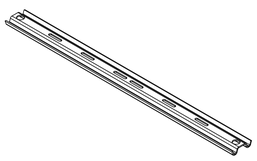
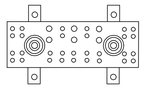
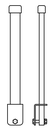
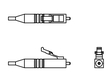
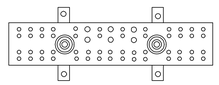
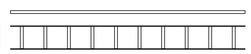
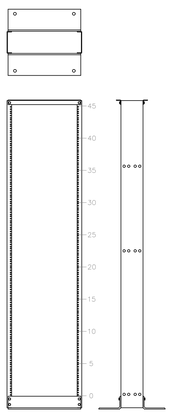
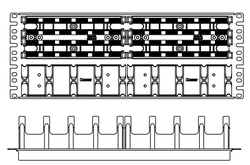
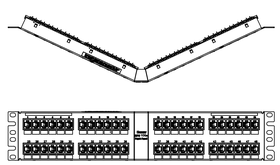
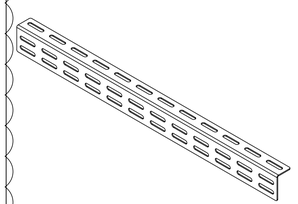
#	DATE	DESCRIPTION
⚠1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY Kvon
CHECKED BY RWillis

SHEET TITLE
TELECOMMUNICATIONS GENERAL NOTES

SHEET NUMBER
TE0.01

CONSTRUCTION DOCUMENTS 12/15/2014

PANDUIT	CFFPLA4xx	PANDUIT	CJ6X88TGxx	ERICO	CAT32	CHATSWORTH	34739-501	CHATSWORTH	30130-719	CHATSWORTH	10457-001	CHATSWORTH	10506-XX6
													
DETAIL G-7	FLEXIBLE FACEPLATE W/ SINGLE GANG FRAME	DETAIL G-6	CAT6A U/UTP OUTLET	DETAIL G-5	J-HOOK	DETAIL G-4	SPLICE BAR	DETAIL G-3	UNIVERSAL HORIZONTAL CABLE MANAGER	DETAIL G-2	SWIVEL SPLICE KIT	DETAIL G-1	6" RUNWAY ELEVATION KIT
PANDUIT	CFPE2xx	PANDUIT	CBX1xx-A	PANDUIT	-	CHATSWORTH	34734-512	CHATSWORTH	11302-001	CHATSWORTH	12100-712 12101-712	CHATSWORTH	12121-712
													
DETAIL F-7	2-PORT FACEPLATE	DETAIL F-6	SURFACE MOUNT BOX, SINGLE PORT	DETAIL F-5	1U SLIDING SHELF	DETAIL F-4	"L" BRACKET	DETAIL F-3	90-DEGREE JUNCTION SPLICE KIT	DETAIL F-2	LC SIMPLEX CONNECTOR	DETAIL F-1	6" RACK RUNWAY PLATE
PANDUIT	-	PANDUIT	CBX2xx-AY	PANDUIT	-	CHATSWORTH	34740-501	CHATSWORTH	10616-001	CHATSWORTH	11746-718	CHATSWORTH	30095-703
													
DETAIL D-7	-	DETAIL D-6	SURFACE MOUNT BOX, DUAL PORT	DETAIL D-5	12LC FIBER PANEL	DETAIL D-4	90-DEGREE BRACKET	DETAIL D-3	ADJUSTABLE JUNCTION SPLICE KIT	DETAIL D-2	LC SIMPLEX CONNECTOR		
PANDUIT	CFPE4xx	PANDUIT	-	PANDUIT	-	CHATSWORTH	34730-512	CHATSWORTH	40156-012	CHATSWORTH	10642-001/10596-712		
													
DETAIL C-7	4-PORT FACEPLATE	DETAIL C-6	-	DETAIL C-5	4U SLIDING ADAPTER	DETAIL C-4	TRAPEZE SUPPORT	DETAIL C-3	12" GROUND BUS BAR	DETAIL C-2	CABLE RETURN POST WITH PROTECTION END CAPS	DETAIL C-1	DOUBLE SIDED VERTICAL CABLE MANAGER
PANDUIT	CFPE6xx	CIRCA	1900A1-50	PANDUIT	LC SIMPLEX	CHATSWORTH	34738-501	CHATSWORTH	40158-020	CHATSWORTH	10250-712	CHATSWORTH	55053-703
													
DETAIL B-7	6-PORT FACEPLATE	DETAIL B-6	BUILDING ENTRANCE TERMINAL	DETAIL B-5	LC SIMPLEX	DETAIL B-4	STANDARD SPLICE KIT	DETAIL B-3	20" GROUND BUS BAR	DETAIL B-2	12" CABLE RUNWAY		
PANDUIT	-	PANDUIT	GPB484R4WJY	PANDUIT	DPA486X88TG	CHATSWORTH	34735-512	CHATSWORTH	12061-001	CHATSWORTH	12816-708 35683-111		
										RESERVED FOR CPI POWER STRIPS #12816-708 & #35683-111			
DETAIL A-7	-	DETAIL A-6	CAT 6 U/UTP DUAL 24-PR PUNCHDOWN	DETAIL A-5	CAT6A U/UTP 48-PORT PATCH PANEL	DETAIL A-4	WALL ANGLE BRACKET	DETAIL A-3	CABLE RUNWAY GROUNDING KIT	DETAIL A-2	HORIZONTAL POWER STRIPS	DETAIL A-1	19"x7'x3" RELAY RACK

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SEALS / APPROVALS

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PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE

Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT

2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS		
#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY Kvon
CHECKED BY RWillis

SHEET TITLE
TELECOMMUNICATIONS APPROVED COMPONENTS

SHEET NUMBER
TE0.02

CONSTRUCTION DOCUMENTS 12/15/2014

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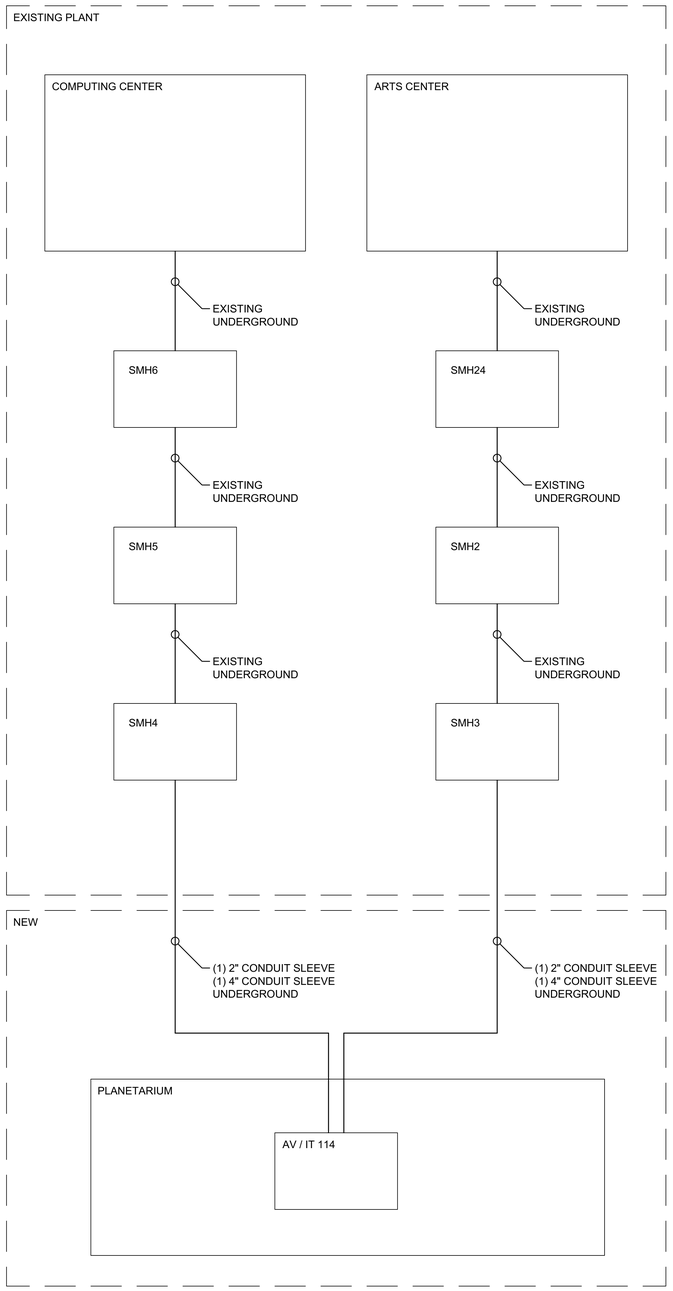
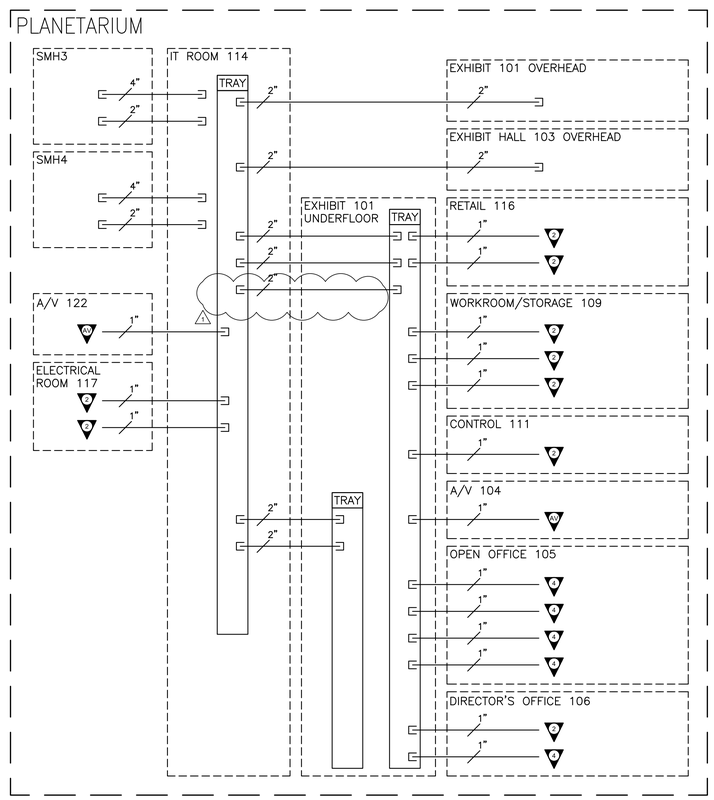
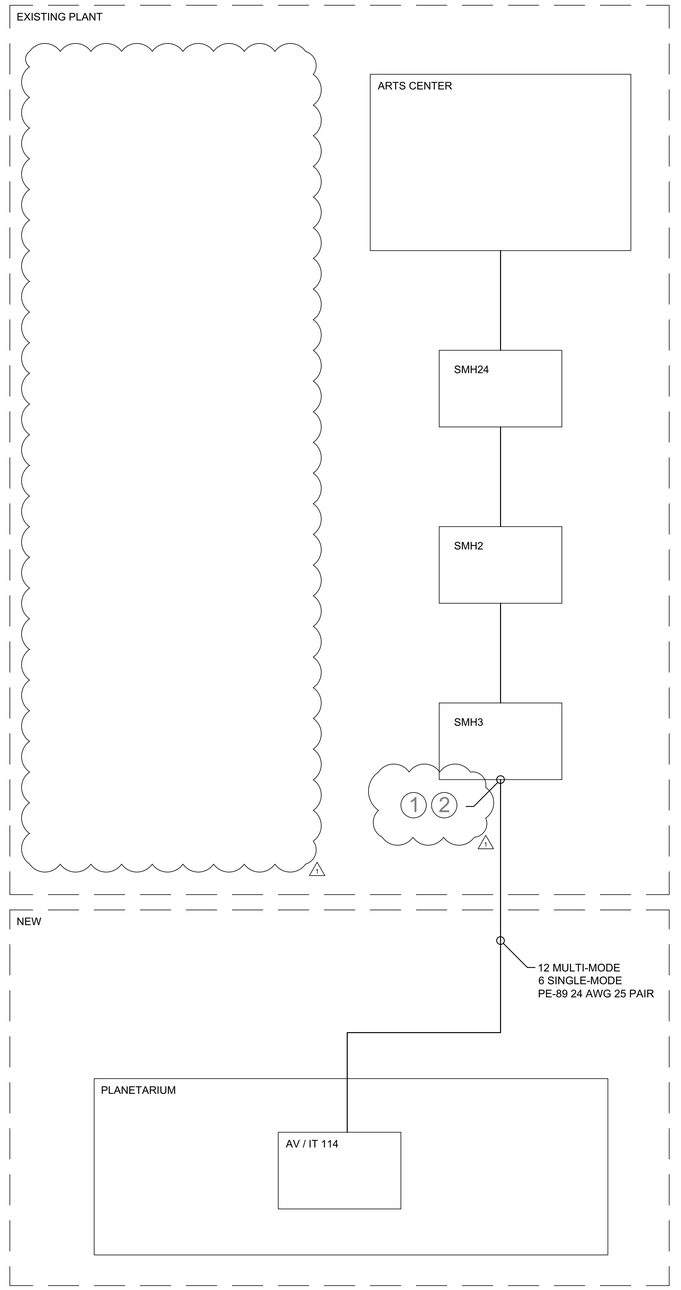


TELECOMMUNICATIONS SITE CONDUIT RISER DIAGRAM | SCALE NONE | 3



TELECOMMUNICATIONS INTERNAL CONDUIT RISER DIAGRAM | SCALE NONE | 2



TELECOMMUNICATIONS OSP COPPER / FIBER DIAGRAM | SCALE NONE | 1

GENERAL NOTES

1	Printed labels shall be attached within 1-foot of patch panel or block and within 1-foot of the pathway (conduit) exiting the IDF room and every 15-feet when the cable is not in conduit. An additional label shall be attached to any service loop.
2	Within vaults, printed labels shall be attached within 1-foot of entry and exit conduits, and every 15-feet of cable not in conduit. An additional label shall be attached to any service loop.
3	Voice copper cable labels shall be laminated type, color yellow, letter machine printed black.
4	Fiber cable labels shall be laminated type, color orange, letter machine printed black.
5	PE-89 24-gauge shall be used for all exterior runs. Both ends of an exterior run shall transition to ARMM 24-guage dry cable using 3M 710 style connectors. PE-89 to ARMM splicing will be done by District Telecom personnel, or under their direct supervision.
6	All fiber connections shall be epoxy type.

APPROVED CABLES

Inter-Building Feeds
Single-mode fiber: Corning Freedom One Riser Cable T4101D20
Multi-mode fiber: Corning Freedom One Riser Cable T4130D20
Copper: General Cable CACSP 24AWG PE-89

In Building Feeds
Single-mode fiber: Corning MIC Riser Cable 33131-24
Multi-mode fiber: Corning MIC Riser Cable 33180-24
Copper: Panduit CMP Plenum UTP PUP6504BU

KEYNOTES

1	During demo, fiber to Reprographics building to be pulled back to SMH3. Fusion splice in a waterproof splice box and extend new fiber to AV/IT 114 when demo is complete.
2	During demo, 50 pair PE89 fiber from science hall to be pulled back to SMH3. After demo is complete, run fiber to AV/IT 114. Splice to 50PR AARM dry cable and secure splice point to wall. Terminate AARM cable in rack mounted 110 blocks. Connectors to be 3M 710 style connectors.

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SEALS / APPROVALS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE#: 30-C3
A#: 04-113620
AC _____ FLS _____ SS _____
DATE _____

PROJECT TITLE
COMMUNITY PLANETARIUM

ORANGE COAST COLLEGE
Coast Colleges
COAST COMMUNITY COLLEGE DISTRICT
2701 FAIRVIEW RD.
COSTA MESA, CA 92626

SUBMITTALS

#	DATE	DESCRIPTION
1	04/20/2016	ADDENDUM 1A

PROJECT IDENTIFICATION 465
DATE 12/15/2014
DRAWN BY Kvon
CHECKED BY RWillis

SHEET TITLE
TELECOMMUNICATIONS RISERs

SHEET NUMBER
TE0.10

CONSTRUCTION DOCUMENTS 12/15/2014

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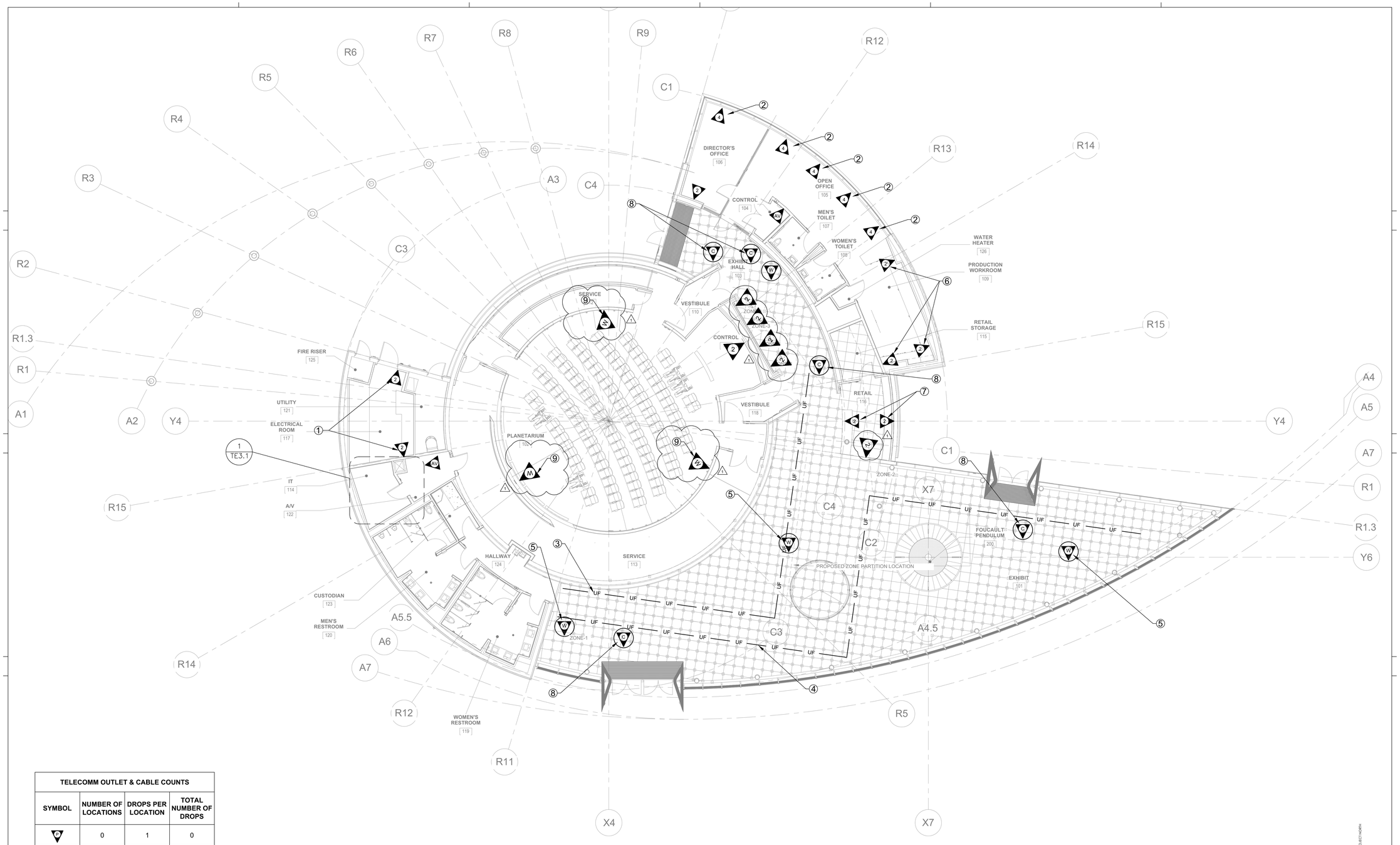

TELECOMM OUTLET & CABLE COUNTS			
SYMBOL	NUMBER OF LOCATIONS	DROPS PER LOCATION	TOTAL NUMBER OF DROPS
C	0	1	0
2	13	2	26
4	5	4	20
6	0	6	0
2	0	2	0
4	0	4	0
6	0	6	0
C	5	2	10
W	4	2	8
AV	10	2	20
W	3	2	6
TOTALS	37		90

GENERAL NOTES

1	Minimum station conduit size shall be 1-inch.
2	Minimum wall-phone feed conduit size shall be 3/4-inch.
3	Wall-phone outlets shall have one voice cable terminating in stainless-steel phone wall-mount plate.
4	Wall boxes providing six or less outlets shall be deep double-gang boxes with a reducer ring to single-gang finished outlet.
5	No more than two wall boxes shall be daisy-chanined. Conduit must increase by 1/4-imch at each upstream box.
6	Raceway used for data distribution shall be designed and sized so that only 40-percent of the capacity is utilized to allow future growth.
7	Office voice/data outlets shall have two voice and two data cables for each desk location.
8	All voice jacks shall be color-coded red. CPI part# CJ6X88TGRD.
9	All data jacks shall be color-coded blue. CPI part# CJ6X88TGBU.
10	All communications conduits ceiling stubs and sleeves shall have push-on bushings installed. Bushings shall be installed prior to cable installation.
11	Cabling installed in conduit shall be riser rated.
12	Plenum sheathed cable shall be required in all installations where cable is to be air-hung.
13	Air-hung cable shall be supported every 5-feet by hangers.
14	Hangers shall not to be filled over 50% of rated cable capacity.
15	Hangers shall have their own hanging rod; do not use existing T-bar hangers.
16	All station cable, voice and data, shall be terminated in the IDF. Data cable to patch panels; voice cables to punch blocks.
17	Patch panel and punch blocks shall have individual number sequence starting at 1. Numbering shall start with low room number and jack number and increase to high room number jack number.
18	The contractor shall be expected to comply with ANSI/TIA/EIA cabling standards for all data and voice cable terminations.

KEYNOTES

1	Outlet identified to support monitoring system for life safety or building management systems. Coordinate final placement of outlet with special systems contractor and OCC representative.
2	Coordinate final placement of outlet with furniture vendor and OCC representative.
3	Wire Mesh Tray, 2"H x 12"W, CPI #34811-612
4	Wire Mesh Tray, 2"H x 6"W, CPI #34811-606
5	Coordinate final placement of ceiling-mounted wireless access point with lighting and fire sprinklers.
6	Mounted 36" AFF. Coordinate final placement of outlet with casework contractor.
7	Mounted within casework at building outlet height. Coordinate final placement with casework contractor.
8	Coordinate final placement of ceiling-mounted surveillance cameras with lighting and fire sprinklers.
9	Coordinate with dome personnel for mounting locations.

TELECOMMUNICATIONS PLAN | SCALE 1/8" = 1'-0" | 1

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SHEET TITLE
TELECOMMUNICATIONS GROUND FLOOR PLAN

SHEET NUMBER
TE1.1

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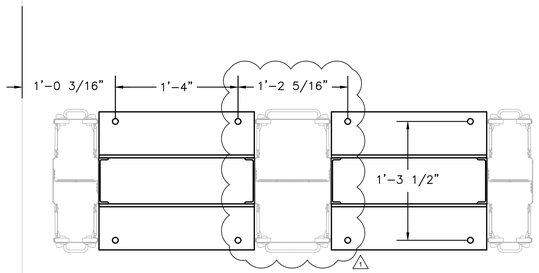
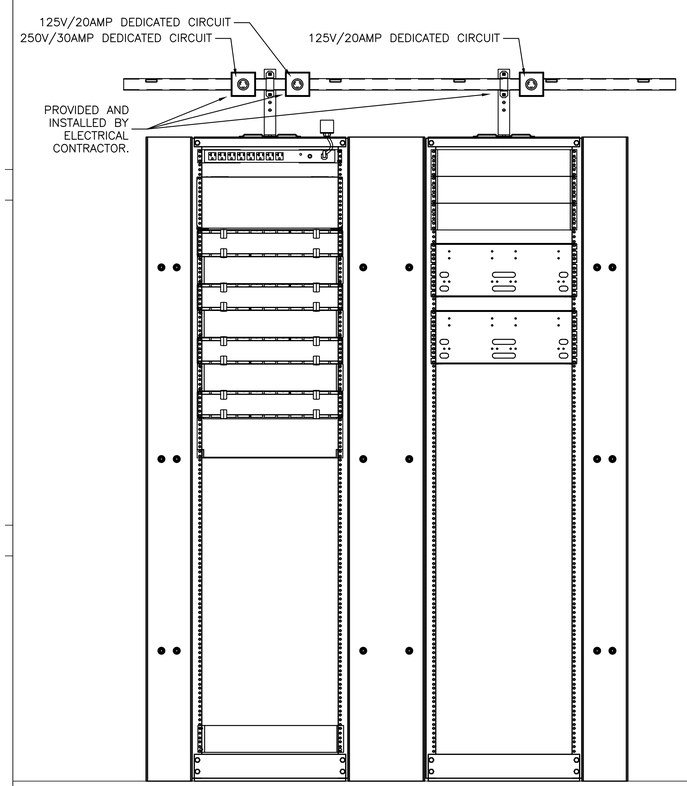
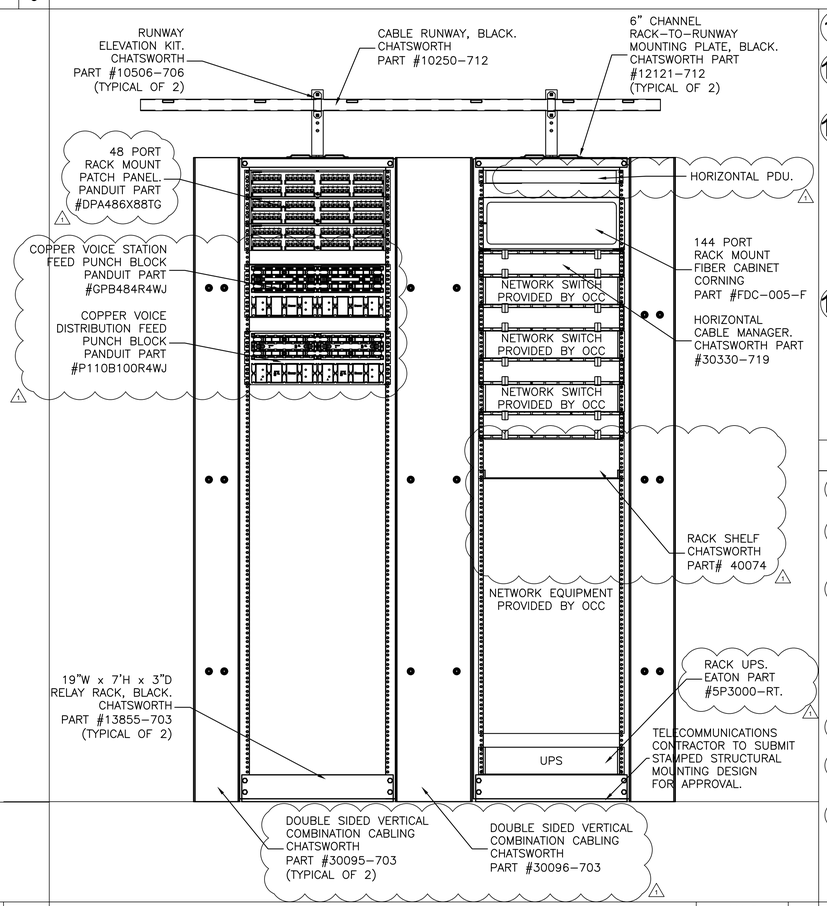


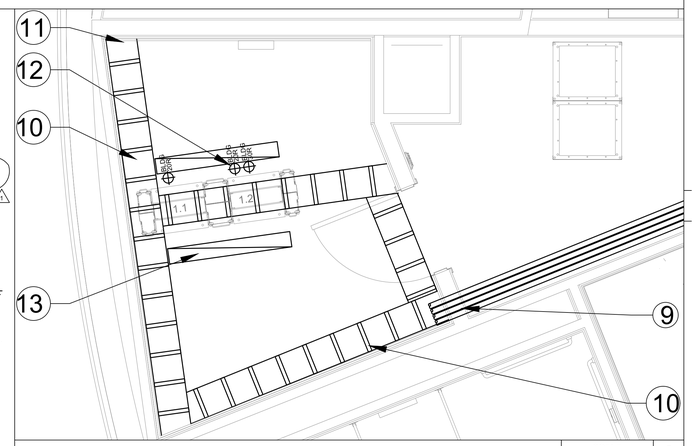
IT RACKS FLOOR MOUNTING DETAIL | SCALE 1-1/2" = 1'-0" | 5



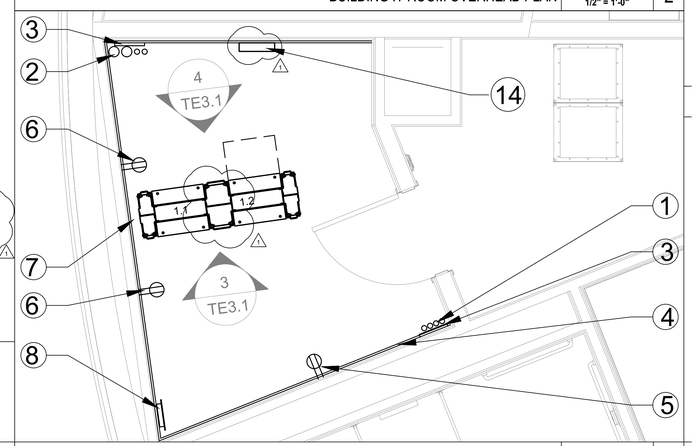
IT RACK REAR ELEVATIONS | SCALE 1-1/2" = 1'-0" | 4



IT RACK FRONT ELEVATIONS | SCALE 1-1/2" = 1'-0" | 3



BUILDING IT ROOM OVERHEAD PLAN | SCALE 1/2" = 1'-0" | 2



BUILDING IT ROOM FLOOR PLAN | SCALE 1/2" = 1'-0" | 1

GENERAL NOTES

1	All walls of the IDF covered in 3/4-inch fire rated plywood to a height of 8-feet, white paint.
2	1-foot wide ladder rack to circle the circumference of the room and connects to each installed rack.
3	ladder rack to connect the top of the racks together allowing inter rack distribution.
4	All rack system to be grounded to earth ground.
5	115V line power will be provided on all four walls. Walls longer than eight feet will have outlets every 6-feet.
6	All installed conduit system must have fire blocking installed as per state, county, and city fire code or plan. In case of conflict, the more stringent requirement will be applied.
7	All horizontal distribution data/voice cabling entering IDF through side walls must be supported within 2-feet of the entry point conduit or sleeve and maintain manufacturer recommended bend radius
8	All horizontal 4-inch EMT conduits will be fitted with a device to control bend radius of the cabling to a minimum bend radius of 4-inches.
9	A 20 amp circuit may not feed more than two outlets and those outlets cannot be located on the same wall.
10	Data Conduit: No more than 180-degrees of bends between access points.
11	All communications conduits ceiling stubs and sleeves must have push-on bushings installed. Bushings will be installed prior to cable installation.
12	Cabling installed in conduit may be riser rated.
13	Plenum sheathed cable is required in all installations where cable is to be air-hung.
14	Air-hung cable must be supported every 5-feet by hangers.
15	Hangers not to be filled over 50% of rated cable capacity.
16	Hangers must have their own hanging rod; do not use existing T-bar hangers.
17	All station cable, voice and data, shall be terminated in the IDF. Data cable to patch panels; voice cables to punch blocks. ARMM cable on 110 blocks.
18	Patch panel and punch blocks will have individual number sequence starting at 1. Numbering will start with low room number and jack number and increase to high room number jack number.
19	The contractor will be expected to comply with ANSI/TIA/EIA cabling standards for all data and voice cable terminations.
20	The contractor will provide a full sized laminated set of telecommunication drawings, mounted on east wall of AV/IT 114.

KEYNOTES

1	(4) 2" conduits to EXHIBIT 101 underfloor trays.
2	(2) 4" & (2) 2" conduit sleeves from SMH3 & SMH4.
3	12" Runway for vertical cable support. Secure with Vertical Wall Kit CPI #10608-701. Typical of (2).
4	4'x8'x3/4" ACX fire rated plywood backboard. No Paint.
5	Access Control power. Mount 18" A.F.F. to top of receptacle.
6	Convenience power, typical of (2). Mount 18" A.F.F. to top of receptacle.
7	4-inches from wall.
8	12" grounding busbar CPI #40168-102.
9	(4) 2" Sleeves to EXHIBIT 101 overhead.
10	12" ladder runway CPI #10250.712. Support runway at 5' intervals using triangle brackets CPI #11746-712.
11	Support runway using wall angle bracket CPI #11421-712.
12	Power receptacles mounted to overhead runway or unistrut support at same elevation as runway.
13	Ligthing fixtures to be mounted so as to provide 50-foot candles of light at 3' A.F.F.
14	Building Entrance Terminal. Circa #1880ENSI-50 with 3B1 series modules.

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TELECOMMUNICATIONS ENLARGED PLANS

SHEET NUMBER
TE3.1

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