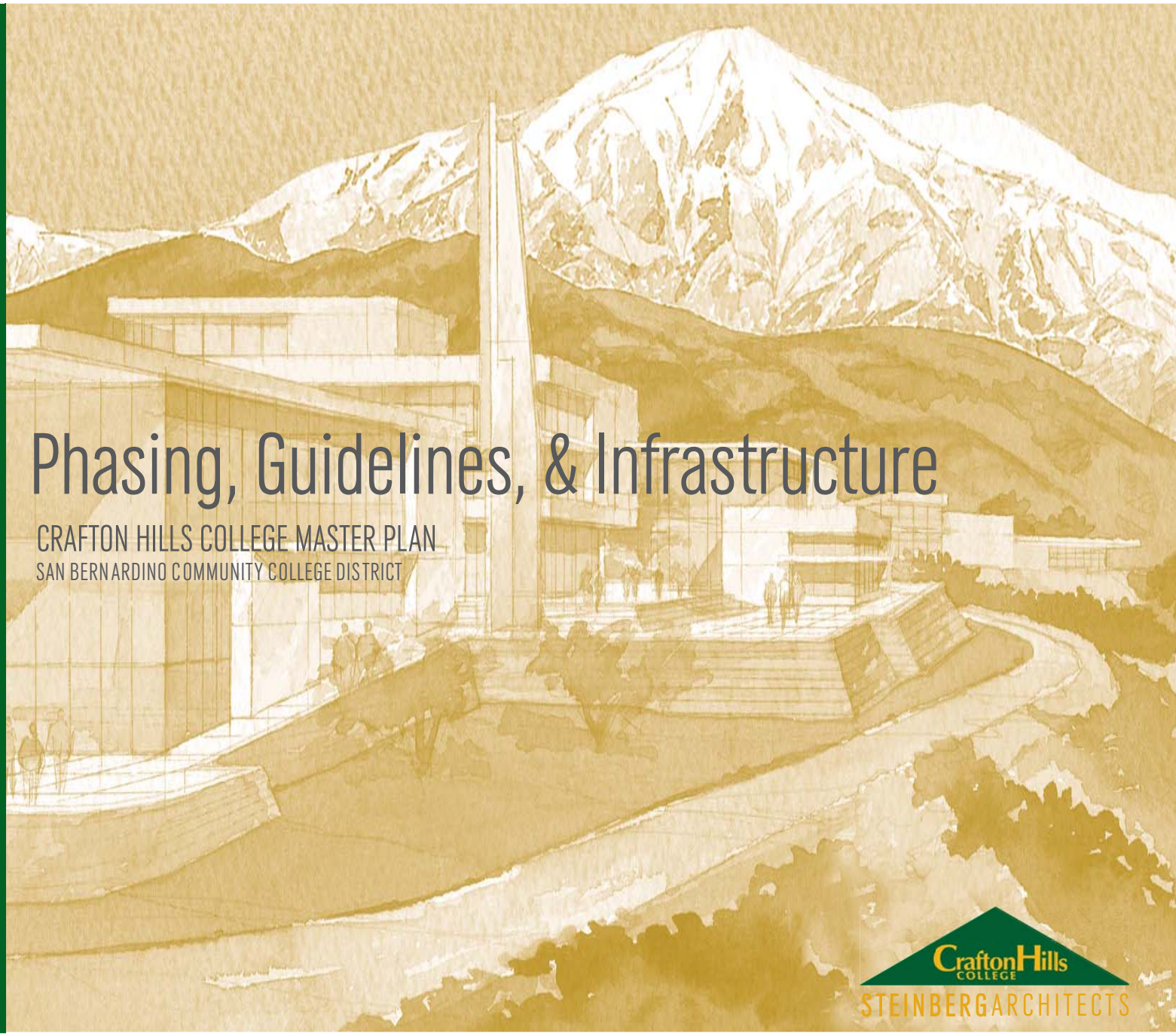
Volume 4 Phasing, Guidelines, & Infrastructure

CRAFTON HILLS COLLEGE MASTER PLAN

SAN BERNARDINO COMMUNITY COLLEGE DISTRICT



Crafton Hills College

STEINBERG ARCHITECTS

Volume 1 Master Plan

Volume 2 Master Program

Volume 3 Existing Facilities Assessment

Volume 4 Phasing, Guidelines, and Infrastructure

1 | SUMMARY

OVERVIEW

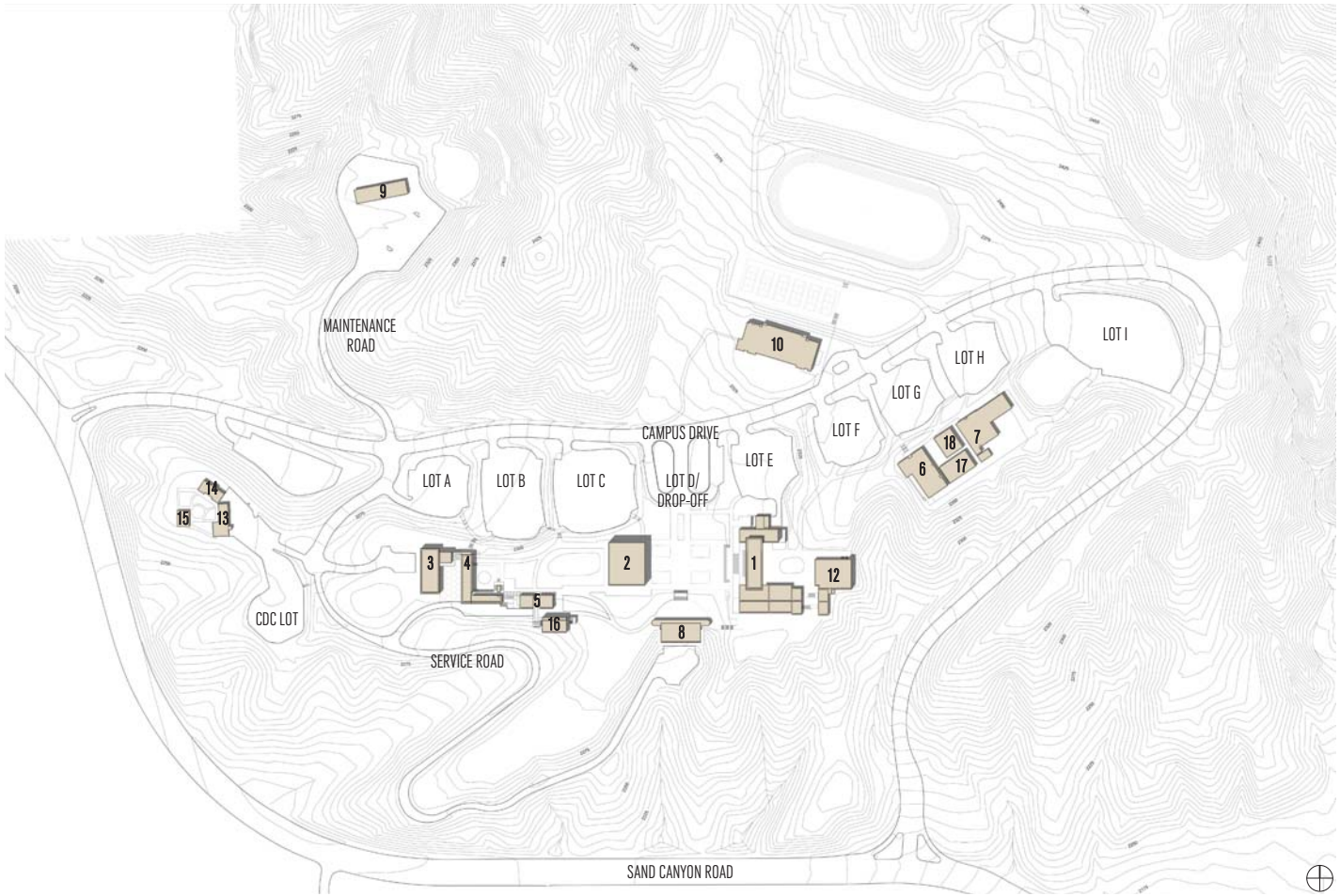
Volume 4 of the Master Planning documents addresses how the college will implement the vision of the Master Plan. Many changes will occur on this campus over the course of the next twenty years. The phasing of the work, the projects, and the project boundaries are outlined in the Chapter 2. Through workshops with the Master Plan Committee, a series of projects have been broken out of the 2025 Master Plan; these are projects which are necessary to lay the foundation for future growth, as well as those that address the college's most pressing academic needs. Therefore an intermediate phase is shown throughout Volume 4 that illustrates projects to be completed by 2012. Chapter 3 illustrates architectural and landscape guidelines that are set forth that give direction for new projects in terms of expression and aesthetic, and standards are set for building materials, hardscape and planting materials, signage, and lighting.

The last chapter addresses campus infrastructure. As detailed in volume 3, the Existing Facilities Assessment, many of the college's site and building systems are outdated and are in need of repair or replacement. Chapter 5 deals with upgrades to the college's fire access routes and parking, as well as the addition of new ones. There are also extensive plans for water distribution and fire protection, site drainage, site grading, and irrigation, along with chilled and hot water lines, gas lines, and electrical and data conduit pathways.

2025 Master Plan

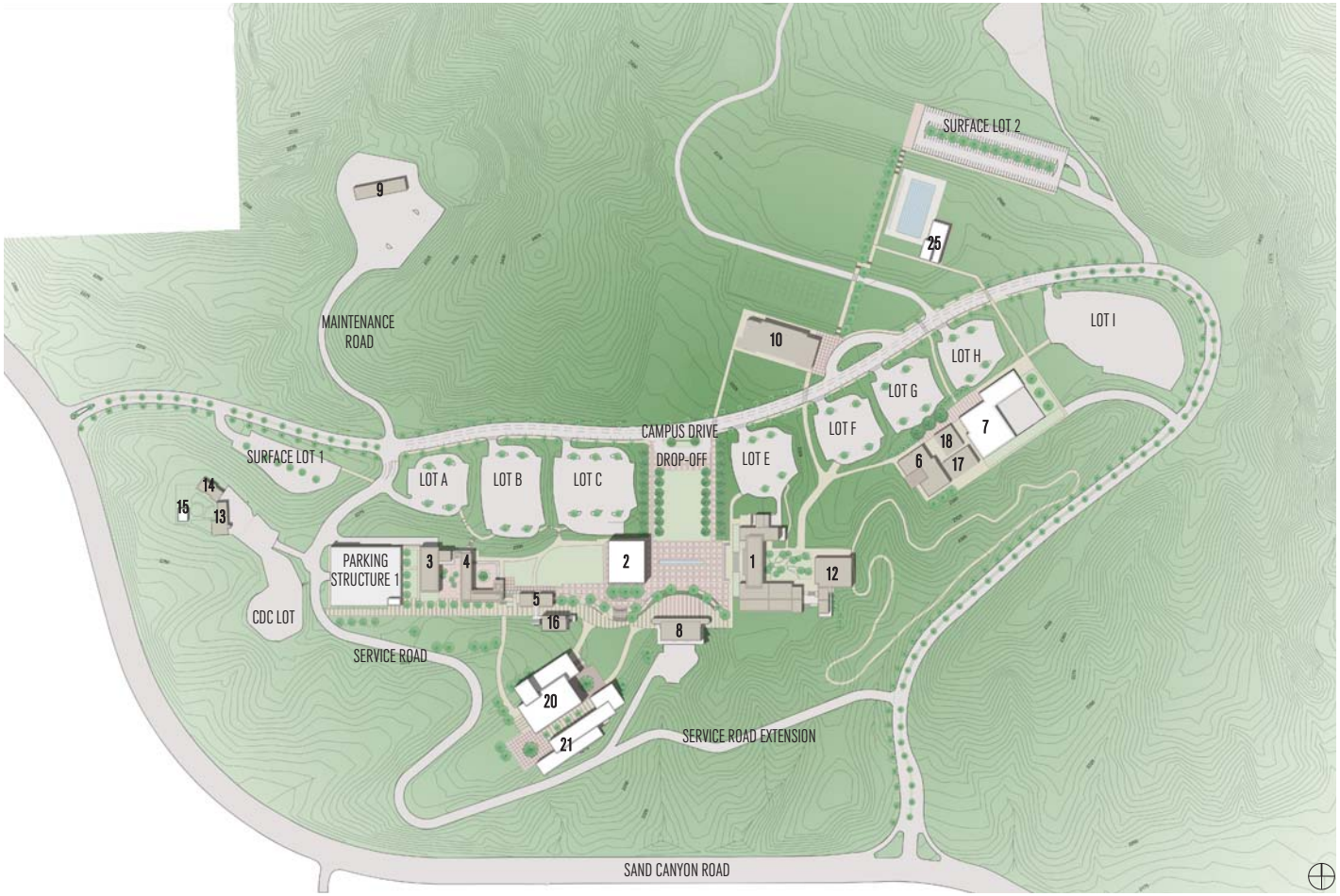
2 | PHASING

EXISTING CAMPUS PLAN



NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	LEARNING RESOURCE CENTER/ LIBRARY
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	CLASSROOM BUILDING
6	OCCUPATIONAL EDUCATION 1
7	OCCUPATIONAL EDUCATION 2
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY/ HEALTH SCIENCES
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	BOOKSTORE
18	CLASSROOM AT BOOKSTORE

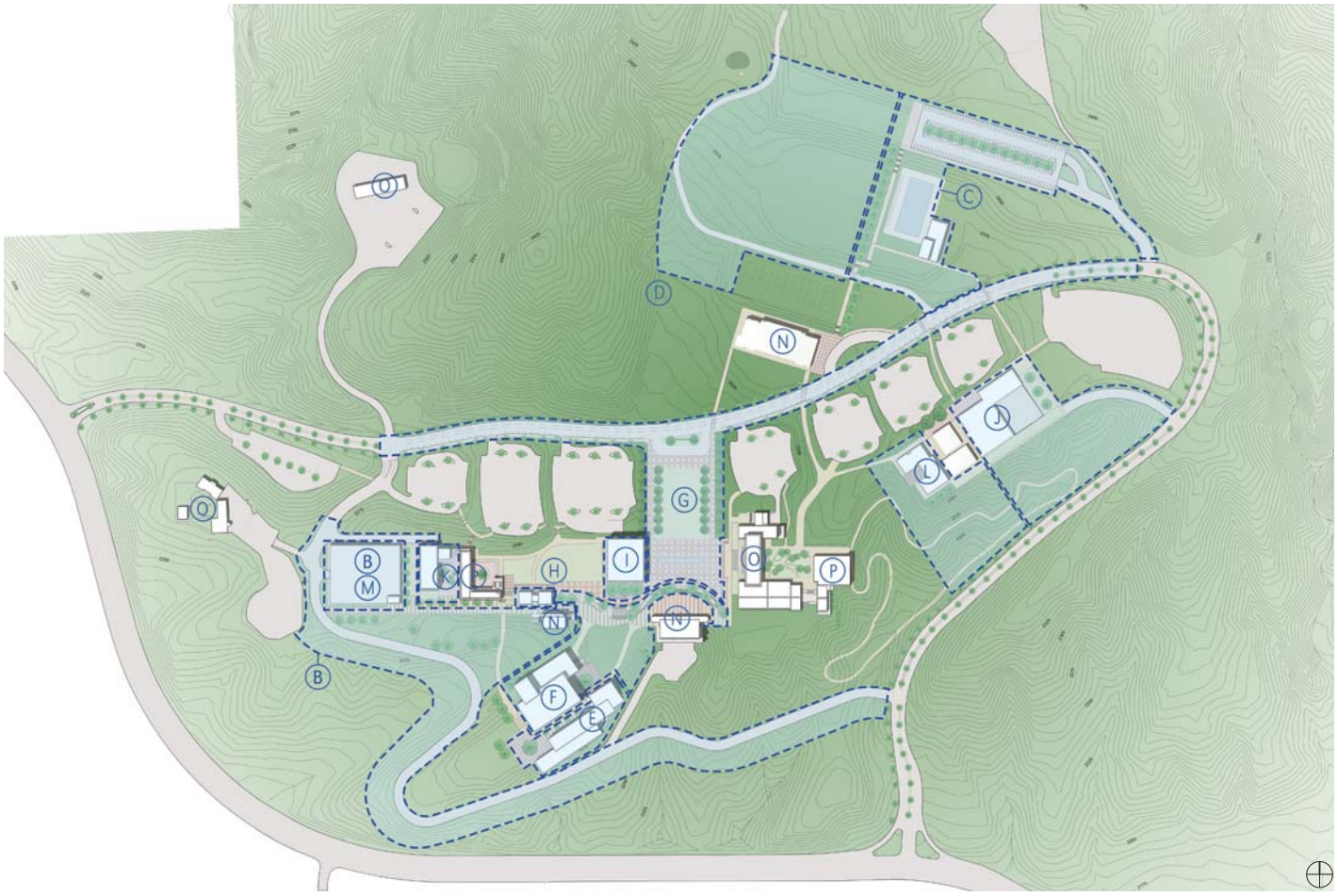
2012 MASTER PLAN



NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	**STUDENT CENTER**
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C (former Classroom Building)
6	OCCUPATIONAL EDUCATION 1
7	**EMERGENCY SERVICES** (OE2 replacement building)
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	CLASSROOMS (former Bookstore)
18	CLASSROOMS
19	NOT USED
20	**LEARNING RESOURCE CENTER**
21	**HUMANITIES 1**
22	NOT USED
23	NOT USED
24	NOT USED
25	**COMMUNITY RECREATIONAL FACILITY**
26	NOT USED

* 2012 new buildings are indicated by bold font

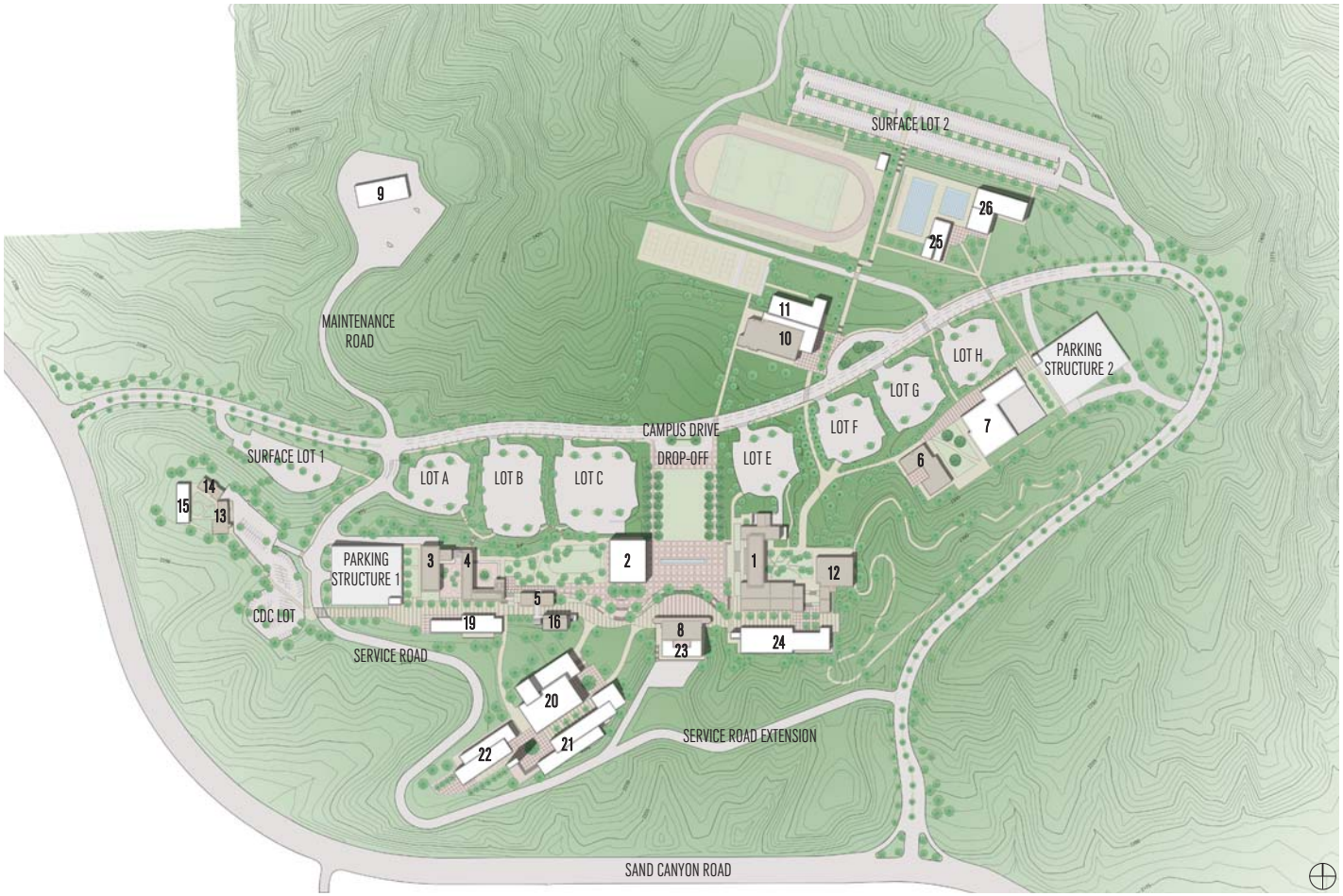
2012 PROJECTS



PROJECT NO.	PROJECT DESCRIPTION
Ⓐ	CAMPUS INFRASTRUCTURE UPGRADES Water, Sewer, Drainage, Irrigation, Gas, CHW, HHW, Electric, Data & Comm., Central Plant Expansion
Ⓑ	NEW PARKING LOT & LOOP ROAD Surface lot - 120 spaces, fire access/ service road, landscape/hardscape
Ⓒ	NEW COMMUNITY RECREATIONAL FACILITY Natatorium (50M pool & locker rooms), parking lot, landscape/hardscape
Ⓓ	ATHLETIC FIELDS SITE GRADING
Ⓔ	NEW GENERAL EDUCATION BUILDING Classrooms, computer labs, offices, meeting rooms, landscape/hardscape
Ⓕ	NEW LRC & PENINSULA DEVELOPMENT/ACCESS Library, computer labs, classroom, office, campus data center, meeting rooms, AV/TV; peninsula site grading; living wall; landscape/hardscape
Ⓖ	ENTRY QUAD Landscape/hardscape, drop-off; campus drive strip ing, sidewalks, landscape/trees
Ⓗ	STUDENT SERVICES C (CLASSROOM BUILDING RENOVATION) Financial Aid, Health Center, EOPS, classroom
Ⓘ	NEW STUDENT CENTER Cafeteria/dining, bookstore, classrooms, student lounge, meeting rooms; new loading dock area
Ⓙ	NEW EMERGENCY SERVICES Classrooms, computer labs, coverd outdoor vehicle storage, fire access/ grading; landscape/hardscape
Ⓚ	COLLEGE CENTER RENOVATION
Ⓛ	OCCUPATIONAL EDUCATION #1 RENOVATION Classrooms, computer labs, offices
Ⓜ	NEW PARKING STRUCTURE #1 740 spaces, sitework
Ⓝ	FINISH UPGRADES Gymnasium, Perfoming Arts Center
Ⓞ	FINISH UPGRADES Maintenance, Lab/Admin, CDC
Ⓟ	FINISH UPGRADES SSA, SSB, Chemistry/ Health Science

- New Buildings - Exterior Plaster Finish, insulated glazing, c.i.p. conc. structural frame.
- Major Renovation - New plumbing, fire protection, electrical, HVAC systems, upgrade struct. as req'd., new finishes & space planning, exterior work as as req'd., complete ADA compliance
- Finish Upgrade - new floor & wall finishes, replace ceiling tile as req'd

2025 MASTER PLAN



NO.	BUILDING NAME
1	LABORATORY CENTER (former Laboratory/Administration Building)
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C (former Classroom Building)
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES (OE2 replacement building)
8	PERFORMING ARTS CENTER
9	**MAINTENANCE & OPERATIONS**
10	GYMNASIUM
11	**WELLNESS CENTER**
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	**CHILD DEVELOPMENT CENTER EXPANSION**
16	STUDENT SERVICES B
17	DEMOLISHED - CLASSROOMS
18	DEMOLISHED - CLASSROOMS
19	**ADMINISTRATION/ STUDENT SERVICES**
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	**HUMANITIES 2**
23	**PERFORMING ARTS CENTER EXPANSION**
24	**SCIENCES**
25	COMMUNITY RECREATIONAL FACILITY
26	**COMMUNITY CENTER**

* 2025 new buildings are indicated by bold font

2025 PROJECTS

PROJECT NO.	PROJECT DESCRIPTION
AA	PARKING LOT UPGRADES
BB	EMERGENCY SERVICES PLAZA
CC	LABORATORY CENTER (EXISTING LADM RENOVATION) Classrooms, labs; landscape/hardscape
DD	CHEMISTRY (EXISTING CHEM/HEALTH RENOVATION) Classrooms, labs; landscape/hardscape
EE	GYMNASIUM & WELLNESS CENTER Gymnasium renovation - gym, multi-purpose rooms; New Wellness Center - multi purpose rooms, fitness center, weight room; locker rooms, showers; landscape/ hardscape
FF	ATHLETICS FIELDS Soccer field, synthetic track, bleachers, lighting; Tennis courts, bleachers, lighting; landscape/hardscape
GG	NEW HUMANITIES BUILDING 2 Classrooms, computer labs, offices, meeting rooms
HH	PARKING STRUCTURE 2 1,300 spaces, landscape/hardscape
II	NEW ADMINISTRATION/STUDENT SERVICES BUILDING Offices, meeting rooms
JJ	PERFORMING ARTS COMPLEX Existing Performing Arts Center Renovation; New Perfoming Arts Expansion - art studios, black box theater, classrooms, computer labs, offices
KK	NEW CHILD DEVELOPMENT EXPANSION Classrooms, offices
LL	NEW SCIENCES BUILDING Wet labs, computer labs, offices
MM	STUDENT SERVICES A RENOVATION Offices, open office, meeting rooms
NN	NEW MAINTENANCE BUILDING
OO	STUDENT SERVICES B RENOVATION Offices, meeting rooms
PP	COMMUNITY BUILDING & WELLNESS POOL
QQ	CAMPUS DRIVE LANDSCAPING, PHASE 2
RR	CAMPUS WIDE SITE LANDSCAPING
SS	CAMPUS WIDE SITE LIGHTING

- New Buildings - Exterior Plaster Finish, insulated glazing, c.i.p. conc. structural frame.
- Major Renovation - New plumbing, fire protection, electrical, HVAC systems, upgrade struct. as req'd., new finishes & space planning, exterior work as as req'd., complete ADA compliance
- Finish Upgrade - new floor & wall finishes, replace ceiling tile as req'd

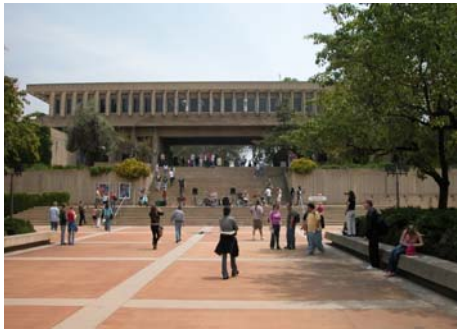
3 | ARCHITECTURAL GUIDELINES

EXISTING CHARACTER

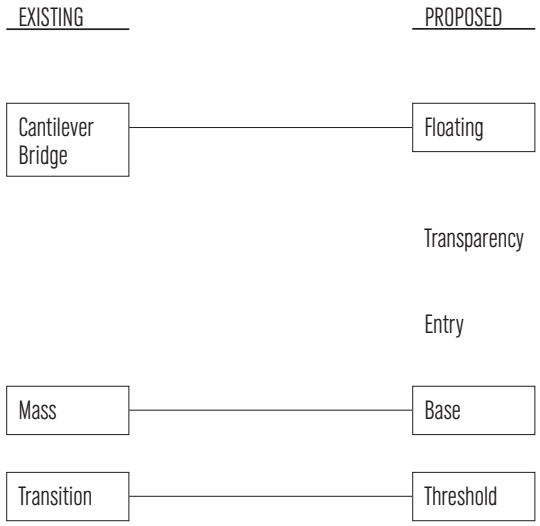
CANTILEVER

BRIDGE

MASS



TRANSITION



ARCHITECTURAL EXPRESSION

Figure 1.

Floating

Figure 2.

Transparency

Floating

Figure 3.

Floating

Base

Transparency

Figure 1. Neurosciences Institute. La Jolla. 1996.
Tod Williams Billie Tsien & Associates.
photo from severud.com

Figure 2. Kunstgalerie Goetz. Munich, Germany. 1992.
Herzog & de Meuron.
photo by: Hisao Suzuki

Figure 3. Centro Deportivo en Galdácano. Vizcaya, Spain.
1996-2000.
Juan Carlos Sancho Osinaga | Sol Madridejos.
photo by: Hisao Suzuki

ARCHITECTURAL EXPRESSION

Figure 1.

Transparency

Figure 2.

Entry

Figure 3.

Transparency

Entry

Figure 1. Pabellón Docente de la Arrixaca. El Dalmar, Spain.
1996-2001.
Juan Carlos Sancho Osinaga | Sol Madridejos.
photo by: Hisao Suzuki

Figure 2. University of Otago Central Library.
Dunedin, New Zealand. 2000.
Hardy Holzman Pfeiffer Associates
photo from HHPA

ARCHITECTURAL EXPRESSION

Figure 1.

Base

Figure 2.

Base

Transition

Figure 3.

Base

Building

Figure 1. Santo Domingo de Bonaval Garden.
Santiago de Compostela, Spain. 1990-1994.
Alvaro Siza
photo from Alvaro Siza Office

Figure 2. The Getty Center. Los Angeles. 1984-1997.
Richard Meier
photo from the Getty Foundation

Figure 3. The Getty Center. Los Angeles. 1984-1997.
Richard Meier
photo from the Getty Foundation

ARCHITECTURAL EXPRESSION

Figure 1.

Transition
Base
Building

Transition
Threshold

Threshold
Transition

Figure 1. David Vieria de Castro House.
Famalicão, Portugal. 1984-1994.
photo from Alvaro Siza Office

Figure 2. Galician Center of Contemporary Art.
Santiago de Compostela, Spain. 1988-1993.
Alvaro Siza
photo by: Hisao Suzuki

Figure 3. Mattin Center. Johns Hopkins University.
Baltimore. 2001.
Tod Williams Billie Tsien Associates
photo by: Michael Moran

MATERIALS

A EXTERIOR PLASTER

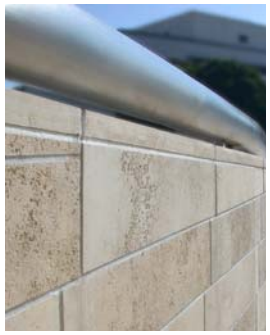


B GLAZING / MULLIONS



MATERIALS

C PRECAST CONCRETE COPING / SILLS


D CONCRETE BOARD FORM



4 | LANDSCAPE GUIDELINES

PLANT MATERIAL GUIDELINES | PLANTING STRATEGIES

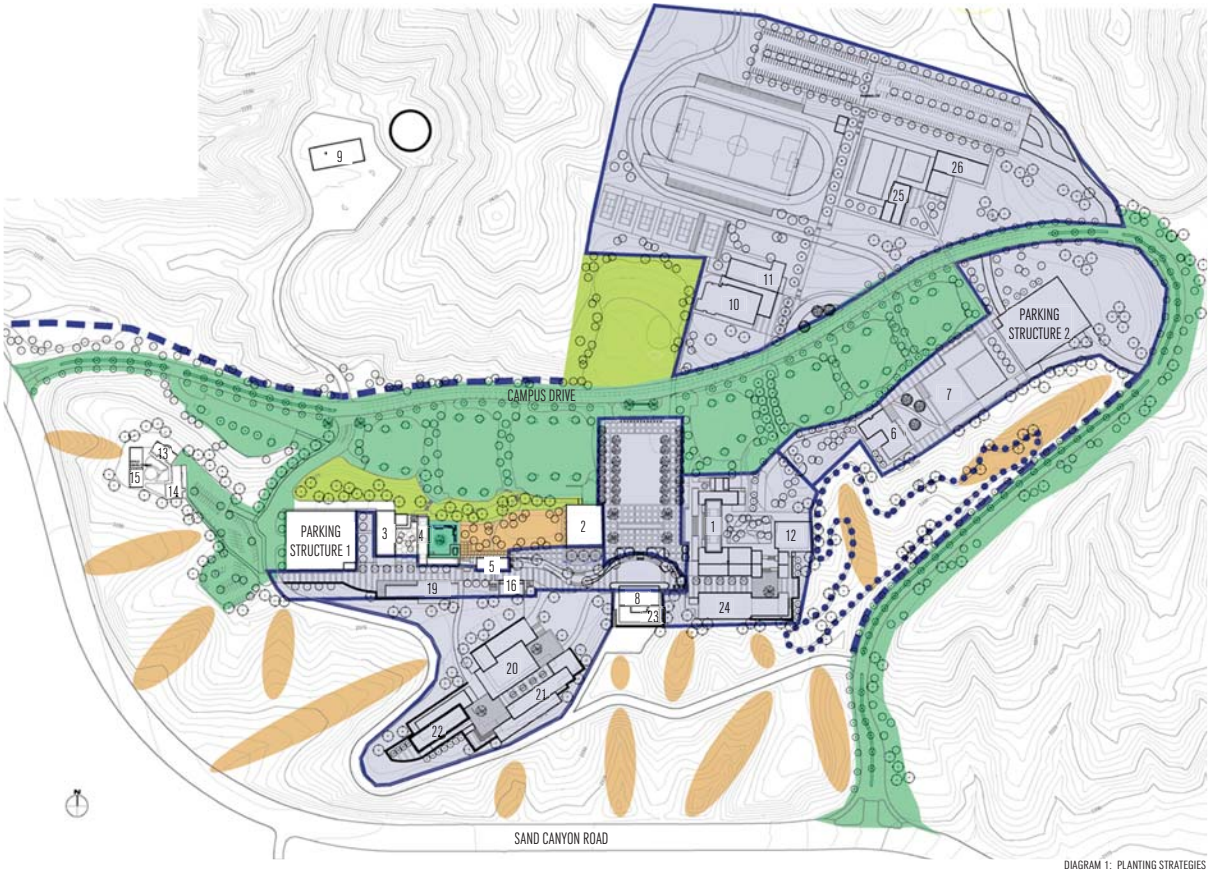


DIAGRAM 1: PLANTING STRATEGIES

Diagram 1 (left) identifies several planting strategies, described below. The planting strategies reinforce the broad vision of the Landscape Plan.

- Enhance the existing natural landscape
- Create distinct Cluster landscapes
- Enhance campus entries and roads
- Vegetate fire buffer zones
- Maintain evergreen screens, particularly along parking lot perimeters and transition areas
- Reduce the current amount of golf course turf area
- Create a sustainable landscape

LEGEND

- ADDITIONS
- RESTORATIONS
- REPLACEMENTS
- ENHANCEMENTS

NO.	BUILDING NAME
1	LABORATORY CENTER
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	WELLNESS CENTER
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER EXPANSION
16	STUDENT SERVICES B
17	NOT USED
18	NOT USED
19	ADMINISTRATION/ STUDENT SERVICES
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	HUMANITIES 2
23	PERFORMING ARTS CENTER EXPANSION
24	SCIENCES
25	COMMUNITY RECREATIONAL FACILITY
26	COMMUNITY CENTER

ADDITIONS

Within the Campus Clusters (Humanities, Sciences/ Math/BIT, etc.), new planting will support the thematic ideas discussed earlier for these areas. Plant selections will focus primarily on low to moderate water use material.

Plant selections and placement around defined areas of structures will be in accordance with the fire department's "fuel modification planting zone requirements".

As part of the Sciences/Math/BIT Cluster, a new hiking trail will provide an opportunity for students to learn about the adjacent hillside habitat. Exotic plant material will be removed and trail markers will identify plants and animals viewed along the trail.

At the western entry of Campus Drive, a new landscape feature will demonstrate ideas of utilizing the existing stormwater channel as a design element. Riparian or coastal sage habitat species will be used accordingly.

At the eastern entry of Campus Drive, a natural swale will be developed into an etnry element that can be viewed from nearby campus overlooks or experienced along the new hiking trail. The landscape will feature riparian or coastal sage habitat plant species.

RESTORATIONS

Within the surrounding naturalized hills, selected areas will be revegetated with coastal sage habitat plant species. The selected revegetation will focus on hillside areas that maximize views from campus.

Within the Central Lawn, west of the Student Center, damaged turf grass and other plant material will be replaced. Existing shade, soil and pedestrian traffic conditions may be reasons for the areas of damage. Replacement plants will be selected as appropriate for the condition without changing the original character of the space.

REPLACEMENTS

A grove of red gum trees (Eucalyptus camaldulensis) and other trees provide an evergreen buffer on the slope between between parking lots A/B/C and the western campus. According to the 2005 Arborist's report*, many of the trees are in decline for numerous reasons, including psyllid infestations and poor pruning. The trees are to be replaced with a grove of pine and cedar trees. The pine trees will continue to provide the evergreen screening desired for this slope.

Most of the existing golf course will be replaced with the new natatorium, athletic and community facilities, while the golf putting greens will remain. The remaining open space (located north of the Central Quad lawn) will be replaced with native and drought tolerant plant species. Existing trees along the perimeter of the open space will be supplemented with an informal placement of new canopy and coniferous trees in keeping with the surrounding coastal sage habitat.

* See Consulting Arborist's Report, "Tree Management & Preservation Study," by Greg Applegate, dated 8/24/05.

ENHANCEMENTS

The existing hedge along the perimeter of the Student Services Terrace planter will be replaced with new plantings within the terraced seating area. New plant material will complement the existing Gingko trees located at the center of the plaza. The existing turf grass within the central planter will be replaced with a drought tolerant groundcover.

Within the parking lot islands, new shade canopy trees will replace damaged, diseased or missing trees (refer to Arborist's recommendations for existing trees*). The new trees will be placed where planting islands are a minimum four-feet wide. Around the perimeters of the parking lots, existing planting will be supplemented in order to increase the visual screening of the parking lots and enhance the Campus Drive experience.

The campus entries at both ends of Campus Drive will be replaced with accent plantings of primarily drought tolerant plant species. Oak trees will be the featured plant material at the entries.

At the eastern entry of Campus Drive, new trees will be planted along the street's perimeter and within new medians. For a segment of the street nearest Sand Canyon Road, large vertical trees will mark the campus entry. All trees will be placed so that views up to the campus are not blocked. They will also be placed equidistantly to create a sense of formality and rhythym along the street.

As Campus Drive curves and becomes an east-west road, a variety of existing evergreen and deciduous trees and shrubs can be seen along its edges. At the road's most eastern end, a repeatedly planting of one tree species will add a sense of arrival and visual continuity along this section of campus.

At the western entry of Campus Drive, the character of the street is once again changed. The existing trees along this end of Campus Drive are primarily conifers (i.e., Pinus and Calocedrus species) and London Plane trees. This entry drive has an informal and naturalized character. Along the new median, oak trees will be planted to enhance this quality. The plantings along the roadsides will be selectively cleared and replanted to allow views from the road into the stormwater catchment area (see "Landscape Additions") at its western perimeter and views up to the campus.

For all new trees placed along Campus Drive, the center of trees will be placed a minimum of six feet away from the road edge or walkways.

SUSTAINABLE DESIGN AND MAINTENANCE

Although not shown on the diagram, sustainable design is an underlying principle for the campus landscape. The following guidelines will be incorporated into the design and ongoing maintenance of the campus landscape.

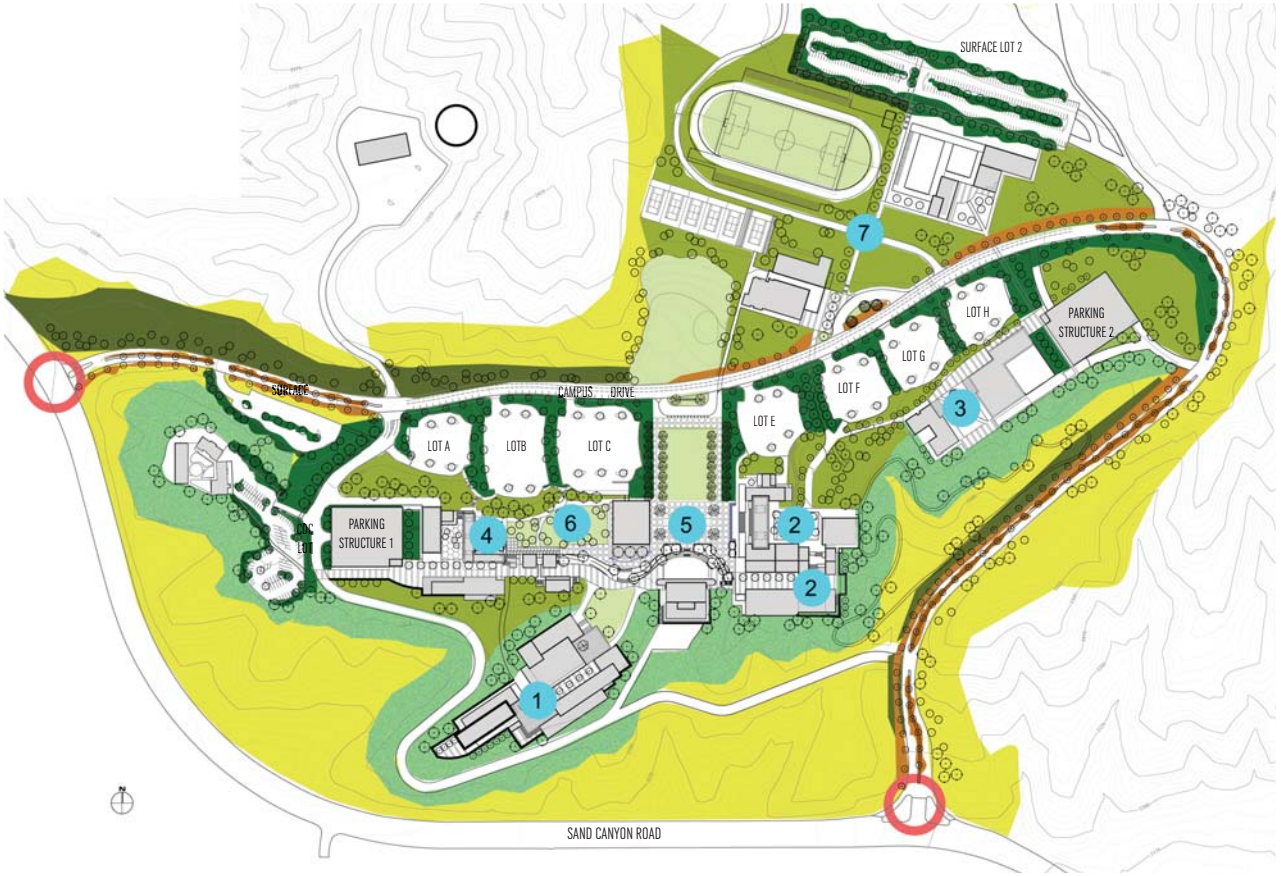
- Provide screening from winds
- Provide plantings that shade structures and outdoor spaces from the summer sun while providing for winter sun exposure
- Increase the biodiversity of plant species
- Consider alternatives for storm drainage management, such as detaining water on-site and allowing it to percolate through porous surfaces
- Reduce reliance on landscape chemical applications by incorporating such maintenance practices as composting or organic amendments, mulch applications, soil management, and recycling materials (such as plant trimmings, building and paving material).

DISPOSITION AND CARE OF EXISTING TREES

Removal and maintenance of remaining existing trees will be completed according to the Consulting Arborist's recommendations*.

* See Consulting Arborist's Report, "Tree Management & Preservation Study," by Greg Applegate, dated 8/24/05.

PLANTING ZONES



LEGEND

- CAMPUS DRIVE
- COASTAL SAGE COMMUNITY
- FUEL MODIFICATION ZONE
- RIPARIAN CORRIDOR
- TRANSITION AREA
- PARKING LOT
- LAWN AREA
- ENTRY GATEWAY
- # CLUSTER AREA: # AS BELOW
  1 HUMANITIES
  2 SCIENCES/MATH/BIT
  3 EMERGENCY SERVICES
  4 STUDENT SERVICES
  5 CENTRAL QUAD
  6 CENTRAL LAWN
  7 COMMUNITY RECREATIONAL

DIAGRAM 2: PLANTING ZONES

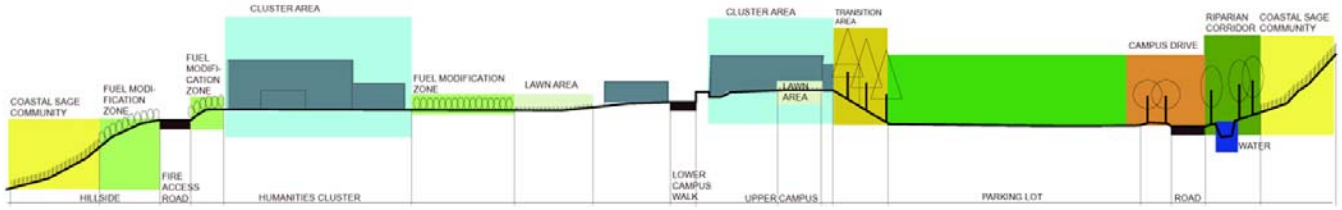


DIAGRAM 3: CROSS SECTION OF PLANTING ZONES

Diagram 2 (previous page) and Diagram 3 (this page) show the intent of the the planting zones for the campus. As the landscape zones move from the campus core to the natural hillsides, the design intent is to increase the use of drought tolerant plant material where possible. Over the long-term, the College can reduce its level of irrigation water needs from current campus-wide levels. Within the "fuel modification zones," the plant palette will meet the fire department's requirements for such areas.

PLANT MATERIAL GUIDELINES | PLANT LIST

			POTENTIAL PLANTING AREA							
Plant Type	Botanical Name	Common Name	Evergreen (E)/ Deciduous (D)	DR	CS	FM	RIP	TRANS	LOT	CLUS
TREE	ACACIA FARNESIANA	SWEET ACACIA	D			X				
TREE	ALBIZIA JULIBRISSIN	MIMOSA, SILK TREE	D					X		X
TREE	BRACHYCHITON ACERIFOLIUS	FLAME TREE	D			X		X	X	
TREE	CALOCEDRUS DECURRENS	INCENSE CEDAR	E					X		X
TREE	CEDRUS ATLANTICA GLAUCA	BLUE ATLAS CEDAR	E					X		X
TREE	CEDRUS DEODORA	DEODAR CEDAR	E					X		X
TREE	CERCIDIUM SP.	PALO VERDE SELECTIONS	D	X		X				
TREE	CERCIS SP.	REDBUD SELECTIONS	D			X	X			
TREE	CHILOPSIS LINEARIS	DESERT WILLOW	D						X	
TREE	CHITALPA TASHKENTENSIS	CHITALPA	D						X	X
TREE	CINNAMOMUM CAMPHORA	CAMPHOR TREE	E							X
TREE	CUPRESSUS SP.	CYPRESS SELECTIONS	E					X		X
TREE	GEIJERA PARVIFOLIA	AUSTRALIAN WILLOW	E					X	X	X
TREE	GINGKO BILOBA	MAIDENHAIR TREE	D							X
TREE	GLEDITSIA TRIACANTHOS	HONEY LOCUST	D	X						
TREE	KOELREUTERIA PANICULATA	GOLDENRAIN TREE	D						X	X
TREE	LAGERSTROEMIA INDICA	CRAPE MYRTLE	D							X

LEGEND
CLUS = CLUSTER AREAS
CS = COASTAL SAGE COMMUNITY
DR = DRIVEWAYS & CAMPUS ENTRIES
FM = FUEL MODIFICATION ZONE
GC = GROUNDCOVER
LOT = PARKING LOT PERIMETERS & ISLANDS
RIP = RIPARIAN CORRIDORS
TRANS = TRANSITION AREAS


CINNAMOMUM CAMPHORA


LAGERSTROEMIA INDICA


OLEA EUROPAEA


KOELREUTERIA PANICULATA


CEDRUS DEODORA

A recommended list of plants is provided in this section. The list also suggests the target areas for using the plant material. Other plant species can be added, but only after considering their compatibility with the design intent and palette (e.g., color, water use) for the specific area.

New trees shall have a minimum size of 24-inch box. Where the design of a plaza or outdoor space requires a significant tree presence, specimen-sized trees, 60-inch box minimum, shall be selected.

Certain tree species are recommended as theme or primary trees for specific areas. These trees are identified below:

- East Campus Drive: Poplar nigra 'Italica' (Lombardy Poplar) along a portion of the entry drive and median and Quercus sp. (Oak) for the balance of the street and median
- Central Campus Drive: Hybrid of Platanus acerifolia (London Plane) that is resistant to anthracnose, such as P. acerifolia 'Bloodgood'
- West Campus Drive: Quercus sp. (Oak) in median
- Central Quad: Cinnamomum camphora (Camphor) along the great lawn promenades. Specimen-sized Quercus sp. (Oak) in the large plaza.
- Humanities Cluster: Olea europaea, (Olive, fruitless varieties only), Cupressus sempervirens (Italian Cypress),
- Sciences/Math/BIT Cluster Display Garden: Quercus sp. (variety of Oak species)
- OE Quad: Cedrus Deodara (Deodar Cedar), Cedrus Atlantica (Atlas Cedar), Metasequoia glyptostroboides (Dawn Redwood, a rare deciduous conifer tree)
- Slope between Parking Lots A/B/C and the western campus: grove of Pinus sp. (pine selections)
- Central Lawn (between Student Center and SSA building): Retain existing tree species – Platanus acerifolia (London Plane).

PLANT MATERIAL GUIDELINES | PLANT LIST

			POTENTIAL PLANTING AREA							
Plant Type	Botanical Name	Common Name	Evergreen (E)/ Deciduous (D)	DR	CS	FM	RIP	TRANS	LOT	CLUS
TREE	LIRIODENDRON TULIPIFERA	TULIP TREE	D			X				
TREE	MAGNOLIA GRANDIFLORA	SOUTHERN MAGNOLIA	E							X
TREE	METASEQUOIA GLYPTOSTROBOIDES	DAWN REDWOOD	D							X
TREE	OLEA EUROPAEA	OLIVE	E							X
TREE	PARKINSONIA ACULEATA	MEXICAN PALO VERDE	D	X					X	
TREE	PINUS BRUTIA	CALABRIAN PINE	E					X		
TREE	PINUS CANARIENSIS	CANARY ISLAND PINE	E					X	X	
TREE	PINUS ELDARICA	MONDELL PINE	E					X		
TREE	PINUS HALEPENSIS	ALEPPO PINE	E					X		
TREE	PINUS PINEA	ITALIAN STONE PINE	E					X		X
TREE	PISTACIA CHINENSIS	CHINESE PISTACHE	D					X	X	X
TREE	PLATANUS ACERIFOLIA	LONDON PLANE	D	X						
TREE	PLATANUS RACEMOSA	CALIFORNIA SYCAMORE	D			X	X		X	X
TREE	POPULUS NIGRA 'ITALICA'	LOMBARDY POPLAR	D	X						
TREE	PRUNUS CAROLINIANA	CAROLINA LAUREL CHERRY	E				X			
TREE	PYRUS CALLERYANA	FLOWERING PEAR	D							X
TREE	QUERCUS SP.	OAK SELECTIONS	D/E	X		X	X		X	X
TREE	ULMUS PARVIFOLIA	CHINESE ELM	E/D					X		X
TREE	UMBELLULARIA CALIFORNICA	CALIFORNIA LAUREL	E			X				
PERENNIAL	ACHILLEA SP.	YARROW SELECTIONS	E		X			X		
SUCCULENT	AGAVE SP.	AGAVE SELECTIONS	E	X		X				X
SUCCULENT	ALOE SP.	ALOE SELECTIONS	E	X		X				X
PERENNIAL	ANIGOZANTHOS FLAVIDUS	KANGAROO PAW	E	X		X				X

LEGEND

CLUS = CLUSTER AREAS
CS = COASTAL SAGE COMMUNITY
DR = DRIVEWAYS & CAMPUS ENTRIES
FM = FUEL MODIFICATION ZONE
GC = GROUNDCOVER
LOT = PARKING LOT PERIMETERS & ISLANDS
RIP = RIPARIAN CORRIDORS
TRANS = TRANSITION AREAS


QUERCUS AGRIFOLIA


PINUS CANARIENSIS


PISTACIA CHINENSIS


MAGNOLIA GRANDIFLORA


ALOE AND OTHER SUCCULENT PLANTINGS


ANIGOZANTHOS HYBRID


CEANOTHUS SP.


PLATANUS RACEMOSA

PLANT MATERIAL GUIDELINES | PLANT LIST

			POTENTIAL PLANTING AREA							
Plant Type	Botanical Name	Common Name	Evergreen (E)/ Deciduous (D)	DR	CS	FM	RIP	TRANS	LOT	CLUS
SHRUB	ARBUTUS UNEDO	STRAWBERRY TREE	E			X		X		X
SHRUB	ARCTOSTAPHYLOS SP.	MANZANITA SELECTIONS	E			X	X			
PERENNIAL	ARTEMESIA SP.	SAGEBRUSH SELECTIONS	E		X	X				
SHRUB/GC	BACCHARIS PILULARIS	DWARF COYOTE BRUSH	E		X	X				
SHRUB	CAESALPINIA SP.	BUSH BIRD OF PARADISE	D/E							X
GC	CAREX SP.	SEDGE SELECTIONS	D/E				X			X
SHRUB/GC	CEANOTHUS SP.	WILD LILAC SELECTIONS	E			X	X		X	
SHRUB	CERCIS OCCIDENTALIS	WESTERN REDBUD	D			X	X			
SHRUB/GC	COPROSMA PUMILA	-	E			X				
PERENNIAL	COREOPSIS SP.	COREOPSIS	E		X	X				
SHRUB	COTONEASTER SP.	COTONEASTER SELECTIONS	D/E							X
SHRUB	DENDROMECON RIGIDA	BUSH POPPY	E			X				
PERENNIAL	DIETES SP.	FORTNIGHT LILY	E	X						X
VINE/GC	DISTICTIS BUCCINATORIA	BLOOD RED TRUMPET VINE	E			X				X
SHRUB	DODONAEA VISCOSA	HOPBUSH	E			X		X		
SUCCULENT	DUDLEYA SP.	DUDLEYA SELECTIONS	E	X		X			X	
SHRUB	ENCELIA SP.	-	D		X	X				
GC	ERIOGONUM PARVIFOLIUM	CALIFORNIA BUCKWHEAT	E		X					
GC	ESCHSCHOLZIA CALIFORNICA	CALIFORNIA POPPY	D			X				
SHRUB	FEIJOA SELLOWIANA	PINEAPPLE GUAVA	E			X				X
GC	FESTUCA SP.	FESTUCA SELECTIONS	E	X					X	X
GC	FRAGARIA CHLOENSIS	EVERGREEN STRAWBERRY	E			X				X
PERENNIAL	GAURA LINDHEIMERI	GAURA	E							X
PERENNIAL	HEMEROCALLIS SP.	DAYLILY SELECTIONS	D/E							X


CERCIS OCCIDENTALIS


COTONEASTER SP.


DIETES SP.


DISTICTIS BUCCINATORIA


DODONAEA VISCOSA


GAURA LINDHEIMERI


LANTANA SP.


LAVANDULA SP.

LEGEND
CLUS = CLUSTER AREAS
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PLANT MATERIAL GUIDELINES | PLANT LIST

			POTENTIAL PLANTING AREA							
Plant Type	Botanical Name	Common Name	Evergreen (E)/ Deciduous (D)	DR	CS	FM	RIP	TRANS	LOT	CLUS
SHRUB	HETEROMELES ARBUTIFOLIA	TOYON	E		X		X			
PERENNIAL	HEUCHERA SP.	CORAL BELLS	E				X	X		X
SHRUB/GC	JUNIPERUS SP.	JUNIPER SELECTIONS	E					X		
SHRUB/GC	LANTANA SP.	LANTANA SELECTIONS	E					X	X	X
PERENNIAL	LAVANDULA SP.	LAVENDER SELECTIONS	E					X		X
SHRUB	LEUCOPHYLLUM FRUTESCENS	TEXAS RANGER	E					X		X
GC	LEYMUS CONDENSATUS	GIANT WILD RYE				X		X		
PERENNIAL	LOTUS SP.	LOTUS SELECTIONS	E			X				
SHRUB	MAHONIA AQUIFOLIUM	OREGON GRAPE	E			X	X			
PERENNIAL	MIMULUS SP.	MONKEY FLOWER	E		X	X				
PERENNIAL	MISCANTHUS SINENSIS	EULALIA GRASS	D							
PERENNIAL	MUHLENBERGIA RIGENS	DEER GRASS	E						X	
SHRUB	MYRTUS COMMUNIS	MYRTLE	E							X
PERENNIAL	NASSELLA SP.	FEATHER OR NEEDLE GRASS	D/E			X		X		
CACTI	OPUNTIA LITTORALIS	PRICKLY PEAR	E	X						
PERENNIAL	PENSTEMON SP.	PENSTEMON SELECTIONS	E					X		X
PERENNIAL	PEROVSKIA 'BLUE SPIRE'	RUSSIAN SAGE	D							X
PERENNIAL	PHORMIUM SP.	FLAX SELECTIONS	E	X				X	X	X
SHRUB	PUNICA GRANATUM	POMEGRANATE	D			X				X
SHRUB	PYRACANTHA SP.	FIRETHORN	E					X		
SHRUB	RHAMNUS SP	-	D/E			X	X			
SHRUB	RIBES SPECIOSA	GOOSEBERRY	D/E		X	X				
PERENNIAL	ROMNEYA COUTIERI	MATILIJA POPPY	E		X	X				
SHRUB/ VINE	ROSA SP.	ROSE SELECTIONS	D					X		X

LEGEND
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MUHLENBERGIA RIGENS


PEROVSKIA 'BLUE SPIRE'


PHORMIUM SP.


PUNICA GRANATUM


ROMNEYA COUTIERI


OPUNTIA LITTORALIS


HEMEROCALLIS HYBRID


MIMULUS SP.

PLANT LIST

			POTENTIAL PLANTING AREA							
Plant Type	Botanical Name	Common Name	Evergreen (E)/ Deciduous (D)	DR	CS	FM	RIP	TRANS	LOT	CLUS
SHRUB/GC	ROSMARINUS SP.	ROSEMARY SELECTIONS	E					X		X
PERENNIAL	SALVIA SP.	SAGE SELECTIONS	E		X			X		X
PERENNIAL	SEDUM SP.	STONECROPS	E	X				X		X
PERENNIAL	STIPA TENUISSIMA	MEXICAN FEATHER GRASS	D							
VINE/GC	TRACHELOSPERMUM JASMINOIDES	STAR JASMINE	E			X		X	X	X
GC	VINCA SP.	PERIWINKLE SELECTIONS	E					X		
SUCCULENT	YUCCA SP.	YUCCA SELECTIONS	E	X		X				X

LEGEND

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ROSMARINUS SP.


SALVIA SP.


ROSA SP.


TRACHELOSPERMUM JASMINOIDES

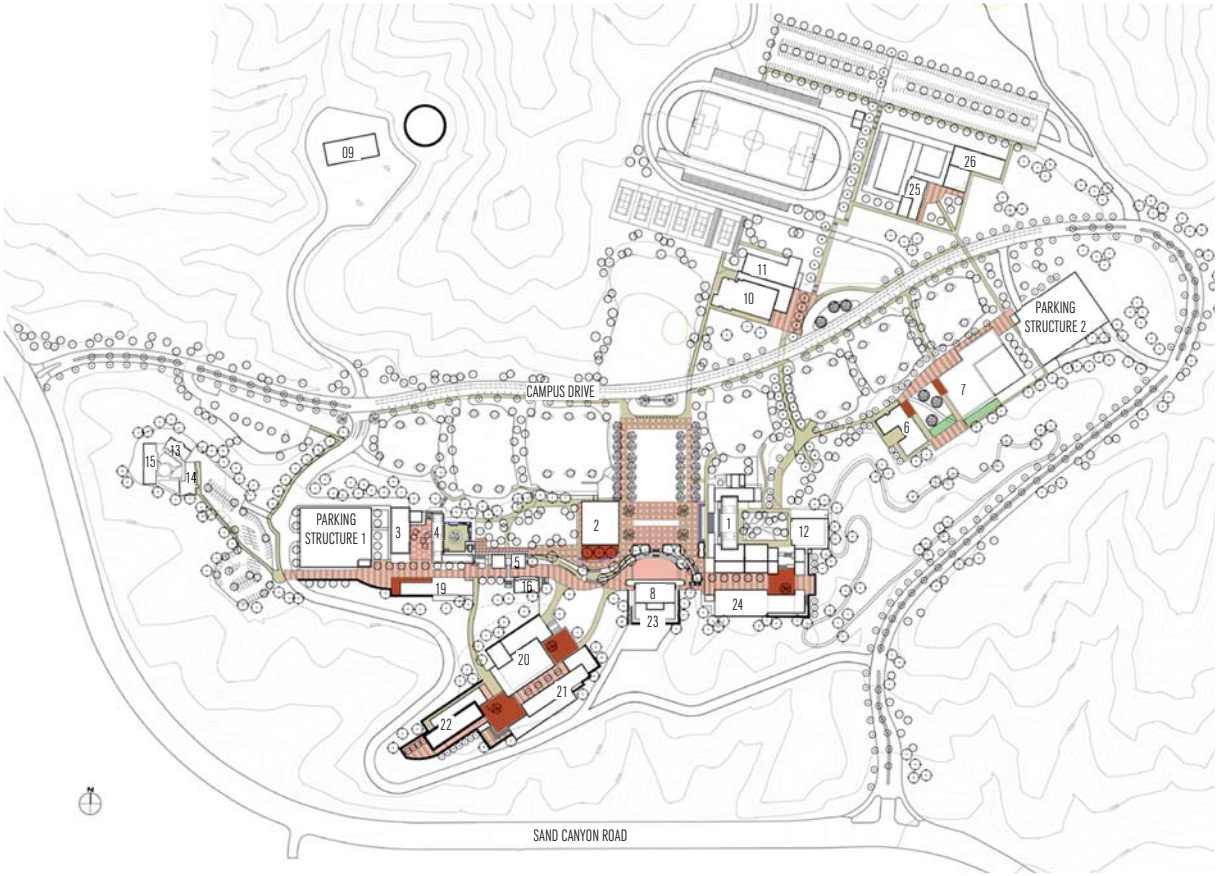

STIPA TENUISSIMA


YUCCA SP.


SEDUM NUSSBAUMERIANUM


VINCA MINOR

HARDSCAPE GUIDELINES



A focused selection of paving material can improve the campus functionality and aesthetics, and enhance the pedestrian environment. The Hardscape Plan (left) has multiple intentions:

- Clarify the hierarchy of pedestrian movement through campus
- Retain the historic character of the grid-patterned, colored concrete paving found within the campus core. The red and natural concrete pattern may require replacement due to wear. The red color should be matched as closely as possible to the historic color. (The original color may no longer be available.)
- Connect the historic core to the new Lower Campus by extending the natural concrete band into the design of its east-west pedestrian spine. Repeated bands of red and natural concrete will focus pedestrians' attention on this path and clarify direction through campus.

LEGEND

- COLORED CONCRETE
- NATURAL CONCRETE
- CONCRETE PAVERS
- REINFORCED GRASS PAVER SYSTEM

NO.	BUILDING NAME
1	LABORATORY CENTER
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	WELLNESS CENTER
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER EXPANSION
16	STUDENT SERVICES B
17	NOT USED
18	NOT USED
19	ADMINISTRATION/ STUDENT SERVICES
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	HUMANITIES 2
23	PERFORMING ARTS CENTER EXPANSION
24	SCIENCES
25	COMMUNITY RECREATIONAL FACILITY
26	COMMUNITY CENTER

HARDSCAPE GUIDELINES

COLORED CONCRETE GRID PATTERN AT HISTORIC CORE OF CRAFTON HILLS COLLEGE

COLORED PAVING BANDS: UC SAN DIEGO CAMPUS WALK

EXAMPLE OF PAVER UNIT: RED COLOR, BASKETWEAVE PATTERN

EXAMPLE OF PAVER IN RED COLOR, HERRINGBONE PATTERN

REINFORCED GRASS UNIT SYSTEM

"GRASSCRETE" STRUCTURAL SYSTEM

- Repeated use of the concrete paving bands in each of the campus clusters will clarify and unify the main pedestrian paths on campus.
- Emphasize major activity areas with the use of modular paver units. Paver patterns can vary according to the distinct quality desired for the space. Color selections, however, should stay within earthtone colors and primarily within the red and buff hues.

- Use reinforced grass unit systems (such as "grasscrete") at the OE Quad and along the OE fire lane. The system will visually extend the green expanse of OE Quad lawn while allowing the fire department and other emergency service vehicles to drive on the grass unit system.

SITE FURNISHING GUIDELINES

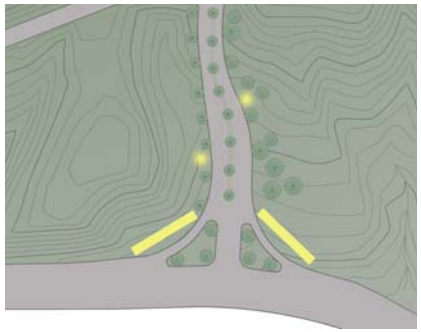
	Description	Location	Color/Finish
	CONCRETE BENCH BY WAUSAU TILE, MODEL TF5030	ALONG MAJOR PEDESTRIAN WALKWAYS CENTRAL QUAD	NATURAL CONCRETE
  	"CATENA" PEDESTAL TABLE: CUSTOM SIZE OF 60" DIA. TOP WITH CUSTOM PEDESTAL BASE AND UMBRELLA STAND HOLE "TRAVERSE" STACKABLE CHAIRS WITH PERFORATED METAL SEAT "EQUINOX" UMBRELLA, 8 FT. DIA. ALL PRODUCTS BY LANDSCAPE FORMS	STUDENT CENTER FOOD COURT STUDY AREAS WITHIN CAMPUS CLUSTERS	"CATENA" TABLE TOP: SOLID POWDERCOATED STEEL, COLOR: SILVER, OLIVE OR STONE "TRAVERSE" CHAIR, POWDERCOATED STEEL. COLOR: SEE TABLE TOP COLORS UMBRELLA: SUNBRELLA FABRIC TO MATCH TABLE
 	WASTE RECEPTACLES: METAL: "SCARBOROUGH" BY LANDSCAPE FORMS. 30-GAL. CAPACITY, SIDE OPENING CONCRETE: WAUSAU TILE, MODEL TF1224, 31-GAL. CAPACITY	LOCATE METAL RECEPTACLES WHERE METAL SITE FURNITURE IS LOCATED LOCATE CONCRETE RECEPTACLES WITH CONCRETE BENCHES	METAL RECEPTACLE: POWDERCOATED, COLOR: MATCH "CATENA" TABLES & "TRAVERSE" CHAIRS CONCRETE WASTE & RECYCLE RECEPTACLES. COLOR: NATURAL CONCRETE
 	BUILT-IN SEAT WALLS AND TABLES	AT "THE LIVING WALL" OVERLOOK WALLS AS PART OF RAISED PLANTERS	COLOR: MATCH CONCRETE WALLS

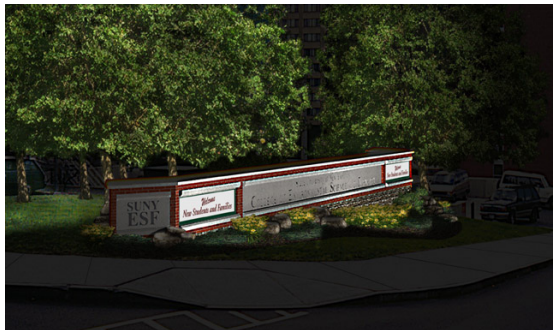
LIGHTING

A	CAMPUS ENTRY LIGHTING
B	STREET LIGHTING PARKING LOT LIGHTING
C	CAMPUS LIGHTING BOLLARDS POLE TOP FIXTURES STEP LIGHTS
D	MOONLIGHTING
E	BUILDING FACADE LIGHTING
F	BUILDING ENTRY LIGHTING

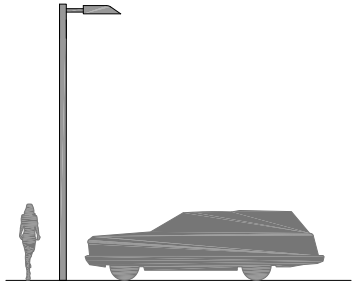
LIGHTING

A CAMPUS ENTRY LIGHTING



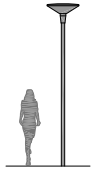


B STREET/ PARKING LOT LIGHTING



LIGHTING

C CAMPUS LIGHTING



LIGHTING

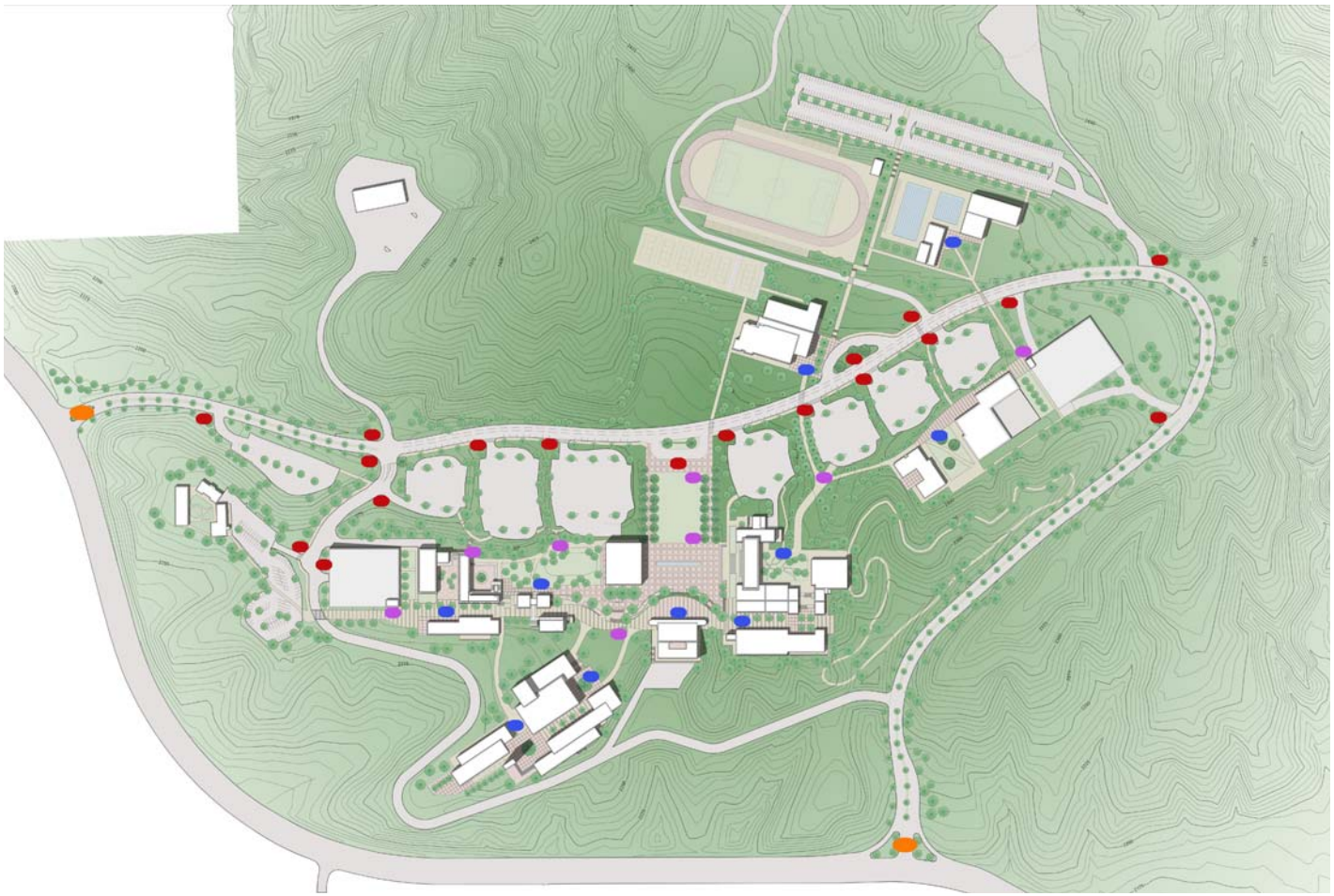
D MOONLIGHTING

E BUILDING FACADE LIGHTING

LIGHTING

F BUILDING ENTRY LIGHTING

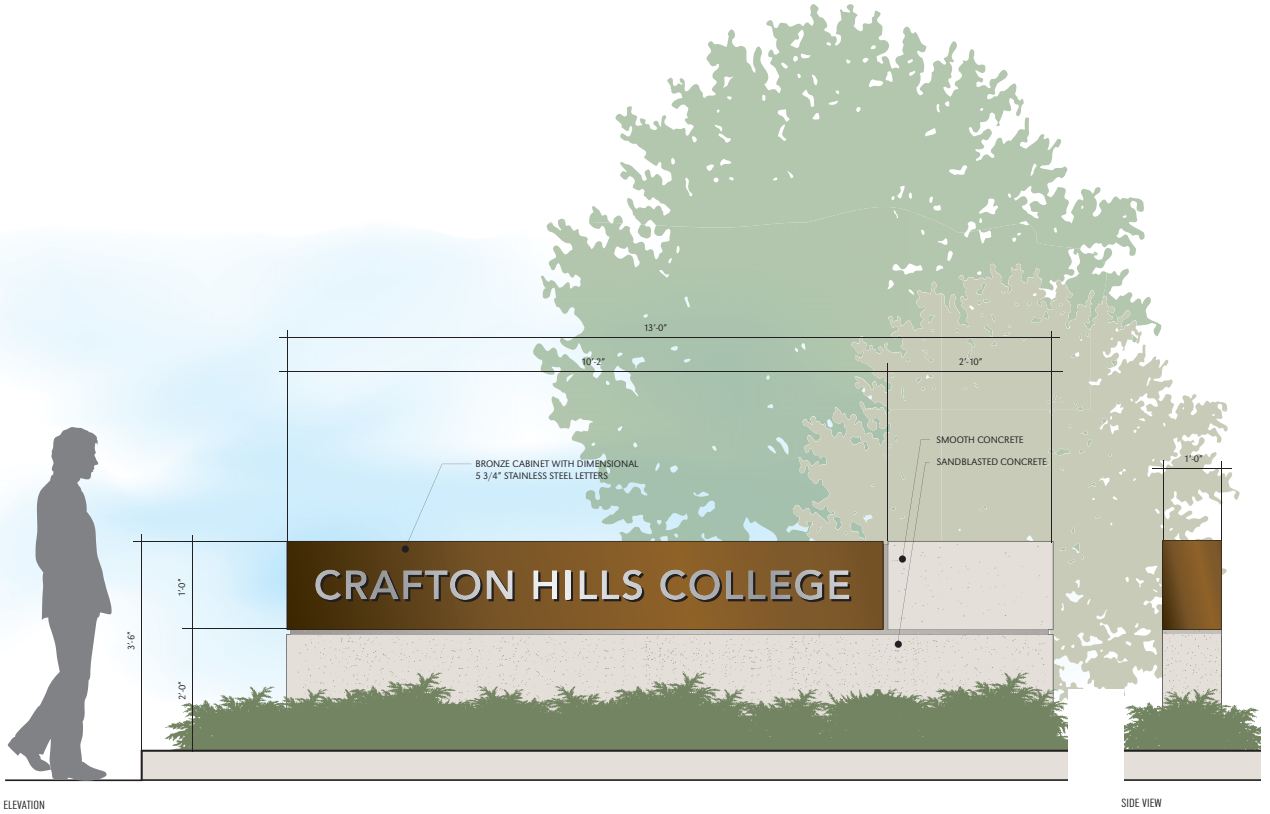
SIGNAGE



- CAMPUS ID MONUMENT
- PARKING LOT ID SIGN
- CAMPUS DIRECTORY/ DIRECTIONAL SIGN
- CLUSTER DIRECTORY SIGN

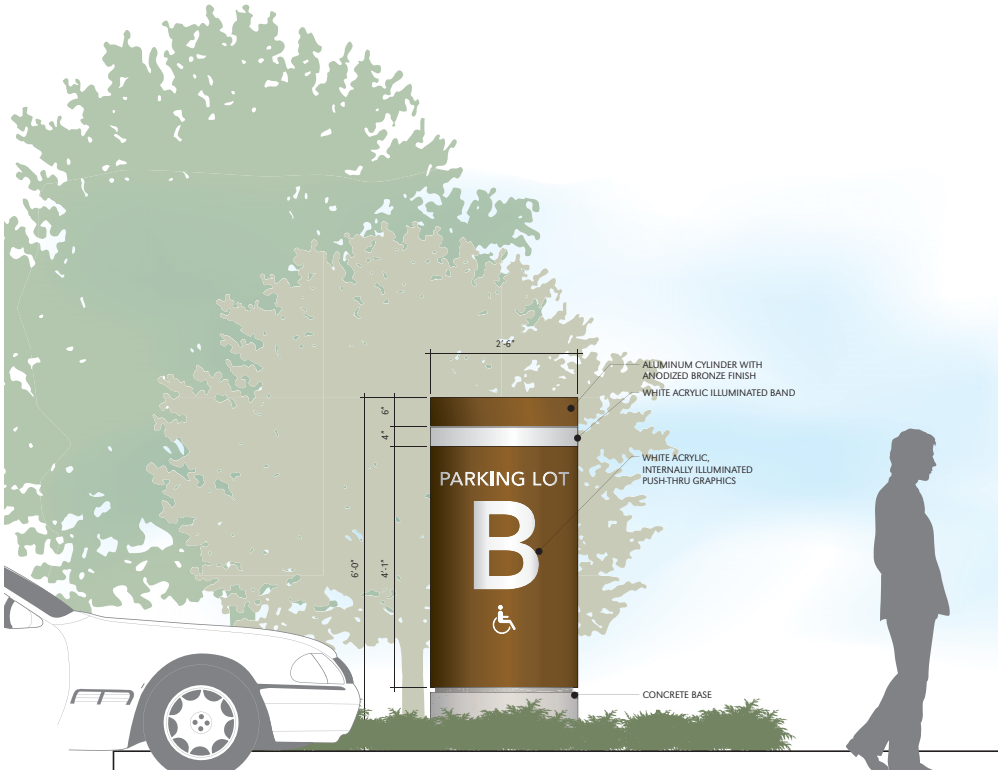
SIGNAGE

CAMPUS ID MONUMENT



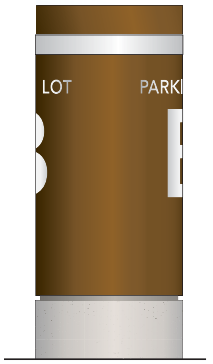
SIGNAGE

PARKING LOT ID SIGN



ELEVATION

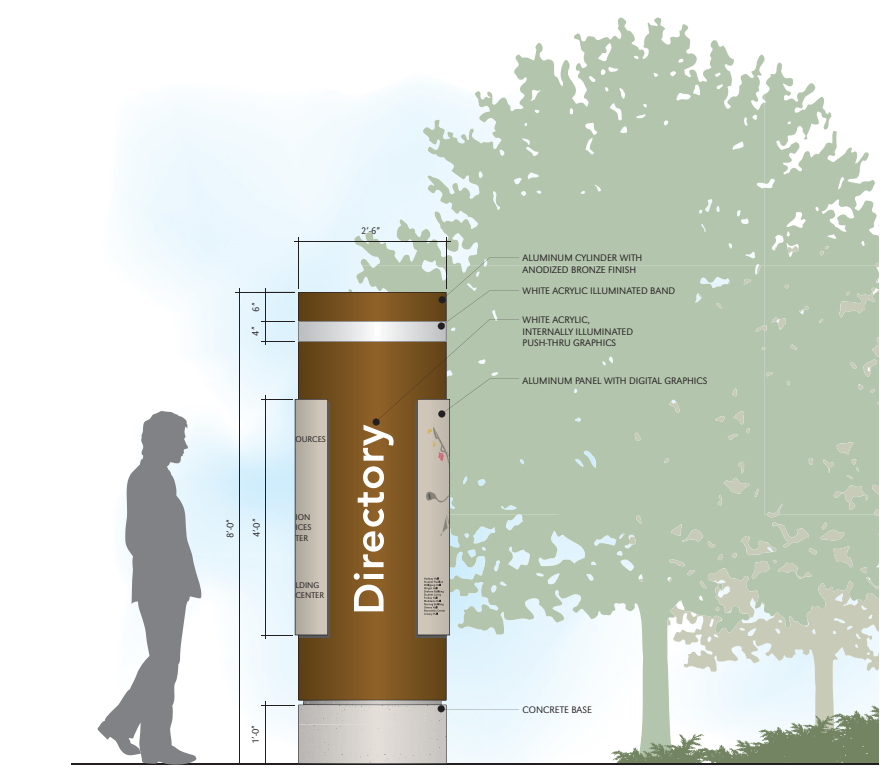
PLAN VIEW



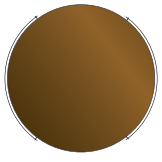
SIDE VIEW

SIGNAGE

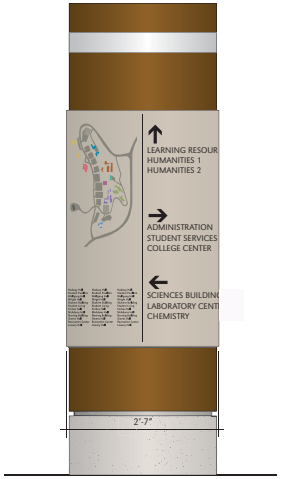
CAMPUS DIRECTORY/ DIRECTIONAL SIGN



ELEVATION



PLAN VIEW

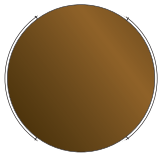


SIDE VIEW

SIGNAGE

CLUSTER DIRECTORY SIGN

ELEVATION

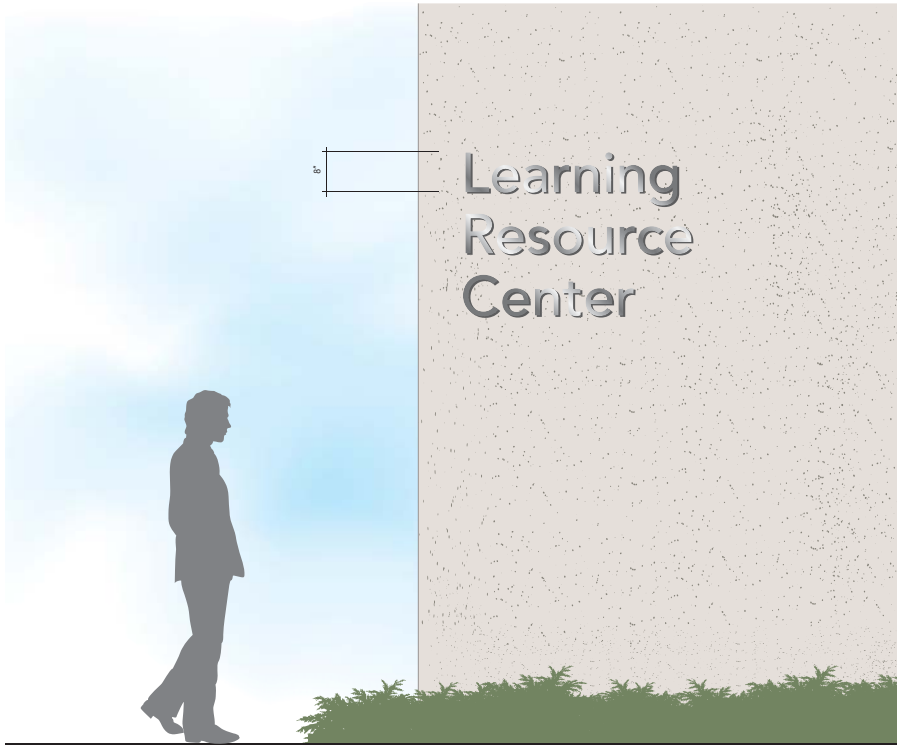


PLAN VIEW

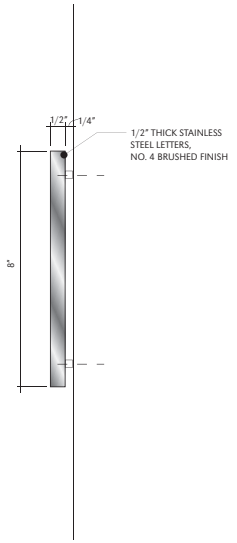
SIDE VIEW

SIGNAGE

BUILDING IDENTIFICATION



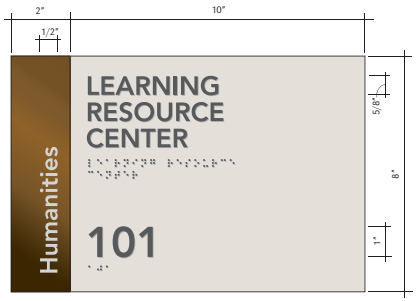
ELEVATION



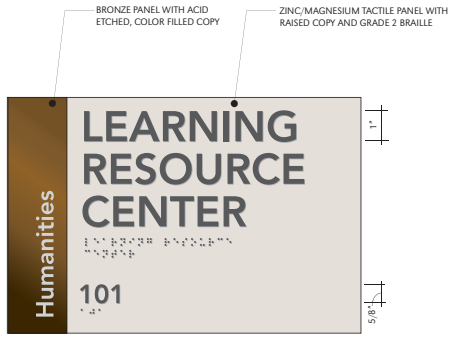
SIDE DETAIL

SIGNAGE

ROOM IDENTIFICATION SIGNS



INTERIOR SIGN

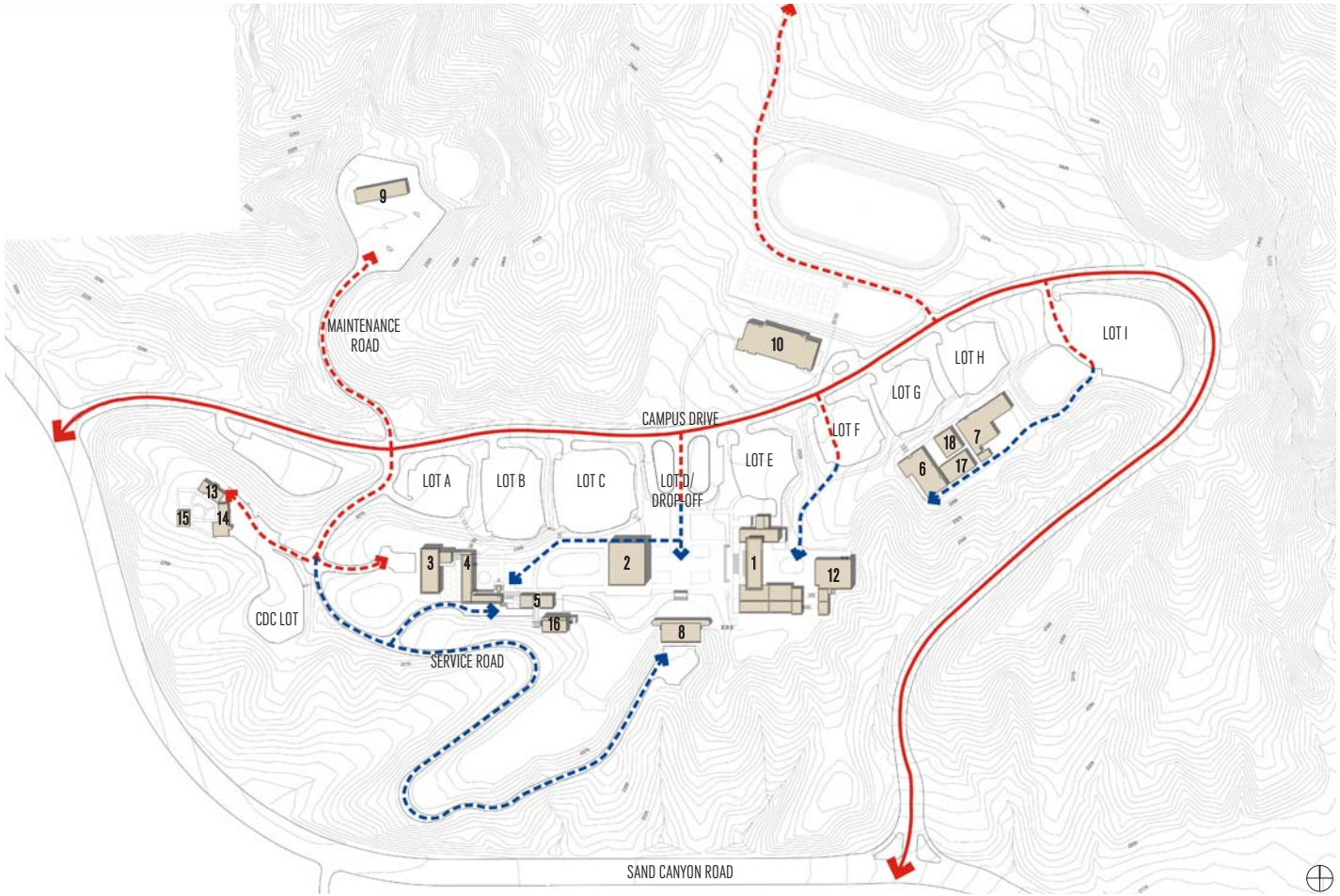


EXTERIOR SIGN

ELEVATION

5 | SITE INFRASTRUCTURE

FIRE ACCESS | EXISTING



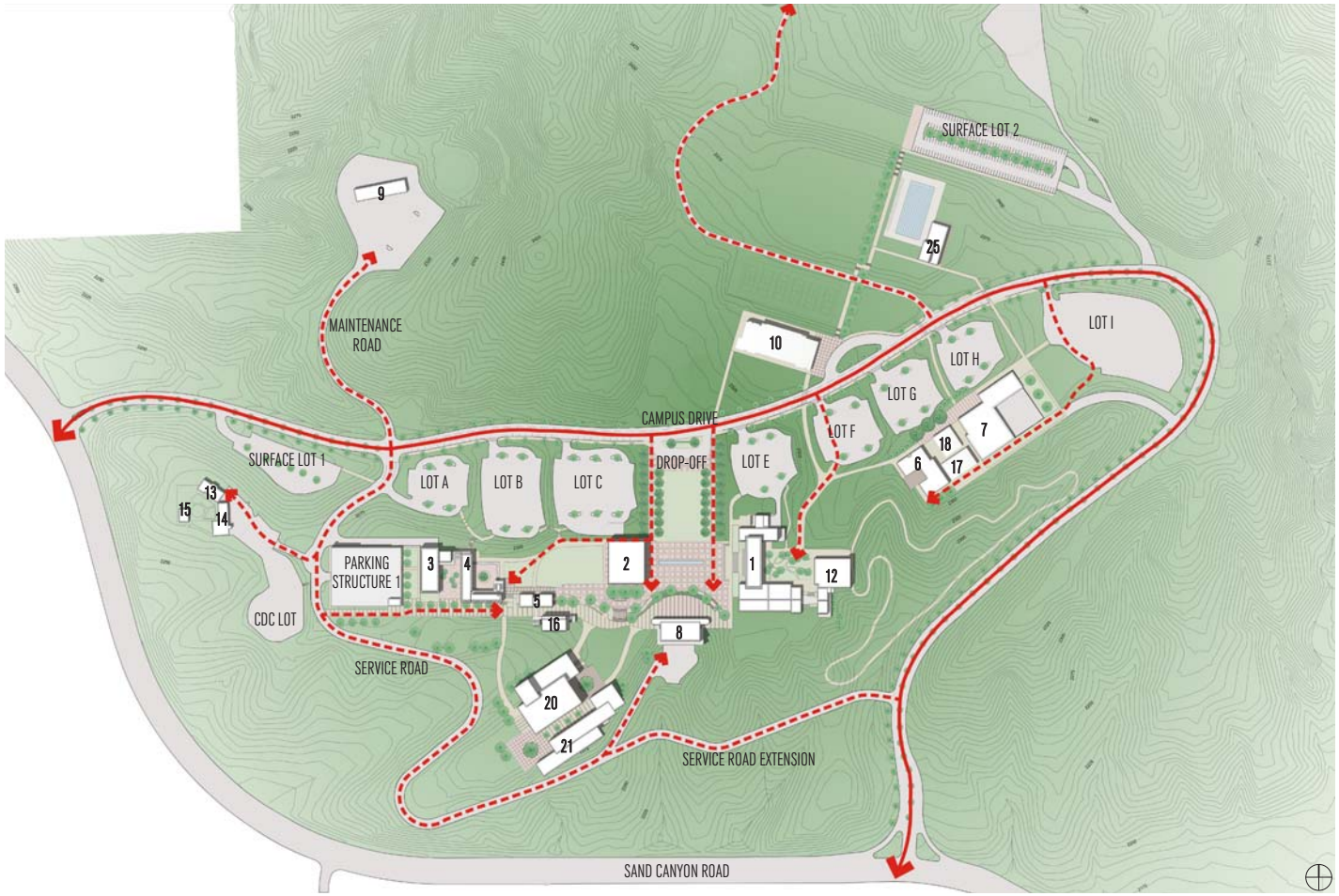
The main acess route along Campus Drive is fully code compliant and easily navigable. There are secondary access routes into portions of campus, but not all of these comply with current code standards.

LEGEND

- MAIN ACCESS ROUTE
- SECONDARY ACCESS ROUTE: COMPLIANT
- SECONDARY ACCESS ROUTE: NON-COMPLIANT

NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	LEARNING RESOURCE CENTER/ LIBRARY
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	CLASSROOM BUILDING
6	OCCUPATIONAL EDUCATION 1
7	OCCUPATIONAL EDUCATION 2
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY/ HEALTH SCIENCES
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	BOOKSTORE
18	CLASSROOM AT BOOKSTORE

FIRE ACCESS | 2012



Emergency access routes throughout the campus have been identified. Existing routes will be improved and new ones developed that conform to the requirements of the California Building Code. Each proposed construction project must be approved and reviewed individually for Fire Department site access and hydrant compliance.

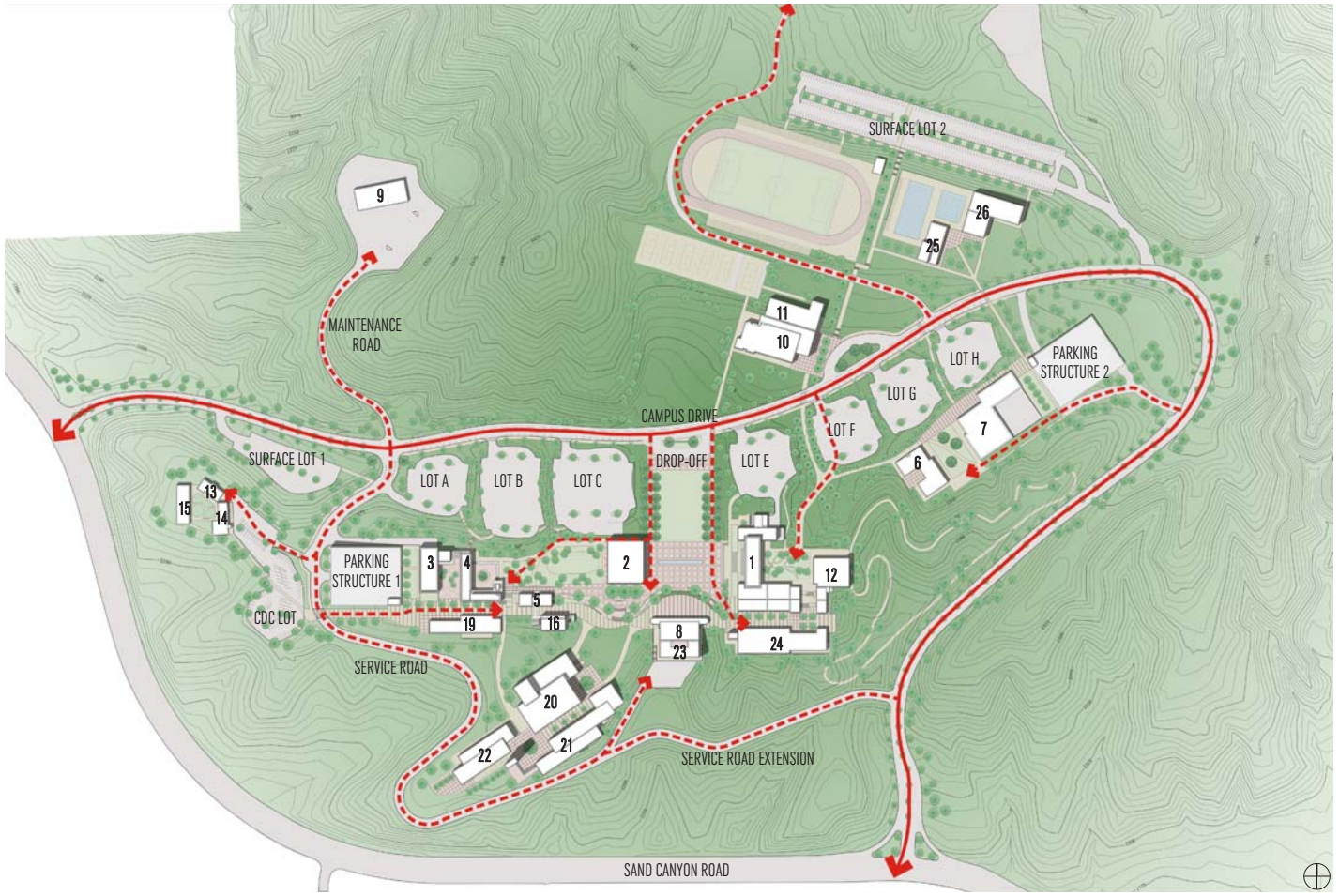
Emergency access roads will also serve as secondary service access routes through the campus.

LEGEND

- MAIN ACCESS ROUTE
- SECONDARY ACCESS ROUTE: COMPLIANT
- SECONDARY ACCESS ROUTE: NON-COMPLIANT

NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	CLASSROOMS
18	CLASSROOMS
19	NOT USED
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	NOT USED
23	NOT USED
24	NOT USED
25	COMMUNITY RECREATIONAL FACILITY
26	NOT USED

FIRE ACCESS | 2025



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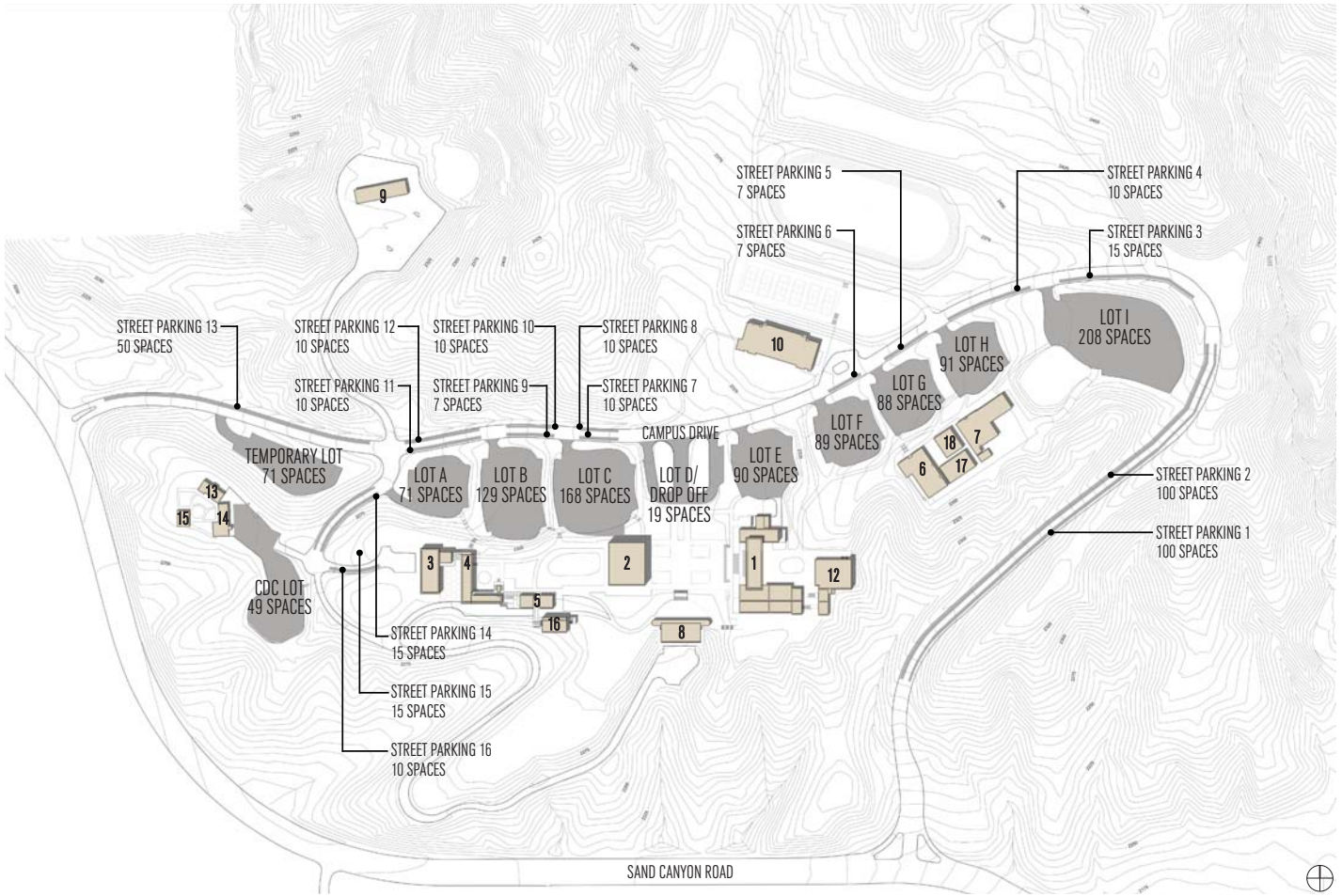
LEGEND

- MAIN ACCESS ROUTE
- SECONDARY ACCESS ROUTE: COMPLIANT
- SECONDARY ACCESS ROUTE: NON-COMPLIANT

NO.	BUILDING NAME
1	LABORATORY CENTER
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	WELLNESS CENTER
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER EXPANSION
16	STUDENT SERVICES B
17	DEMOLISHED - CLASSROOMS
18	DEMOLISHED - CLASSROOMS
19	ADMINISTRATION/ STUDENT SERVICES
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	HUMANITIES 2
23	PERFORMING ARTS CENTER EXPANSION
24	SCIENCES
25	COMMUNITY RECREATIONAL FACILITY
26	COMMUNITY CENTER

PARKING | EXISTING



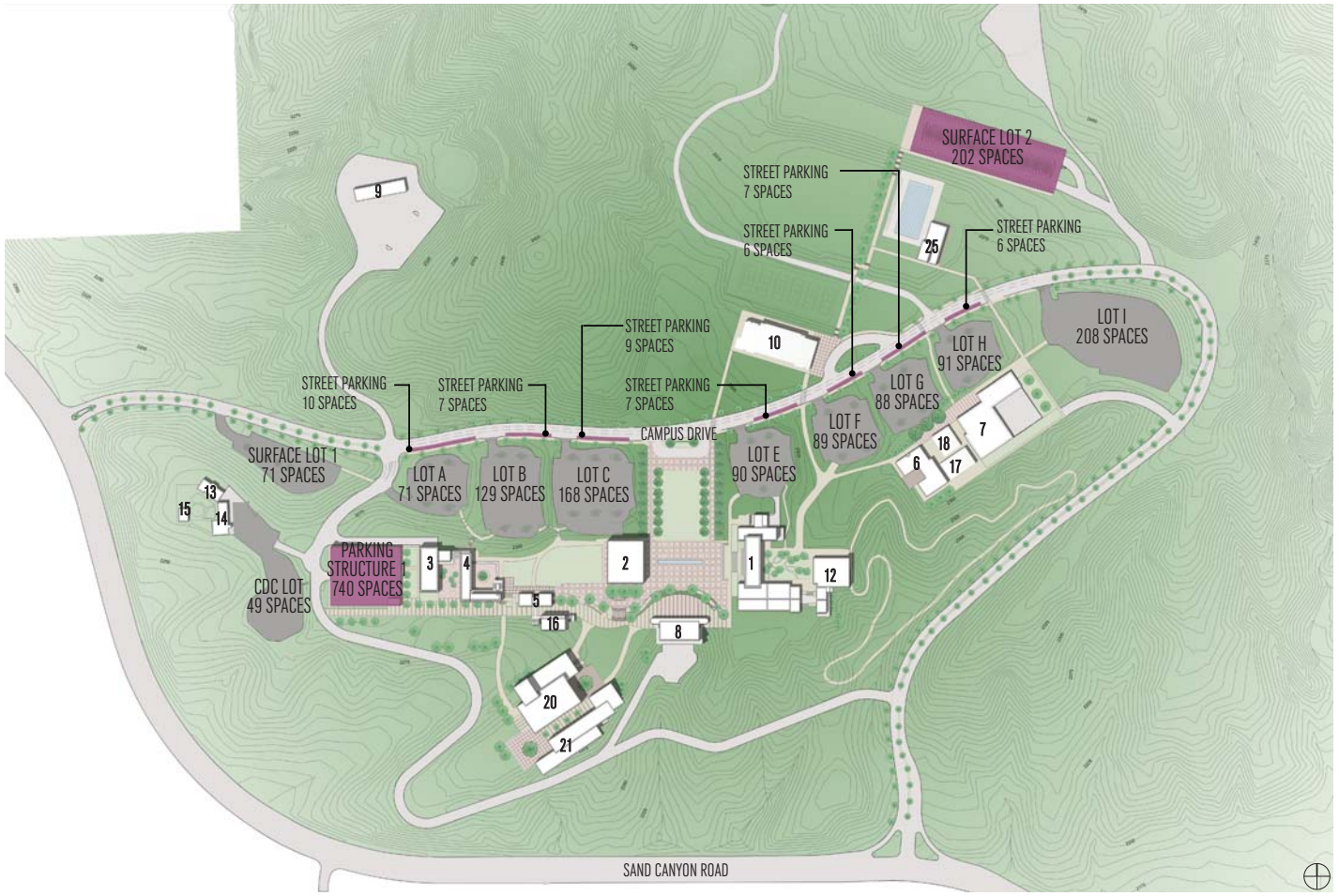
EXISTING: 1,459 SPACES

LEGEND

- EXISTING PARKING
- NEW/ RENOVATED PARKING

NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	LEARNING RESOURCE CENTER/ LIBRARY
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	CLASSROOM BUILDING
6	OCCUPATIONAL EDUCATION 1
7	OCCUPATIONAL EDUCATION 2
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY/ HEALTH SCIENCES
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	BOOKSTORE
18	CLASSROOM AT BOOKSTORE

PARKING | 2012



EXISTING:	1,054 SPACES
NEW/RENOVATED:	994 SPACES
TOTAL:	2,048 SPACES

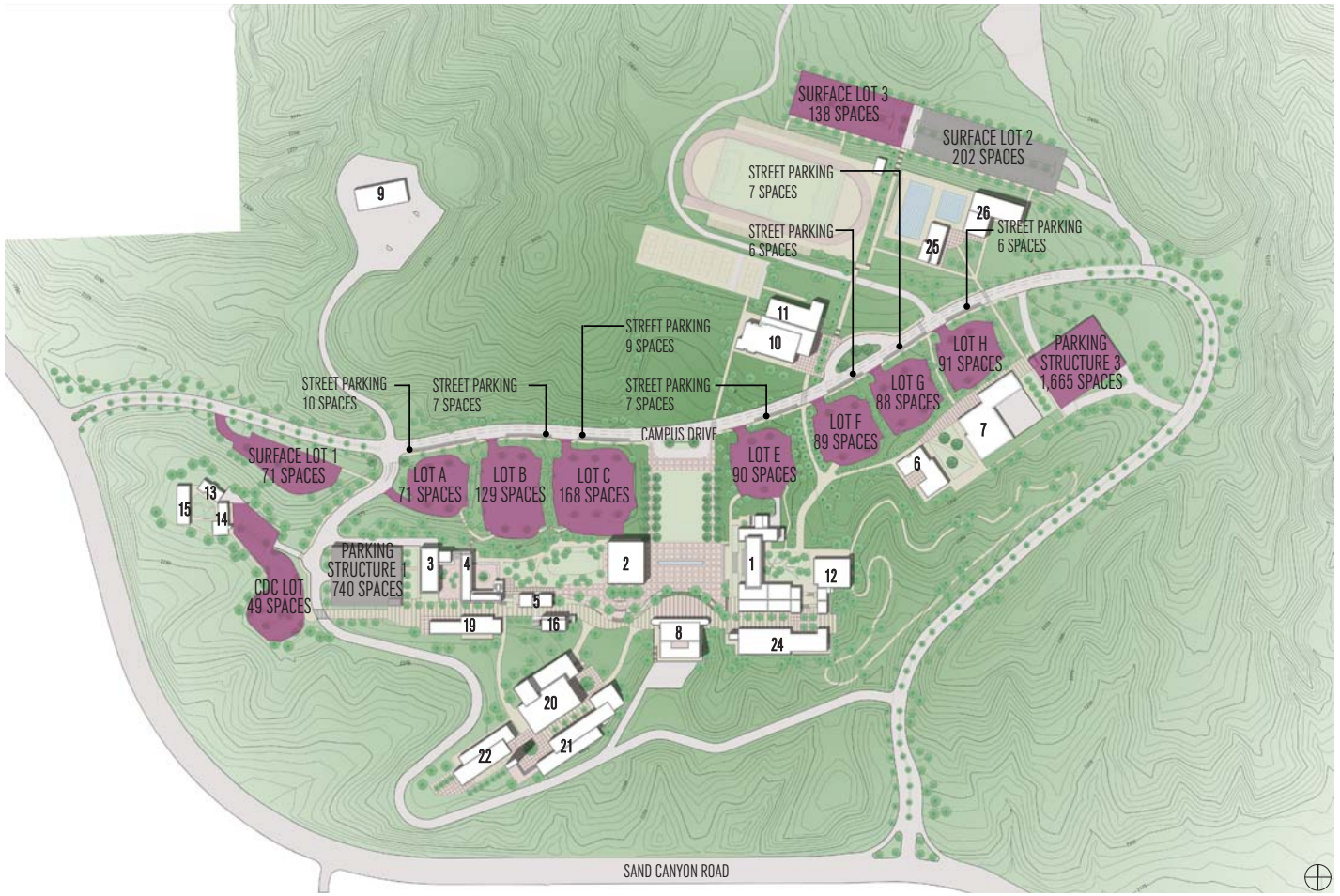
LEGEND

EXISTING PARKING

NEW/ RENOVATED PARKING

NO.	BUILDING NAME
1	LABORATORY/ ADMINISTRATION
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	NOT USED
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER 3
16	STUDENT SERVICES B
17	CLASSROOMS
18	CLASSROOMS
19	NOT USED
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	NOT USED
23	NOT USED
24	NOT USED
25	COMMUNITY RECREATIONAL FACILITY
26	NOT USED

PARKING | 2025



EXISTING:	994 SPACES
NEW/RENOVATED:	1,665 SPACES
TOTAL:	3,643 SPACES

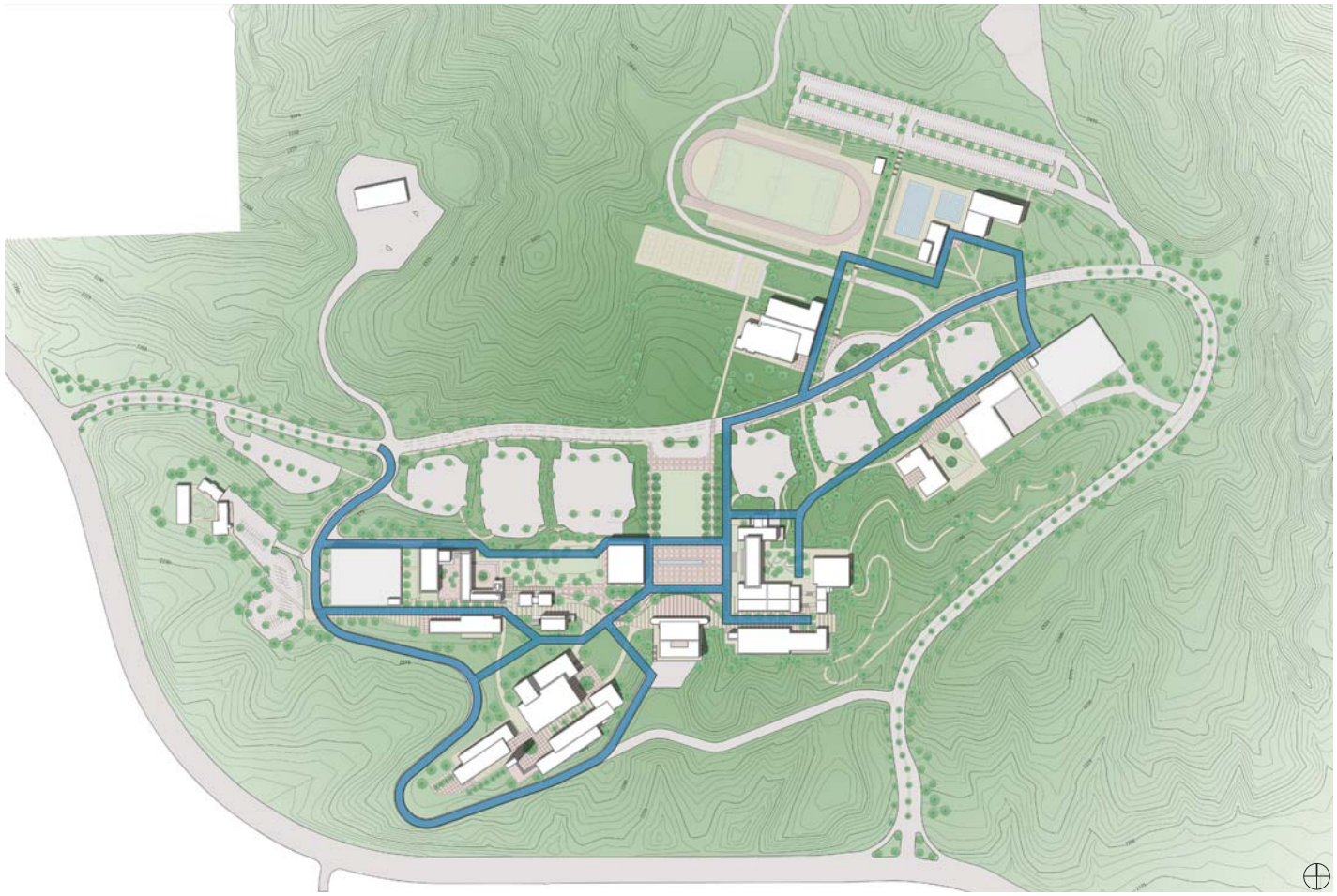
LEGEND

EXISTING PARKING

NEW/ RENOVATED PARKING

NO.	BUILDING NAME
1	LABORATORY CENTER
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	WELLNESS CENTER
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER EXPANSION
16	STUDENT SERVICES B
17	DEMOLISHED - CLASSROOMS
18	DEMOLISHED - CLASSROOMS
19	ADMINISTRATION/ STUDENT SERVICES
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	HUMANITIES 2
23	PERFORMING ARTS CENTER EXPANSION
24	SCIENCES
25	COMMUNITY RECREATIONAL FACILITY
26	COMMUNITY CENTER

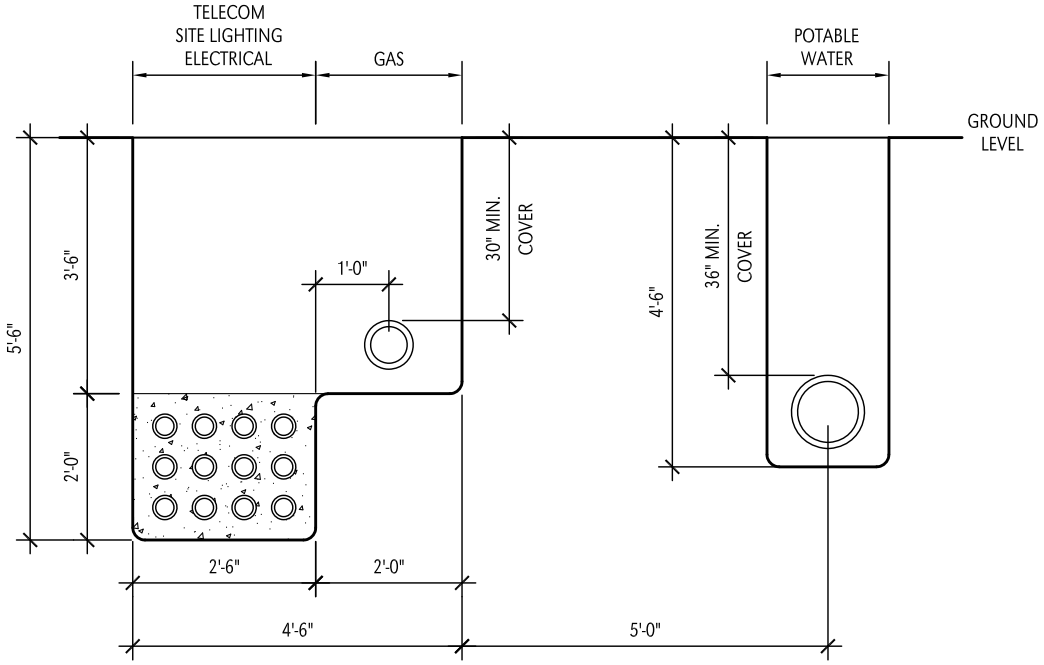
UTILITIES OVERVIEW | UTILITIES ROUTING



A series of utilities corridors and looping systems have been developed, expanding existing pathways and establishing new routes through campus. All major utilities constructed on campus will be located within these corridors.

NO.	BUILDING NAME
1	LABORATORY CENTER
2	STUDENT CENTER
3	COLLEGE CENTER
4	STUDENT SERVICES A
5	STUDENT SERVICES C
6	OCCUPATIONAL EDUCATION 1
7	EMERGENCY SERVICES
8	PERFORMING ARTS CENTER
9	MAINTENANCE & OPERATIONS
10	GYMNASIUM
11	WELLNESS CENTER
12	CHEMISTRY
13	CHILD DEVELOPMENT CENTER 1
14	CHILD DEVELOPMENT CENTER 2
15	CHILD DEVELOPMENT CENTER EXPANSION
16	STUDENT SERVICES B
17	DEMOLISHED - CLASSROOMS
18	DEMOLISHED - CLASSROOMS
19	ADMINISTRATION/ STUDENT SERVICES
20	LEARNING RESOURCE CENTER
21	HUMANITIES 1
22	HUMANITIES 2
23	PERFORMING ARTS CENTER EXPANSION
24	SCIENCES
25	COMMUNITY RECREATIONAL FACILITY
26	COMMUNITY CENTER

UTILITIES OVERVIEW | UTILITY TRENCH



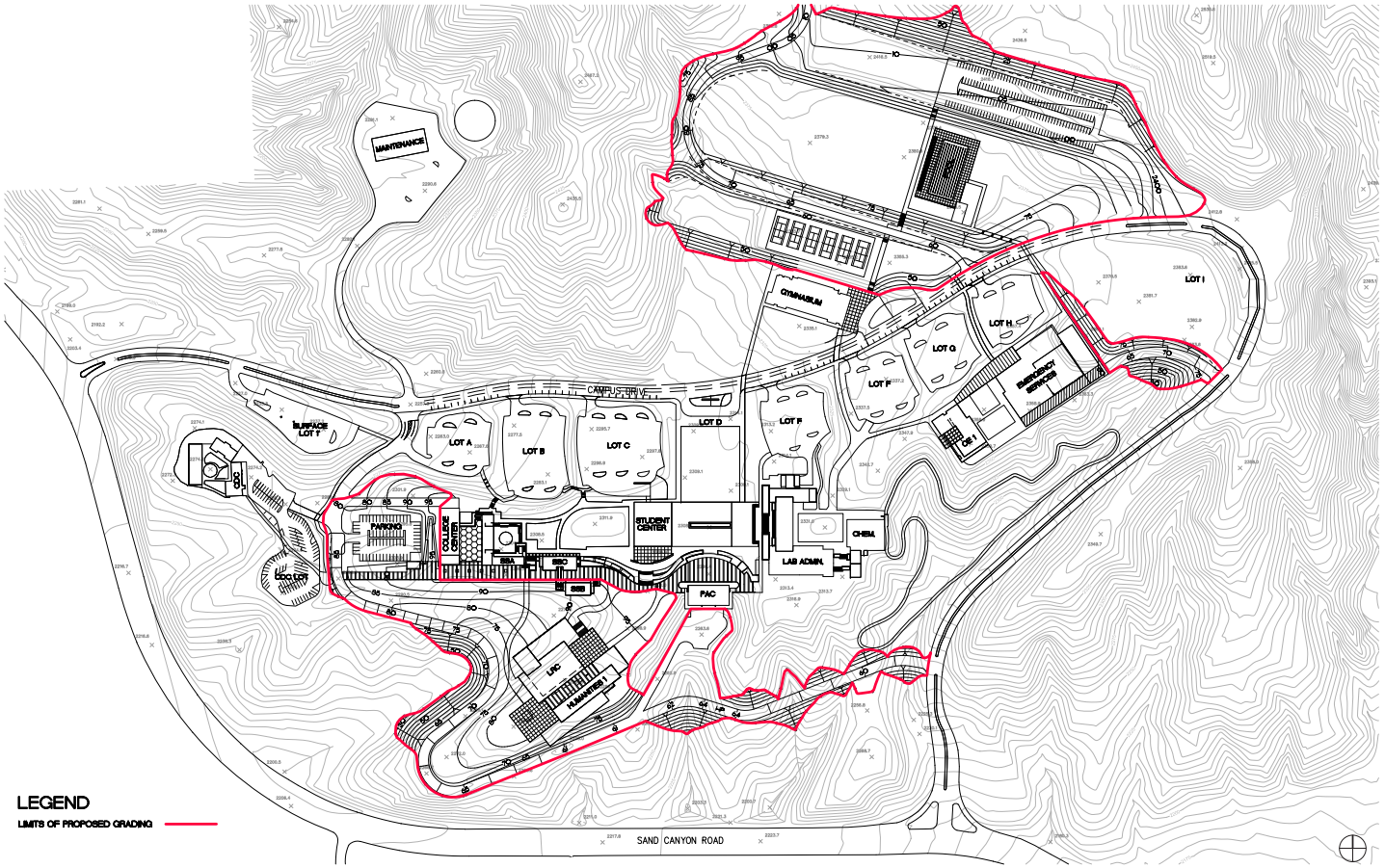
The trench diagram shows the layout and adjacencies of various utilities, as well as the minimum requirements for their ground cover and separation from one another.

NOT TO SCALE

SITE GRADING | EXISTING

The existing grading diagram shows the campus topography as it is today.

SITE GRADING | 2012



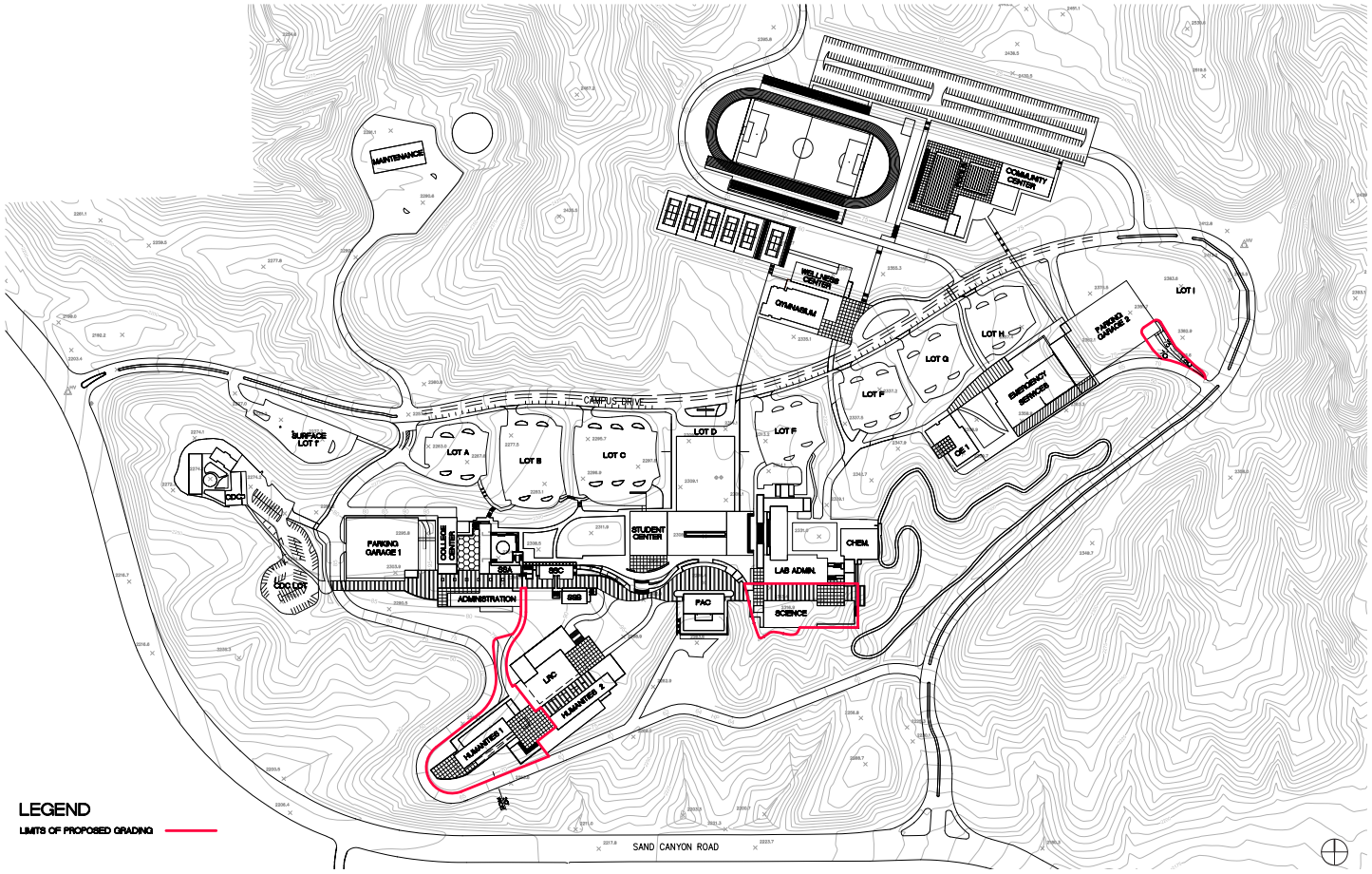
Site grading proposed with the 2012 Master Plan includes the grading of the surface parking lot at the location of Parking Structure 1, the mass grading of the Learning Resource Center/ Humanities site, the development of the southerly perimeter road alignment, the grading of the rear access road for the Occupational Education Building 2, and the mass grading for the Aquatics Center and future athletic fields.

Grading for the surface parking lot at the location of future Parking Structure 1 generates export material that will be utilized in grading the building pad for the proposed Learning Resource Center/Humanities site. Grading of the Learning Resource Center/Humanities site requires approximately 65,000 cubic yards of material to be excavated and placed in embankment. The extension of the southerly perimeter road east of the Performing Arts parking lot requires approximately 6,000 cubic yards of excavation and embankment.

The grading of the access road to the proposed Occupational Educational Building 2 requires approximately 10,000 cubic feet of excavation and embankment.

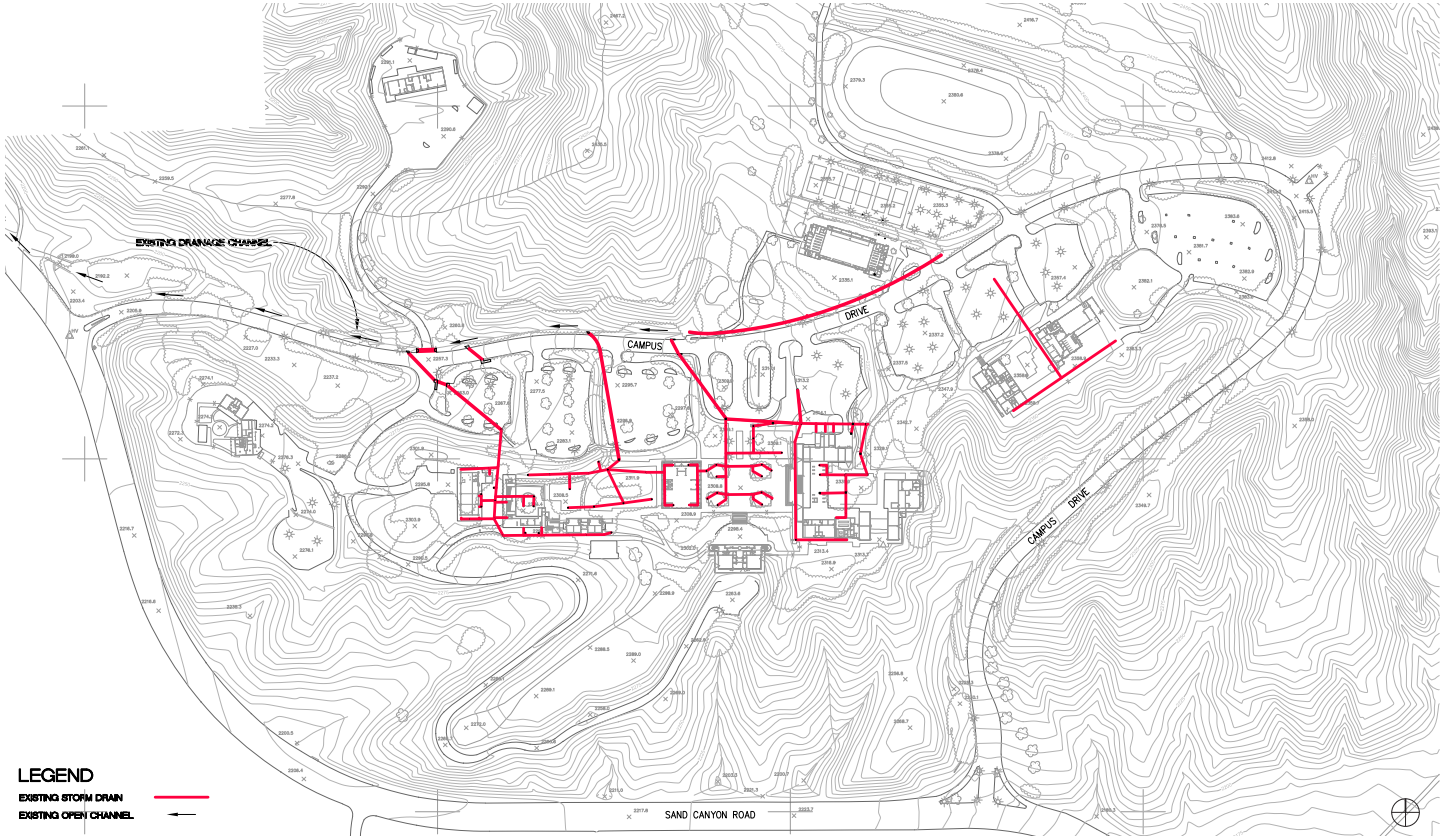
The grading for the Aquatics Center generates substantially greater quantities of excavation than embankment. In order to balance the grading of this area, the entire Aquatics Center and future athletic field and tennis court site will be graded simultaneously. Grading of this site includes approximately 120,000 cubic yards of excavation and embankment. Grading of the site will include the realignment of the access road, easement, and water transmission main for the City of Redlands reservoir located northeasterly of the proposed Aquatics Center.

SITE GRADING | 2025



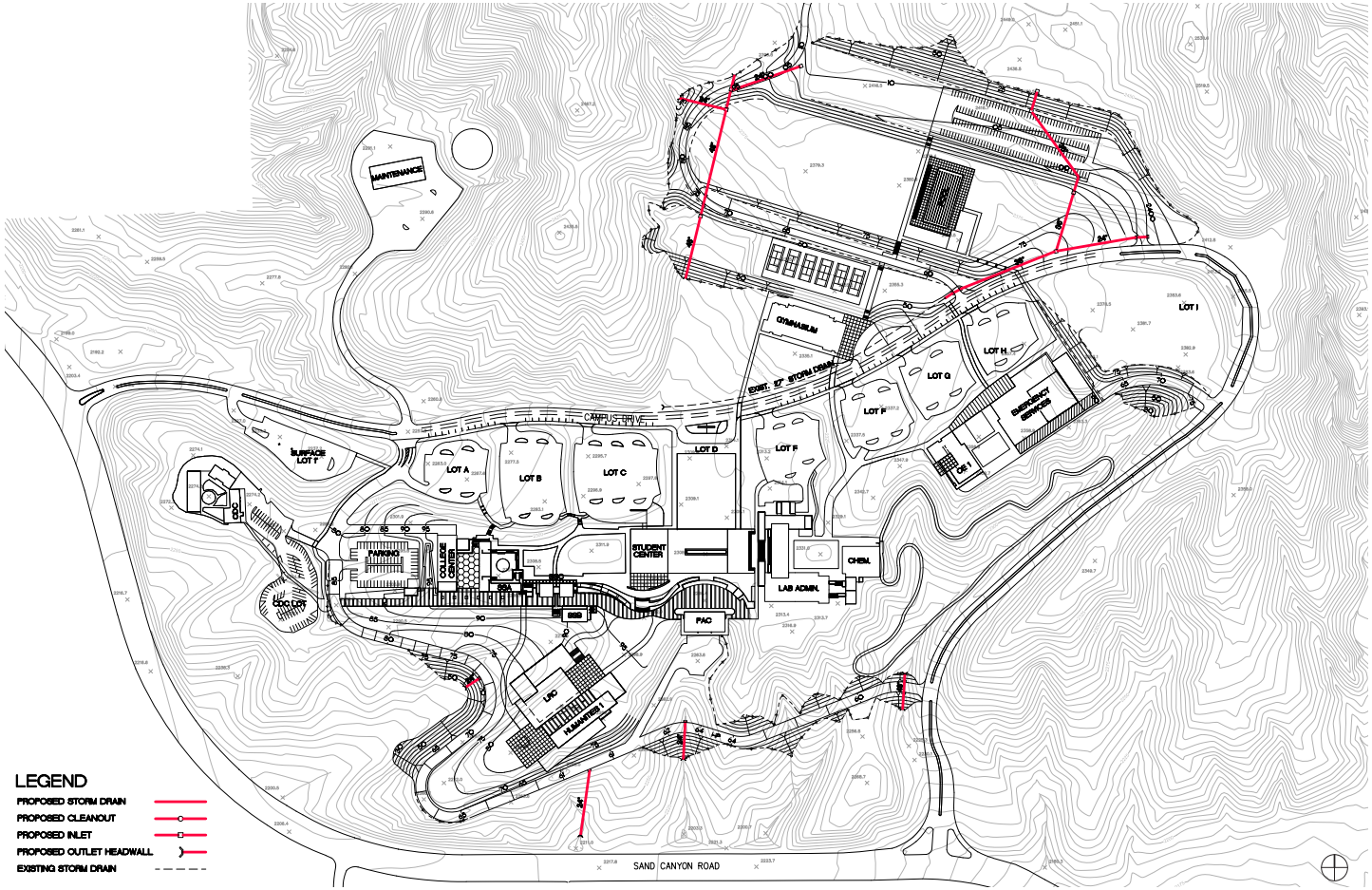
Grading for the majority of the proposed 2025 Master Plan sites is completed in the 2012 Master Plan. The only significant site grading with the 2025 plan will be pad excavation for the proposed Science Building. Excavation of the building pad should balance with the embankment behind the proposed site retaining walls. Grading for the site will be approximately 5,000 cubic yards of excavation and embankment.

STORM DRAINAGE | EXISTING



Site storm drainage consists of a system of surface flow to catch basins and inlets, conveyance through small diameter pipes, connecting to larger diameter storm drains and discharging to an open channel located along the northerly side of Campus Drive. The open channel discharges to a retention pond located in the vicinity of Campus Drive and Sand Canyon Road. Drainage flows from the pond, offsite in a natural swale running northwesterly along Sand Canyon Road.

STORM DRAINAGE | 2012

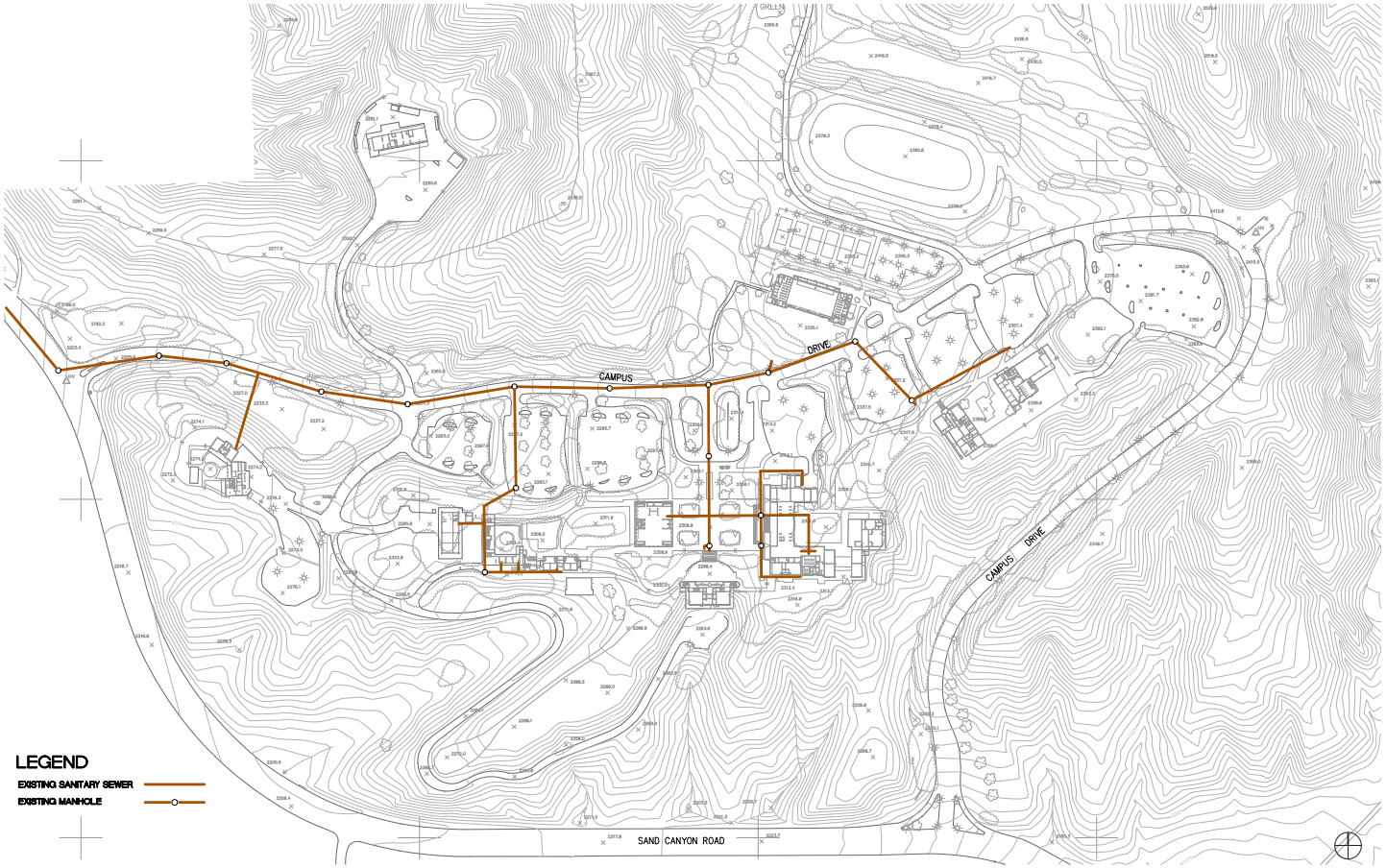


The grading of the Aquatics Complex will necessitate the development of a storm drain system to convey surface drainage from the northeasterly portion of campus through the proposed site development, discharging to the existing drainage swale located along the northerly side of campus Drive.

The development of the Learning Resource Center/Humanities Complex in conjunction with the perimeter road will require the installation of catch basins, slope drains, and culverts.

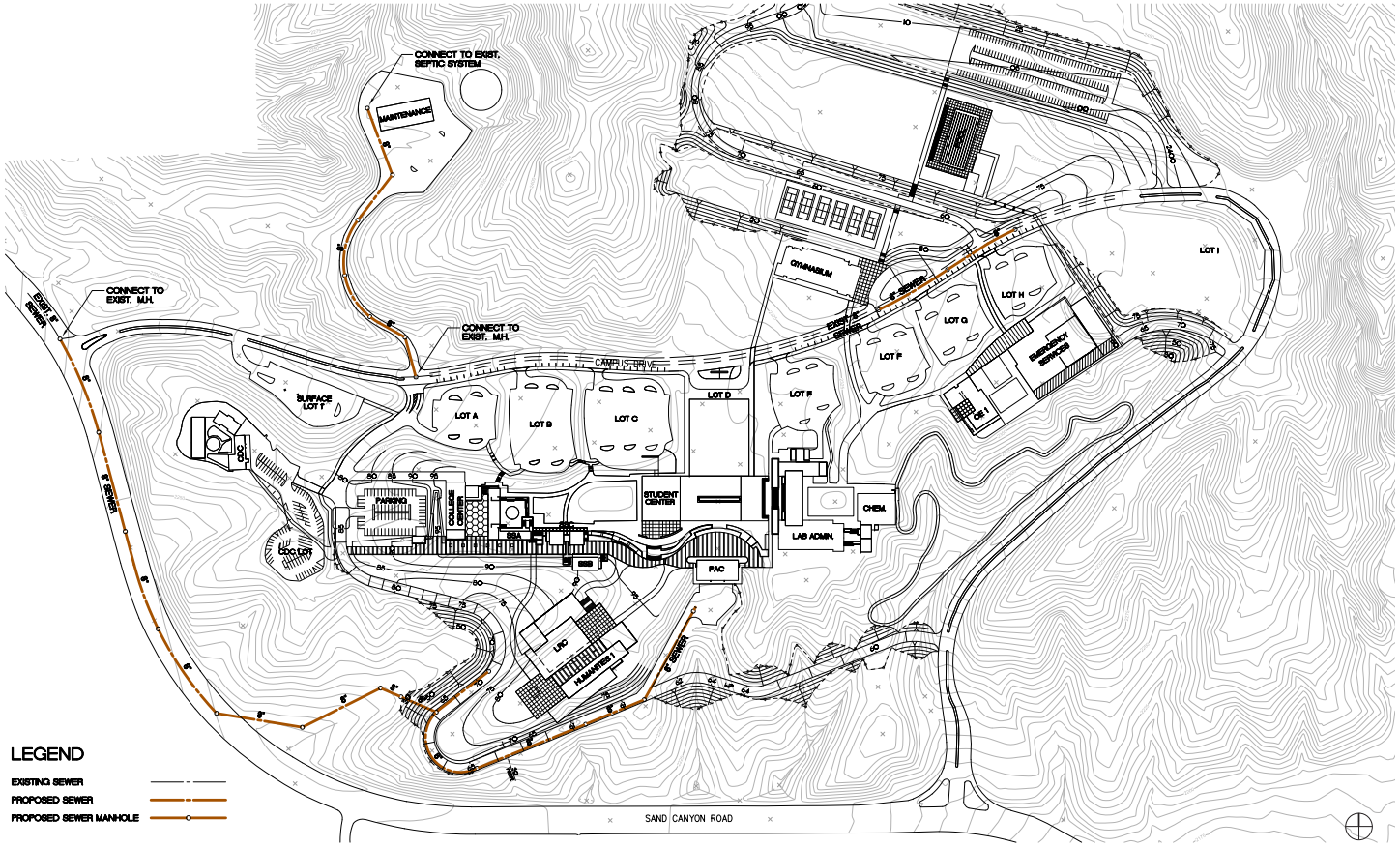
Site drainage for 2025 will be completed in the 2012 period.

SANITARY SEWER | EXISTING



The site sanitary sewer system consists of building waste lines connecting to site sewers at cleanouts located adjacent to the buildings. Site sewers consisting of gravity flow 6" and 8" pipes, cleanouts, and manholes convey the sewage to the campus trunk line located in Campus Drive. The trunk line flows westerly in Campus Drive, connecting to the City of Redlands sanitary sewer located in Sand Canyon Road.

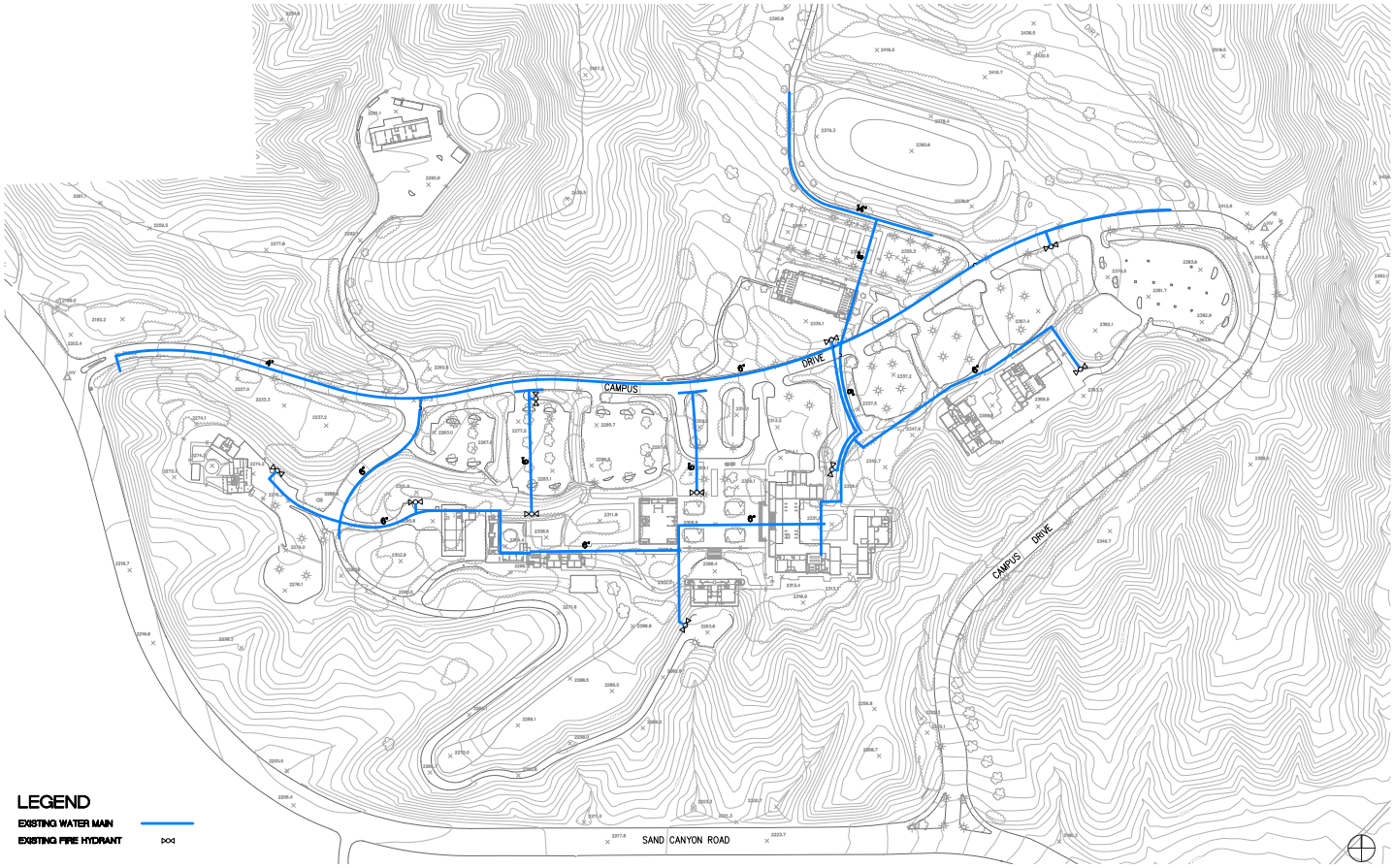
SANITARY SEWER | 2012



The development of the southerly side of campus necessitates the installation of a sanitary sewer to gravity serve the proposed Learning Resource Center/Humanities Complex. The main will be extended to provide gravity sewer to the existing Performing Arts Building and the proposed 2025 Science Building. The main will be connected to the City of Redlands sewer main located at the westerly intersection of Campus Drive and Sand Canyon Road. The main will extend southeasterly in Sand Canyon Road to the southerly end of the LRC/Humanities complex.

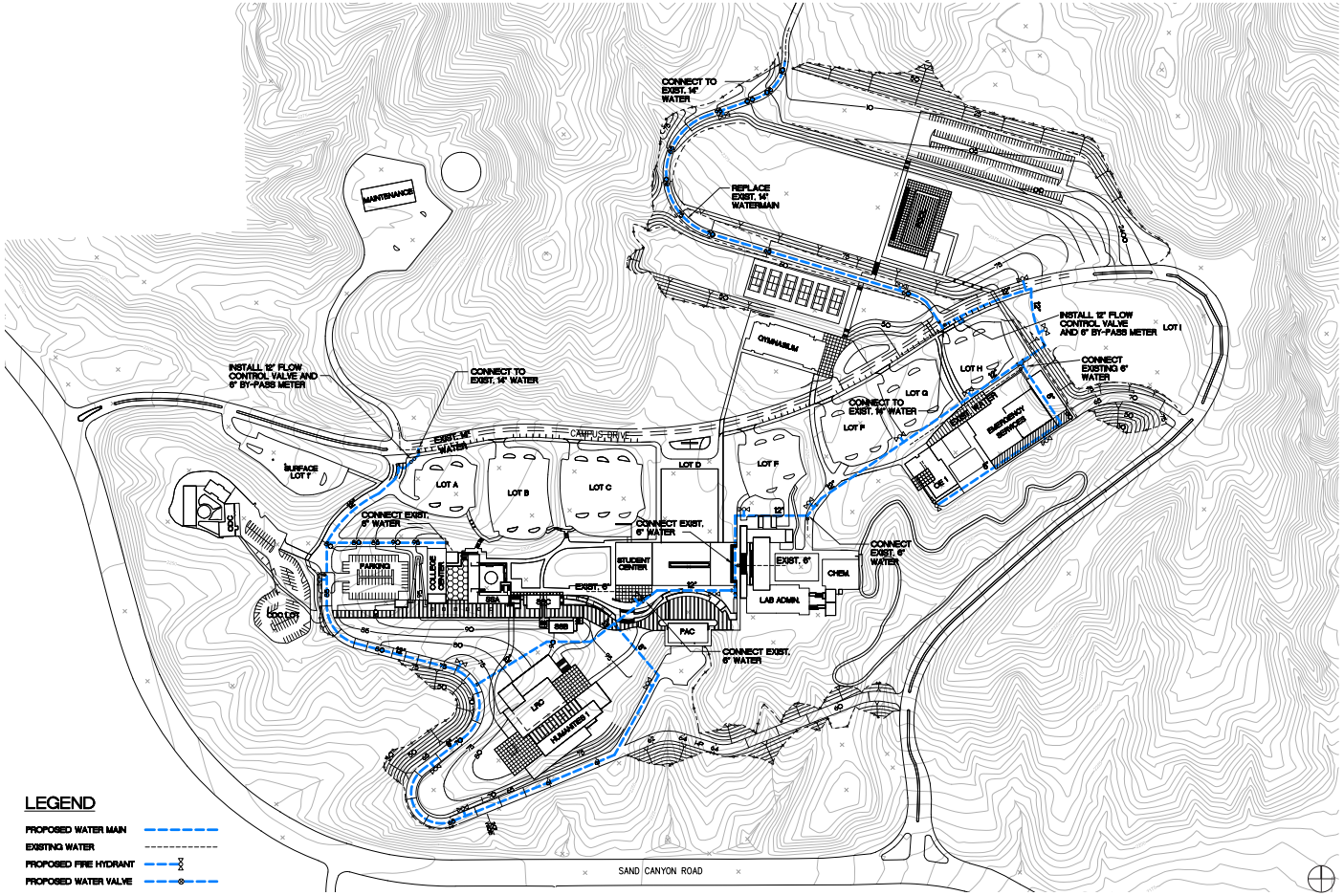
The existing sanitary sewer located in Campus Drive will require extension easterly from the vicinity of the Gymnasium approximately 450 feet to serve the proposed aquatics complex.

WATER DISTRIBUTION & FIRE PROTECTION | EXISTING



The site water distribution system consists of potable water supplied by the City of Redlands Water Department. The City supplies water to the campus through a system of transmission mains, regulating reservoirs, and a pumping station. The City water main located in Sand Canyon Road extends onto campus easterly in Campus Drive and northerly to a regulating reservoir locate adjacent to the campus Maintenance and Receiving facility. Water from the reservoir is pumped through a transmission main located in Campus Drive, easterly and northerly to a second regulating reservoir located at a higher elevation in the northeasterly portion of campus. Water and fire protection water are provided to campus facilities from the transmission main. Fire hydrants located along Campus Drive and several hydrants located near the campus buildings are serviced from the transmission main.

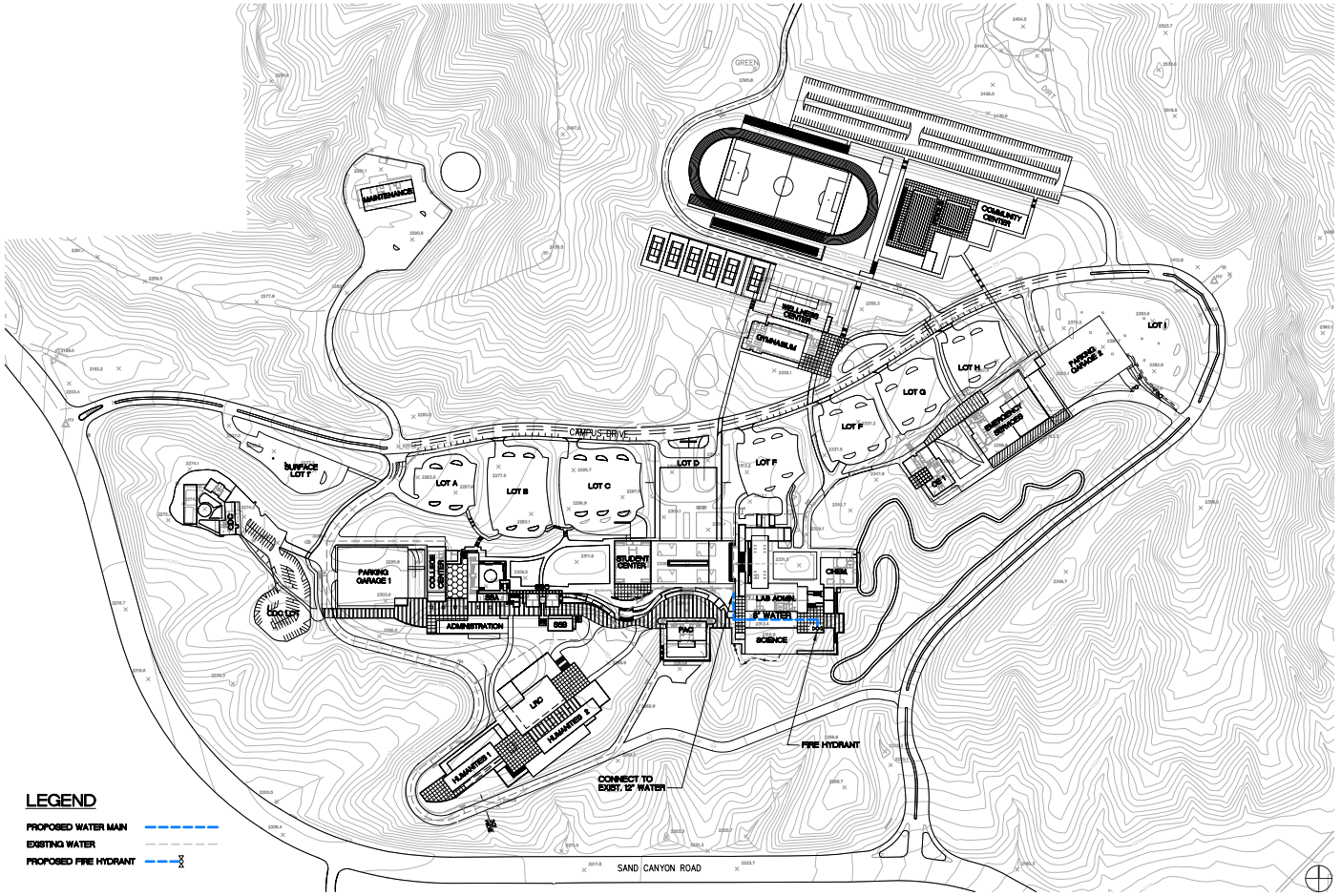
WATER DISTRIBUTION & FIRE PROTECTION | 2012



The current water distribution system is undersized to provide adequate fire protection to the campus. A twelve inch watermain located within the proposed utility corridor will connect to the City of Redlands transmission main located in Campus Drive in the vicinity of Parking Lot A and at the intersection of the reservoir access road and Campus Drive. The twelve inch main will connect to the existing campus water distribution system at several locations, providing improved flow. Fire hydrants connected to the twelve inch main will be located at appropriate intervals as prescribed by the local Fire Authority. An eight inch loop will be included in the perimeter access road to provide fire protection along the southerly side of the LRC/Humanities Buildings. Additionally, an eight inch main will be installed along the easterly and southerly sides of the Occupational Educational Building 2 for the installation of fire hydrants.

The grading of the Aquatics Center and future athletic field with the 2012 Master Plan will necessitate the realignment of the access road to the City of Redlands reservoir located in the northeasterly portion of the campus. In conjunction with the road realignment, the existing fourteen inch watermain located within the road must be relocated.

WATER DISTRIBUTION & FIRE PROTECTION | 2025



An eight inch watermain extension will be required to serve the proposed Science Building. Fire hydrants will be connected to the main to provide protection for the proposed structure.

MECHANICAL SYSTEMS

CAMPUS WIDE HVAC SYSTEM SUMMARY - EXISTING SYSTEMS OVERVIEW

1. Chilled Water Systems

The campus has three existing chiller central plants, which provide the cooling requirements of the existing campus buildings:

- The chiller central plant at the Gymnasium consists of (1) one Trane 30-ton and (1) one Trane 70-ton scroll compressor chillers.
- The chiller central plant at the Laboratory/Administration Building consists of (2) two Trane 200-ton centrifugal chillers. In addition to serving this building this central plant also serves the Occupational Education Building No.1 and the Performing Arts Center.
- The Student Services Building (SSA) chiller central plant consists of one 75-ton Trane centrifugal chiller (reciprocating chiller conversion by Siemens), (1) one 90-ton Trane hermetic rotary screw compressor chiller and one 35-ton Carrier reciprocating chiller.

The existing Child Development Center Buildings #1 and 2, Bookstore, Classrooms at the Bookstore and the Maintenance Building are provided with the unitary packaged or split units and will not be converted to the chilled water.

The energy conservation project conducted by Siemens Building Technologies (under the Performance Contracting Agreement in 2005) included a number of the chiller plant upgrades:

- Converting of the constant volume chilled water distribution system to a primary/secondary chilled water distribution system. The secondary loop provides variable chilled water flow.
- Replacement of the 3-way control valves with the 2-way control valves.
- Interconnecting of the Laboratory/Administration Building and SSA central plants into common chilled water system loop through underground piping.
- Converting the 75-ton reciprocating chiller in the SSA building to a centrifugal chiller.
- Inspection of all existing chillers.

The total installed cooling capacity of the Laboratory/Administration and the SSA central plants is approximately 700 nominal tons.

The chiller plant at the Gymnasium building is stand-alone and provides cooling for the Gymnasium building only.

The existing underground chilled water piping throughout the campus is in poor condition due to severe corrosion. According to the campus maintenance department staff, due to the numerous leaks in the piping it requires extensive time-consuming repairs. A sample of the pipe highlighting the pipe condition is stored at the campus maintenance facility.

2. Heating Water Systems

Several existing heating hot water boilers are installed on campus to accommodate the heating requirements of the campus buildings. The boiler systems are as follows:

- The boiler central plant at the Gymnasium consists of (2) two 1,600,000 btu/hr input (1,280,000btu/hr output) heating hot water boilers. These boilers serve only the Gymnasium building.
- The boiler central plant at the Laboratory/Administration Building consists of (2) two 990,000 btu/hr input (815,000btu/hr output) heating hot water boilers. In addition to serving the Laboratory/Administration Building this heating hot water central plant serves the Library Building, the Chemistry Building and the Performing Arts Center.
- The boiler central plant at the Student Services Building (SSA) consists of (2) two 1,500,000 btu/hr input (1,253,000btu/hr output) heating hot water boilers. This heating hot water central plant serves buildings SSA, SSB, SSC and the College Center.
- A heating water boiler with 625,000 btu/hr input (502,000 btu/hr output) provides heating hot water for the Occupational Education Building No.1.

The energy conservation project performed by Siemens Building Technologies (under the Performance Contracting Agreement in 2005) included adding the control points for the boiler and heating system pumps start/stop, status and reset. Unlike the chilled water system, the heating systems distribution systems have not been interconnected.

The existing boilers total capacity is approximately 8,805,000 btu/hr input (5,562,000 btu/hr output).

The existing underground heating hot water system piping throughout the campus is in poor condition. According to the maintenance staff, the piping frequently ruptures at the points of connections to the buildings. This may be related to inadequate expansion compensation provided during the original piping installation and may happen in any point of the piping with increased lateral movement. The underground piping leaks may not be noticed for long periods of time, during which the feedwater is being introduced into the system in substantial quantities. The untreated feed water is the primary reason for the scaling on the boilers and piping interior and causes the reduction in the boiler efficiency. In light of the above statement, it would be prudent to assume the boilers capacity reduction by about 15%, thus reducing the available boilers total output to about 9,000,000 btu/hr. Even with this reduction the capacity is more then adequate for the existing campus heating.

Table 1 - 2012 Cooling Requirements

BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	COOLING	
			TONS*	GPM**
1	LABORATORY/ ADMINISTRATION	38,205	266	456
2	STUDENT CENTER (former Library)	37,535	150	257
3	BOOKSTORE (former College Center)	10,515	31	53
4	STUDENT SERVICES A	10,855	30	51
5	STUDENT SERVICES C (former Classroom Building)	7,110	25	43
6	OCCUPATIONAL EDUCATION 1	9,745	40	69
7	EMERGENCY SERVICES (OE2 replacement building)	34,104	100	171
8	PERFORMING ARTS CENTER	32,715	312	535
9	MAINTENANCE & OPERATIONS	14,286	–	–
10	GYMNASIUM	17,930	–	–
12	CHEMISTRY	17,270	100	171
13	CHILD DEVELOPMENT CENTER 1	3,970	–	–
14	CHILD DEVELOPMENT CENTER 2	2,685	–	–
16	STUDENT SERVICES B	5,745	30	51
20	LEARNING RESOURCE CENTER	53,500	215	368
21	HUMANITIES 1	24,369	170	291
25	COMMUNITY RECREATIONAL FACILITY	7,000		
	TOTALS		1,469	2,516

* Calculated based on the Cooling Load Check figure provided in ASHRAE Guide for HVAC.

**Based on 14° F chilled water delta T. 16° F to 18° F delta T will be evaluated during the detailed systems study in the construction documents phase.

3. Air Handling Systems

The majority of the air handling systems on campus are multizone type and are of original construction. Over the years, there was very little remodeling done on the buildings. The air handling units are provided with the heating and cooling coils, supply air blower and 30%efficiency filters.

In 2005 the multizone air handling units were converted from the constant volume into the variable air volume systems under the Performance Contracting Agreement conducted by Siemens Building Technologies. The two position control dampers located at the units were replaced with the modulating control dampers and the supply air fans were equipped with the variable frequency drives. This has increased the units' efficiency due to the utilization of the cooling load diversity factor.

However, with the introduction of the information technology, the cooling demand on campus has increased substantially. Due to the limited air handling unit capabilities the air circulation in classrooms is ineffective and the elevated room temperature compromises the comfort level. Stagnated air was noticeable especially in the science classrooms. Additionally the existing air handling systems have the following deficiencies:

- The units' condensate drain pans have no slope and are noncompliant with the Indoor Air Quality Counsel (IAQ) requirements. The non-sloped condensate drain pan is a main sourse of breading algae.
- The air handling units have developed numerous leaks around doors and panels.
- The duct liner in units is missing in many places and will require substantial repairs.
- The units are of a commercial grade and have poor access to the cooling coil and to the condensate drain pan. The coils and pans are not cleaned since the original buildings construction.
- The vibration isolators are shot on most of the units and don't absorb supply fan vibration.
- The existing ductwork is at the limit where the additional airflow cannot be delivered without generating excessive noise in the ducts.
- The existing air handling systems are noncompliant with the mechanical code and NFPA-45 in respect to the chemical fume hood exhaust requirements, the number of air change in laboratories, chemical storage room ventilation and missing fire smoke dampers.
- Over the years the air handling units and the air distribution systems have collected a lot of dust and require professional environmental cleaning.
- Room thermostats are mounted at elevations non compliant with the Americans with Disabilities Act (ADA), which requires thermostats to be mounted at 48" above finished floor.

Campus Wide Chilled Water System Master Planning

1. 2005 - 2012

By year 2012, when the renovation of the existing buildings and the new buildings are completed as outlined in the current master plan, the projected cooling load on campus will increase from the existing 700 tons to approximately 1500 tons. For the 2012 projected cooling load summary including the two central plants see Table No.1 below. The load can be handled by supplementing of the Laboratory/Administration Building and SSA existing chiller plants with an 700-ton centrifugal chiller. The Gymnasium 100-ton central plant will continue operating as a self contained facility.

The new chiller should be provided in the Laboratory/Administration Building central plant and will be equipped with variable frequency drive (VFD). The chiller shall be manufactured by Carrier or Trane. A matching cooling tower manufactured by Baltimore Air Coil will be provided to handle the new chiller load. The central plant will be also equipped with a new primary and secondary chilled water pumps to handle the system water circulation. All pumps will be equipped with VFDs. For the central plant modifications see the Laboratory/Administration Building central plant floor plan. The following modifications to the Laboratory/Administration Building and SSA existing chiller plants should be made:

- The primary/secondary chilled water piping shall be reconfigured at the Laboratory/Administration Building existing chiller plant in order to accommodate the new chiller installation. As an option, the piping at the plant may be reconfigured as required to accommodate the 2025 installation. Otherwise the related to 2025 work can be accomplished at the later phase.
- The secondary chilled water system pump will be replaced at both chiller plants in order to satisfy the chilled water flow increase and the new pump head.
- A new single-cell 2100 gpm cooling tower matching the 700-ton chiller capacity and equipped with VFD will be provided in the existing cooling tower yard located outside adjacent to the boiler room. The (two) existing cooling towers will remain in place and the existing yard will need to be expanded in order to provide space for the new cooling tower.

The existing underground chilled water distribution piping is old, severely corroded, the pipe sizes are inadequate for the new loads. We recommend abandoning the existing piping in place. Parts of the existing piping system interfering with the new piping routing will be removed. Where feasible, the existing points of the underground piping to building connection will be utilized for the new piping in order to minimize the building down time and the construction cost.

The new piping will be preinsulated steel pipe Sch. 40 manufactured for the underground installation and will be sized to handle the future cooling load projected for the year 2025.

Where indicated on the Master Plan drawings, the chilled water pipe will be arranged to transit through the existing building basements in order to reduce the distribution piping installation cost.

Table 2 - 2025 Cooling Requirements

			COOLING	
BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	TONS*	GPM**
1	LABORATORY CENTER (former Laboratory/Administration Bldg.)	38,205	266	456
2	STUDENT CENTER (former Library)	37,535	150	257
3	BOOKSTORE (former College Center)	10,515	31	53
4	STUDENT SERVICES A	10,855	30	51
5	STUDENT SERVICES C (former Classroom Building)	7,110	25	43
6	OCCUPATIONAL EDUCATION 1	9,745	40	69
7	EMERGENCY SERVICES (OE2 replacement building)	34,104	100	171
8	PERFORMING ARTS CENTER	32,715	312	535
9	MAINTENANCE & OPERATIONS	14,286	–	–
10	GYMNASIUM	17,930		
11	WELLNESS CENTER	24,475		
12	CHEMISTRY	17,270	100	171
13	CHILD DEVELOPMENT CENTER 1	3,970	–	–
14	CHILD DEVELOPMENT CENTER 2	2,685	–	–
15	CHILD DEVELOPMENT CENTER EXPANSION	12,118	–	–
16	STUDENT SERVICES B	5,745	30	51
19	ADMINISTRATION/ STUDENT SERVICES	27,713	45	77
20	LEARNING RESOURCE CENTER	53,500	215	369
21	HUMANITIES 1	24,369	170	291
22	HUMANITIES 2	44,531	360	617
23	PERFORMING ARTS CENTER EXPANSION	13,295	144	247
24	SCIENCES	36	175	300
25	COMMUNITY RECREATIONAL FACILITY	7,000		
26	COMMUNITY CENTER	15,000		
	TOTALS		2,193	3,758

* Calculated based on the Cooling Load Check figure provided in ASHRAE Guide for HVAC.

**Based on 14° F chilled water delta T. 16° F to 18° F delta T will be evaluated during the detailed systems study in the construction documents phase.

2. 2013 - 2025

By 2025, when the renovation of the existing buildings and the new buildings are completed as outlined in the current master plan, the projected cooling load on campus will increase from 1400 tons to about 2,100 tons. For the cooling load tabulation see Table No.2 below.

All Laboratory/Administration and SSA building existing chillers with the exception of the 700-ton chiller installed under the 2012 master plan will approach the end of useful service life and should be decommissioned. The new chillers will be provided at the Laboratory/Administration Building chiller central plant and will be installed in place of the (2) two existing 200-ton chillers. The new central plant will consist of (2) two new 700-ton centrifugal chillers and the 700-ton existing chiller. For the central plant modifications see Laboratory/Administration Building central plant floor plan.

The following modifications to the plant will be required:

- The primary/secondary chilled water piping system shall be reconfigured at the Laboratory/Administration Building existing chiller plant in order to accommodate the new chillers installation. (2) Two new primary and (3) three new secondary chilled water pumps will be provided and the piping in plant will be reconfigured in order to accommodate the new equipment layout.
- The secondary chilled water system pumps will be replaced in order to satisfy the increase in the chilled water flow rate.
- The (2) two existing cooling towers will be decommissioned. (2) Two new 2,100 gpm each cooling towers will be provided in the existing cooling tower yard.

At that time the Gymnasium central plant will be retrofitted with new 175-ton centrifugal chiller sized to handle the adjacent Wellness Center. The new 525 gpm cooling tower and chilled water pump both equipped with the VFD will be provided and the piping modified to handle the increased system capacity.

The 15,000 sq.ft Community Building due to its remote location will not be feasible to feed with the chilled and heating water from the central plant. Therefore, the building will be provided with rooftop packaged units.

Campus Wide Heating Hot Water System Master Planning

1. Year 2012 Phase

By the year 2012 the heating requirements will increase from the present 5,562,000 btu/hr output to the estimated output of 11,840,000 btu/hr. The existing boiler located on the roof of the Occupational Education Building No. 1 is in poor operating condition and should be decommissioned. A new 8,200,000 Btu/hr input (6,840,000 output) Low-NOx forced draft heating hot water boiler will be added to supplement the remaining existing boilers and will be located in the existing Laboratory/Administration Building Boiler Room. See table 3. Boilers will be heavy-duty commercial grade made by Ajax Boilers or equal.

Boilers located in the Laboratory/Administration Building and in the SSA Buildings will be interconnected through the underground heating water piping into a common primary circulating loop. With the exception of the Gymnasium Building, all buildings indicated in Table 3 will be fed off the new heating hot water loop.

The primary loop heating hot water circulating pumps will be sized for the individual boiler water flow with the pressure head adequate to assure water flow in the loop at the different flow conditions. Each building secondary piping loop will be connected to the primary loop with a crossover piping equipped with the 3-way modulating mixing valve. Each building will be provided with the variable flow secondary heating water pump.

Due to the numerous problems associated with the underground distribution heating water piping we recommend abandoning it in place and providing new piping to meet the requirements of the buildings outlined in the 2012 master plan. The new piping will be preinsulated steel pipe Sch. 40 manufactured for the underground installation and will be sized to handle the future heating load projected for the year 2025.

The gymnasium building will continue operating as a stand-alone until year 2025. The Natatorium building will be heated only and will be fed off the pool heating system.

2. Year 2025 Phase

By the year 2025 the heating requirements will increase from established for the year 2012 the 11,040,000 btu/hr to the estimated 18,300,000 btu/hr. See Table 4 below for the tabulated heating loads.

At that time with the exception of the boiler installed in 2012, we recommend decommissioning of all the existing boilers located in the Lab/Admin Building and in the SSA Building. (2) Two new 7,350,000 btu/hr input (6,247,500 btu/hr output) Low-NOx forced draft heating hot water boilers. These boilers shall be located in the Laboratory/Administration Building boiler room. The primary and secondary loop heating water pumps shall be provided to handle the entire campus.

The gymnasium building will be retrofitted with the new 1,500,000 btu/hr boiler sized to handle the new Wellness Center. The Community Center heating will be provided by the rooftop packaged equipment.

Table 3 - 2012 Heating Requirements

BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	HEATING	
			Btu/hr	GPM*
1	LABORATORY/ ADMINISTRATION	38,205	2,300,000	115
2	STUDENT CENTER (former Library)	37,535	1,500,000	75
3	BOOKSTORE (former College Center)	10,515	320,000	16
4	STUDENT SERVICES A	10,855	320,000	16
5	STUDENT SERVICES C (former Classroom Building)	7,110	280,000	14
6	OCCUPATIONAL EDUCATION 1	9,745	500,000	25
7	EMERGENCY SERVICES (OE2 replacement building)	34,104	1,020,000	51
8	PERFORMING ARTS CENTER	32,715	1,000,000	50
9	MAINTENANCE & OPERATIONS	14,286	–	–
10	GYMNASIUM	17,930	–	–
12	CHEMISTRY	17,270	1,040,000	52
13	CHILD DEVELOPMENT CENTER 1	3,970	–	–
14	CHILD DEVELOPMENT CENTER 2	2,685	–	–
16	STUDENT SERVICES B	5,745	180,000	9
20	LEARNING RESOURCE CENTER	53,500	1,600,000	80
21	HUMANITIES 1	24,369	980,000	49
25	COMMUNITY RECREATIONAL FACILITY	7,000		
	TOTALS		11,040,000	552

* Based on 40° F heating water delta T.

Campus Wide Air Handling Systems Master Planning

Based on the evaluation of the existing air handling systems, we recommend replacing the air handling units for the following reasons:

- The existing air handling unit cooling coils are sized without the consideration for the cooling loads increase associated with the addition of the information technology on campus.
- The existing coils chilled water delta T is many cases 10 degrees, which will require higher water flow and consequently larger pipe sizes. A deeper - more row coil may be required to do the job.
- The condensate drain pans have no slope and are noncompliant with the Indoor Air Quality Counsel (IAQ).
- The units have numerous air leaks around doors and panels.

The new DDC controls such as sensors, smoke detectors, control valve operators, etc installed by Siemens on the existing units are in good operating condition and will be reused and relocated into the new systems. The room thermostats elevation above floor will be brought into compliance with the Americans with Disabilities Act throughout the campus.

The existing ductwork will be reused in places where it can be easily adapted to the new space planning requirements and will not require substantial rework. In all other cases the ductwork will be completely replaced. A more detailed assessment of the ductwork will be conducted at the later phase of the project.

Heating, Ventilation and Cooling (HVAC) Systems

1. General Requirements

Air conditioning will be provided to the laboratories, classrooms, and the offices. The air-handling units for the remodeled existing buildings will be located in the present locations. Air handling units serving the new buildings will be located in new mechanical rooms. Variable Speed pumping will be provided on the Chilled Water and Heating Hot Water systems to circulate the chilled water to the air-handling units and heating hot water to reheat coils. The exhaust fans in general will be located on the roof of the building.

2. Codes and Standards

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers • Standard 90 A, B, C, Energy Conservation in New Building Design • Design Guidelines relating to Laboratory Design
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CISPI	Cast iron Soil Pipe Institute
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association • Section 34 • Section 45: Laboratories using Chemicals • Section 54 •Section 90 • Section 91
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
UL	Underwriters Laboratories, Inc
ANSI	American National Standards Institute
AABC	Associated Air Balance Association
CPC	California Plumbing Code
EPA	Environmental Protection Agency
CBC	California Building Code
CMC	California Mechanical Code
CFC	California Fire Code
CEC	Title 24 California Energy Code for Non-Residential Buildings
SFM	Los Angeles Fire Department

Table 4 - 2025 Heating Requirements

			HEATING	
BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	Btu/hr	GPM*
1	LABORATORY CENTER (former Laboratory/Administration Bldg.)	38,205	2,300,000	115
2	STUDENT CENTER (former Library)	37,535	1,500,000	75
3	BOOKSTORE (former College Center)	10,515	320,000	16
4	STUDENT SERVICES A	10,855	320,000	16
5	STUDENT SERVICES C (former Classroom Building)	7,110	280,000	14
6	OCCUPATIONAL EDUCATION 1	9,745	400,000	20
7	EMERGENCY SERVICES (OE2 replacement building)	34,104	1,020,000	51
8	PERFORMING ARTS CENTER	32,715	1,000,000	50
9	MAINTENANCE & OPERATIONS	14,286	–	–
10	GYMNASIUM	17,930		
11	WELLNESS CENTER	24,475		
12	CHEMISTRY	17,270	1,040,000	52
13	CHILD DEVELOPMENT CENTER 1	3,970	–	–
14	CHILD DEVELOPMENT CENTER 2	2,685	–	–
15	CHILD DEVELOPMENT CENTER EXPANSION	12,118	–	–
16	STUDENT SERVICES B	5,745	180,000	9
19	ADMINISTRATION/ STUDENT SERVICES	27,713	360,000	18
20	LEARNING RESOURCE CENTER	53,500	1,600,000	80
21	HUMANITIES 1	24,369	980,000	49
22	HUMANITIES 2	44,531	2,100,000	105
23	PERFORMING ARTS CENTER EXPANSION	13,295	380,000	19
24	SCIENCES	36	1,880,000	94
25	COMMUNITY RECREATIONAL FACILITY	7,000		
26	COMMUNITY CENTER	15,000		
	TOTALS		15,660,000	783

* Based on 40° F heating water delta T.

Design Criteria

1. Climatic Design Parameters

See Table 1.
Mechanical Rooms shall be designed to maintain a maximum of 90 F
Electrical and Elevator Machine Rooms shall be conditioned as required to offset heat rejection of equipment and maintain room below 80 F.
Telecommunication Spaces shall be maintained below a maximum of 72 F.
Indoor Relative Humidity: The cooling systems shall be designed to ensure the summer humidity is maintained below 70% RH during part load conditions. In general, humidity will not be controlled.

2. Building Envelope

The new building envelope shall exceed requirements of 2005 California Energy Code for minimum thickness of roof and wall insulation. As a basis glazing shall be double pane Low-E type, however consideration shall be given to the net benefit to the building of omitting the low e-coating to promote heat loss due to the high internal loads. External shading shall be considered where it will minimize the effects of solar radiation on the building interior. Internal blinds shall be provided on all exterior windows.

3. Building Hours of Operation

The Building is a facility that should allow staff 24-hour availability to the laboratories, and the informational technology areas. HVAC systems in the laboratories should run at all times because of the hazards that might exist in the laboratories. The systems serving the laboratories shall be designed to allow normal maintenance without shutting down the complete system. The classrooms and offices are considered 7am to 9pm operation and will be designed to close down outside these hours.

4. Internal Heat Gains

The HVAC system shall be sized to compensate for the following internal heat gains as the basis of design: see tables 2, 3, & 4.
Lighting loads are shown for estimating purposes; actual heat gain from lighting shall be determined by the electrical engineer.
Loads for laboratories are shown for estimating purposes; actual heat gains will be determined based on the equipment cut sheets for each space with 50% load diversity.

5. Ventilation Requirements

Laboratories & Laboratory Support Areas:

The Laboratory areas shall be supplied with 100% outdoor air, no return air; with exhaust either through fume hoods or the general laboratory exhaust. Special consideration shall be given to laboratories, which do not utilize chemicals. In these cases the laboratories may utilize conventional variable air volume control systems with return air.

Classrooms, Offices and Conference Rooms:

Classroom, Offices and Conference Rooms shall be provided with 15-cfm/person outside air. The total air supplied will meet the maximum cooling load. The occupancy shall be based on block load amount and not individual occupant room total. All areas will utilize overhead supply air distribution and air return.

Storage and Equipment areas:

Storage room four air changes exhaust per hour minimum.

Toilets and Janitor rooms:

Twelve air changes per hour exhaust for toilets.
Six air changes per hour exhaust for janitor rooms.

Fume Hood Exhaust systems:

The chemical fume hood exhaust system shall be designed to maintain 100 feet per minute across the fume hood sash at any sash opening.

Table 5 - Climatic Data Parameters

Location	Yucaipa, California	
Latitude	34	
Elevation	2600 feet	
Climate Zone	10	
Room Types	Office	Laboratory
	Conference Rooms	Laboratory Support Spaces
	Classrooms	(@ .1% occurrence)
	Auditorium	
	Lobby Spaces	
	(@ .5% occurrence)	
Outside Design Wet Bulb	67 F	68 F
Outside Design Dry Bulb	Summer Design 102 F	Summer Design 106 F
Winter Design	27 F	27 F
Indoor Design Summer	75 F & 50% RH	75 F & 50% RH
Indoor Design Winter	72 F	72 F

- Laboratory includes labs, support areas, specialty rooms, etc.

Table 6 - Internal Heat Gains

Space	Basis	Heat gain Sensible/ Latent
Laboratories	30 sq. ft./person	250/250 Btuh
Lab Support	100 sq. ft./person	250/250 Btuh
Meeting Rooms, Conference Rooms	20 sq. ft./person	250/200 Btuh
Open Plan Offices	100 sq. ft./person	250/200 Btuh
Individual Offices	1 person	250/200 Btuh
Lobbies, Foyers, Corridors	200 sq. ft./person	245/200 Btuh
Café	10 sq. ft./person	275/275 Btuh
Classrooms, Lecture Halls, Auditorium	20 sq. ft./person or number of fixed seating	250/200 Btuh

Table 7 - Lighting Heat Gains

Space	Lighting Load
Laboratories	2.0 watts/sq. ft.
Lab Support	2.0 watts/sq. ft.
Meeting Rooms, Conference Rooms	1.3 watts/sq. ft.
Offices	1.3 watts/sq. ft.
Lobbies, Foyers, Corridors	1.0 watts/sq. ft.
Café	1.5 watts/sq. ft.
Classrooms, Lecture Halls, Auditorium	1.3 watts/sq. ft.

Table 8 - Miscellaneous Internal Heat Gains

Space	Miscellaneous Loads	% Gain to return/ exhaust air
Laboratories	10.0 watts/sq. ft.	0
Meeting Rooms, Conference Rooms	1.0 watts/sq. ft.	0
Open Plan Offices	1.0 watts/sq. ft.	0
Individual Offices	2.5 watts/sq. ft.	
Lobbies, Foyers, Corridors	0.5 watts/sq. ft.	0
Café	1.0 watts/sq. ft.	
Classrooms, Lecture Halls, Auditorium	1.0 watts/sq. ft.	0

6. Future Capacity and Diversity within the Classroom and Office Areas

Design of the Air Handling system shall allow for 10% additional capacity for future use.

7. Energy Conservation:

A goal of the project is to pursue an energy conscious design and beat the 2005 California Energy Code maximum energy usage. This can be accomplished in a number of ways including the following:

- Pipe and duct insulation minimum thickness shall exceed Title 24 by 30% minimum.
- Building Envelope: Thermal insulation of a performance up to 30% greater than the minimum required meeting Title 24.
- Fenestration: Double Glazed, Low-E solar heat gain coefficient (SHGC) glazing, and internal blinds and/or external sun control or shades shall be an integral part of the design
- The premium efficient motors shall be provided for equipment.
- Variable volume air systems shall be used.
- Fans, pumps and chillers will be equipped with the variable frequency drives (VFD).
- Reduced coil face velocity design for low air pressure drop to save fan horsepower all year.
- Two-way valves for coils with variable pumping systems using a VFD where appropriate.

8. Noise Criteria

The following noise criteria levels will be achieved. It should be noted that these levels address the mechanical systems only. Mitigation of traffic noise and air traffic noise will utilize the building fabric to ensure the interior spaces are not affected.

- Offices NC 35
- Enclosed Offices, Meeting Rooms NC 30 to NC 35
- Conference Rooms, Classrooms NC 30
- Info Technology (Recording areas) NC 15
- Laboratories NC 40

9. Classroom and Office Air Handling Units

- Classroom and Office Air handling units shall be double wall unit and be located in a mechanical room.
- The units will be a Variable Air Volume air handling unit containing the following minimum components in a draw-through arrangement: supply air fan, chilled water cooling coil, pre-filter and final filter section, return air fan, outside air economizer, outside air, return and relief dampers and vibration isolators. Outside air and relief air will be ducted to and from the unit.
- Air is distributed and returned via four perimeter riser shafts. VAV boxes with terminal reheat will be provided for each 600 sq. ft. at the perimeter and 1,000 sq. ft. in the interior of the building. Dedicated VAV boxes will be provided for corner offices, classrooms and conference rooms. The ceiling void will be used as a return air plenum within the offices. Ducted return air will be provided in the classrooms.

Sustainable Power Generating Technology

In light of the of LEED™ Certification – resulting in "green" buildings that can leverage state and/or federal financial incentives, we have evaluated the UTC Power PureComfort™ Cooling, Heating, and Power system. The system is designed to operate as a self contained cogeneration system providing clean, effective, and reliable power. It consists of a heat recovery absorption chiller manufactured by Carrier and multiple microturbines manufactured by Capstone. The entire system is fully integrated with proven design and performance.

The PureComfort™ system uses air-cooled, lubricant-free, low-maintenance microturbine generators. Microturbines generate electricity through the combustion of natural gas. The power generated is clean by virtue of advanced digital power electronics and has an ultra low emission of less then 9 ppm of NOx. The system is CARB-certified, meeting California's stringent air emissions standard as a prime mover for 24/7 operation.

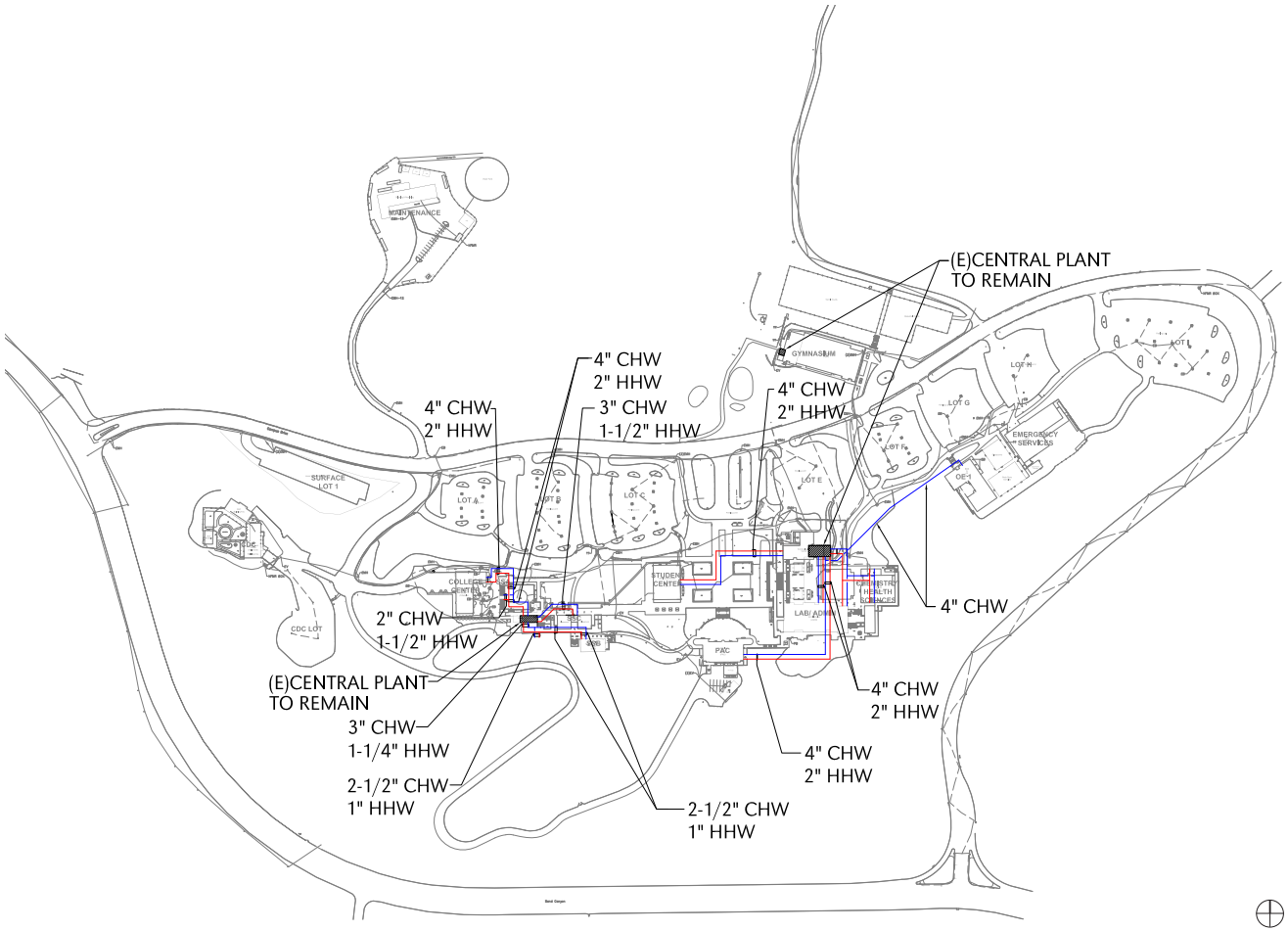
Cooling or heating is provided by an absorption chiller/heater. This chiller/heater is driven by recaptured exhaust heat from the microturbines, producing cooling/heating with zero-cost fuel. The absorption chiller/heater is a double-effect type which maximizes the heat recovery ensuring high system efficiency. The system can operate in three different modes:

- Power/Cooling Mode: In this mode the system provides electricity and chilled water.
- Power/Heating Mode: In this mode the system provides electricity and heating hot water.
- Power Mode: In this mode the system generates electricity only.

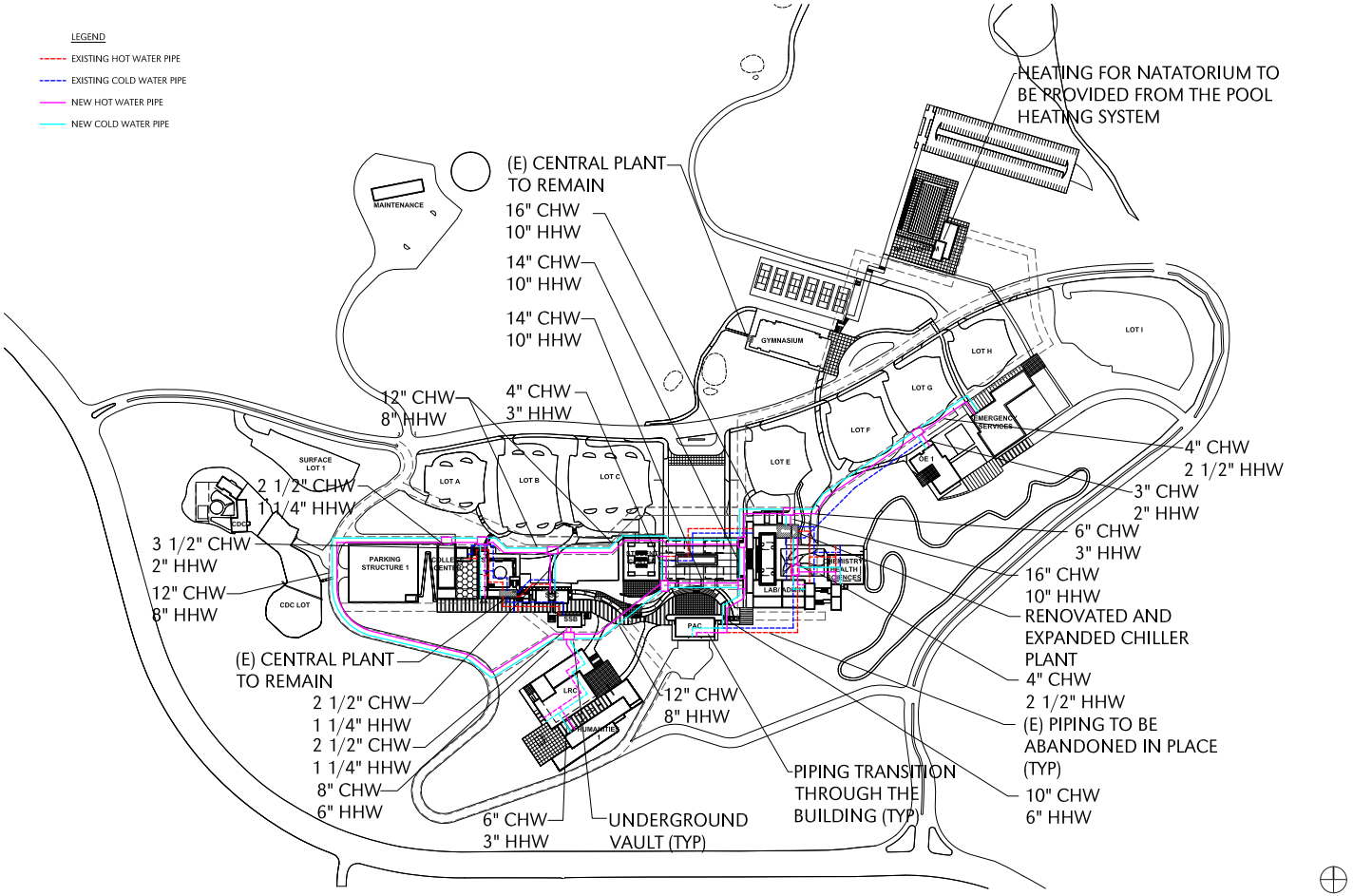
Based on the evaluation, the PureComfort™ system can generate only 360 kW of power and 160 tons of cooling.

In light of the limited size of the system feasible for the campus we do not recommend the system inclusion into the Master Planning Program.

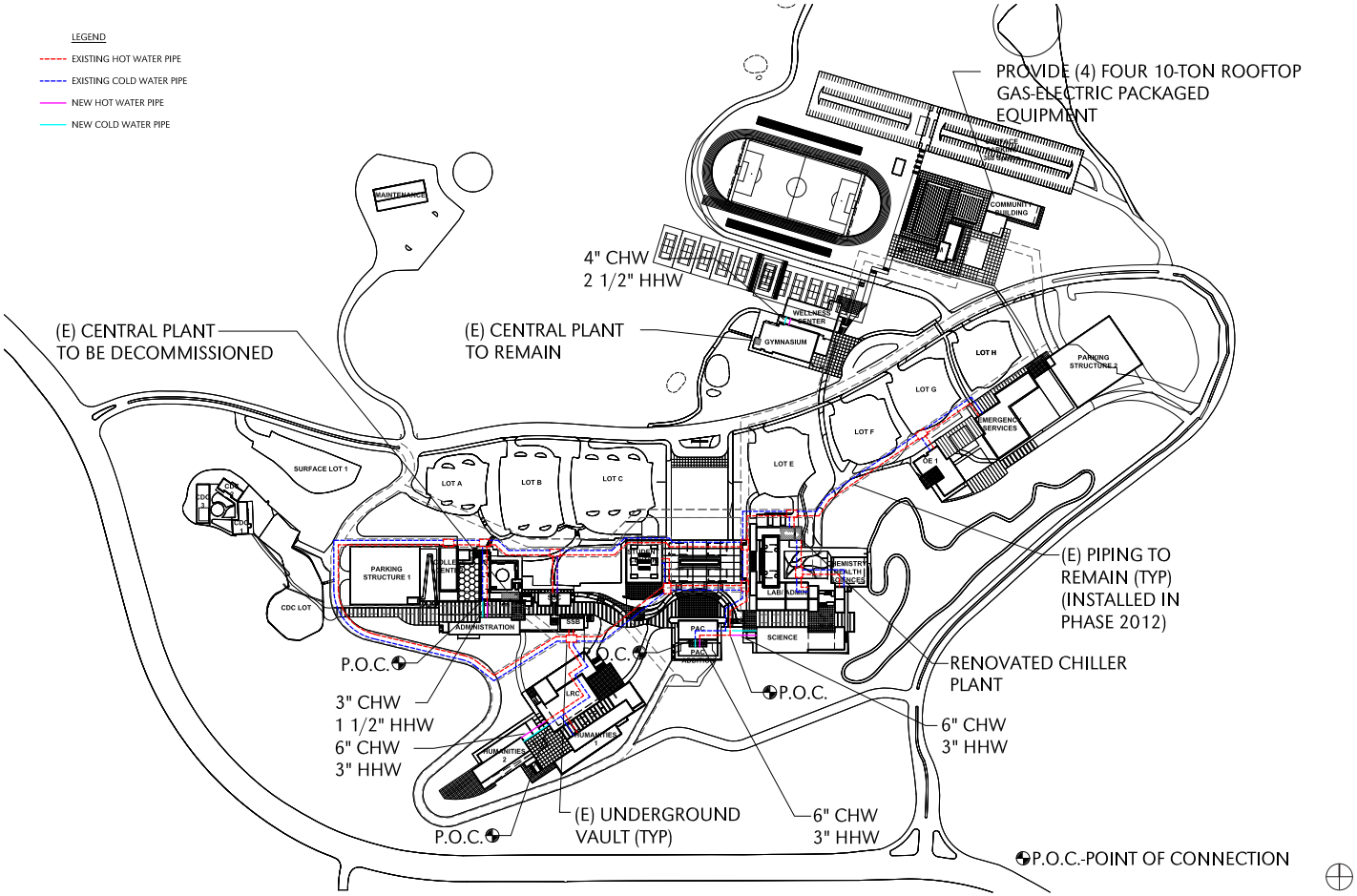
CHILLED WATER/ HOT WATER SYSTEM | EXISTING



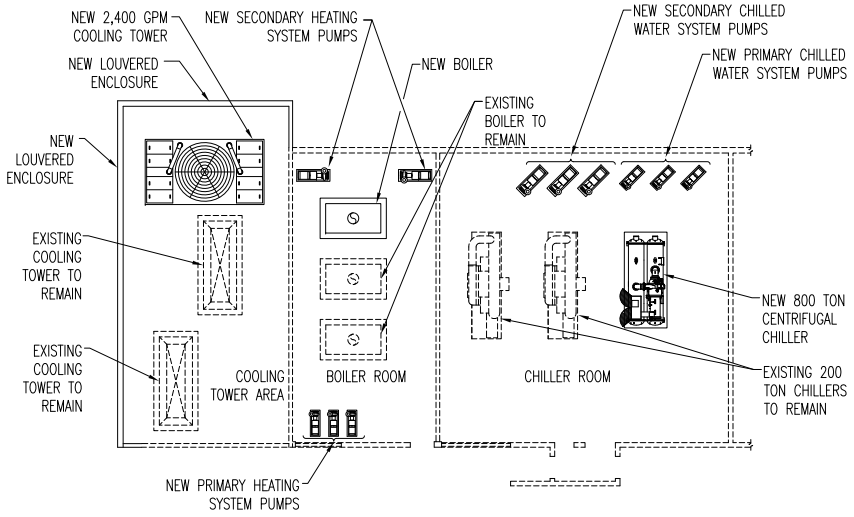
CHILLED WATER/ HOT WATER SYSTEM | 2012



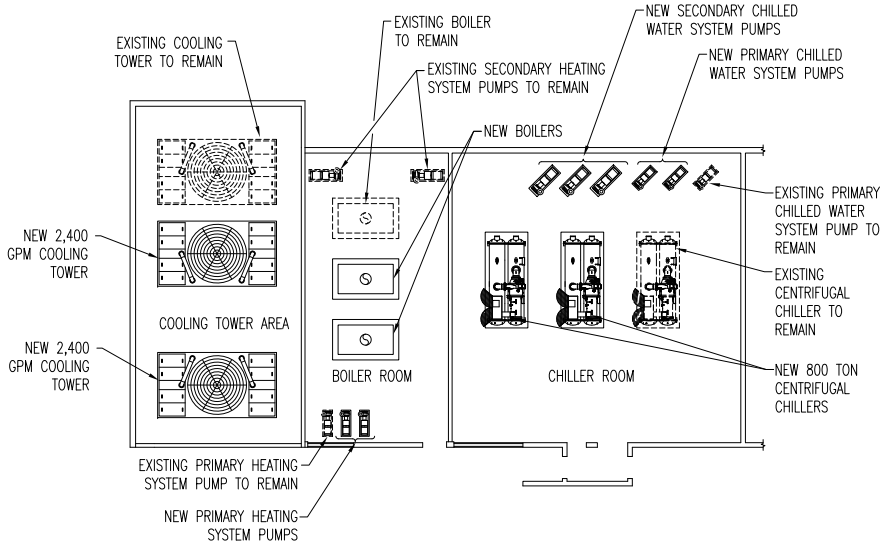
CHILLED WATER/ HOT WATER SYSTEM | 2025



CHILLER PLANT RENOVATION

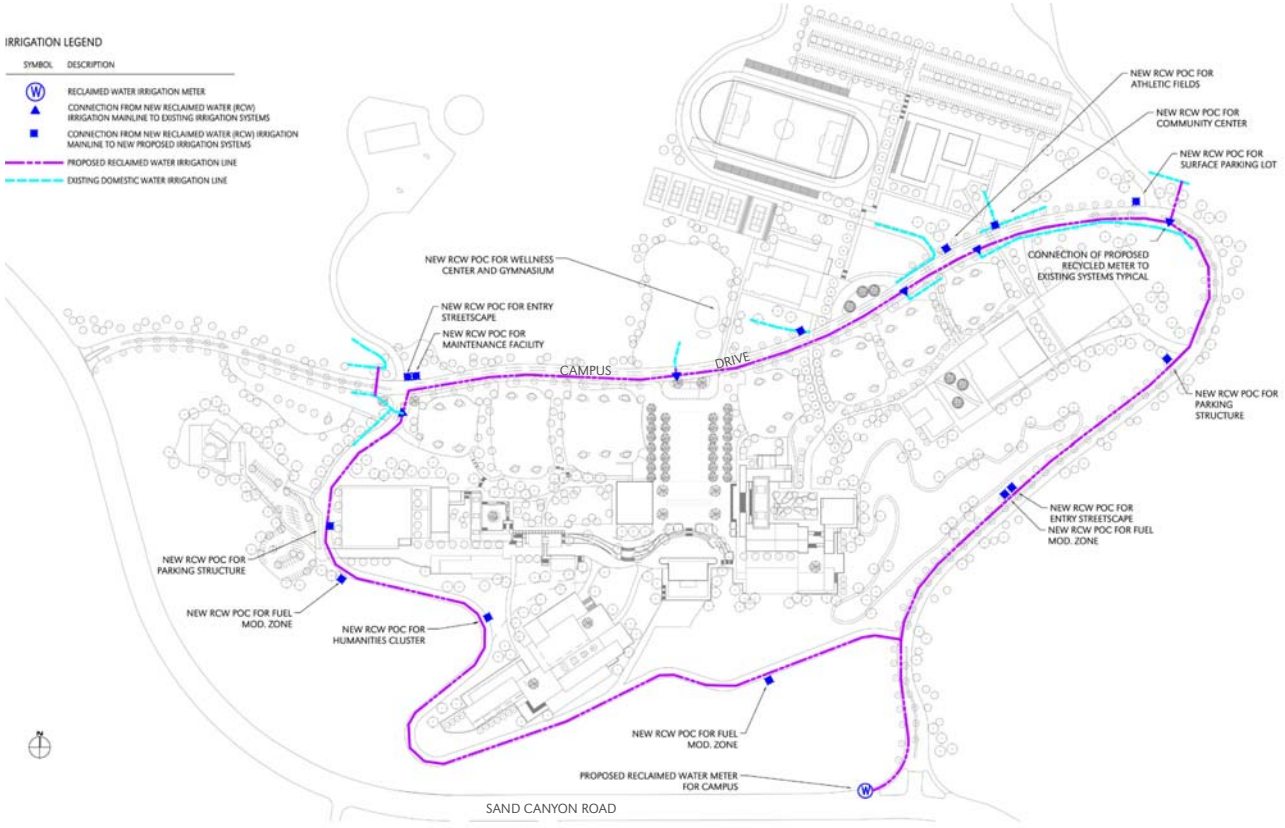


2012 LAB/ADMIN BUILDING CHILLER PLANT RENOVATION



2025 LAB/ADMIN BUILDING CHILLER PLANT RENOVATION

IRRIGATION GUIDELINES | MAINLINE ROUTING



OPTION A: RECLAIMED WATER MAINLINE ROUTING

Under the current irrigation system, the College is experiencing water shut-offs during critical periods and increased water costs from its water purveyor, the City of Redlands. With the exception of the Child Development Center facility, a new reclaimed water system is recommended and would take advantage of an alternative water source available through the Yucaipa Valley Water District.

Two alternatives for a reclaimed water irrigation system are presented in this section. Option A (this page) implements a nearly full conversion to reclaimed water. This option is the preferred recommendation. If cost is a concern, Option B (next page) presents a combination of reclaimed and domestic water systems. Under this alternative, the reclaimed water will cover the new areas at the College's southern edge, including the fuel modification and hillside coastal sage zones. The domestic water system will re-use existing irrigation mainlines whenever possible.

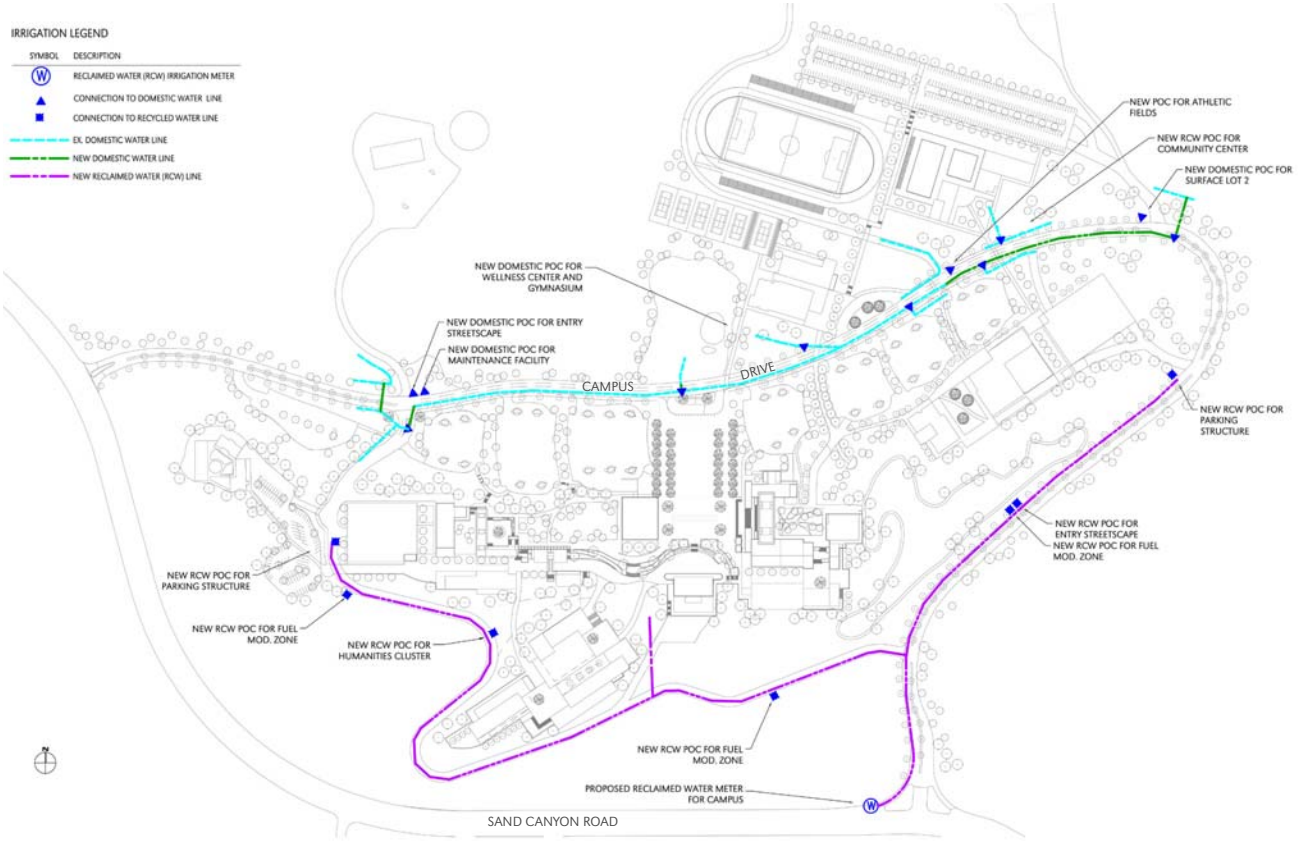
The conversion to a full or partial reclaimed water system will require agreement between the two water districts regarding the provision of reclaimed water to Crafton Hills College. At the time of this writing, discussions among the water districts and the college had not yet occurred. Although the connection to the reclaimed water system should provide savings in water cost per unit, specific savings cannot be evaluated until the Yucaipa Valley Water District and City of Redlands reach an agreement.

In the event that a reclaimed water irrigation system is not feasible, a third alternative – a Domestic Water mainline routing – is also presented in this section as "Option C".

Several steps are recommended for converting from the existing system to a reclaimed water system. The last two items listed below are also recommended if a domestic water irrigation system is implemented.

- Make connection to the existing reclaimed water line at the street, provide one meter for the entire campus.
- Provide irrigation booster pump at the reclaimed water point of connection, size to be determined as part of final calculations.

IRRIGATION GUIDELINES | MAINLINE ROUTING

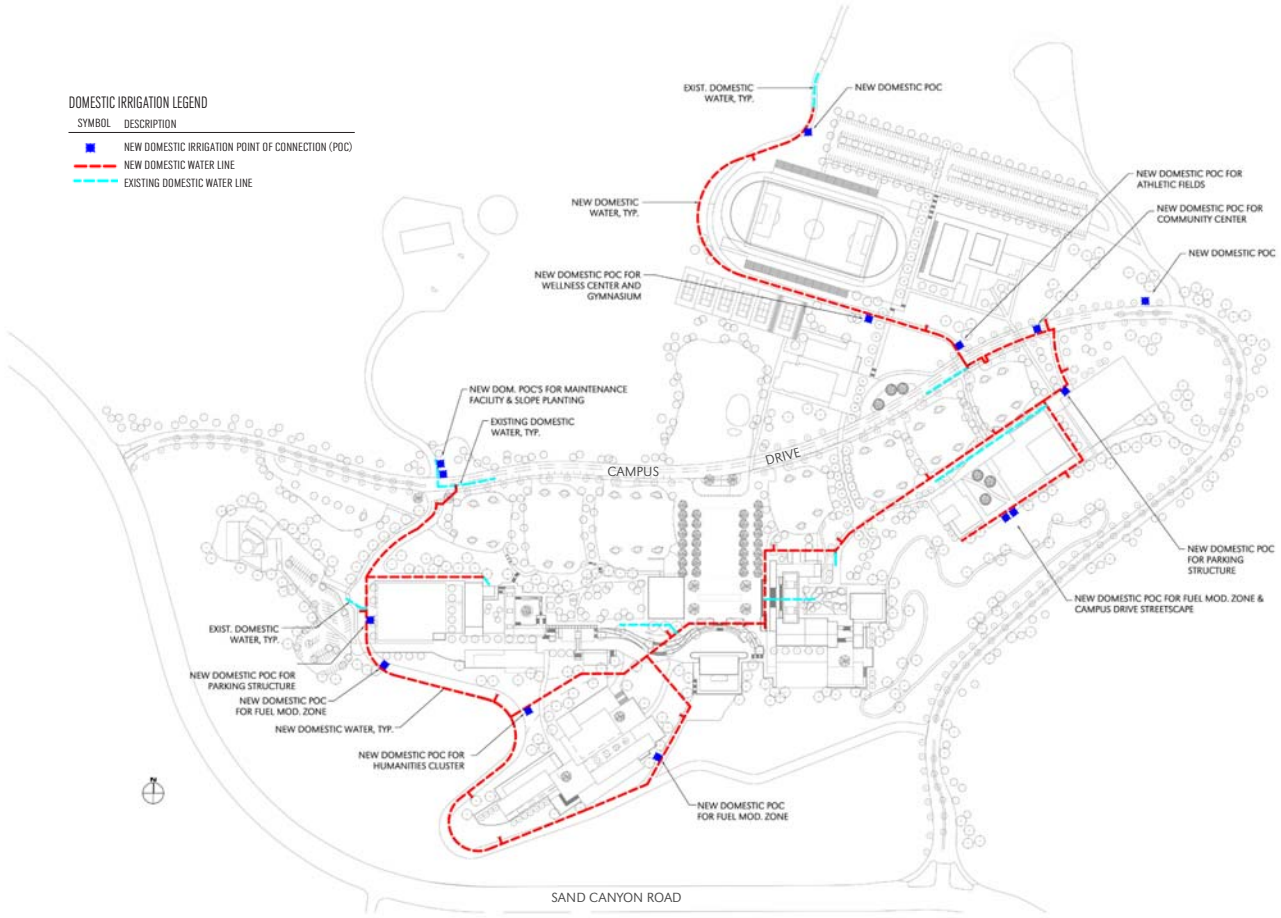


OPTION B: COMBINED RECLAIMED WATER AND DOMESTIC WATER MAINLINE ROUTING

- The initial phase of improvements will include the backbone reclaimed water loop to provide water for any existing domestic irrigation systems that will be converted to reclaimed water, as well as to provide connections for future improvement areas.
- According to the Yucaipa Valley Water District, conversions to reclaimed water systems do not require replacement of the existing potable irrigation lines to purple pipes. Typically, conversions require only reclaimed water tags on valves, purple caps on all irrigation heads, irrigation water signage, purple valve boxes, etc. When the water districts reach an agreement, conversion requirements by the water purveyor should be confirmed. Any new irrigation lines, however, will be installed using the purple pipes required for reclaimed water systems.
- Rain Master irrigation control systems will be used to connect to the campus irrigation central control. Irrigation master valves and flow sensors are proposed for all new work, as well as for the existing irrigation systems if feasible. Controllers with flow sensors will allow the College to track water usage. If the College desires more accurate usage tracking, meters can be installed at each point of connection.
- Under Options A, B and C, the Child Dvelopment Center will remain on a domestic water irrigation system.

City and Water District Contacts:

- City of Redlands water district, contact: Mike Taylor at 909-557-6447.
- City of Redlands, Municipal Utilities Engineering, contact Doug Heddrick at 909-798-7698
- Yucaipa Valley Water District (reclaimed water), contact: Brett Anton, 909-797-5118, extension 5.



OPTION C: DOMESTIC WATER MAINLINE ROUTING

This page shows the mainline routing for a domestic water irrigation system, Option C.

IRRIGATION GUIDELINES | EQUIPMENT LIST

MANUFACT.	MODEL NO. / DESCRIPTION	GPM	PSI	RADIUS
HUNTER	INST-06-CV POP-UP TURF HEAD W/ RAIN BIRD 5-Q/T/H NOZZLES	.20, .30, .40	30	5 FT
HUNTER	INST-06-CV POP-UP TURF HEAD W/ RAIN BIRD 8-Q/T/H/F NOZZLES	.26, .35, .52, 1.58	30	8 FT
HUNTER	INST-06-CV POP-UP TURF HEAD W/ RAIN BIRD 10LA-Q/T/H/F NOZZLES	.39, .52, .79, 1.57	30	10 FT
HUNTER	INST-06-CV POP-UP TURF HEAD W/ RAIN BIRD 12-Q/T/H/F NOZZLES	.65, .87, 1.3, 2.6	30	12 FT
HUNTER	INST-06-CV POP-UP TURF HEAD W/ RAIN BIRD 15-Q/T/H/F NOZZLES	.93, 1.23, 1.85, 3.70	30	15 FT
HUNTER	INST-06-CV-LCS-515/RCS-515/SS-530 POP-UP TURF HEAD	.65, 1.30	30	4X15 FT 4X30 FT
HUNTER	INST-12-CV POP-UP SHRUB HEAD W/ RAIN BIRD 5-Q/T/H NOZZLES	.20, .30, .40	30	5 FT
HUNTER	INST-12-CV POP-UP SHRUB HEAD W/ RAIN BIRD 8-Q/T/H NOZZLES	.26, .35, .52, .1.58	30	8 FT
HUNTER	INST-12-CV POP-UP SHRUB HEAD W/ RAIN BIRD 10LA-Q/T/H/F NOZZLES	.39, .52, .79, 1.57	30	10 FT
HUNTER	INST-12-CV POP-UP SHRUB HEAD W/ RAIN BIRD 12-Q/T/H/F NOZZLES	.65, .87, 1.3, 2.6	30	12 FT
HUNTER	INST-12-CV POP-UP SHRUB HEAD W/ RAIN BIRD 15-Q/T/H/F NOZZLES	.93, 1.23, 1.85, 3.70	30	15 FT
HUNTER	INST-12-CV-LCS-515/RCS-515/SS-530 POP-UP SHRUB HEAD	.65, 1.30	30	4X15 FT 4X30 FT
HUNTER	INST-06-CV POP-UP BUBBLER HEAD W/ RAIN BIRD 5FB/5CST-PCS-040 NOZZLES, USE 5F-B NOZZLES FOR PLANTERS WIDER THAN 21/2', USE 5CST-B NOZZLES FOR PLANTERS LESS THAN 21/2'	.40	30	3 FT
HUNTER	INST-06-CV-PCN-50 POP-UP BUBBLER HEAD, EACH SYMBOL REPRESENTS TWO BUBBLERS PER TREE, PLACE BUBBLERS AT EDGE OF ROOTBALL ON OPPOSITE SIDES OF TREE TYPICAL.	.50 (1.O)	30	N/A
HUNTER	I-20-6P-ADS/36S W/ NOZZLES 1.0/1.5/3.0 POP-UP TURF ROTOR HEAD	1.0, 1.4, 2.4	40	25 FT
HUNTER	I-20-6P-ADS/36S W/ NOZZLES 1.0/2.0/4.0 POP-UP TURF ROTOR HEAD	1.0, 1.8, 3.7	40	30 FT
HUNTER	I-20-6P-ADS/36S W/ NOZZLES 1.5/3.0/6.0 POP-UP TURF ROTOR HEAD	1.4, 2.4, 4.9	40	35 FT
HUNTER	I-20-6P-ADS/36S W/ NOZZLES 2.0/3.5/8.0 POP-UP TURF ROTOR HEAD	1.8, 3.0, 6.0	40	40 FT
HUNTER	I-20-HP-ADS/36S W/ NOZZLES 1.0/1.5/3.0 POP-UP TURF ROTOR HEAD	1.0, 1.4, 2.4	40	25 FT
HUNTER	I-20-HP-ADS/36S W/ NOZZLES 1.0/2.0/4.0 POP-UP TURF ROTOR HEAD	1.0, 1.8, 3.7	40	30 FT
HUNTER	I-20-HP-ADS/36S W/ NOZZLES 1.5/3.0/6.0 POP-UP TURF ROTOR HEAD	1.4, 2.4, 4.9	40	35 FT
HUNTER	I-20-HP-ADS/36S W/ NOZZLES 2.0/3.5/8.0 POP-UP TURF ROTOR HEAD	1.8, 3.0, 6.0	40	40 FT
HUNTER	I-40-ADS/36S W/ NOZZLE 43 POP-UP TURF ROTOR HEAD	13.5	50	56 FT

NOTE:
NOZZLES NUMBERS WITHIN THE ROTOR HEAD SYMBOLS TO NOT EXACTLY CORRESPOND TO THE HUNTER NOZZLE NUMBERS. NOZZLE NUMBERS FOR QUARTER, HALF, AND FULL HEADS ARE SHOW WITHIN THE HEAD MODEL NUMBER AS SHOWN IN THE LEGEND.

MANUFACT.	MODEL NO. / DESCRIPTION
HUNTER	HC-75F-75M SERIES CHECK VALVES INSTALLED BELOW ALL ROTORS W/ELEVATION CHANGE GREATER THAN 10 FEET FROM HIGHEST HEAD IN ZONE
P.O.C.	RECLAIMED WATER METER, VERIFY SIZE, LOCATION, AND STATIC WATER PRESSURE IN FIELD
HAYWARD	MODEL #72 BASKET STRAINER 2" - 8" SIZE W/ FLANGED CONNECTIONS AND 80 MESH FILTER ELEMENT
U.G.T.	BARRETT IRRIGATION BOOSTER PUMP, BEP/XX/XX/XX/230/X/X/X, SEE DETAIL. INSTALL PER MANUFACTURERS RECOMMENDATION. ASSEMBLED BY UNITED GREEN TECH, LAGUNA HILLS, CA CONTACT DARYL GREEN (800) 427-0779
GRISWOLD	MODEL 2230 11/2" "EPOXY FUSED' NORMALLY CLOSED PRESSURE REGULATING MASTER CONTROL VALVE
RAIN MASTER	FS-150 FLOW SENSOR, INSTALL PER MANUFACTURER'S RECOMMENDATIONS AND WIRE TO CONTROLLER
WATTS	B-6080-SS-SH FULL PORT BRONZE VALVE, STAINLESS STEEL BALL, STEM AND HANDLE USE ON 2" MAINLINE AND SMALLER, LINE SIZE UP TO 2"
MATCO	B-4 BUTTERFLY VALVE WITH B4-LTCH LATCH NUT AND B4-IND INDEX PLATE, 3" THROUGH 10" TO MATCH MAINLINE SIZE
HUNTER	HQ-44-LRC-AW QUICK COUPLER VALVE
HUNTER	ICV-XX-1G-AS (1", 11/2", 2") SERIES PRESSURE REGULATED PLASTIC REMOTE CONTROL VALVE, SIZE AS SHOWN INSTALL WITHIN VALVE MANIFOLD (SIZE MANIFOLD TO MATCH LARGEST LATERAL LINE IN MANIFOLD) WITH WATTS B-6080-SS-SH BALL VALVE (SIZE BALL VALVE TO MATCH LARGEST RCV IN MANIFOLD)
HUNTER	ICV-XX-1-FS (1", 1 1/2") SERIES DRIP REMOTE CONTROL VALVE ASSEMBLY , SIZE AS SHOWN, INSTALL AG PRODUCTS 1" #4E 200 MESH WYE FILTER AND SENNINGER PRESSURE REGULATOR PMR-40MF FOR DEMANDS LESS THAN 18 GPM, AG PRODUCTS 11/2" SIZE #4E 200 MESH WYE FILTER AND SENNINGER PR-40HF PRESSURE REGULATOR FOR DEMANDS GREATER THAN 18 GPM. INSTALL BOTH ON THE DOWNSTREAM SIDE OF EACH DRIP RCV
RAIN MASTER	DX-48-RETRO-DX-FLOW 48 STATION IRRIGATION CONTROLLER WITH FLOW SENSOR OPTION, REMOTE RECEIVER KIT, SIZE AS SHOWN, INSTALLED WITHIN STAINLESS STEEL ENCLOSURE. (SEE BELOW FOR TYPE)
V.I.T.	SB-18SS STRONGBOX STAINLESS STEEL CONTROLLER ENCLOSURE WITH CSA SUB-ASSEMBLY, RGVRSS, AND QP-18
W.C.S.	RAIN SENSOR, RG/RG-VR, MOUNT TO REAR OF ENCLOSURE AND WIRE TO CONTROLLER
N/A	230 VOLT (SINGLE/THREE) PHASE ELECTRICAL POWER FOR PUMP SYSTEM, PROVIDED BY ELECTRICIAN, VERIFY ACTUAL LOCATION IN FIELD
N/A	120 VOLT ELECTRICAL POWER, PROVIDED BY ELECTRICIAN, VERIFY ACTUAL LOCATION IN FIELD
TORO	RGP-2-12 DL2000 DRIP TUBING W/ .5 GPH EMITTERS 12" ON CENTER, INSTALL TUBING ROWS A MAXIMUM OF 16" APART IN SHRUB AREAS. ALL TUBING SHALL BE INSTALLED 4" BELOW FINISHED SOIL GRADE W/ 9" WIRE STAKES FIVE (5) FEET ON CENTER; VERIFY THE LAYOUT AND SPACING IN THE FIELD PRIOR TO STARTING WORK
AG PROD.	S3TS "SPIN-LOC" TEE OR ELL FITTING FOR CONNECTION BETWEEN PVC LATERAL LINES AND DRIP TUBING
AG PROD.	ALL CONNECTIONS BETWEEN DRIP TUBING SHALL BE MADE USING "SPIN-LOC" FITTINGS

IRRIGATION GUIDELINES | EQUIPMENT LIST

MANUFACT.	MODEL NO. / DESCRIPTION
TORO	PROVIDE A FCH-H AUTOMATIC FLUSH VALVE AT END/MIDDLE OF DRIPLINE 3/4" PCV FLUSH MANIFOLD LINE, INSTALL FLUSH VALVE INSIDE A SEPARATE VALVE BOX, ONE AT THE END OF TUBING RUNS IN EACH DIRECTION. INSTALL MIN. ONE FLUSH VALVE PER 1000' OF TUBING IN EACH DIRECTION ON DRIPLINE FLUSH MANIFOLD. INSTALL 18" FROM PAVING. INSTALL ALL FLUSH EQUIPMENT PER MANUFACTURER'S SPECIFICATIONS.
TORO	YD-500-34 AIR/VACUUM RELIEF VALVE INSTALLED WITH A FT-050 COMBINATION TEE AND A 3/4" X 1/2" REDUCER BUSHING, INSTALL AIR RELIEF ASSEMBLY INSIDE A 6" ROUND VALVE BOX AT THE HIGH POINT OF EACH PLANTER, MIN. 1 ARV PER 500' OF DRIPLINE. USING AIR RELIEF LATERAL, CONNECT AIR RELIEF VALVE TO ALL DRIPLINE LATERALS WITHIN THE ELEVATED AREA. MULTIPLE ARV'S SHALL BE REQUIRED PER RCV WITHIN UNDULATING AREAS, VERIFY QUANTITY PRIOR TO STARTING WORK, INSTALL VALVE BOX 18" FROM PAVING AND AT HIGH POINTS OF PLANTER AREA. INSTALL ALL AIR VACUUM RELIEF EQUIPMENT PER MANUFACTURER'S SPECIFICATIONS.
AS APPROVED	UVR PVC PIPE 3/4" - 3" SCH. 40 AS LATERAL LINES ON GRADE STAKE PIPE AT 8' O.C. USING #4 REBAR J-HOOKS
AS APPROVED	PVC PIPE 3/4" - 3" SCH 4 AS LATERAL LINES 12" BELOW GRADE
AS APPROVED	PVC PIPE 2-21/2" CL. 315 3"-10" CL. 200 BELL AND GASKET AS MAINLINES 18"-24" BELOW GRADE
AS APPROVED	PVC PIPE SCH. 40 AS SLEEVING, TWICE THE DIAMETER OF PIPE OR WIRE BUNDLE CARRIED PLACE BELOW ALL PAVING, HARDSCAPE, ETC., AND AS DIRECTED BY OWNER'S AUTHORIZED REPRESENTATIVE.
AS APPROVED	11/4" SCH. 40 ELECTRICAL CONDUIT FOR FUTURE CENTRAL CONTROL COMMUNICATION CABLE, PROVIDE COMMUNICATION CABLE PULL BOX AT A MAXIMUM OF 200 FEET ON CENTER, AT EACH FIELD SATELLITE LOCATION, AT EACH CHANGE IN DIRECTION. PROVIDE A 1/4" NYLON PULL ROPE WITHIN CONDUIT. PROVIDE A MINIMUM OF 18" COVER.
AS APPROVED	IRRIGATION CONTROL WIRE #14UF AWG DIRECT BURIAL (U.L. APPROVED)
3M	DBY DIRECT BURIAL WATER-PROOF WIRE CONNECTORS FOR USE ON ALL WIRE CONNECTIONS
K.B.I.	KSC-XXX-S SWING CHECK VALVE, LINE SIZE, 1 DOWNSTREAM OF EACH RCV WHEN RCV IS LOWER THAN THE SPRINKLERS
K.B.I.	KC-XXX-S SPRING CHECK VALVE, LINE SIZE, 1 DOWNSTREAM OF EACH RCV IMMEDIATELY ABOVE FIRST LATERAL LINE TEE, WHEN RCV IS HIGHER THAN THE SPRINKLERS
LEEMCO	ALL FITTINGS USED WITH RING TITE PIPE SHALL BE LEEMCO "DEEP BELL" DUCTILE IRON FITTINGS. USE LEEMCO JOINT RESTRAINTS ON ALL DIRECTIONAL CHANGES AND ON COUPLINGS WITHIN 50 FEET OF DIRECTIONAL CHANGE. USE JOINT RESTRAINTS ON ALL EQUIPMENT INSTALLED ON RING TITE PIPE.

NOTE:
RECLAIMED WATER REQUIREMENTS ARE TO BE VERIFIED WITH THE WATER DISTRICT. TYPICALLY, A RECLAIMED WATER SYSTEM WILL INCLUDE:
- PURPLE CAPS ON IRRIGATION HEADS
- PURPLE IRRIGATION PIPES
- PURPLE VALVE BOXES
- RECLAIMED WATER TAGS ON VALVES
- RECLAIMED WATER WARNING HANDLE ON VALVES
- RECLAIMED SIGNAGE

ELECTRICAL SYSTEMS

Existing Site Power System Assessment

The Campus electrical service connection is provided by the Southern California Edison Company (SCE). The service point of connection is from the SCE 12KV overhead distribution system located on the West side of the Campus near the junction of Sand Canyon Road and Campus Drive. The 12KV SCE service runs underground along Campus Drive and terminates at an outdoor 2500KVA, 12KV/4160V SCE substation located on the outside of the Laboratory/Administration Building. This SCE substation serves the 3000A, 4160V Main Service Switchboard and Meter located in the main electrical room of the Laboratory/Administration Building. The main service switchboard has three fused switches serving the three main feeders which are distributed radially throughout the Campus.

Power is distributed at 4,160V via a system of underground cables in underground ducts, pull boxes, and manhole structures. The three main feeders feed all the buildings in the campus. Each building power service is typically tapped from the existing 500 Kcmil, 5KV feeders through a 5KV oil-filled fuse cut-out and step-down transformer. All existing buildings in the Campus have two transformers to step down the 4160V service voltage to 480/277V, 3-phase, 4-wire to feed all the lighting and mechanical equipment loads and 208/120V, 3-phase, 4-wire for all receptacle outlets, office equipment and small motor loads in the building.

The three main feeders from the main service switchboard are called out as circuits "A", "B", and "C". Circuit "A" serves the Library, Performing Arts Center, Student Services, College Center, Maintenance and Operations Building and the Child Development Center Building including one street lighting circuit. Circuit "B" serves the Laboratory/Administration building, Classroom, Bookstore, Occupational Education 1 & 2, Gymnasium, Satellite/T.V. Communication station, Clock Generator Station, and two street lighting circuits. Circuit "C" serves the Chemistry & Health Sciences building.

Circuits "A" and "B", per the load calculation shown on the as-built single line diagram, are at their full load condition. Circuit "C" is lightly loaded and has spare capacity available.

Information obtained from SCE showed that the previous 12 Months power demand of the Campus is at 60% of the SCE transformer capacity, which translates to an available spare capacity of approximately 1200KVA at 5KV or 1,440Amps at 480V, 3-phase.

Existing feeders are made up of single conductor, shielded copper 500kcmil rated at 5KV. In the 1990's these feeders were inspected and tested and partially replaced with new cable of the same size as shown on the as-built drawings. As part of the Master Plan scope of work, we had the opportunity to visually inspect and examine the existing feeders and found out that they are in good operational condition, although no testing was done. At the present time we will leave all existing feeders as is but will recommend that all existing feeders be inspected and tested when opportunity comes.

As part of the Master Planning exercise we also had the opportunity to assess all the existing building electrical systems and found that all electrical service equipment from the high voltage switch to the switchboard and panelboards in the building are antiquated and beyond their life expectancy. The electrical equipment is discontinued models with no available spare parts. The equipment is still operational and there is no immediate need for replacement. However as buildings are renovated, it is recommended that all electrical equipment in the building be first on the priority list to be replaced. Existing buildings will remain connected to existing feeders through the existing service conduit(s).

Master Plan

The Campus twenty-year master plan involves several new classroom buildings, a competition swimming pool and parking garage structures, and etc. The program also involves extensive and minor renovations of most if not all of the existing building in the Campus. Refer to the Architectural Master Plan for more information.

The Existing Campus distribution system is a simple radial system with a Main Switchboard and three circuits serving all the existing building. Two of the three existing circuits are fully loaded and cannot take any new load; the third circuit is lightly loaded and has spare capacity available. In order for the existing electrical infrastructure to support the Master Plan program the following is proposed:

Master Plan to 2012

For the proposed new LRC, Humanities 1, Parking Structure 1 located on the West side and Natatorium on the East side of the Campus, we will add two new circuits to the existing Main Switchboard to feed all future buildings on the campus. Two new additional fuse switch sections will be added to the existing main switchboard to accommodate the two new additional circuits. The two additional switchboard sections will fit in the existing electrical room where the existing main Campus switchboard is located. The new circuits from the main switchboard in the electrical room of the Laboratory/ Administration Building will be routed to utilize existing manholes and existing spare conduits along with new manholes and new underground duct banks to serve the future buildings on the East and West side of the Campus. New underground duct banks and new manholes will match the existing manholes and conduit sizes.

New underground duct banks will be routed along the Main Utilities Corridor in the campus. Three 500 kcmil, single conductor copper cable rated 5KV will be the standard feeder size for circuit run to match existing. Three 2/0 single conductor copper cable rated at 5KV will be the standard minimum size conductor to feed the new or renovated buildings.

The Campus distribution system is a simple radial system. Cable fault in one feeder will render the connected facilities without power until the faulty cable is replaced, a major disadvantage of a radial distribution system. To minimize power service downtime due to fault in the cable, we will use non-loadbreak elbow connectors with test point and fault indicators. The non-loadbreak elbow connectors will be installed in all new manholes.

The 2012 Electrical Infrastructure Plan shows the routing of feeders to feed the new buildings. Routing of new underground ducts as mentioned above will be routed along the new campus utilities corridor. New under ground ducts will include two 4" spare conduits for future use.

As part of the Master Planning to 2012, existing buildings including College Center, the Classroom Building (to become Student Services), the Library (to become the Student Center), and Occupational Education will be heavily renovated. In the assessment done on existing buildings we made recommendations that all existing electrical equipment in the building should be replaced when the opportunity comes; therefore all existing electrical equipment in all buildings to be renovated will be replaced including the existing high voltage incoming feeder. A new High Voltage switch, new step down transformer, new main building switchboard and new panelboards will be installed in each building, as well as new service conductors in existing service conduit(s).

Master Plan to 2025

In the second half of the Campus Master Plan up to 2025, new buildings such as Administration/Student Services Building, Humanities 2, Science Building, Wellness Center, Community Building, Child Development Center 3 and Parking Structure 2 will be built on the campus. Renovations of Student Services A and B, Laboratory/ Administration, Chemistry/Health Science, Gymnasium, renovations and addition to the Performing Arts Center, and the Maintenance and Operations Building will also take place in this phase of the Master Plan.

Evaluation, analysis, and calculation of the existing and future loads were undertaken to find out if the existing capacity of the Campus Main Switchboard is sufficient to accommodate the Campus upgrade to 2025. Based on the electrical loads of existing buildings and the preliminary load information available for the new buildings we found out that the existing main switchboard have the capacity to handle the new and renovated buildings and still have spare capacity available.

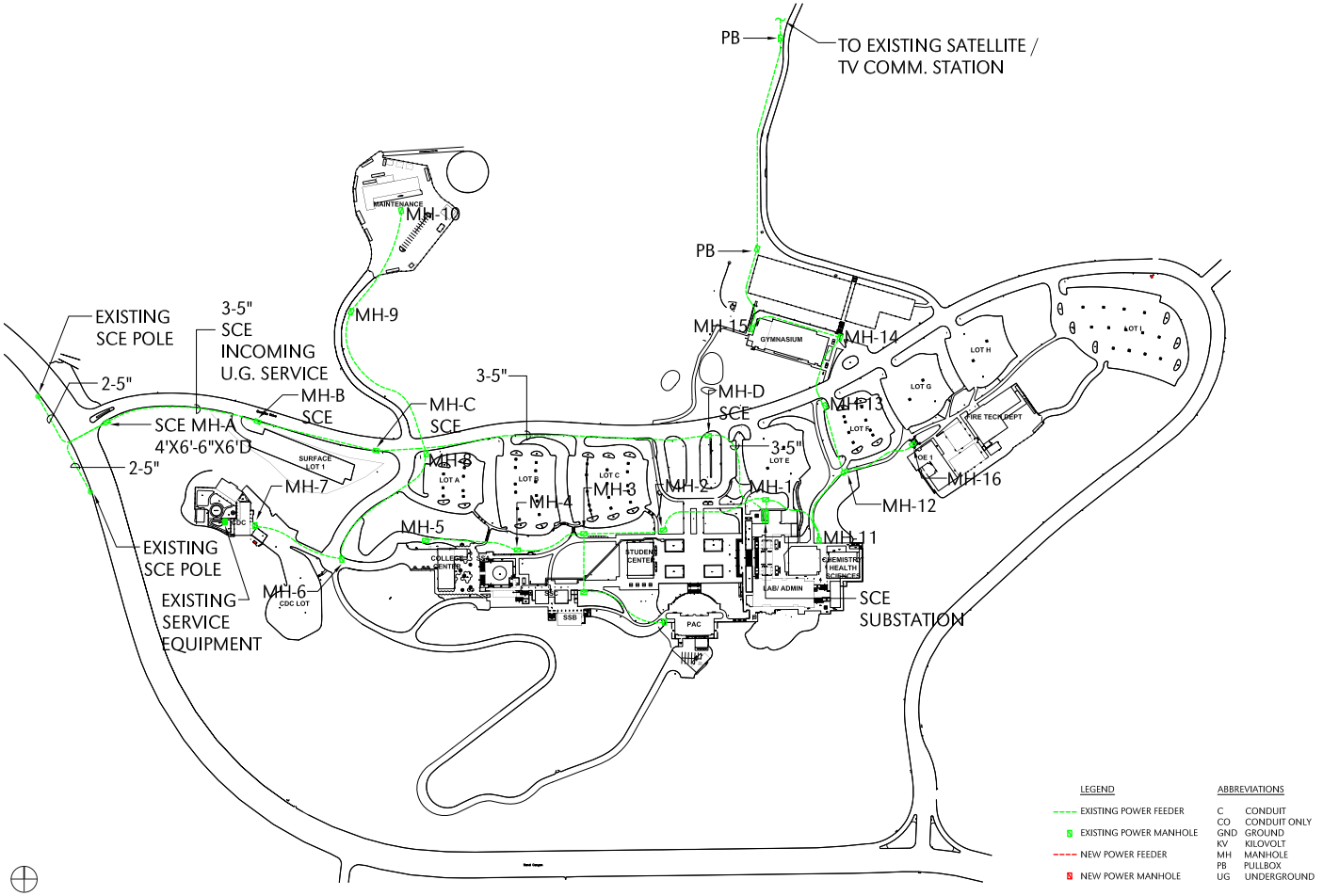
The two new feeders added during the 2012 upgrade will be extended and will accommodate the additional new buildings. Stub out conduits in the underground duct banks for extension to this phase of the upgrade were included during the first phase. New underground manholes and extension of underground ducts are shown on the 2025 Electrical Infrastructure Master Plan to serve the new buildings in this phase of the upgrade.

The same strategies in connecting the new and renovated buildings in the campus electrical distribution system are as described in the first phase (2012) of the campus upgrade.

Summary

- Existing main switchboard have the capacity to support existing building renovations and new buildings up to year 2025.
- The available spare capacity on circuit "C" will remain as spare.
- Additional two new switchboard sections will be provided in the existing main switchboard to accommodate two new feeder circuit breakers to serve all new buildings on the Campus.
- Additional new 4" conduits to existing underground ducts will be installed to accommodate new feeders and to provide minimum of two 4" spare conduits.
- Additional new manholes will be installed to extend duct banks to new building locations as shown on plans. Stub-out conduit from new manholes to the extent of hardscape will be installed for future extension to new building.
- Buildings for renovation will have new service equipment and new high voltage feeders to replace all existing equipment and feeders, while reusing existing service conduit(s).
- New fire alarm and security systems will be included in the campus upgrade.

ELECTRIC | EXISTING



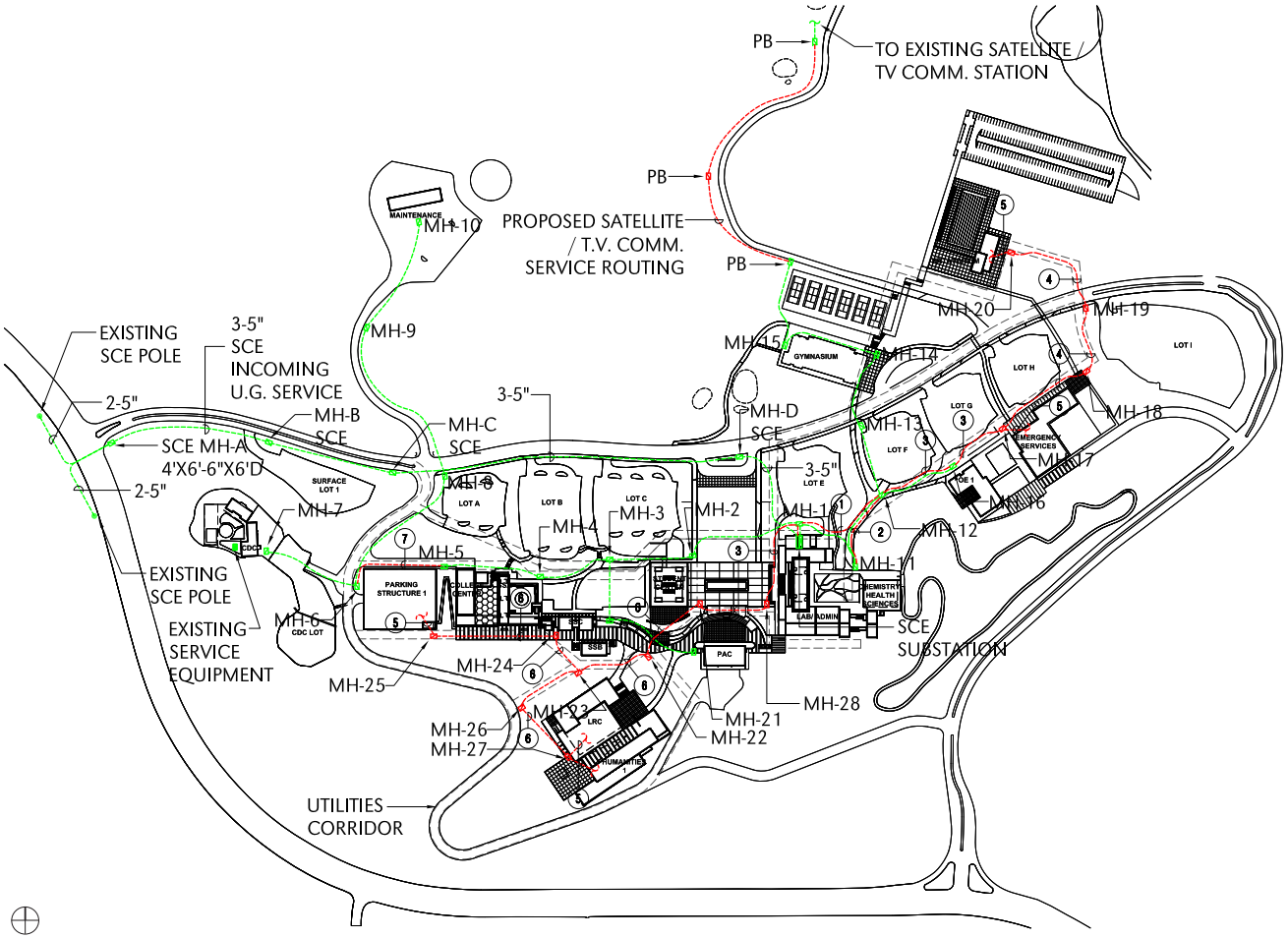
LEGEND

- EXISTING POWER FEEDER
- EXISTING POWER MANHOLE
- NEW POWER FEEDER
- NEW POWER MANHOLE

ABBREVIATIONS

C	CONDUIT
CO	CONDUIT ONLY
GND	GROUND
KV	KILOVOLT
MH	MANHOLE
PB	PULLBOX
UG	UNDERGROUND

ELECTRIC | 2012



GENERAL NOTES:

1. ALL NEW CONDUITS WILL BE LOCATED IN THE CAMPUS UTILITY CORRIDORS
2. ALL NEW UNDERGROUND POWER MANHOLE SHALL BE 4'X6'-6"X6' DEEP TO MATCH EXISTING.
3. ALL EXISTING ELECTRICAL EQUIPMENT IN THE EXISTING BUILDING SCHEDULED FOR RENOVATION SHALL BE REPLACED WITH ALL NEW ELECTRICAL EQUIPMENT.
4. ALL FEEDER CONDUCTORS ARE RATED AT 5KV AND SINGLE CONDUCTOR COPPER CABLE.

REFERENCE NOTES:

1. FEEDER "E" FROM EXISTING SWBD. (1) 4"C., 3#500KCMIL & 1#4 GND, AND (1) 4"C.O. SPARE CONDUITS.
2. NEW (2) 4"C.O. SPARE.
3. (1) 4"C., 3#500KCMIL 5KV & 1#4 GND FOR FEEDER "E" AND (2) 4"C.O. SPARE CONDUITS.
4. (1) 4"C., 3#500KCMIL 5KV & 1#4 GND FOR FEEDER "E" AND (3) 4"C.O. SPARE CONDUITS.
5. (1) 3"C., 3#2/0 5KV & 1#4 GND FEEDER CONDUCTORS AND (1) 3"C.O. SPARE CONDUIT STUB-UP IN THE BUILDING ELECTRICAL ROOM.
6. (1) 4"C., 3#500KCMIL 5KV & 1#4 GND FOR FEEEDER "D" AND (3) 4"C.O. SPARE CONDUITS.
7. NEW (2) 4"C.O. AND (2) 3"C.O. ROUTED IN THE UTILITIES CORRIDOR TO ACCOMODATE RE-ROUTING OF EXISTING CIRCUITS AFFECTED BY FUTURE PARKING STRUCTURE 1.

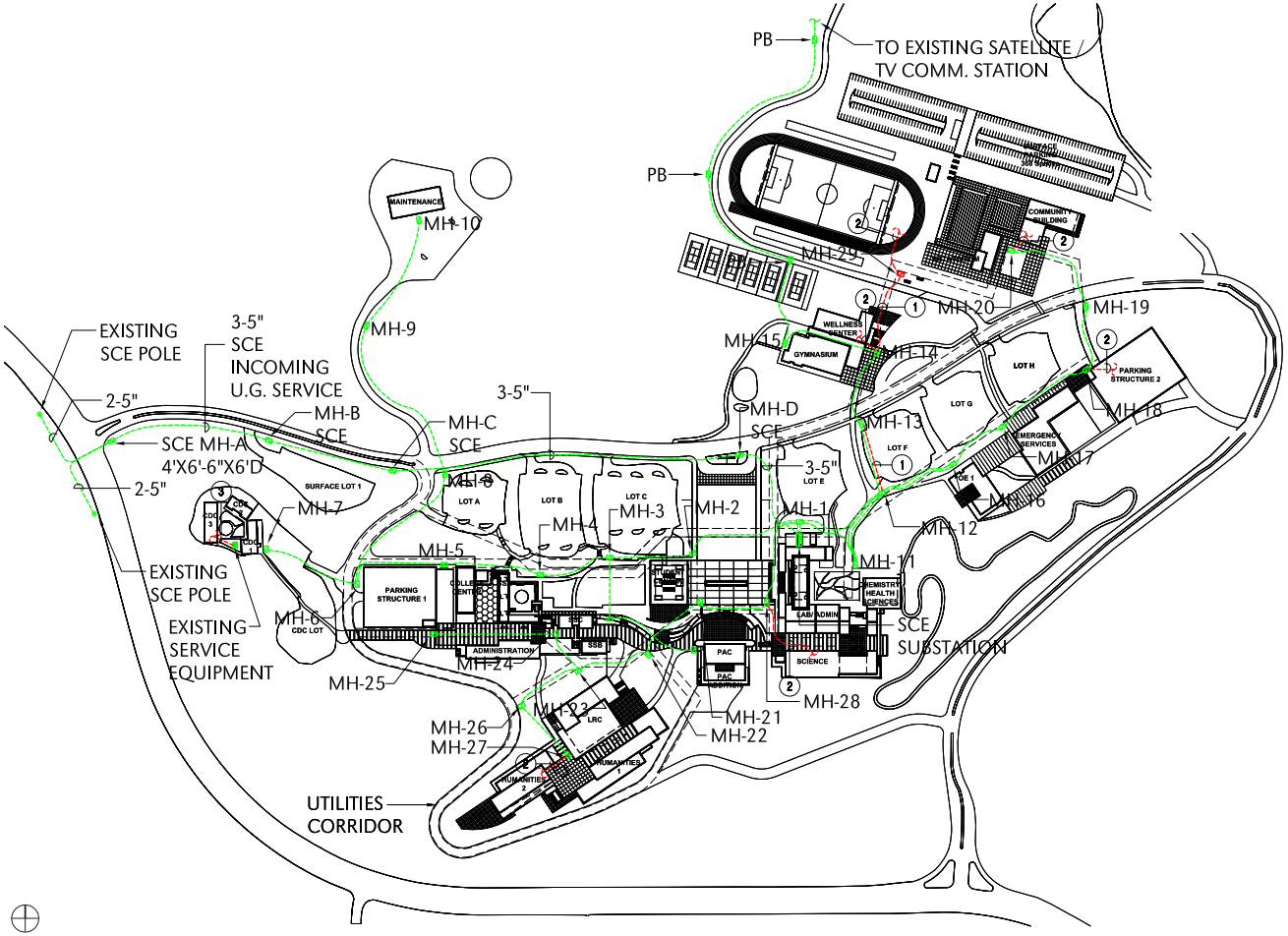
LEGEND

- EXISTING POWER FEEDER
- EXISTING POWER MANHOLE
- NEW POWER FEEDER
- NEW POWER MANHOLE

ABBREVIATIONS

C	CONDUIT
CO	CONDUIT ONLY
GND	GROUND
KV	KILOVOLT
MH	MANHOLE
PB	PULLBOX
UG	UNDERGROUND

ELECTRIC | 2025



GENERAL NOTES:

1. ALL NEW CONDUITS WILL BE LOCATED IN THE CAMPUS UTILITY CORRIDORS
2. ALL NEW UNDERGROUND POWER MANHOLE SHALL BE 4'X6'-6"X6' DEEP TO MATCH EXISTING.
3. ALL EXISTING ELECTRICAL EQUIPMENT IN THE EXISTING BUILDING SCHEDULED FOR RENOVATION SHALL BE REPLACED WITH ALL NEW ELECTRICAL EQUIPMENT.
4. ALL FEEDER CONDUCTORS ARE RATED AT 5KV AND SINGLE CONDUCTOR COPPER CABLE.

REFERENCE NOTES:

1. (1) 4"C., 3#500KCMIL & 1#4 GND AND (1) 4"C.O. SPARE CONDUIT.
2. (1) 3"C., 3#2/0 5KV & 1#4 GND FEEDER CONDUCTORS AND (1) 3"C.O. SPARE CONDUIT STUB-UP IN THE BUILDING ELECTRICAL ROOM.
3. (2) 2"C., 3#4/0 & 1#2 GND FROM EXISTING SERVICE EQUIPMENT TO THE ELECTRICAL ROOM IN NEW CDC 3.

LEGEND

- EXISTING POWER FEEDER
- EXISTING POWER MANHOLE
- NEW POWER FEEDER
- NEW POWER MANHOLE

ABBREVIATIONS

C	CONDUIT
CO	CONDUIT ONLY
GND	GROUND
KV	KILOVOLT
MH	MANHOLE
PB	PULLBOX
UG	UNDERGROUND

CAMPUS GAS SYSTEM

Campus Master Gas Meter

General Description

- The existing master gas meter is located on West Side of the Crafton Hills College Campus at an above ground exterior location exposed to the weather (see photo on 5.37).
- The gas meter is part of a service assembly provided by the Southern California Gas Company. High pressure gas (range of 15 to 50 psig) is supplied to the meter by Gas Company. Gas Company's gas pressure regulators further reduces the pressure to 5 psig. Natural gas systems at buildings are reduced to low pressure gas (Maximum of 11 inches of water column) via gas regulator (GPR) outside of each buildings.

Piping

- The size of main gas pipe above ground is a 6". The pipe appears to be black steel and is in fair condition.
- The main 6" metal pipe descends underground and delivers gas to the Campus.

Existing Campus Natural Gas Demand

See table 9.

Future Development and Gas Load

Natural gas load for new buildings for each construction phase year 2012 and 2025 are shown in tables 10 and 11.

- Ultimate natural gas load through year 2025 will be 40,332 CFH and the developed length from the gas meter to the furthest building will be 2900 feet.
- For the above ultimate gas load the 6" main at 5 PSI is adequate. This pipe size can handle a maximum of 66,500 CFH.

Recommendations

- According to the maintenance personnel, the newly installed boiler in the central plant at the Laboratory/Administration building is starving for gas. It seems that ample gas capacity can be delivered in the existing underground piping to building #1. This building is fed with a five inch line; which is adequate for the gas load of this building. We recommend consulting the boiler manufacturer for equipment performance and installation procedure.
- Prior start of any gas piping replacement work, contractor to inform gas company to up date the existing meter to have the ability to deliver 37,000 CFH gas, 5 PSI at 2900' developed length.
- Install new underground gas piping, size to match the gas load for year 2025 as shown on the plans.
- Install branch gas piping to existing building's gas pressure regulators, size to match existing branches and connect to new mains.
- Existing gas mains and branches to the buildings shall remain in service until the new branch lines are connected to the existing gas pressure regulators.
- Abandon in place all existing gas piping. No open end piping shall remain underground. All open end existing piping shall be capped.
- Gas master plan has been developed in two phases, they are: Phase I through year 2012, Phase II through year 2025.

Table 9 - Existing Natural Gas Demand

BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	CUBIC FEET PER HOUR
1	LABORATORY/ ADMINISTRATION	38,205	9,990
2	LIBRARY/ LEARNING RESOURCES	37,535	–
3	COLLEGE CENTER	10,515	5,855
4	STUDENT SERVICES A	10,855	
5	CLASSROOM BUILDING	7,110	–
6	OCCUPATIONAL EDUCATION 1	9,745	700
7	OCCUPATIONAL EDUCATION 2	34,104	900
8	PERFORMING ARTS CENTER	32,715	–
9	MAINTENANCE & OPERATIONS	14,286	1159
10	GYMNASIUM	17,930	1980
12	CHEMISTRY	17,270	250
13	CHILD DEVELOPMENT CENTER 1	3,970	409
14	CHILD DEVELOPMENT CENTER 2	2,685	274
16	STUDENT SERVICES B	5,745	–
17	BOOKSTORE	53,500	600
18	CLASSROOMS AT BOOKSTORE	24,369	600
	TOTALS		22,717

Table10 - 2012 New Buildings Natural Gas Demand

BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	SPACE HEATING (CFH)	DOMESTIC WATER HEATING (CFH)
7	EMERGENCY SERVICES (OE2 replacement building)	24,104	800	100
20	LEARNING RESOURCE CENTER	53,500	2,000	200
21	HUMANITIES 1	24,400	1,225	100
25	COMMUNITY RECREATIONAL FACILITY	7,000	750	4,100
	TOTALS		4,775	4,500

Table 11 - 2025 New Buildings Natural Gas Demand

BLDG. NO.	BUILDING NAME	BUILDING AREA (GSF)	SPACE HEATING (CFH)	DOMESTIC WATER HEATING (CFH)
9	MAINTENANCE & OPERATIONS	14,286		
11	WELLNESS CENTER	24,475	890	100
15	CHILD DEVELOPMENT CENTER EXPANSION	12,118	50	50
19	ADMINISTRATION/ STUDENT SERVICES	27,713	450	100
22	HUMANITIES 2	44,531	2,625	200
23	PERFORMING ARTS CENTER EXPANSION	13,295	475	100
24	SCIENCES	36	2,350	400
26	COMMUNITY CENTER	15,000	575	75
	TOTALS		7,415	1,025

2012 Buildings

1. Humanities 1

- This building consists of public toilets, class rooms, computer labs and offices.
- Domestic cold water main will be 2-1/2" and hot and cold water piping will be copper tubing.
- Where water pressure exceed 80 PSI, there will be a pressure reducing valve installed prior water entering the building.
- Waste, vent and storm drain piping will be cast iron service weight piping.
- Roof drains and overflow drains will be each piped separately to approved receptors.
- Water closets will be wall hung, flush valve, American Standard or Kohler.
- Medium pressure gas will be reduced to low pressure gas via a gas pressure regulator outside of the building. Gas will run into the building with schedule 40 black steel pipe to support the domestic water heater and HVAC equipment.
- Low pressure gas, schedule 40 black steel pipe will enter the building. Gas will be piped to domestic water heater and to HVAC equipment that are requiring gas supply.
- A 100-gallon water heater with circulating pump and expansion tank will be adequate to serve the domestic hot water requirement.

2. Learning Center (LRC) Building

- This building consists of small toilet rooms, class rooms and small kitchen.
- Domestic cold water main will be 2" and hot and cold water piping will be copper tubing.
- Where water pressure exceed 80 PSI, there will be a pressure reducing valve installed prior water entering the building.
- Waste, vent and storm drain piping will be cast iron service weight piping.
- Roof drains and overflow drains will be each piped separately to approved receptors.
- Water closets will be wall hung, flush valve, American Standard or Kohler.
- Medium pressure gas will be reduced to low pressure gas via a gas pressure regulator outside of the building. Gas will run into the building with schedule 40 black steel pipe to support the domestic water heater and HVAC equipment.
- Low pressure gas, schedule 40 black steel pipe will enter the building. Gas will be piped to domestic water heater and to HVAC equipment that are requiring gas supply.
- A 50-gallon water heater with expansion tank will be adequate to serve the domestic hot water requirement.

HVAC

Air Handling Units

- Classroom and Office Air handling units shall be double wall unit and be located in a mechanical room.
- The units will be a Variable Air Volume air handling unit containing the following minimum components in a draw-through arrangement: supply air fan, chilled water cooling coil, pre-filter and final filter section, return air fan, outside air economizer, outside air, return and relief dampers and vibration isolators. Outside air and relief air will be ducted to and from the unit.
- Air is distributed and returned via four perimeter riser shafts. VAV boxes with terminal reheat will be provided for each 600 sq. ft. at the perimeter and 1,000 sq. ft. in the interior of the building. Dedicated VAV boxes will be provided for corner offices, classrooms and conference rooms. The ceiling void will be used as a return air plenum within the offices. Ducted return air will be provided in the classrooms.

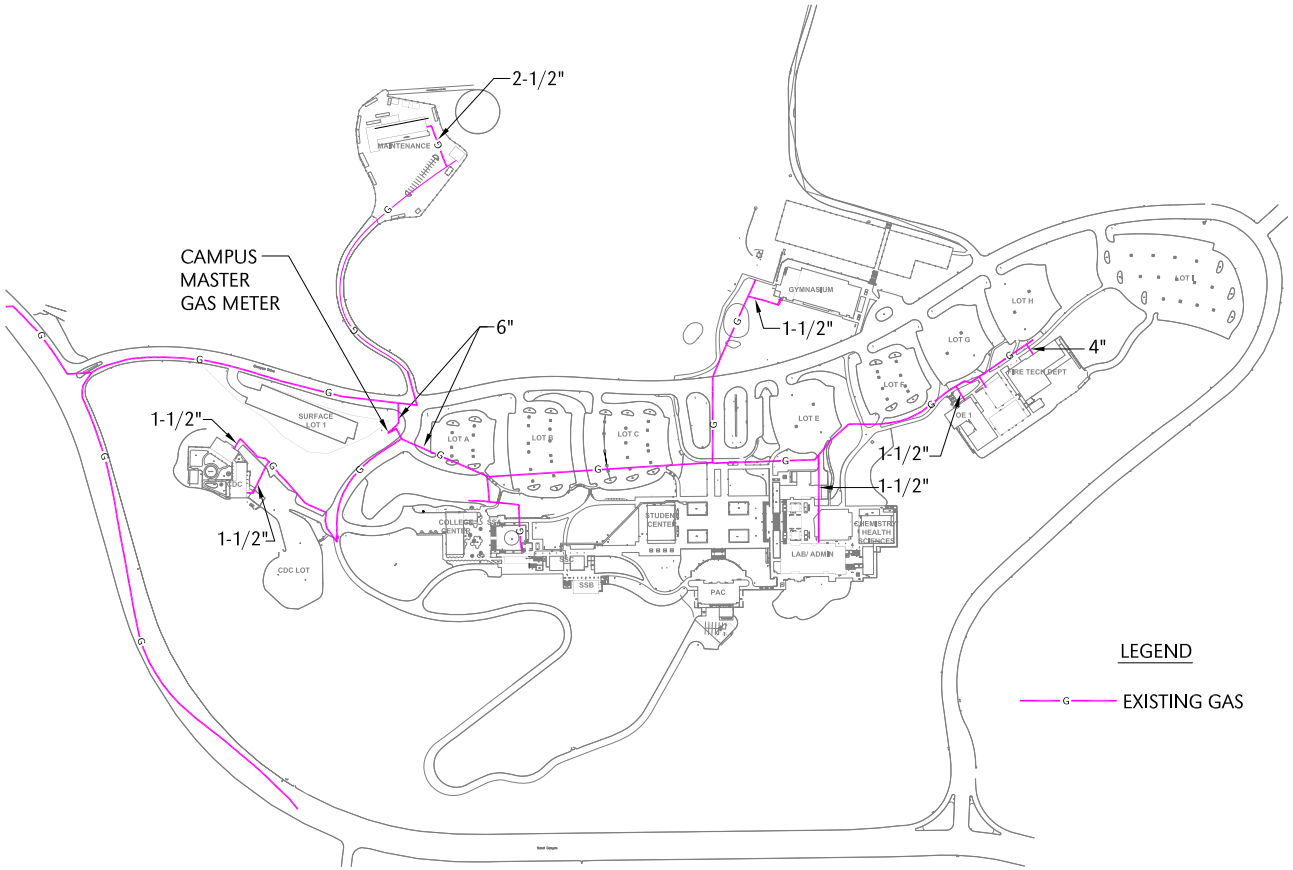
3. Natatorium Building

- This building consists of a prefabricated swimming pool, public toilets, showers and locker rooms.
- Domestic cold water main will be 4" and hot and cold water piping will be copper tubing.
- Where water pressure exceed 80 PSI, there will be a pressure reducing valve installed prior water entering the building.
- Waste, vent and storm drain piping will be cast iron service weight piping.
- Roof drains and overflow drains will be each piped separately to approved receptors.
- Water closets will be wall hung, flush valve, American Standard or Kohler.
- Showers will be gang column type with stainless steel panel.
- Medium pressure gas will be reduced to low pressure gas via a gas pressure regulator outside of the building. Gas will run into the building with schedule 40 black steel pipe to support the domestic water heater and HVAC equipment.
- Low pressure gas, schedule 40 black steel pipe will enter the building. Gas will be piped to domestic water heater and to HVAC equipment that are requiring gas supply.
- Domestic water heater will be consists of a 1000-gallon storage tank with (2) water heaters each at 800,000 BTUH input together with expansion tank and circulating pump.
- Domestic hot water will be tempered via a mixing valve to 105 F for showers and 120 F for laundry and other use.

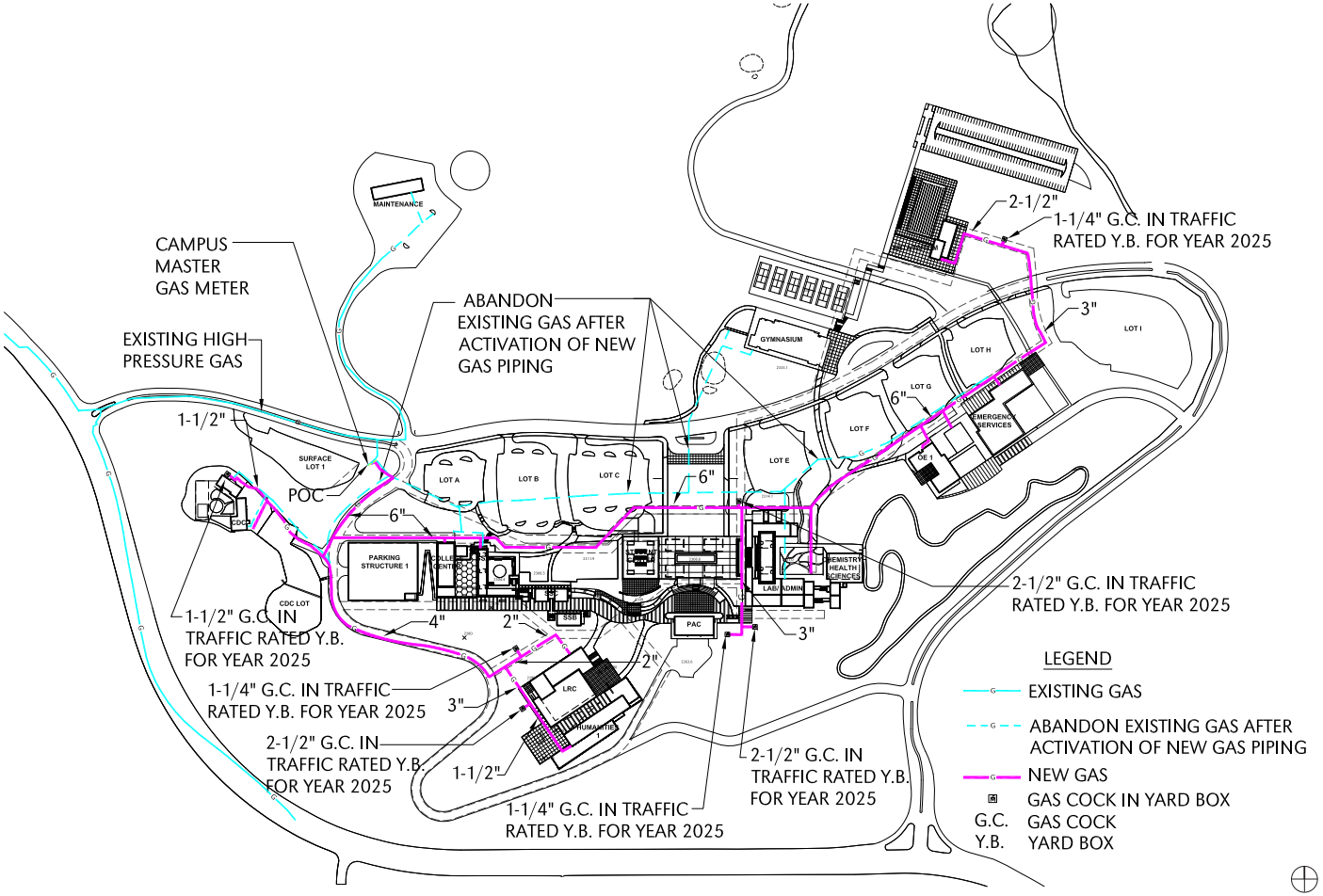
TABLE 12-6
Medium Pressure Natural Gas Systems for Sizing Gas Piping Systems
Carrying Gas of 0.60 Specific Gravity
Capacity of Pipes of Different Diameters and Lengths in Cubic Feet Per Hour for Gas Pressure of 5.0 psi with a Drop 1.5 psi

Pipe Size	Length (Feet)											
	650	**700**	**750**	**800**	**850**	**900**	**950**	**1000**	**1100**	**1200**	**1300**	**1400**
1/2	349	335	323	312	302	293	284	277	263	251	240	231
3/4	730	701	676	653	632	612	595	578	549	524	502	482
1	1375	1321	1273	1229	1190	1153	1120	1089	1035	987	945	908
1-1/4	2824	2713	2614	2524	2442	2368	2300	2237	2124	2027	1941	1865
1-1/2	4231	4065	3916	3781	3659	3548	3446	3351	3183	3037	2908	2794
2	8149	7828	7542	7283	7048	6833	6636	6455	6130	5848	5600	5380
2-1/2	12,988	21,477	12,020	11,608	11,233	10,891	10,577	10,288	9771	9321	8926	8575
3	22,960	22,057	21,249	20,520	19,858	19,253	18,698	18,187	17,273	16,478	15,780	15,160
4	46,830	44,990	43,342	41,855	40,504	39,271	38,139	37,095	35,231	33,611	32,186	30,921
	1500	**1600**	**1700**	**1800**	**1900**	**2000**	**2100**	**2200**	**2300**	**2400**	**2500**	**2600**
1/2	222	214	208	201	195	190	185	181	176	172	168	165
3/4	464	449	434	421	409	398	387	378	369	360	352	345
1	875	845	818	798	770	749	729	711	694	678	664	650
1-1/4	1796	1735	1679	1628	1581	1537	1497	1460	1425	1393	1363	1334
1-1/2	2691	2599	2515	2439	2368	2303	2243	2188	2136	2087	2042	1999
2	5183	5005	4844	4696	4561	4436	4321	4213	4113	4020	3932	3849
2-1/2	8261	7978	7720	7485	7270	7071	6886	6715	6556	6406	6267	6135
3	14,605	14,103	13,648	13,233	12,851	12,500	12,174	11,871	11,589	11,326	11,078	10,846
4	29,789	28,766	27,838	26,991	26,213	25,495	24,831	24,214	23,639	23,100	22,596	22,121
5	53,892	52,043	50,363	48,830	47,422	46,124	44,923	43,806	42,765	41,792	40,879	40,021
6	87,263	84,269	81,550	79,067	76,787	74,686	72,740	70,932	69,247	67,671	66,193	64,803

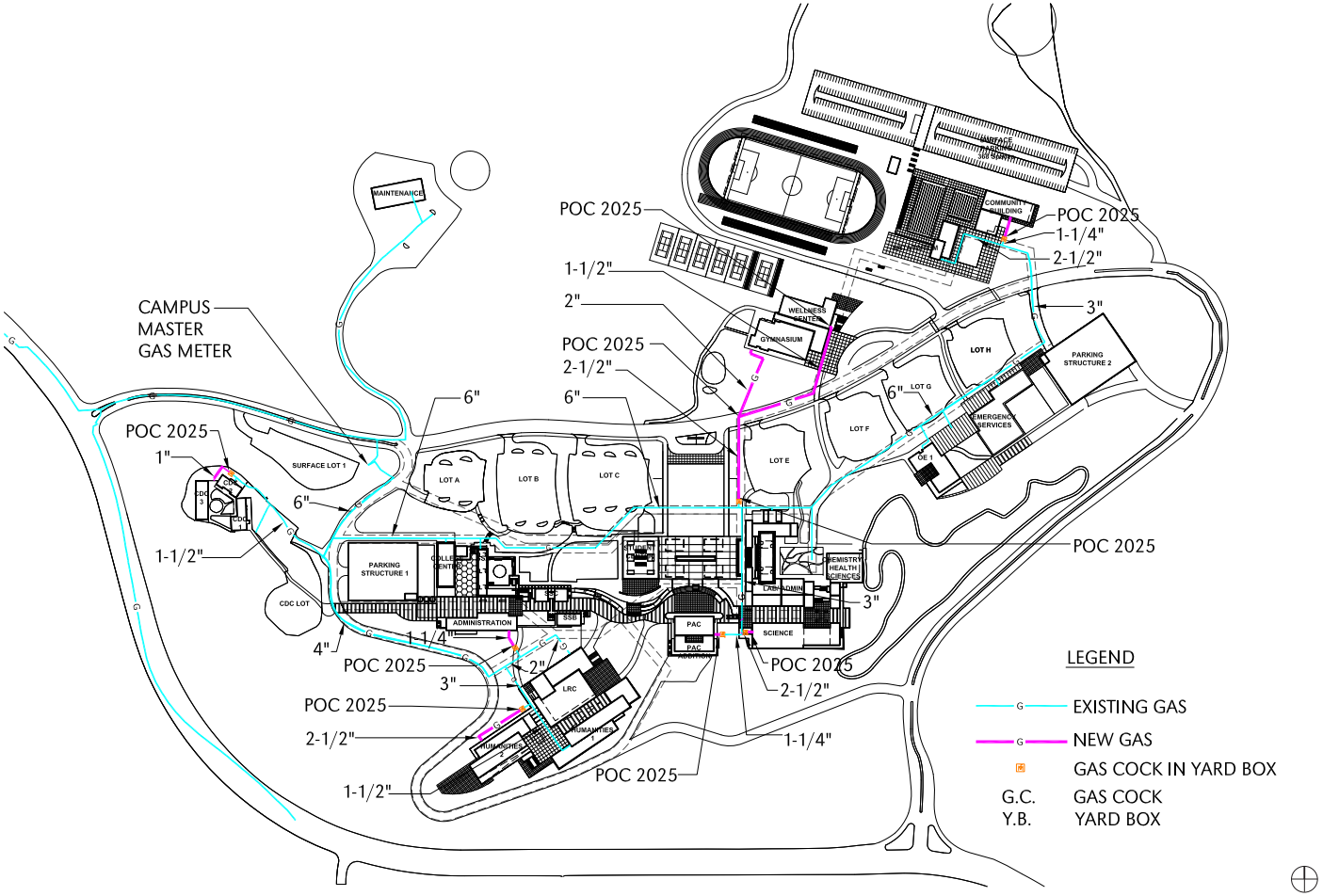
GAS | EXISTING



GAS | 2012


CAMPUS MASTER GAS METER
EXISTING HIGH PRESSURE GAS
ABANDON EXISTING GAS AFTER ACTIVATION OF NEW GAS PIPING
2-1/2"
1-1/4" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
3"
1-1/2"
POC
6"
4"
2"
1-1/2" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
1-1/4" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
2-1/2" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
1-1/4" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
2-1/2" G.C. IN TRAFFIC RATED Y.B. FOR YEAR 2025
MAINTENANCE
GYMNASIUM
LOT A
LOT B
LOT C
LOT E
LOT F
LOT G
LOT H
LOT I
PARKING STRUCTURE 1
CDC LOT
LRC
HUMANITIES
PAC
LEGEND
EXISTING GAS
ABANDON EXISTING GAS AFTER ACTIVATION OF NEW GAS PIPING
NEW GAS
GAS COCK IN YARD BOX
G.C. GAS COCK
Y.B. YARD BOX

GAS | 2025


CAMPUS
MASTER
GAS METER
MAINTENANCE
SURFACE LOT 1
LOT A
LOT B
LOT C
LOT E
LOT F
LOT G
LOT H
CDC
CDC LOT
PARKING STRUCTURE 1
PARKING STRUCTURE 2
COLLEGE CENTER
ADMINISTRATION
SSB
LRC
HUMANITIES 1
HUMANITIES 2
PAC
PAC ADMIN
SCIENCE
CHEMISTRY HEALTH SCIENCES
GYMNASIUM
WELLNESS CENTER
COMMUNITY BUILDING
EMERGENCY SERVICES
OE 1
POC 2025
1"
6"
1-1/2"
4"
1-1/4"
2"
3"
2-1/2"
LEGEND
EXISTING GAS
NEW GAS
GAS COCK IN YARD BOX
G.C. GAS COCK
Y.B. YARD BOX

DATA & COMMUNICATIONS

Introduction

In this report, the proposed build out of the campus communications infrastructure consisting of the main campus equipment rooms, campus duct bank pathways and the campus communications cabling serving the College is discussed as an integral part of the Architectural Master Plan. The critical campus communications infrastructure upgrades that will have an impact on future installations of technology equipment and use are addressed. The goal of the proposed master plan campus communications infrastructure is to ensure sufficient IT capacity to serve the technology build out of the campus while also effectively serving the needs of the master plan development.

The specific focus on supporting technology across the campus is not for the sake of using technology. The effort is made to ensure that the College's technology infrastructure is adequate to allow new technologies to be used that will help the College address its ultimate needs and goals required to provide a quality education to its students.

The communications infrastructure incorporated into the master plan addresses long and short term needs with the following guidelines:

- Technology Changes – The infrastructure must support ongoing changes such as increased network speeds and capacities, expanded use of monitoring and control systems and personal communication services.
- Distribution – The infrastructure should enable access to every Campus building and every area of the Campus, providing redundant routing wherever practicable.
- Adaptability – The infrastructure should be designed to allow a high degree of flexibility and adaptability.
- Standards Based – The infrastructure should adopt a standards based approach to provide the capability to utilize a wide range of alternative system designs without the need to reinvent the basic infrastructure.
- Fault Tolerance – The infrastructure should be designed to allow for the installation of a fault tolerant network configuration.

Incoming Services

The campus currently has hardwired incoming service connections provide by Verizon. The incoming services connections are made with 24 strands of optical fiber and 300 pair of copper cabling extended from Verizon's Mentone Central Office location. The incoming service route runs from the west entrance at Sand Canyon Road to the Library/LRC building for fiber connections and to the LADM building for copper connections. The incoming service lines are used to distribute Internet and telephone system connections.

As part of the master plan efforts the incoming service routes will be relocated in a small section of the existing duct bank but, the campus connection points will remain in the Library and LADM buildings. The routing of incoming services near the College Center will be relocated due to the grading and future construction of a parking lot to be located just west of the College Center. A new conduit pathway will be constructed and connected to existing maintenance hole locations. After the conduit is in place the existing cables and air blown fiber cells will be spliced. This cut-over will require a phone service and Internet connection disruption of approximately three days. Verizon will have to be contacted to coordinate the splicing of their cables by their service technicians.

As part of this duct bank relocation and cable splicing it is recommended that the amount of incoming Verizon copper lines be reduced by at least 50%. The need for copper lines has been reduced since the installation of a campus-wide Voice of IP system used for telephone service. This reduction in incoming copper cables will also increase the capacity in a section of the main communications infrastructure backbone pathway allowing for future cable installations in these areas. It is also recommended that any abandoned cabling be removed from this main infrastructure pathway during this relocation effort and any master plan cabling installations.

It is recommended that the MPOE locations remain in place in order to avoid costs for the installation of a new dedicated Verizon duct bank and cable installations. Existing MPOE locations are in good working order and provide adequate services to the campus. Connections from the existing MPOE locations and incoming signaling will be extended to the new campus data center location.

Campus Main Technology Equipment Rooms

The following is a list of main technology equipment rooms that will be used to serve the campus as part of the proposed master plan:

- Data Center (New room to be located in the future LRC building. This is a purpose built data center that will serve the campus for the next 20 years.)
- Redundant Core Equipment Room (The existing Data Center will be used as a redundant equipment room that will house the DS-3 equipment, redundant core switch, redundant servers and redundant data storage equipment. Room shall be upgraded to provide equipment protection from potential water damage by leakage of existing plumbing and fire sprinkler pipes.))

- MPOE Optical Fiber (The existing Data Center will continue to be the location for the optical fiber connection for the campus from Verizon. A dedicated optical fiber connection will run from the DS-3 equipment in this room to the new Data Center location for delivery of Internet to the campus data network.)
- MPOE Copper (The existing communications equipment room in the LADM building will be continue to be the location for incoming services copper cable terminations.)

Data Center

As part of the campus master plan improvements a new campus data center will be constructed in the future LRC building. The new data center will provide a "state of the art facility" for the Campus data network, telephone and low voltage technology systems. Crafton Hills College has become increasingly reliant on the use of technology with the use of its Voice of IP telephone system and on-going data network usage. It is expected that the reliance on technology will only continue to increase justifying the need for a properly built data center. The data center will be a 24 hour 7 day a week facility with redundant power and mechanical systems. The facility will be designed to support future equipment expansion and is expected to support the campus needs for more than twenty years. The existing data center will remain as a redundant core equipment location providing network redundancy.

The performance requirements for the new Data Center are as follows:

Architectural Requirements

- Estimated Room Size – 1,200 square feet.
- Architectural finishes will comprise raised floor system and a standard drop ceiling with lighting positioned over each aisle.
- Double door entry to Data Center and from building entry location. Access shall support the delivery and installation of large equipment with a minimum turning radius of 6'.

Resilient and Redundant Systems

The systems will be designed to maintain data room environmental conditions in compliance with the performance criteria with 99.9% reliability under all foreseeable and unforeseeable circumstances including:

- Data center system maintenance, breakdown, repair & replacement.
- Building system maintenance, breakdown, repair & replacement.
- Utility brownout & interruption, system maintenance, breakdown, repair & replacement.

Not withstanding the foregoing description of performance, the following levels of system resilience and redundancy will be provided.

Electrical

- Redundant power routing direct to the data room.
- Tie to building's emergency generator, direct routing to data center, supports network equipment (and restricted air conditioning), online within 60 seconds.
- Existing UPS equipment to be reused providing parallel (maintenance) bypass, isolation from raw utility power and 30 minute battery capacity at full load.
- Existing UPS equipment to provide network based power management for automatic server control, automatic fault reporting via network and dial out, and to be SNMP enabled for computer integration.
- PDU with duplicate isolation transformers feeding redundant switchgear and panel boards. Two individual 30A circuits, to serve each equipment rack/cabinet will be required. Provide 120V supplies throughout and 208 Volt at predetermined locations. PDUs in Data Center to allow individual circuits to be activated / deactivated remote from the equipment rack/cabinet.
- Receptacles to be fixed to overhead cable tray, with conduits running up to ceiling level to maintain power / communications cabling separation.
  - In addition to the conditioned equipment power, convenience receptacles will be required in the data center and associated areas.
  - An emergency protected power-off button shall be provided at each exit.
  - Provide signal ground bus bar throughout the data center.

Mechanical

- Multiple, dedicated, data room specification up-flow a/c units. The system should comprise not less than independent three units, sized such that two units will maintain design conditions within the specified range and located such that maintenance and repair will not disrupt data center operation. (Note: The building's a/c may be used as one of the three systems supporting cooling in the data room.)
- Air filtration
- Drip trays with moisture detectors located under pipes running in ceiling void above data center location.
- An HVAC System Control Panel shall be provided at the main entrance to the Data Center.

Fire Protection
- Fire alarm system with heat and smoke detectors.
- Multi-zone, pre-action, dry pipe fire suppression system.
- In addition, an FM200, CO2 or equivalent system will be considered as an option.
- A Fire Alarm Control Panel will be provided at main entrance to Data Center.

Environmental Sensors and Alarms
- Fire: Smoke and heat detectors at ceiling level. Detector monitor panel at main entrance to Data Center and at 24-security location.
- Moisture detectors around perimeter and in ceiling drip trays.
- Automatic notification, via phone, page and email.

Seismic
- All seismic provisions (mounting, restraint, connections, etc) to be as required in critical services facilities (hospitals, emergency services etc).

Campus Communications Infrastructure

The campus communications infrastructure consists of duct banks, maintenance holes and pull boxes used to distribute communications and low voltage cabling for the use of data network, telephone, emergency phones, and other low voltage services across the Crafton Hills campus. The following sections identify the master plan approach for the development of the communications infrastructure. As part of the master plan the goal of the infrastructure design is to provide adequate and redundant pathways that support connections to each existing and future building locations on campus.

Campus Communications Pathways

The existing campus communications cabling pathways consist of conduit duct banks, maintenance holes and pull boxes. Access at infrastructure pathways is made at maintenance holes and pull boxes for cable servicing and installations. Duct banks consist of 3 or 4 inch trade size conduits running between backbone manhole and pull box locations. The proposed master plan communications pathways make use of the existing pathways. Additional pathways will extend from the existing central spine pathway creating two duct bank loops that will provide pathway redundancy. The two main loops will support the east and west ends of the campus. The loops originate from the campus Data Center to be located in the new LRC building. The duct bank pathways will mainly consist of (6) 4" conduits encased in slurry and used for the distribution of copper and optical fiber cabling supporting data network, telephone, security, fire alarm and the remaining campus low voltage systems. The duct bank has been sized to support the existing buildings and new buildings identified as a part of the Master Plan and to provide future capacity and flexibility. The infrastructure design is based on a redundant loop topology in order to reduce the likelihood of a single point of failure.

See table 12 for estimated master plan communications infrastructure installations; it is intended to be used for budgeting purposes.

Building Communications Pathways

The horizontal communications cabling system infrastructure includes the pathway and support hardware which concentrates, supports and protects horizontal cable media between its origination point in the equipment room and the workstation outlet location. The riser pathway supports backbone cable distribution between stacked floors. The existing campus buildings were not designed with horizontal or riser cabling pathways. As a result cabling is distributed using wall mounted hooks, wiremold cable containment or otherwise surface mounted.

Riser pathways at buildings with multiple floors have been cored where possible. However, there are few instances where communications equipment rooms stack on one another that allow the cored riser pathway to be most beneficial. Horizontal pathways have been created with the use of j-hooks in accessible ceiling spaces or placed above ceiling tiles with no containment method. This type of installation does not provide for cable protection and does not allow cable to be replaced efficiently. Cable replacement will cause significant disruption in these spaces.

As part of the master plan new and renovated buildings will include communications pathways that begin with a minimum of (2) 4" and (2) 2" conduits running from a campus pull box or maintenance hole to the building main communications equipment room. The installation of these conduits will coincide with the renovation of existing buildings or the construction of the new buildings. Cable pathways from building equipment rooms will consist of wire basket and conduits located in accessible ceiling space that allow for horizontal cable installations and service with minimal disruption. Communications equipment rooms shall be stacked and linked together with a minimum of (4) 4" riser conduits used for the distribution of backbone cabling.

Table 12 - Communications Infrastructure

Item	Description	Quantity	Remarks
Conduit	(6) 4" conduits encased in slurry	4,300	Quantity per lineal foot
Pull Boxes	3' x 5' x 4' precast with traffic lid	6	
Maintenance holes	6' x 10' x 7'	12	
Trenching	Minimum 24" below grade	4,300	Quantity per lineal foot

Campus Backbone Cabling

The campus backbone cabling currently consists of optical fiber and multi-pair copper cabling used for the distribution of data network and telephone service. Additional low voltage cabling is installed for fire alarm and other building management systems.

Optical Fiber Cabling

The College has an installation of air blown optical fiber pathways running throughout the campus infrastructure. The fiber pathway originates in the existing Library building and extends to each building on campus. The air blown fiber system is a series of tubes connected to allow for the installation of optical fiber. The existing optical fiber installed consists of multimode 62.5 micron cabling. Fiber strands are terminated in wall mounted or rack mounted termination panels at each building.
As part of the master plan it is recommended that the College continue to use air blown fiber products for distribution of optical fiber throughout the campus. However, the campus main distribution point of optical fiber will originate from the new LRC building. An additional change to the current air blown fiber installation is an upgrade in fiber types. It is recommended that as the fiber installations be upgraded to a minimum of (12) strand of 50 micron multimode and (6) strands of single mode optical fiber to allow for increased bandwidths in the backbone. New buildings and existing renovated buildings shall have a minimum of 5 dedicated air blown fiber cells for distribution of cabling.

Copper Cabling

The backbone copper cabling installed across the campus is now in limited use as the majority of telephone signals are distributed over backbone fiber cabling using the new VoIP system. The copper cabling is still used to connect outside phone lines to fax modems and direct line phones.
As part of the master plan the multi-pair copper cabling will be reduced where possible. New buildings will have a small amount of copper pair cabling installed, i.e. 25 pair backbone cable. Where possible existing campus buildings that currently have large quantities of multi-pair copper cabling shall be reduced as part of the master plan effort. These reductions of unused copper cabling will increase the capacity of existing sections of campus backbone infrastructure duct banks.

See table 13 for revised cable types and quantities to be installed as part of the master plan upgrades.

Key Aims and Assumptions for the Development of the Master Plan Communications Infrastructure

The following key points underscore the proposed development of the IT Infrastructure on Campus.

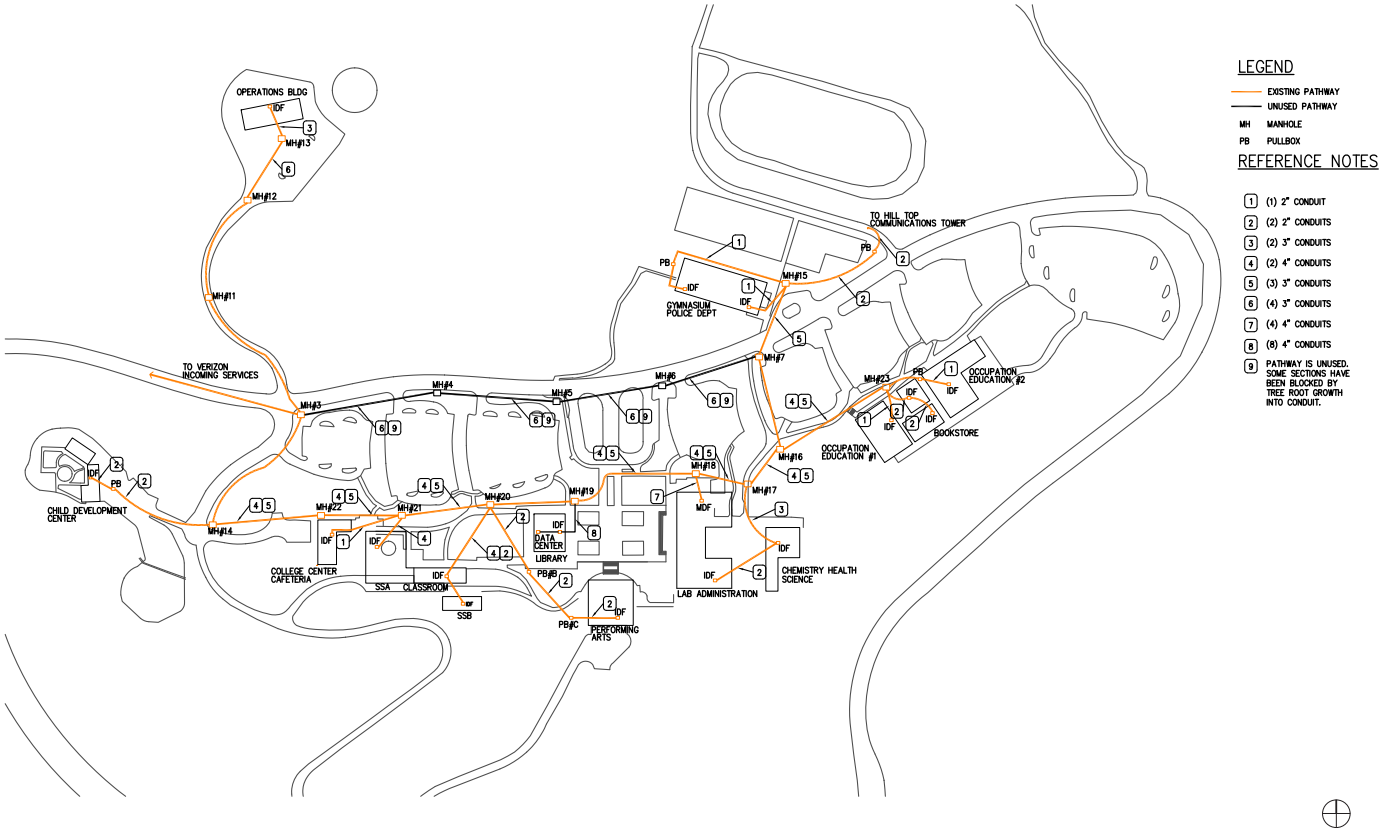
- The plan identifies a backbone infrastructure route that serves, but is separate from, the current buildings and the sites of future buildings as identified in the master plan. This approach will facilitate the renovation and construction of campus buildings in any sequence without interruption to voice and data network services.
- The infrastructure will designed for construction in a minimal amount of stages to minimize cost. The infrastructure plan will ensure that the component constructed at each stage forms a viable part of the final campus wide infrastructure.
- The infrastructure will reflect the increasing operational dependence on the network and aim to provide physical and logical network redundancy.
- Existing infrastructure that is in good condition and with a long lifespan will be retained and incorporated into the long-term plan in order to reduce costs.
- The Data Center will continue to occupy the current space in the Library/LRC in the near future. However, planning for the IT infrastructure will emphasize the move of data network equipment to a new data center location leaving the existing data center as a location for redundant core equipment.

Table 13 - Campus Communications Cabling

		Single Mode*		Multimode*		Fiber Cells***	
BLDG. NO.	BUILDING NAME	Pair Quantity	Linear Feet	Pair Quantity	Linear Feet	Cell Quantity	Linear Feet
1	LABORATORY CENTER (former Laboratory/Administration Bldg.)	6	1,000	12	1,000		
2	STUDENT CENTER (former Library)	6	1,450	12	1,450		
3	BOOKSTORE (former College Center)	6	1,000	12	1,000		
4	STUDENT SERVICES A	6	950	12	950		
5	STUDENT SERVICES C (former Classroom Building)	6	800	12	800		
6	OCCUPATIONAL EDUCATION 1	6	1,850	12	1,850		
7	EMERGENCY SERVICES (OE2 replacement building)	6	1,900	12	1,900		
8	PERFORMING ARTS CENTER	6	950	12	950		
9	MAINTENANCE & OPERATIONS	6	2,250	12	2,250	5	750
10	GYMNASIUM	6	2,350	12	2,350		
11	WELLNESS CENTER	6	2,000	12	2,000	5	600
12	CHEMISTRY	6	1,450	12	1,450	5	600
13	CHILD DEVELOPMENT CENTER 1						
14	CHILD DEVELOPMENT CENTER 2						
15	CHILD DEVELOPMENT CENTER EXPANSION	6	1,250	12	1,250	3	750
16	STUDENT SERVICES B	6	900	12	900		
19	ADMINISTRATION/ STUDENT SERVICES	6	300	12	300	5	300
20	LEARNING RESOURCE CENTER	6	–	12	–	100	500
21	HUMANITIES 1	6	500	12	500	5	500
22	HUMANITIES 2	6	500	12	500	5	500
23	PERFORMING ARTS CENTER EXPANSION	6	1,000	12	1,000	5	1,000
24	SCIENCES	6	1,000	12	1,000	5	1,000
25	COMMUNITY RECREATIONAL FACILITY	6	2,300	12	2,300	5	1,000
26	COMMUNITY CENTER	6	2,700	12	2,700	5	1,550
	TOTALS	6	28,400	12	28,400	153	9,050

* Optical fiber installations are based on the use of fiber strands inair blown fiber cells.
** Air blown fiber cells will be used to distribute campus backbone optical fiber cabling.

TECHNOLOGY | EXISTING



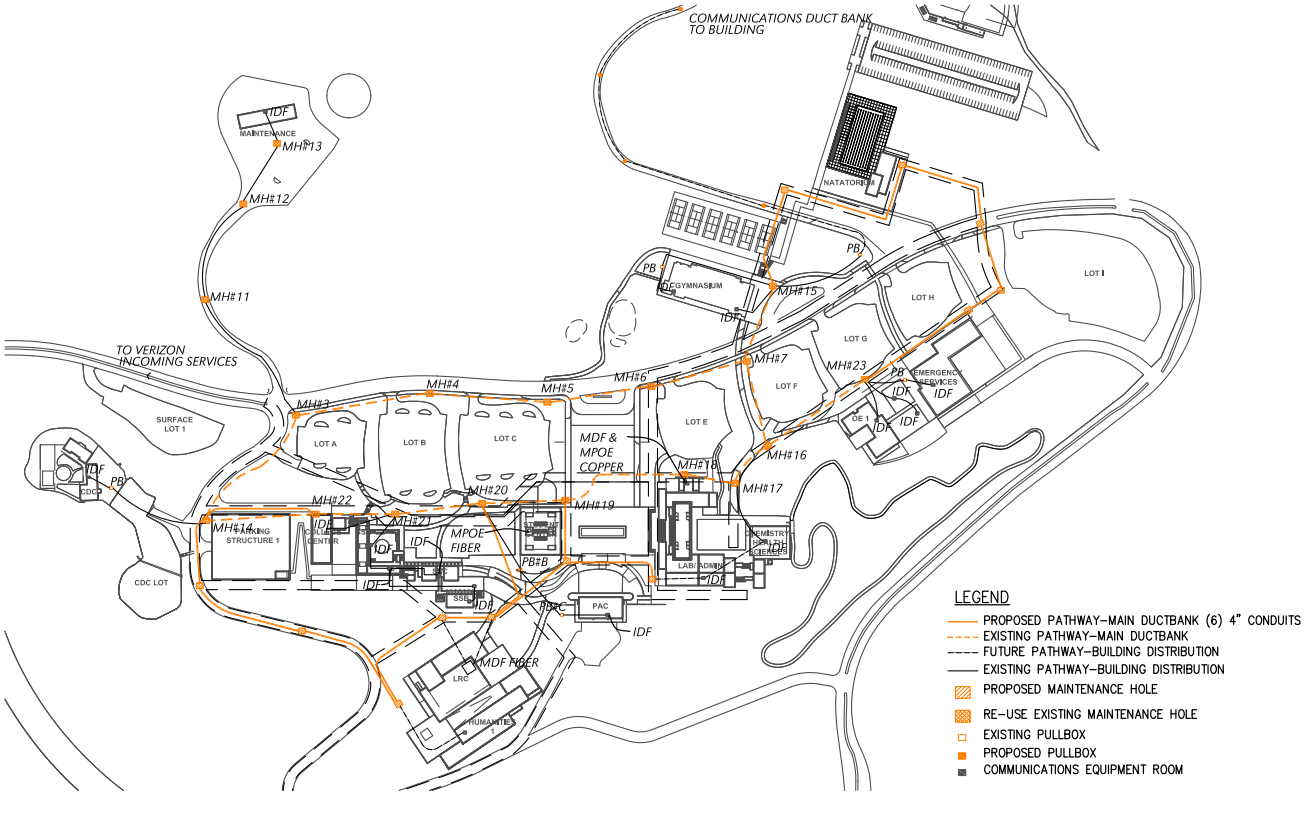
LEGEND

- EXISTING PATHWAY
- UNUSED PATHWAY
- MH MANHOLE
- PB PULLBOX

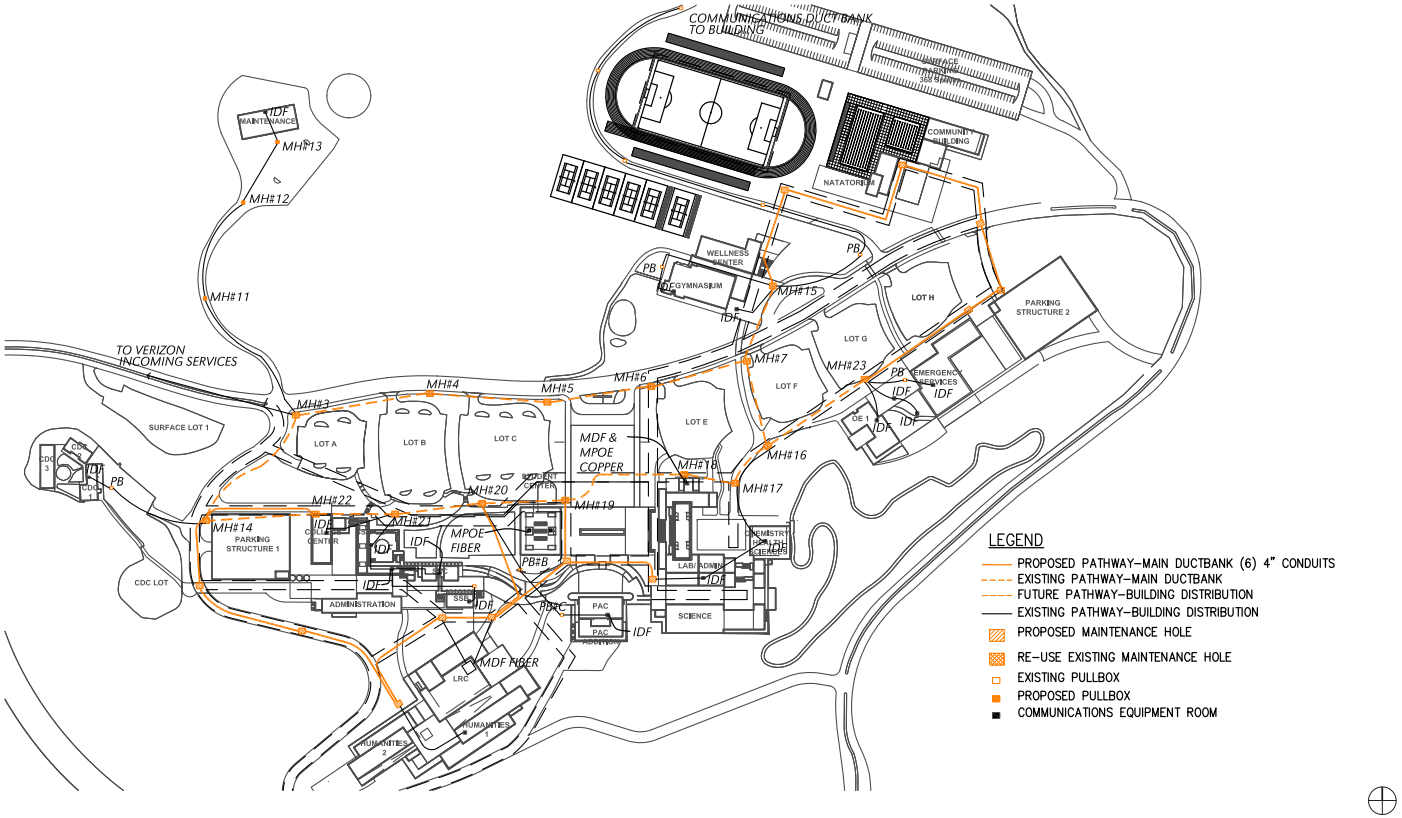
REFERENCE NOTES

1. (1) 2" CONDUIT
2. (2) 2" CONDUITS
3. (2) 3" CONDUITS
4. (2) 4" CONDUITS
5. (3) 3" CONDUITS
6. (4) 3" CONDUITS
7. (4) 4" CONDUITS
8. (8) 4" CONDUITS
9. PATHWAY IS UNUSED. SOME SECTIONS HAVE BEEN BLOCKED BY TREE ROOT GROWTH INTO CONDUIT.

TECHNOLOGY | 2012



TECHNOLOGY | 2025



6 | ACKNOWLEDGEMENTS

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Kaku Associates, Inc. – Traffic

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