School of Medicine Infrastructure - Phase 1 Detailed Project Program

June 24, 2009

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1.0 INTRODUCTION

This Detailed Project Program (DPP) for the School of Medicine Infrastructure – Phase 1 provides the planning of the utilities, hardscape, landscape, and transportation infrastructure necessary to support the initial phase of the School of Medicine (SOM) development on the West Campus of the University of California, Riverside.

Background

As part of its 2005 Long Range Development Plan, the University of California, Riverside (UCR) is initiating development of the West Campus for an anticipated enrollment of 25,000 students. New buildings on the West Campus will provide space for academic, research, medical school, recreational, residential, and support functions.

The majority of the West Campus land area is currently in use as Agricultural Teaching and Research Fields, mostly citrus groves. The area proposed for development is approximately 227 acres, and includes the area north of Martin Luther King (MLK) Jr. Boulevard, generally bounded by Everton Place and its extension on the north, Chicago Avenue on the west, and the I-215/SR-60 freeway to the east. Iowa Avenue, a City of Riverside north-south arterial, bisects the site.

The most recent planning for the West Campus has included the 2008 Campus Aggregate Master Planning Study (CAMPS) and the 2008 West Campus Infrastructure Development Study (WCIDS). CAMPS served as a general planning and capacity document for the West Campus while the WCIDS focused on the infrastructure planning for the entire West Campus north of MLK. The School of Medicine Infrastructure 1 Detailed Project Program builds upon the information provided in CAMPS and WCIDS, and utilizes current School of Medicine program information.

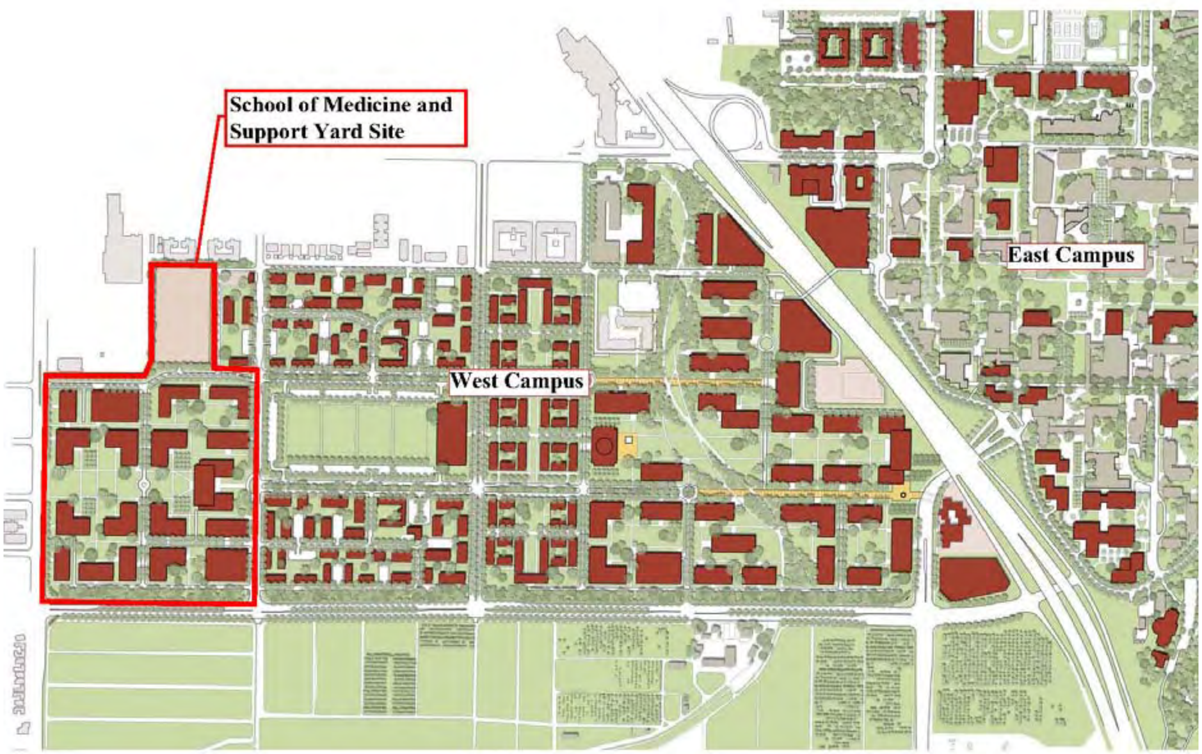
The School of Medicine (SOM) is planned to occupy an approximately forty acre site within the West Campus bounded by MLK Boulevard, Chicago Avenue, Northwest Mall, and Cranford Avenue. The land area is currently in use as Agricultural Teaching and Research Field 5. An additional 5-acre Support Yard is planned to the north of the SOM.

In developing this DPP, our team refined the analyses performed in the WCIDS using the additional information available on the program for the SOM. This DPP provides the detail for the infrastructure to support the first phase of development of the SOM as well a more general analysis of the infrastructure that will be required for full buildout of the SOM site. This DPP also assumes that the SOM infrastructure will be the first campus construction for the West Campus west of Iowa Avenue. (At the time the WCIDS was prepared, the Family Student Housing development east of Cranford Avenue and west of Iowa Avenue was anticipated to be developed first.)

2.0 EXECUTIVE SUMMARY

The 2008 Campus Aggregate Master Planning Study (CAMPS) established the School of Medicine (SOM) as an integral component of the West Campus with building configurations and coordinated circulation and open space systems (See Figure 2-1). The resulting concept for the SOM follows established campus planning principles, with new buildings bordering quadrangles and featuring a fine-grained network of pedestrian, bicycle and vehicular circulation. Since the completion of CAMPS, a revised program for development has been prepared based on further understanding of the specific needs of the SOM. Based on this revised program, the forty acre site of the SOM was adjusted. The key master plan elements from CAMPS were maintained in the subsequent revised plan.

Figure 2-1 Project Location



As part of the development of this Detailed Project Program (DPP), the team evaluated the concepts presented in CAMPS and the 2008 West Campus Infrastructure Development Study (WCIDS) and made adjustments to the building and development program to reflect the current information on the program needs for the SOM. The process for the development of the DPP revolved around stakeholder meetings and workshops with the project team and University staff including the Project Management Team and the Steering Committee. The workshops were used as a forum to discuss the project team's concepts and incorporate key input from key stakeholders.

Section 4 of the DPP discusses the site and includes a Revised Building Plan for the SOM that updates the envelopes shown in CAMPS to reflect the revised program, parking requirements, utility corridors and constraints such as a 4-story limit on Research structures (defined by code and programmatic restrictions).

As part of the development of the West Campus, the University has opportunities to implement sustainable design practices with the goal of demonstrating its commitment to improving the University's effect on the environment and reducing the University's dependence on non-renewable energy. Several of those sustainable options are discussed in Section 5 with a focus on the elements that could be incorporated into the Phase 1 Infrastructure.

The overall goal of this DPP is to provide guidance for the further planning and design of the infrastructure that will be needed to support the first phase of the SOM development.

2.1 Phase 1 Infrastructure

The School of Medicine (SOM) Phase 1 Infrastructure will consist of utility distribution systems (potable water, irrigation water, sanitary sewer, storm drain, chilled water, heating hot water, and domestic hot water, natural gas, electrical, communications, fire alarm), a central plant, circulation and landscape improvements, and a support yard.

Utility service will be provided by a number of private utilities and public agencies including the City of Riverside (City), Riverside County Flood Control and Water Conservation District (District), Sempra Energy Utility (Sempra), and various communication service providers.

Potable Water

For the SOM Phase 1 Infrastructure, the West Campus domestic water supply will be from temporary connection points to the City of Riverside (City) domestic water distribution system. The new water distribution system to support the SOM development will include two connection points to the City water distribution system:

- Primary Connection Point
  - University Ave at Cranford Ave (University Ave Connection)
    Connect to 12-inch line in University Ave.
- Standby Connection Point
  - Cranford Ave at Martin Luther King Blvd (Cranford Ave. Connection)
    Connect to 20-inch line in Cranford Ave.

At the University Ave Connection, the City has an existing 8-inch pipeline along Cranford Ave between University Ave and Everton Pl. The hydraulic analysis for the water distribution system indicated that for the Phase 1 SOM development, the existing 8-inch pipe provides sufficient capacity to the Campus. Therefore, during the Phase 1 condition, the SOM water distribution system will connect to the existing 8-inch pipe on Cranford Ave and

Everton Place. The Phase 1 onsite water distribution system will consists of a 14-inch pipe system along Cranford Ave, Northwest Mall, and the proposed utility tunnel alignment.

For more details on the Potable Water System refer to Section 6.

Irrigation Water

The new irrigation water distribution system to support the SOM development will include a new interim pump station and pipeline system to the SOM site from the asphalt lined reservoir adjacent to Gage Canal. Due to their condition and age, the existing pipeline and pumping facilities will not be utilized in the future SOM irrigation system. Portions of the existing system will remain in service during the course of the West Campus development in order to serve the irrigation needs of the remaining fields within the SOM development area.

The new irrigation pipeline system for the Phase 1 SOM development includes new 10-inch to 16-inch pipeline. At the asphalt lined reservoir, a new booster pump station is needed to pressurize the proposed irrigation pipeline system. Since the proposed pump station is an inline booster pump station, the pump station should be equipped with variable speed drives to modulate the pumps to match the irrigation demands. The pump station will need future expansion to meet the demand for the entire West Campus landscape irrigation needs unless recycled water is made available from the City of Riverside.

In addition, the southern portion of Field 5 would remain during the Phase 1 SOM development. Since the existing main feeder pipeline from the onsite irrigation pump station will be removed as part of the development, the remaining irrigation feed lines will connect to the new irrigation pipeline parallel to MLK Blvd. Since the proposed irrigation water pipeline system is pressurized, no onsite irrigation pump station is needed.

Due to the Phase 1 SOM development, the existing double drain line across Field 5 and the salvage pump station adjacent to Chicago Ave will be removed. Runoff from the remaining southern part of Field 5 will sheet flow north toward a series of temporary swales at the northern edge. The swales flow west towards Chicago Ave and discharge to a new swale parallel to Chicago Ave, which is a part of the proposed Phase 1 SOM storm drain system.

For the runoff in the double drain line from east of Cranford, a new temporary salvage pump station will be built adjacent at Cranford Ave. The salvage pump station will collect field drainage from east of Cranford and pump it south along Cranford Ave through a temporary 12-inch force main to connect to the existing irrigation drain return line south of MLK Blvd. The new temporary salvage pump station will remain in service until the Family Student Housing development east of Cranford Ave takes place in the future.

For more details on the Irrigation Water System refer to Section 7.

Sanitary Sewer

The new sewer system for the proposed West Campus development utilizes two tie-in locations to the existing City sewer system. The primary connection point is at Chicago and

12th Street just outside the public right of way, and the secondary connection point is at Cranford Ave and Everton Place within the public right of way.

The first phase of the SOM development will only require the primary connection point at Chicago Ave near 12th St. The total flow that will be conveyed to the existing city system is 1.2cfs. This primary connection point will be made to an existing University 8-inch sewer line. This line flows into an 8-inch City owned and maintained sewer line immediately downstream of this connection. Both the short segment of pipe owned by UCR and the city line located in Chicago Avenue will need to be upsized. These lines will need to be upsized and operational prior to occupation of the SOM Phase 1 buildings.

For more details on the Sanitary Sewer System refer to Section 8.

Storm Drain

The new storm water collection system to support the SOM development mainly consists of a combination of bioswales and retention basins with a limited amount of 18-inch piping under walkway and roadway crossings. The bioswales within the SOM site are dual purpose facilities for drainage and treatment. From the drainage standpoint, the bioswales collect storm water runoff in the campus either by overland sheet flow or via lateral pipe connections. The bioswale system routes the collected runoff downstream to the ultimate system discharge point at the District's 30-inch pipeline on Chicago Ave. and 12th St. From the treatment standpoint, the bioswales allow runoff from a low intensity storm event to filter through the vegetation layers for treatment and percolation.

The retention basins are mainly to detain excess flow that exceeds the District's pipeline system capacity, as well as the 12th St. overland flow capacity. The basins, especially the one at the Central Mall, are envisioned to be dual use facilities. During the dry period it is a natural open space with landscape features. During a high storm event the basins allow stormwater ponding and percolation.

The existing grading defines the stormwater overland flow pattern, from the southeast corner of the site towards the Chicago Ave. and 12th St. intersection at the northwest corner. Two north-south bioswale systems are placed to intercept stormwater runoff from the eastern half and western half of the SOM site respectively. During the Phase 1 development condition, these two bioswales also convey runoff from the temporary drain bioswales in the remaining Field 5 at the southern portion of the SOM site.

In addition, a north-south bioswale along the west side of the support yard is needed. This bioswale along with the bioswale systems in the main SOM site interconnects with the retention basins. In the Phase 1 SOM development, there are two retention basins located at the Central Mall and at the northern edge of the NW mall.

For more details on the Storm Drain System refer to Section 9.

Central Plant
The SOM Central Plant will be located in a Support Yard north of the SOM site and will provide chilled water, heating hot water, and domestic hot water to the SOM campus. The importance of the critical facilities dictate that the Central Plant be conservatively sized and allowed to expand to meet the phased development in a planned manner with expansion space and central systems sized for a conservative full build out.

The Central Plant will include a chiller building, boiler building, and associated support space. Sustainable features have been incorporated into the Central Plant including the use of thermal energy storage tanks, solar thermal water heating, templifier heat pump heating system, and geothermal heat exchange. The Energy Management System (EMS) will include the front end of the EMS system in the Central Plant, the Central Plant's EMS points, and the EMS backbone cabling in the SOM utility tunnels.

For more details on Sustainability refer to Section 5, for Central Plant refer to Section 10, for the Energy Management System refer to Section 13, and for the Support Yard refer to Section 17.

Natural Gas
For the first phase of development at the SOM, natural gas will be supplied from a connection to the Sempra distribution system at MLK Blvd. and Cranford Ave.

For more details on the Natural Gas System refer to Section 11.

Electrical
A new 69 kV – 12.47 kV substation will be constructed within the northwest portion of the Support Yard. The substation will be inserted into the proposed RPU 69 kV transmission line that will connect the SCE 240 kV Vista Substation located to the north with the RPU La Colinda Substation located to the south.

The 12.47 kV switchgear will consist of two 12.47 kV main buses protected by two 12.47 kV main circuit breakers and connected by a tie circuit breaker. The new 12.47 switchgear will be connected to the RPU distribution system in a loop configuration. Multiple 12.47 kV underground feeders will be routed along utility corridors to secondary unit substations located throughout the School of Medicine Precinct.

A diesel fueled standby generating plant will supply critical School of Medicine loads during pubic utility power outages. The plant will be sized to supply emergency power for all of the SOM buildings, and full standby power for the central heating and cooling loads of the critical facilities as well as critical distributed loads.

Normal and standby power at 12.47kV will be distributed to the SOM through the utility tunnel system.

For more details on the Electrical System refer to Section 12.

Data/Telecommunications
Data and telecommunications infrastructure required as part of the SOM Phase 1 will be limited to the creation of pathways (i.e., conduits and cable trays within utility tunnels) for the distribution of service. Cabling will be the responsibility of the building developments.

For more details on the Data/Telecommunications System refer to Section 14.

Fire Alarm
Similar to the data and telecommunication system, the fire alarm system infrastructure required as part of the SOM Phase 1 will be limited to the creation of pathways (i.e., conduits and cable trays within utility tunnels) for the distribution of service. This is based on the assumption that a Firemesh Network will be installed with the first SOM building. Cabling will be the responsibility of the building developments.

For more details on the Data/Telecommunications System refer to Section 15.

Receiving Dock and Service Tunnel
Due to the sensitive nature of transporting materials and animals to and between the vivarium and research buildings, a separate receiving dock and service tunnel have been planned for the SOM. The receiving dock will be located within the Support Yard and will be connected to the reseach buildings and vivarium by a service tunnel. The receiving dock will facilitate the delivery and distribution of materials for the School of Medicine and will include several small storage areas, one with refrigeration capabilities, for temporary holding of materials before distribution, and an oversized freight elevator to transfer materials from the dock to the tunnel elevation. Further information on the receiving dock and service tunnel is located in Section 17.

2.2 Phase 1 Implementation

The infrastructure required to serve the SOM Phase 1 development will be implemented in phases. The first phase would involve construction of underground utilities and utility tunnels around the site. The second phase would involve construction of the central plant, support yard, and circulation improvements and would occur in conjunction with the SOM academic and research building design process.

The interim steps for the implementation would be as follows:

- Step 1 – Demolition and rough grading of the entire Phase1 SOM development site.
- Step 2 – Construct underground utilities, utility tunnels, and service tunnel.
- Step 3 – Establish temporary site and construction access.
- Step 4 – Construct the support yard including central plant, electrical substation, loading dock, and other utilities within the support yard.
- Step 5a – In conjunction with the development of the SOM buildings, construct permanent roadways and streetscape improvements. Also construct interim fire department access as needed.
- Step 5b – Construct final landscape improvements including campus open space, storm drain swales, and detention basins.

Additional information on the implementation plan steps are shown in Section 18.

3.0 PROGRAM SUMMARY

The 2008 Campus Aggregate Master Planning Study (CAMPS) established the School of Medicine as an integral component of the West Campus with building configurations and coordinated circulation and open space systems. The resulting concept for the School of Medicine follows established campus planning principles, with new buildings bordering quadrangles and featuring a fine-grained network of pedestrian, bicycle and vehicular circulation (See Figure 3-1). Since the completion of CAMPS, a revised program for development has been prepared based on further understanding of the specific needs of the School of Medicine (SOM). Based on this revised program, the forty acre site of the SOM was adjusted. The key master plan elements from CAMPS were maintained in the subsequent revised plan.

Campus Configuration

CAMPS called for the SOM area to be integral to the West Campus with coordinated circulation and open space systems. The forty-acre site in the southwest area of the West Campus north of MLK provides sufficient area for the envisioned SOM educational, clinical and research facilities. The site is currently citrus research groves on fine sandy loam (Arlington Series) with a 1% slope (or 24 feet of grade change in 1800 feet) from the southeast corner of the site to the northwest corner.

The SOM campus will grow over a series of years and will occupy the entire forty acres. Phasing will allow for the orderly disposition of the citrus groves that currently utilize the forty-acre site. These groves may incrementally be replaced in certain locations with buildings, infrastructure and parking. Surface parking lots may be constructed on an interim basis while the campus awaits development with sufficient capacity to justify construction of parking structures. Parking garages are proposed early in the project to reduce the amount of land required for the initial development and to address concerns about replacing surface parking with garages (this leaves no place to park during garage construction). Building parking in structured garages is a more sustainable, efficient use of land.

The primary SOM buildings should be located in prominent locations, relating to the rest of the UCR campus. New buildings should be configured to optimize solar orientation and take advantage of day lighting and solar energy generation opportunities. Such orientation, primarily east-west, will in turn provide structure to the campus open space and circulation system. The campus can take advantage of prevailing summer winds across the site that reach up to 7 mph from the west-northwest (See Figure 3-2)

The SOM's primary open space should be centered on the Southwest Mall (SW Mall). This open space, mandated by the UCR Design Guidelines to be a minimum of 200 feet wide, should open the campus to Chicago Avenue to provide a welcoming public presence. Other, more intimate open spaces will be enclosed as courtyards and plazas by new buildings. The landscape legacy of the groves could be expressed with planting designs placed within campus open spaces. As indicated in this document, campus landscape will be planted with drought-tolerant, climate-adapted plants selected from the 2007 Campus Design Guidelines, with the use of turf restricted to high-use areas.

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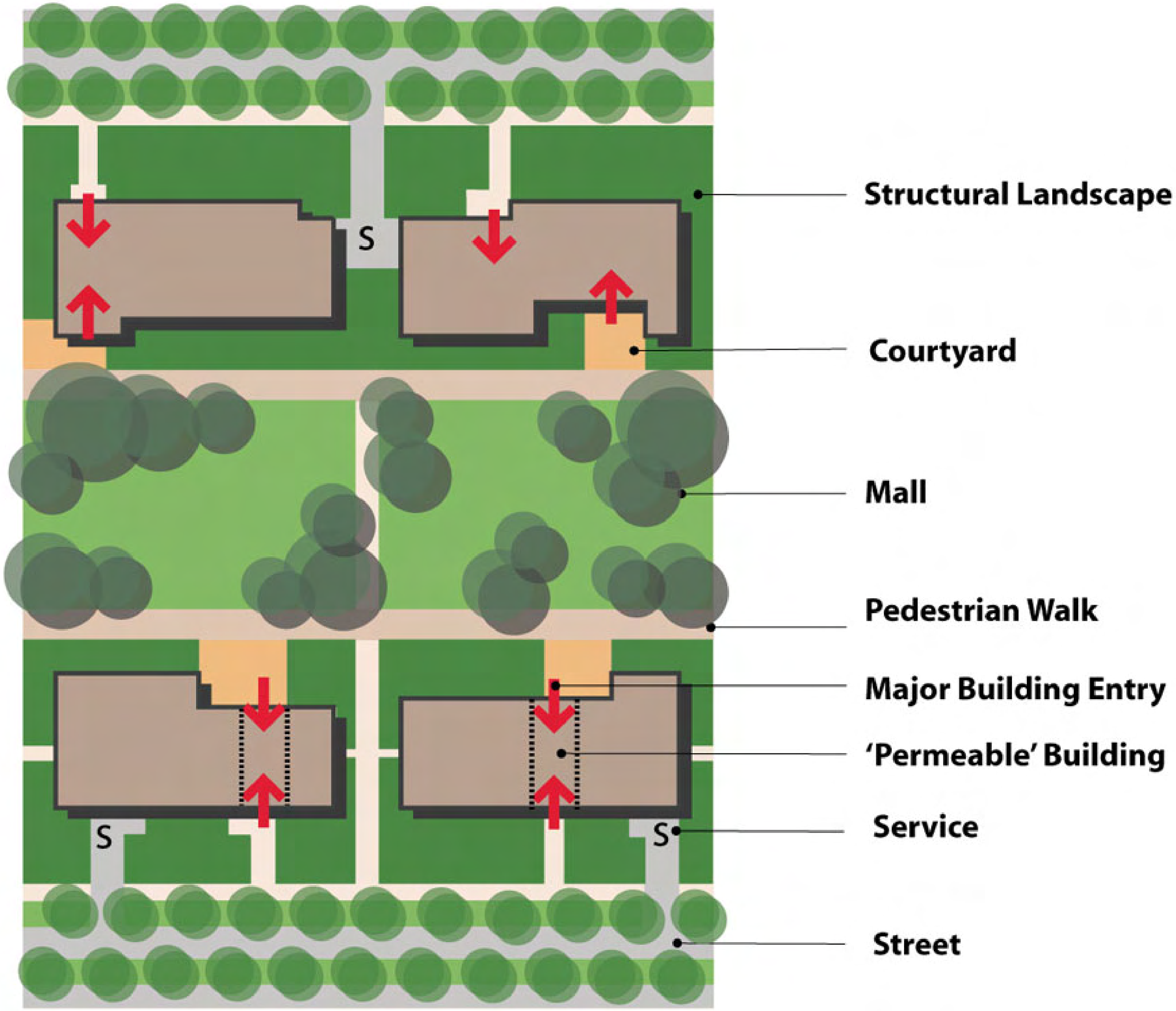
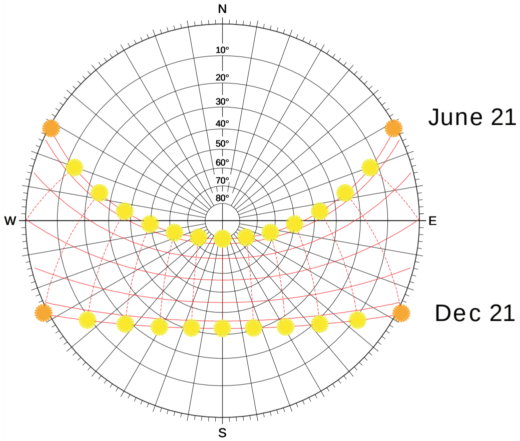


Figure 3-1: Campus Landscape Framework

SOLAR DIAGRAM



GROUNDWATER

Average Depth to Groundwater:

>50 FEET (SOURCE: WESTERN MUNICIPAL WATER DISTRICT, YEAR 2000 DATA)

>75 - 150 FEET (SOURCE: CARSON AND MATTI, DATA COLLECTION 1973 TO 1979)

SOILS

Soils Boundary

Arlington Series : AoA, AoC, ArB

Buren Series : BuC2

Hanford Series : HcC, HgA

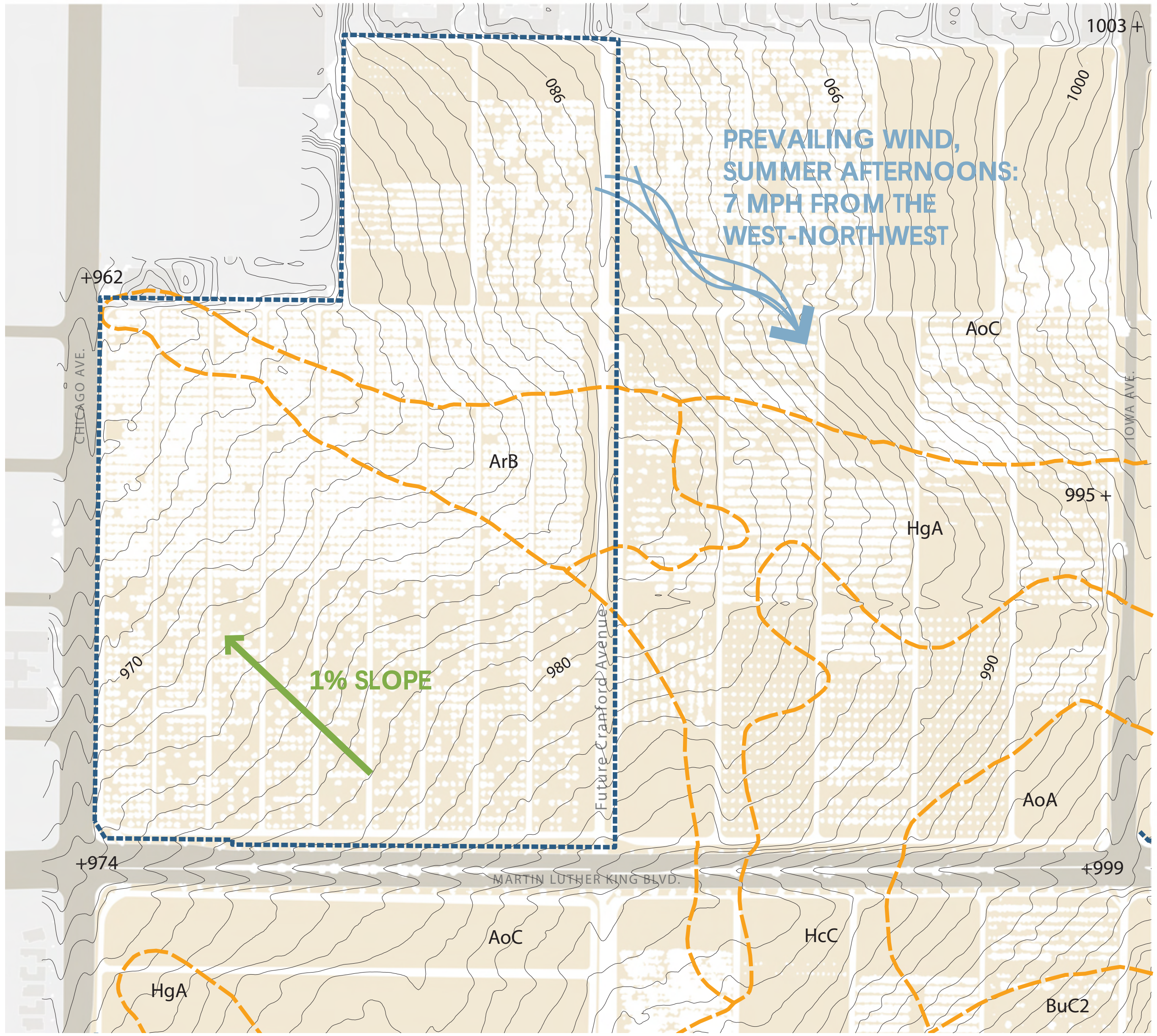


Figure 3-2: Site Analysis

The buildings facing Chicago Avenue to the west of a central, limited access road are intended to support the SOM with future office, research, ambulatory and laboratory uses which complement the mission of the University and the SOM. These buildings are not specifically programmed at this time.

To meet sustainability goals established by UCR, the SOM campus should be pedestrian-oriented and provide good transit and shuttle service to the rest of UCR. Initially, the campus will be accessed from two new intersections, at Chicago Avenue and the new NW Mall and at MLK Jr. Boulevard and the new Cranford Avenue. Future traffic studies and negotiations with the City of Riverside will determine the ultimate configuration of these intersections. In later phases, the full circulation system of the West Campus will link the SOM to the academic core areas to the east, via the NW and SW Malls.

Campus walkways should be sufficiently wide to support large numbers of students, bicycles and in some locations, delivery and passenger carts. Walks should also be conveniently located to encourage walking, with direct connections between buildings. The walks should be well-shaded with trees and building elements such as arcades to further encourage pedestrian travel. Early phases of the campus should consider interim pedestrian access to the existing academic core via Martin Luther King Jr. Boulevard or University Avenue (See Figure 3-3 and Figure 3-4), both city streets.

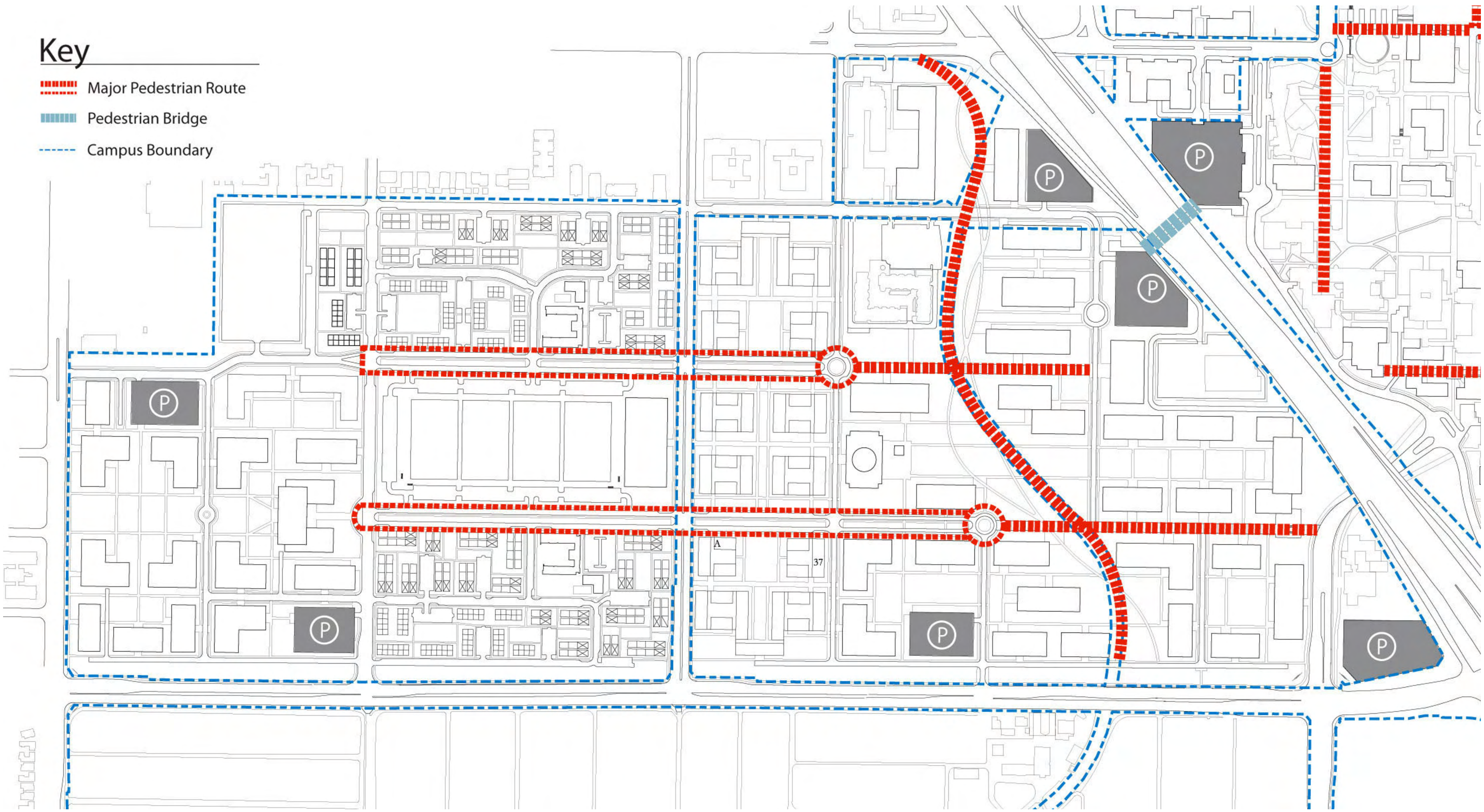


Figure 3-3: CAMPS Pedestrian Circulation **(Not to Scale)**

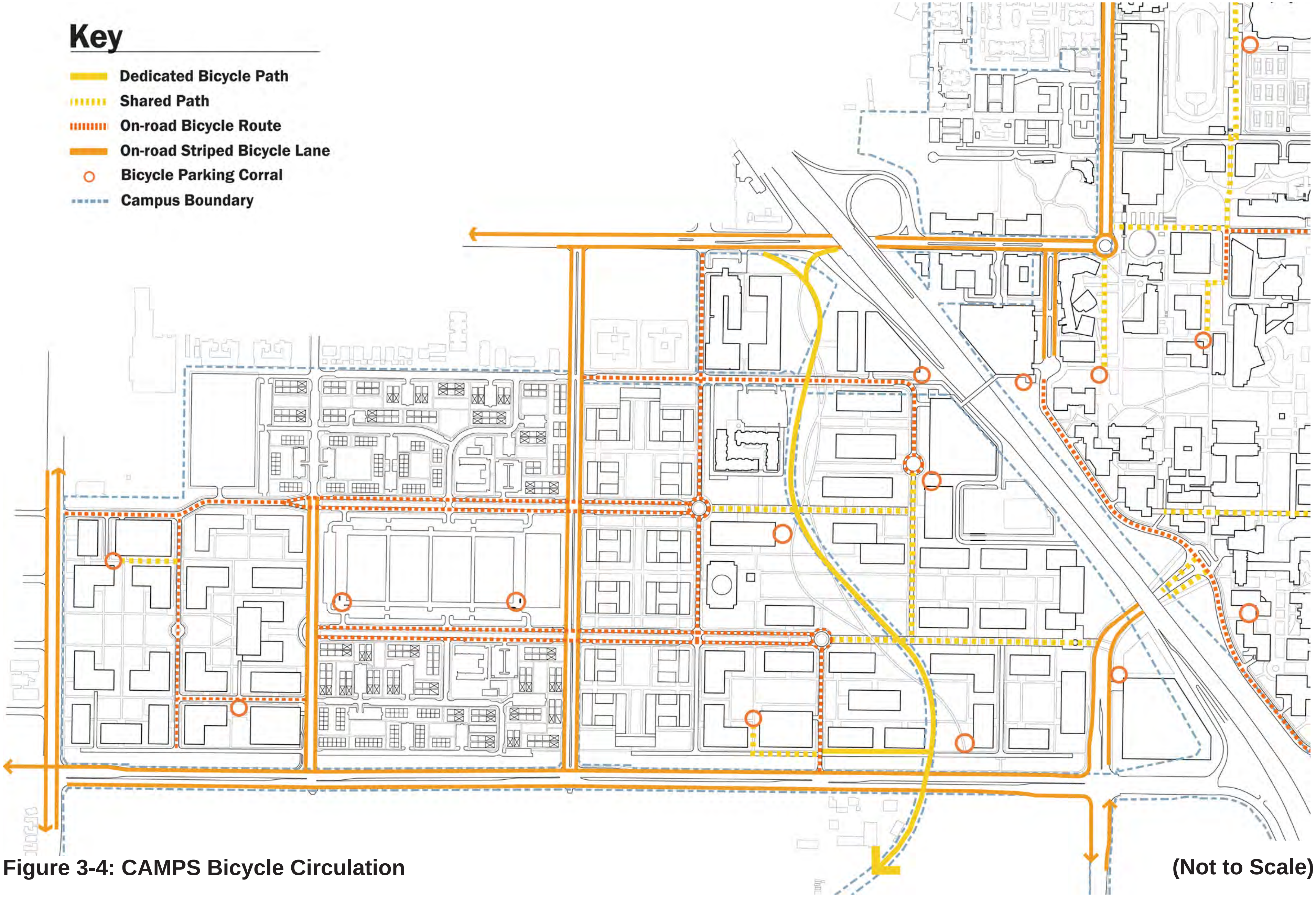


Figure 3-4: CAMPS Bicycle Circulation

(Not to Scale)

4.0 SITE AND PROJECT ANALYSIS

As part of the development of this Detailed Project Program (DPP), the team evaluated the concepts presented in the 2008 Campus Aggregate Master Planning Study (CAMPS) and the 2008 West Campus Infrastructure Development Study (WCIDS) and made adjustments to the building and development program to reflect the current information on the program needs for the School of Medicine (SOM).

4.1 Building Form

Individual buildings proposed for the SOM should adhere to the principles outlined in the 2005 LRDP, so that new buildings efficiently use the limited campus land base, maintaining a minimum Floor Area Ratio of 1.0 and allowing for efficient placement of future buildings.

School of Medicine Building

The Medical Education building (M4) is identified as a signature building in the 2007 Campus Design Guidelines. The future design of this building should recognize its prominent location with an iconic design. It will serve to anchor the west end of the SW Mall, providing a visual connection between the SOM, the East Campus and the developing West Campus in between. The height of this building has been planned at five stories in order to accommodate its program in a more compact footprint and allow sufficient setbacks from other SOM buildings. It could be considered as a central building with potential north and south wings built at the same time or later, such as the original Citrus Experiment Station’s south wing, and its later north wing.

Research Buildings

The building envelopes shown are based on the programmatic requirements outlined in Table 4-1 and are not necessarily indicative of final building form. An overview of the physical form of existing medical schools reveals that they often feature large buildings growing amorphously through relatively continuous additions, linked with skybridges or tunnels, to accommodate sensitive medical functions within. The intent of the SOM plan is to provide sufficient flexibility for the program to be accommodated while establishing a campus pattern that is based on the existing UCR campus building, open space and circulation systems. This plan delineates building parcels that create open space and circulatory boundaries, and within these parcels, individual building design will vary.

Research buildings on the SOM plan have been arranged as 90-foot wide footprints, which are envelopes to guide future detailed design. This dimension is based on a concept of 30-foot deep labs or offices flanking both sides of a central 10-foot corridor, leaving 10 feet for additional design elements or classroom uses. The Materials Science and Engineering building on the East Campus is a good model for this building form. The footprints are also arranged where possible in an east-west orientation, to enable the buildings to be designed to take full advantage of natural daylighting and solar orientation.

Table 4-1

School of Medicine Infrastructure 1

Summary of Proposed Buildings in the School of Medicine Precinct

CAMPS/West Campus Infrastructure Development Plan						School of Medicine Infrastructure 1					
Type	**Bldg #**	**Description**	**Footprint**	**Stories**	**Total GSF**	**Bldg #**		**Footprint**	**Stories**	**Total GSF**	**Assumed Occupancy**
M	M2	Research	32,000	4	128,000	M2a	Medical Research Laboratory	31,800	4	127,200	2014-15
						M2b	Medical Research Laboratory	23,800	4	95,200	
M	M3	Research	25,000	4	100,000	M3	Medical Research Laboratory	21,300	4	85,200	2014-15
M	M4	Education	56,000	4	224,000	M4	Medical Education Building	28,900	5	144,500	2013-14
M	M5	Ambulatory Care	30,000	4	120,000	M5	Ambulatory Care Facility - Phase II	10,000	5	50,000	2018-19
M	M6	Ambulatory Care	25,000	4	100,000	M6	Ambulatory Care Facility - Phase I	20,000	5	100,000	2016-17
M	--	--	--	--	--	M	Ambulatory Care Facility - Phase III	20,000	5	100,000	2020-22
M	M7	Research	31,000	4	124,000	M7	Medical Research Laboratory Phase II	38,430	4	153,720	2017-18
M	MV	Vivarium	--	--	23,000	MV	Vivarium Facility	40,100	1	40,100	2014-15
		Subtotal	**199,000**		**819,000**		**Subtotal**	**234,330**		**895,920**	
H	H1	Graduate Housing	25,000	5	125,000		SOM Housing	35,300	5	176,500	2015-16
H	H2	Graduate Housing	25,000	5	125,000						
		Subtotal	**50,000**		**250,000**		**Subtotal**	**35,300**		**176,500**	
M	M1	Research	30,000	4	120,000	M1	Research	30,000	4	120,000	n/a
M	MOB 1	Medical Office Buildings	18,000	4	72,000	RA1	Research/Ambulatory (RA)	17,800	5	89,000	n/a
M	MOB 2	Medical Office Buildings	31,000	4	124,000	RA2	Research/Ambulatory (RA)	30,400	5	152,000	n/a
M	MOB 3	Medical Office Buildings	30,000	4	120,000	RA3	Research/Ambulatory (RA)	30,400	5	152,000	n/a
M	MOB 4	Medical Office Buildings	30,000	5	150,000	RA4	Research/Ambulatory (RA)	30,400	5	152,000	n/a
M	MOB 5	Medical Office Buildings	17,500	4	70,000	RA5	Research/Ambulatory (RA)	18,000	4	72,000	n/a
M	MOB 6	Medical Office Buildings	20,500	4	82,000	RA6	Research/Ambulatory (RA)	20,500	4	82,000	n/a
M	MOB 7	Medical Office Buildings	19,500	4	78,000						
		Subtotal	**196,500**		**816,000**		**Subtotal**	**177,500**		**819,000**	
		Total SOM			**1,885,000**		**Total SOM**			**1,891,420**	
P	PM	Parking Garage	47,000	7	329,000	PM1	Parking Garage	69,600	7	487,200	2014-15
P	PMOB	Parking Garage	50,500	7	353,500	PM2	Parking Garage	80,400	7	562,800	2,020
		Total Parking	**97,500**		**682,500**		**Total Parking**	**150,000**		**1,050,000**	
		Total SOM with Parking	**543,000**		**2,567,500**		**Total SOM with Parking**	**597,130**		**2,941,420**	

Sources

1) West Campus Infrastructure Development Plan, Revised January 8, 2008
2) School of Medicine Development Plan, June 2009
3) SOM Initial Development Assumptions. Provided 02-03-09 via email

This plan also provides a minimum of 60 feet between buildings, in order to allow for solar access to lower floors and natural ventilation, as well as useable open spaces between buildings and uses. This dimension also allows for adequate circulation systems between buildings. The 60-foot dimension may vary during detailed design depending on items such as the benefit of shading from adjacent structures.

Research buildings have also been planned at a height of four stories, with additional space atop for mechanical penthouses, based on code requirements and UCR’s direction. This resulted in the shifting of some program locations shown in CAMPS. Buildings formerly indicated as un-programmed Medical Office Buildings (MOBs), have been re-labeled as Research and Ambulatory (RA) buildings to clarify their intended use and infrastructure needs. The limited access road bisecting the SOM campus has been shifted 65 feet to the west from its location in CAMPS and WCIDS. This shift provides additional flexibility to the SOM to accommodate the refined program and preferred building heights while still allowing ample space for future un-programmed buildings to support and/or complement the SOM.

Vivarium

CAMPS assumed that a vivarium for the SOM would be located underground. The team conducted research into vivaria precedents and found a strong case for locating the Vivarium (MV on plans) underneath a research building. Alternative arrangements of a vivarium under open space were studied but these resulted in a less efficient campus layout and such locations might compromise the function and quality of the open space above.

The Vivarium has been co-located with the M2 Research complex, which can also take advantage of the adjacent Service Tunnel extending down the central utility corridor through the SOM site, which may be used for delivery of sensitive materials.

Examples of Vivaria located in basements with buildings above:

UC Santa Barbara	Bioengineering Building (RFQ released Feb. 2009) Academic Research, 99,000 gsf, 4-stories above grade
UC Los Angeles	SRB 1+2
UC San Diego	Leichtag Biomedical Research Building Center for Molecular Medicine, Unit 2 Pharmaceutical Science Building Powell-Focht Bioengineering Building
UC Santa Cruz	Thimann Lab Biological Sciences
Stanford University	Large underground vivarium that connects to several buildings
Oregon Health Sciences	Vivarium in several levels below grade
University of Missouri	Christopher Bond Center for Life Sciences

Ambulatory Care Buildings

Ambulatory care buildings often do not conform to a standard academic building dimension and feature more custom corridors and rooms based on their users' programs, these facilities often include clinics and outpatient surgeries. A simple comparative analysis of several recent ambulatory care buildings found a range of dimensions, from 90-foot to 125-foot widths and a range of lengths, from rectangular to square building footprints. The parcels identified for ambulatory care uses on the SOM campus should be sufficient to accommodate these variations in building floor plans.

SOM Housing

CAMPS and the Strategic Plan for Housing (2008) proposed two 150-unit graduate and professional student apartment buildings on the north edge of the SOM campus, along the NW Mall. These apartments were intended to serve as higher-density housing units for graduate students, medical students and/or short-term/visiting faculty. With the revised SOM program, it became evident that the westernmost building site would be better suited to academic or research uses, being directly south of the Support Yard. These uses would be less likely to be affected by activities and aesthetic impacts from the Support Yard and they would be better positioned to take efficient advantage of service tunnels.

A consolidated, 300-unit apartment building was therefore proposed at the corner of the NW Mall and Cranford Avenue, within the School of Medicine precinct. The building is envisioned as Type V construction, perhaps with steel framing to accommodate five stories over two stories of podium parking (see Figure 4-1).

CAMPS and the Strategic Plan for Housing (SPH) identified that the graduate and professional student housing would conceptually include structured parking underneath. It was estimated that such parking would be provided at a ratio of 0.5 spaces per resident and would therefore fit in a single level of podium parking underneath each building. Further analysis determined that a ratio of one space per resident is required to maximize the appeal of this housing to potential tenants. This amount of parking would require a single-story surface of almost three acres, making it unlikely that a single podium could accommodate all of the parking. An additional surface lot surrounding the entire 300-unit apartment site could accommodate half of the parking, if the other half was on a single-level of podium parking (See Figure 4-2). This was deemed unacceptable by UCR at Workshop #2/#3. If only a single-story of podium parking is deemed possible under the footprint shown on the Refined Building Plan, the nearby PM1 parking structure could add one floor to accommodate the parking.

The One Miramar Street project at UC San Diego is noted as a useful precedent for this project. The UC San Diego project features 806 beds in two-bedroom, two bath apartments. Each resident has a parking space, with 2/3 of the parking located in a stand-alone structure and the remainder in surface lots. This parking ratio of one space per resident was determined to be optimal for attracting graduate students, particularly if the housing is developed by a third-party developer, with privately-provided infrastructure.

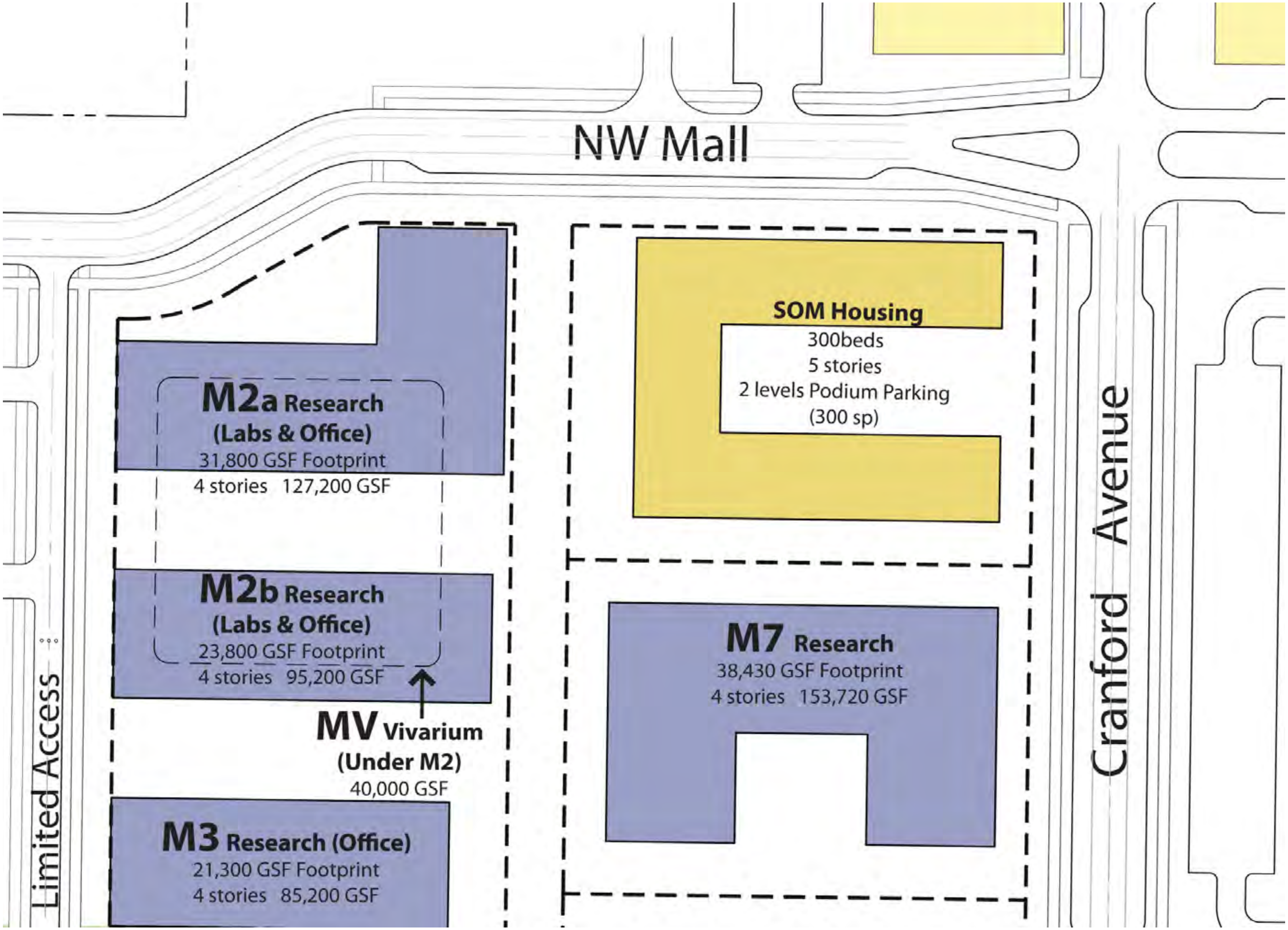


Figure 4-1: Revised SOM Housing Footprint

(Not to Scale)

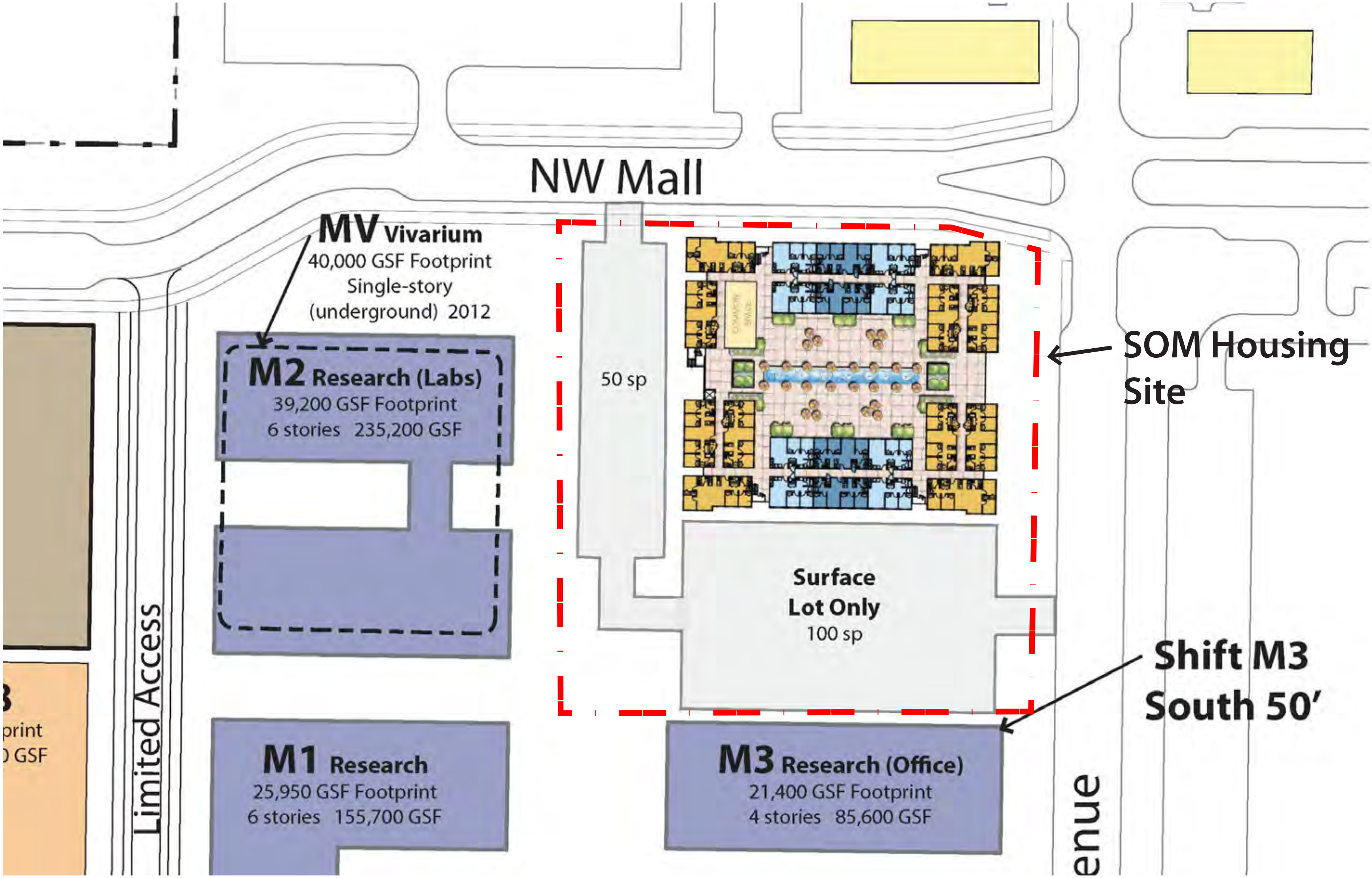


Figure 4-2: SOM Housing Surface Parking Study (Workshop 2/3) **(Not to Scale)**

If only a single-story of podium parking is deemed possible under the footprint shown, the nearby PM1 parking structure can accommodate the parking with the additional spaces added.

As an alternative, the 300 units of housing could also be accommodated elsewhere on campus, which would open up a significant SOM parcel for a new, yet un-programmed Research or Ambulatory building.

4.2 Development Parcels

CAMPS outlined a series of building envelopes for the West Campus and the School of Medicine, which were intentionally conceptual to provide an outline within which future detailed design solutions could be accommodated. These building envelopes identify the east-west orientation and where buildings should frame significant open spaces such as the Central Mall through the SOM. The Revised Building Plan for the SOM (See Figure 4-3) updates the envelopes shown in CAMPS to reflect the revised program, parking requirements, utility corridors and constraints such as a 4-story limit on Research structures (defined by code and programmatic restrictions).

Given the conceptual nature of these footprints, it will be useful for UCR and future design teams to consider larger development parcels, within which future academic and research projects must fit, using the footprints as guides. Within the parcels, projects would fund site improvements. Outside the boundaries, landscape and circulation improvements must be funded through infrastructure project budgets (See Figure 4-4). With the establishment of these parcels, UCR retains the flexibility to adjust square footage on building projects, combine footprints and arrange site improvements and respond to future conditions while maintaining a 1.0 FAR (Floor Area Ratio).

4.3 Utility Corridors

It is important to the future of the SOM to have sufficient and effective utility corridors established that can accommodate current and future needs. The plan calls for a looped system of 40-foot wide corridors located to serve the primary uses on campus. The corridors are sized and located to allow for tunnels or direct buried utilities to be brought directly to the primary buildings. The corridor system has been located through the SOM campus, starting from Receiving facilities in the Support Yard and extending due south to the east of the M2 Research parcel. The corridors will pass to the west of the M4 Medical Education parcel and extend south to the limited access road running west from Cranford Avenue. The system will be phased based on the needs of the campus. The corridor locations allow for access and maintenance into the future while minimizing disruption of campus (See Figure 4-5).

Subsequent chapters of this DPP identify the configuration of tunnels and utility lines that will be placed within these utility corridors.

4.4 Parking

UC Riverside is dedicated to reducing the use of private vehicles on campus as it develops to accommodate an expected dramatic increase in enrollment. One overarching concept

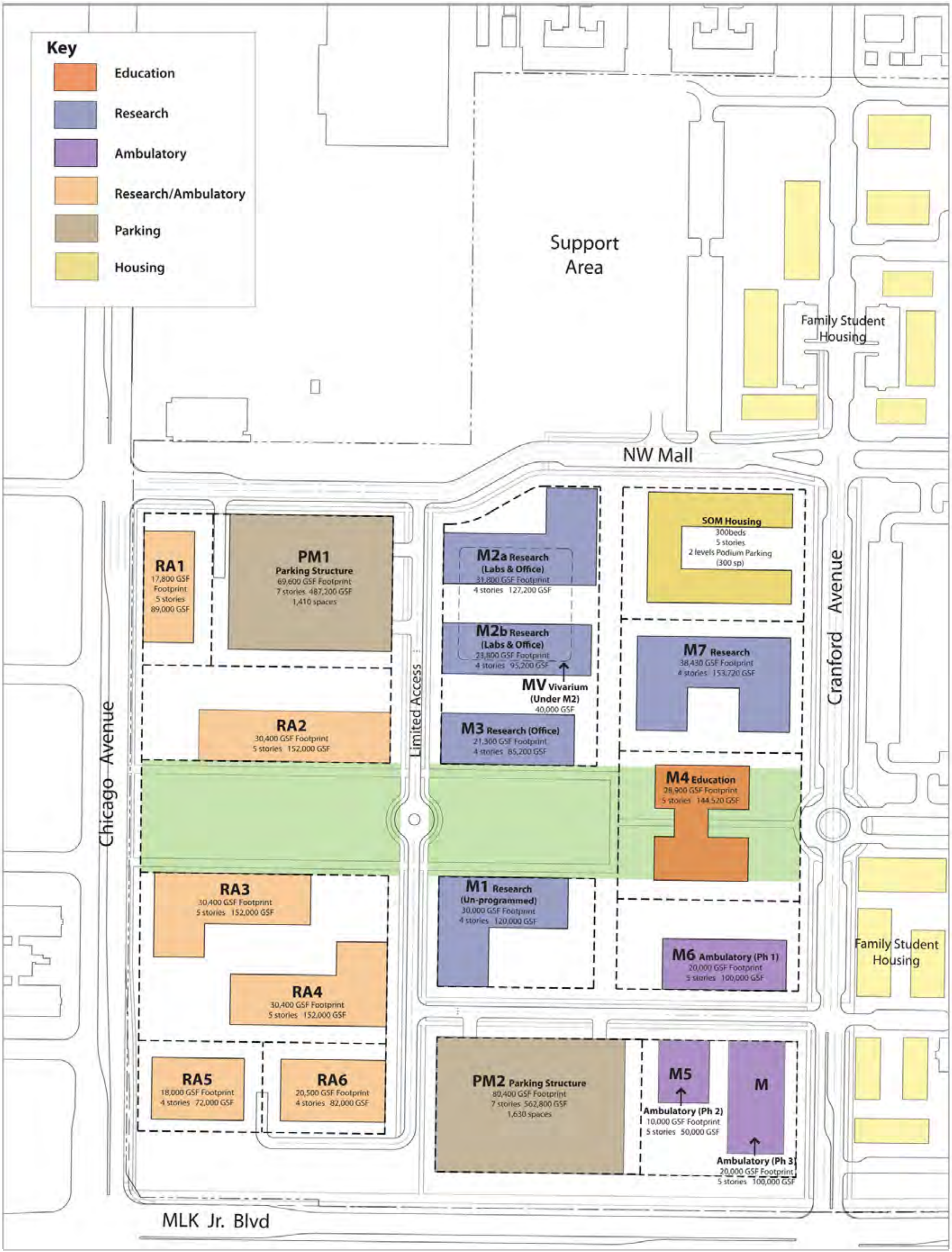


Figure 4-3: Refined Building Plan

0 240

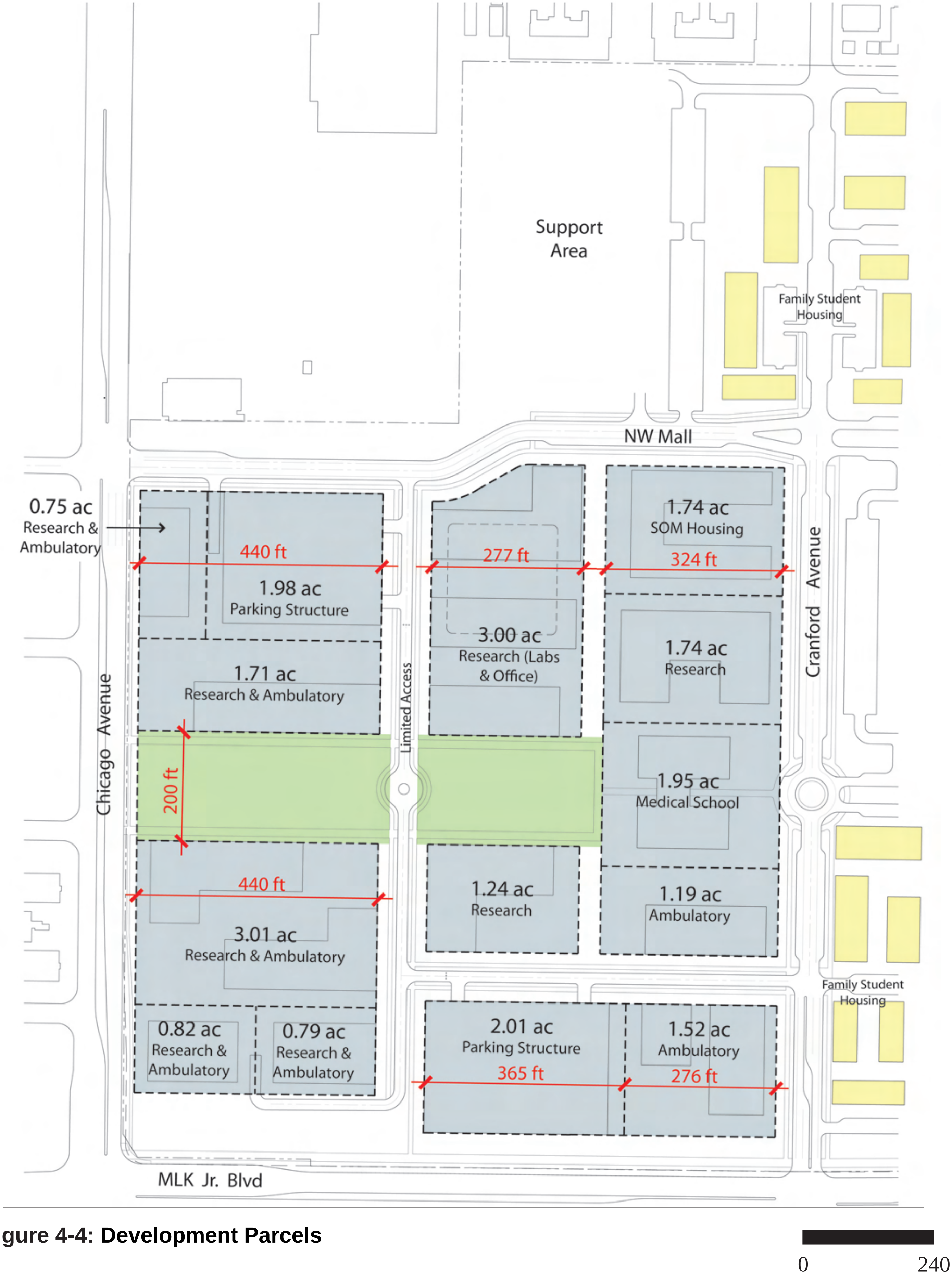


Figure 4-4: Development Parcels

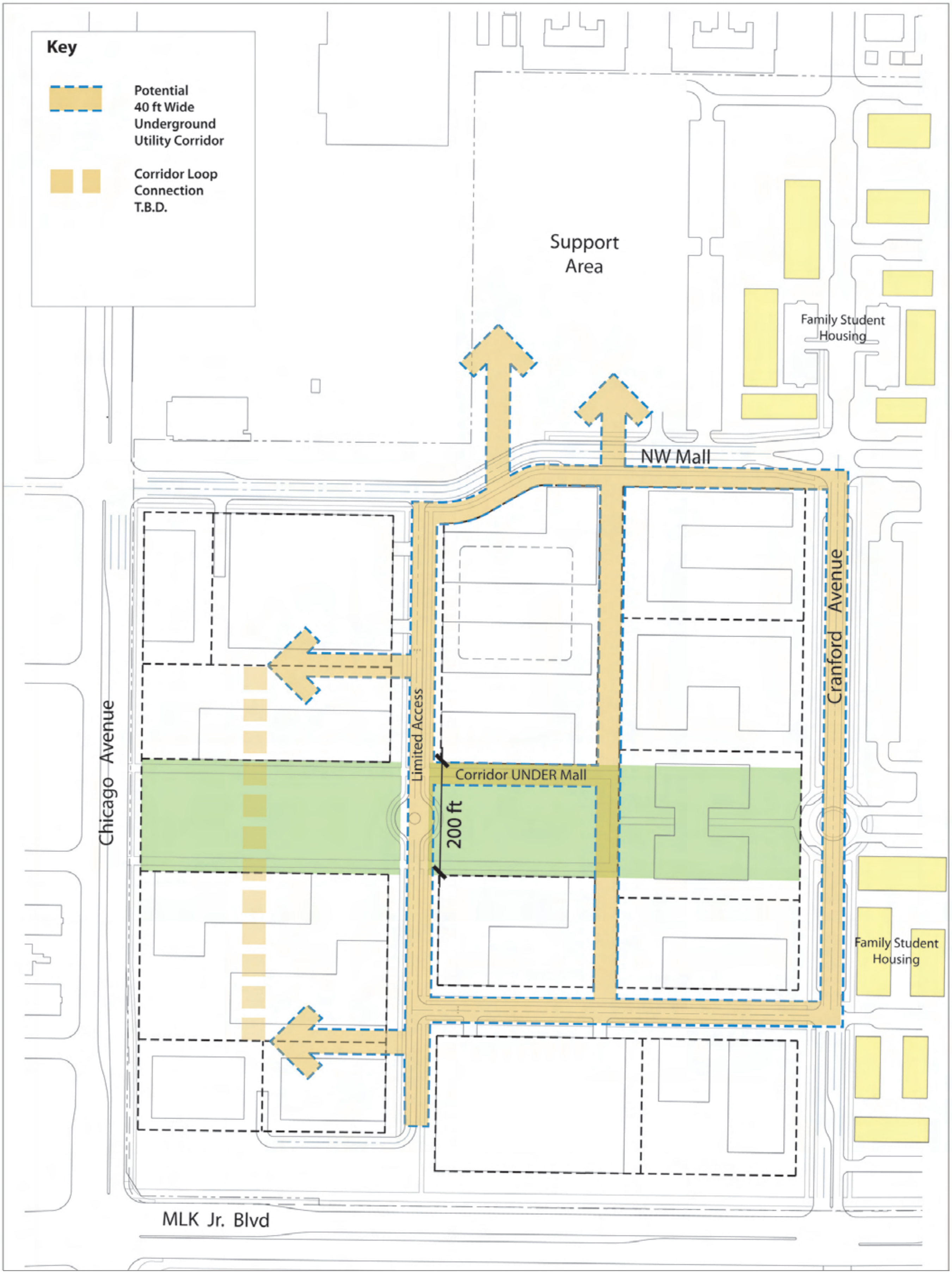


Figure 4-5: Utility Corridors

expressed in UCR's 2004 Multi-Modal Transportation Plan is the consolidation of parking within multi-story garages peripheral to the academic cores of the East and West campus. Combined with this is an aggressive shift to reduce private auto use through alternatives such as bicycling, carpooling, walking and transit, as well as an increased on-student resident population. It is essential that the demand and capacity for parking according to present-day demand levels still be considered in the planning for a new SOM campus as UCR still expects to have need for parking and to compromise future parking supply to expand buildable land.

These assumptions informed the CAMPS plan, which located two large parking structures on the SOM site. The two parking structures identified on the Refined Building Plan drawing as PM1 and PM2 replace the structures that were labeled PMOB and PM, respectively in both CAMPS and WCIDS. These structures were sized according to their footprint, not according to a specific program. The development of this DPP permitted the campus to evaluate the scale of these structures according to the revised, detailed program for the SOM.

A detailed analysis was undertaken, which is described in Tables 4-2 through 4-8.

- Table 4-2 describes the Phased program outlined for the SOM, with projected student, staff, headcount and visitor parking demand. The demand is based on providing one parking space per campus user.
- Table 4-3 describes the Phased program outlined for the SOM, with projected student, staff, FTE and visitor parking demand. The demand is based on providing 0.48 parking spaces per campus user. This ratio was determined by UCR TAPS as a reasonable estimation of future reductions in private vehicle parking demand due to the implementation of campus transportation and land use policies, including increased on-campus housing, improved bicycle and pedestrian facilities and increased transit service.
- Table 4-4 outlines the original CAMPS development and parking assumptions in order to arrive at a reasonable parking ratio for the un-programmed Research and Ambulatory spaces on the west side of the SOM campus.
- Table 4-5 is the same analysis using the lower demand ratio of 0.48 spaces per campus user.
- Table 4-6 outlines an estimate of parking demand using annual student, staff and FTE projections only, instead of square footage ratios. Table 4-7 is the same analysis at a lower demand ratio.
- Finally, Table 4-8 describes the adjustments needed to the Refined Building Plan in this document, to accommodate a range of conditions related to the demand analysis. (For example, if further future analysis determines that a high ratio of one parking space per campus user cannot be reduced with future modal splits from transit, walking, biking and mixed land uses, then the existing parking structures shown on the Refined Building Plan will each require two additional floors.)

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Table 4-2: SOM Development and Parking Assumptions

Phase	Code	Type	Footprint (gsf)	Floors	Desired Program (Feb. 3 09) ASF (65%)	GSF	Assumed Occupancy	Phase 1 Headcount (2014-2017) Faculty	Students	Staff (4/FTE)	Parking Ratio	Parking Needed	*Notes*
PHASE ONE	M2	Medical Research (Lab) Phase 1	37,170	6	144,375	222,116	2015	65 FTE		260	1/FTE and 1/Staff	325	
	M3	Medical Research (Office/Meet.) Phase 1	21,150	4	55,000	84,615	2015	--	--	--	--	--	
	M4	Medical Education Building	36,000	4	83,500	144,000	2014	14 FTE	 100 Med 33 Grad 60 Resident	56	 1/student " "	70 100 33 60	
	MV	Vivarium Facility	40,100	1	22,060	40,100	2015	--		20	--	20	*Vivarium Staff Allowance (20)*
	M6	Ambulatory Care Facility Phase 1	25,100	4	65,000	100,000	2017	60 doctors			5/1000 gsf*	500	**See Demand Reduction Options*
											Visitor Parking	152	*25% of spaces*
					Phase 1 Gross Square Footage	590,831					Phase 1 Parking	1,260	
								Phase 2 Headcount (2018-2019)					*Notes*
					ASF (65%)	GSF		Faculty	Students	Staff			
PHASE TWO	M7	Medical Research Lab Phase 2	30,673	5	99,687	153,364	2018	30 FTE		120	1/FTE	150	*The populations presented in this phase are additional Faculty Staff and Students to Phase 1*
		Additional Students (Medical Education)							300 Med 77 Grad 100 Resident		1/student " "	300 77 100	
	M5	Ambulatory Care Facility Phase 2	10,000	5	32,500	50,000	2019	30 doctors			5/1000*	250	**See Demand Reduction Options*
											Visitor Parking	157	
					Phase 2 Gross Square Footage	203,364					Phase 2 Parking	1,034	
					Cumulative Gross Square Footage	*794,195*					*Cumulative Parking*	*2,294*	
								Phase 3 Headcount (2022)					*Notes*
					ASF (65%)	GSF		Faculty	Students	Staff			
PHASE THREE	M--	Ambulatory Care Facility Phase 3	20,300	5	65,000	100,000	2022	60 doctors			5/1000*	500	**See Demand Reduction Options*
		Additional Students (Medical Education)							60 Grad		1/student	60	*The populations presented in this phase are additional Faculty Staff and Students to Phase 2*
											Visitor Parking	15	
					Phase 3 Gross Square Footage	100,000					Phase 3 Parking	575	
					Total Gross Square Footage	894,195					Total Parking Need	2,869	1 space per 330 gsf
											Non-student (staff and faculty) parking needs	*1,815*	

NOTES:

Desired Program Data from "SOM Initial Development Assumptions", provided by UCR February 3, 2009

Parking Ratio direction from UCR, March 17 2009: See document "SOM Infrastructure Parking Demand Analysis LOW" for analysis based on a 0.48/FTE, Student and Staff ratio

See accompanying Table 4 "Annual SOM Student, FTE and Staff Parking Need" for parking demand on annual basis (not including MOBs)

Table 4-3: SOM Development and Parking Assumptions:

	Code	Type	Footprint (gsf)	Floors	Desired Program (Feb. 3 09)		Assumed Occupancy	Phase 1 Headcount (2014-2017)			Parking Ratio	Parking Needed	Notes
					ASF (65%)	GSF		Faculty	Students	Staff (4/FTE)			
PHASE ONE	M2	Medical Research (Lab) Phase 1	37,170	6	144,375	222,116	2015	65 FTE		260	0.48/FTE and 0.48/Staff	156	
	M3	Medical Research (Office/Meet.) Phase 1	21,150	4	55,000	84,615	2015	--	--	--	--	--	
	M4	Medical Education Building	36,000	4	83,500	144,000	2014	14 FTE		56	0.48/FTE and 0.48/Staff	34	
									100 Med		.48/student	48	
									33 Grad		"	16	
									60 Resident		"	29	
	MV	Vivarium Facility	40,100	1	22,060	40,100	2015	--		20	--	10	*Vivarium Staff Allowance (20)*
	M6	Ambulatory Care Facility Phase 1	25,100	4	65,000	100,000	2017	60 doctors			5/1000 gsf*	500	**See Demand Reduction Options*
											Visitor Parking	73	
					Phase 1 Gross Square Footage	590,831					Phase 1 Parking	865	
								Phase 2 Headcount (2018-2019)					*Notes*
					ASF (65%)	GSF		Faculty	Students	Staff			
PHASE TWO	M7	Medical Research Lab Phase 2	30,673	5	99,687	153,364	2018	30 FTE		120	0.48/FTE	72	
		Additional Students (Medical Education)							300 Med		0.48/student	144	
									77 Grad		"	37	
									100 Resident		"	48	
	M5	Ambulatory Care Facility Phase 2	10,000	5	32,500	50,000	2019	30 doctors			5/1000*	250	**See Demand Reduction Options*
											Visitor Parking	75	
					Phase 2 Gross Square Footage	203,364					Phase 2 Parking	626	
					Cumulative Gross Square Footage	*794,195*					*Cumulative Parking*	*1,491*	
								Phase 3 Headcount (2022)					*Notes*
					ASF (65%)	GSF		Faculty	Students	Staff			
PHASE THREE	M--	Ambulatory Care Facility Phase 3	20,300	5	65,000	100,000	2022	60 doctors			5/1000*	500	**See Demand Reduction Options*
		Additional Students (Medical Education)							60 Grad		0.48/student	29	
											Visitor Parking	7	
					Phase 3 Gross Square Footage	100,000					Phase 3 Parking	536	
					Total Gross Square Footage	894,195					SubTotal Parking Need	2,027	*1 space per 330 gsf*
											Non-student (staff and faculty) parking needs	*1,521*	

Table 1 NOTES:

Desired Program Data from "SOM Initial Development Assumptions", provided by UCR February 3, 2009

Parking Ratio direction from UCR, March 17 2009: See document "SOM Infrastructure Parking Demand Analysis" for analysis based on a 1.0/FTE, Student and Staff ratio

See accompanying spreadsheet "Annual SOM Student, FTE and Staff Parking Need" for parking demand on annual basis (not including MOBs)

Table 4-4: CAMPS (2008) SOM Development and Parking Assumptions

Plan Code	Building Use	Footprint (gsf)	Floors	Total GSF	Parking Spaces	Parking Ratio	Notes
M1	Research	30,000	4	120,000			
M2	Research	32,000	4	128,000			
M3	Research	25,000	4	100,000			
M4	Education	56,000	4	224,000			
M5	Ambulatory Care	30,000	4	120,000			
M6	Ambulatory Care	25,000	4	100,000			
M7	Research	31,000	4	124,000			
MV	Vivarium	--	--	23,000			
				939,000			
PM	**SOM Parking**	**47,000**	**7**	**329,000**	**940**	***1/1,000 gsf***	
MOB 1	Medical Office/Research	18,000	4	72,000			
MOB 2	Medical Office/Research	31,000	4	124,000			
MOB 3	Medical Office/Research	30,000	4	120,000			
MOB 4	Medical Office/Research	30,000	5	150,000			
MOB 5	Medical Office/Research	17,500	4	70,000			
MOB 6	Medical Office/Research	20,500	4	82,000			
MOB 7	Medical Office/Research	19,500	4	78,000			
				696,000			
PMOB	**MOBs Parking**	**50,500**	**7**	**353,500**	**1,010**	***1/690 gsf***	*1.5/1000*
				Total SOM Parking (CAMPS)	**1,950**	***1/838gsf***	*Average Ratio*
				2005 Non-resident campus parking	**7,190**	***1/415gsf***	*2005 LRDP p.91 (Need recent stats)*
				2025 Non-resident campus parking	**10,380**	***1/700gsf***	*CAMPS/2005 LRDP*

SOM Program (February 3 2009)

	Building Use			Total GSF	Parking Spaces	Parking Ratio	Notes
	Research			460,095	475		
	Education			144,000	800		
	Ambulatory			250,000	1,250		*Ratio of 5/1000gsf*
	Vivarium			40,100	20		
			Total SOM Square Footage	**894,195**	**2,545**	**1/330 gsf**	
			Visitor Parking		**324**		
			Additional MOB/Research Square Footage	**696,000**	**994**	**1/700 gsf**	*2025 Campus Ratio*
			Total SOM and MOB Parking Demand		**3,863**	*spaces*	

Table 4-5: CAMPS (2008) SOM Development and Parking Assumptions

Plan Code	Building Use	Footprint (gsf)	Floors	Total GSF	Parking Spaces	Parking Ratio	Notes
M1	Research	30,000	4	120,000			
M2	Research	32,000	4	128,000			
M3	Research	25,000	4	100,000			
M4	Education	56,000	4	224,000			
M5	Ambulatory Care	30,000	4	120,000			
M6	Ambulatory Care	25,000	4	100,000			
M7	Research	31,000	4	124,000			
MV	Vivarium	--	--	23,000			
				939,000			
PM	**SOM Parking**	**47,000**	**7**	**329,000**	**940**	***1/1,000 gsf***	
MOB 1	Medical Office/Research	18,000	4	72,000			
MOB 2	Medical Office/Research	31,000	4	124,000			
MOB 3	Medical Office/Research	30,000	4	120,000			
MOB 4	Medical Office/Research	30,000	5	150,000			
MOB 5	Medical Office/Research	17,500	4	70,000			
MOB 6	Medical Office/Research	20,500	4	82,000			
MOB 7	Medical Office/Research	19,500	4	78,000			
				696,000			
PMOB	**MOBs Parking**	**50,500**	**7**	**353,500**	**1,010**	***1/690 gsf***	*1.5/1000*
				Total SOM Parking (CAMPS)	**1,950**	***1/838gsf***	*Average Ratio*
				2005 Non-resident campus parking	**7,190**	***1/415gsf***	*2005 LRDP p.91 (Need recent stats)*
				2025 Non-resident campus parking	**10,380**	***1/700gsf***	*CAMPS/2005 LRDP*

SOM Program Parking Assumptions (February 3 2009)

	Building Use			Total GSF	Parking Spaces	Parking Ratio	Notes
	Research			460,095	228		
	Education			144,000	384		
	Ambulatory			250,000	1,250		*Ratio of 5/1000gsf*
	Vivarium			40,100	10		
	Total SOM Square Footage			**894,195**	**1,872**	**1/330 gsf**	
	Visitor Parking				**155**		
	Additional MOB/Research Square Footage			**696,000**	**994**	**1/700 gsf**	*2025 Campus Ratio*

Total SOM and MOB Parking Demand **3,021** *spaces*

Table 4-6: Annual SOM Student, FTE and Staff Parking Need

Year	2007-2008	'08-'09	'09-'10	'10-'11	'11-'12	'12-'13	'13-'14	'14-'15	'15-'16	'16-'17	'17-'18	'18-'19	'19-'20	'20-'21	'21-'22
								**Phase 1 SOM Buildings*				**Phase 2 SOM Buildings*			**Phase 3 SOM*
Enrollment															
Medical Students															
1st Year	24	28	28	28	28	50	50	100	100	100	100	100	100	100	100
2nd Year	24	24	28	28	28	28	50	50	100	100	100	100	100	100	100
3rd Year								50	50	100	100	100	100	100	100
4th Year									50	50	100	100	100	100	100
Total Medical Students	48	52	56	56	56	78	100	200	300	350	400	400	400	400	400
Graduate Academic (PhD)	20	25	25	25	25	25	33	49	70	90	110	130	145	155	160
Intern and Residents						26	60	107	128	147	160	160	160	160	160
Total Enrollment	**68**	**77**	**81**	**81**	**81**	**129**	**193**	**356**	**498**	**587**	**670**	**690**	**705**	**715**	**720**
Student Parking Ratio	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*	*1/student*
Student Parking Need	**68**	**77**	**81**	**81**	**81**	**129**	**193**	**356**	**498**	**587**	**670**	**690**	**705**	**715**	**720**
Faculty FTE															
Existing Faculty	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Research Leader Faculty					1	1	2	2	3	3	4	4	4	4	4
Other Basic Science/Clinical Research Faculty			2	2	6	8	12	14	31	34	46	48	49	50	50
Clinical Education Faculty			1	3	6	13	18	32	35	40	43	43	43	43	43
Community Clinical Physicians (1st/2nd Year)						4	5	5.5	6.3	5.5	4.7	4	3.2	2.4	2
Community Clinical Physicians (Clerkships)								10.5	12.7	22.5	24.3	24	24.8	24.6	25
Total FTEs	14	14	17	19	27	40	51	78	102	119	136	137	138	138	138
FTE Parking Ratio	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*	*1/FTE*
FTE Parking Need	**14**	**14**	**17**	**19**	**27**	**40**	**51**	**78**	**102**	**119**	**136**	**137**	**138**	**138**	**138**
Staff	56	56	68	76	108	160	204	312	408	476	544	548	552	552	552
Staff Parking Ratio	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*	*1/staff*
Staff Parking Need	**56**	**56**	**68**	**76**	**108**	**160**	**204**	**312**	**408**	**476**	**544**	**548**	**552**	**552**	**552**
Annual SOM Parking Space Needs (FTE, Staff and Student)	**138**	**147**	**166**	**176**	**216**	**329**	**448**	**746**	**1,008**	**1,182**	**1,350**	**1,375**	**1,395**	**1,405**	**1,410**
Annual Visitor Parking Needs	**35**	**37**	**42**	**44**	**54**	**82**	**112**	**187**	**252**	**296**	**338**	**344**	**349**	**351**	**353**
Ambulatory Care Parking Needs by Phase											**500**	**500**	**750**	**750**	**1250**
Total SOM Parking Space Needs	**173**	**184**	**208**	**220**	**270**	**411**	**560**	**933**	**1,260**	**1,478**	**2,188**	**2,219**	**2,494**	**2,506**	**3,013**

NOTES:

Data from "Table 1. UCR School of Medicine Student Enrollment and Faculty Projections", included in document "SOM proposal PART III-Chapters 1-2 Rev", provided by UCR
Does not include MOB Parking (Strictly SOM)
Assume parking to be sized to accommodate need at later end of phases

Table 4-7: Annual SOM Student, FTE and Staff Parking Need

Year	2007-2008	'08-'09	'09-'10	'10-'11	'11-'12	'12-'13	'13-'14	'14-'15	'15-'16	'16-'17	'17-'18	'18-'19	'19-'20	'20-'21	'21-'22
								**Phase 1 SOM Buildings*				**Phase 2 SOM Buildings*			**Phase 3 SOM*
Enrollment															
Medical Students															
1st Year	24	28	28	28	28	50	50	100	100	100	100	100	100	100	100
2nd Year	24	24	28	28	28	28	50	50	100	100	100	100	100	100	100
3rd Year								50	50	100	100	100	100	100	100
4th Year									50	50	100	100	100	100	100
Total Medical Students	48	52	56	56	56	78	100	200	300	350	400	400	400	400	400
Graduate Academic (PhD)	20	25	25	25	25	25	33	49	70	90	110	130	145	155	160
Intern and Residents						26	60	107	128	147	160	160	160	160	160
Total Enrollment	**68**	**77**	**81**	**81**	**81**	**129**	**193**	**356**	**498**	**587**	**670**	**690**	**705**	**715**	**720**
Student Parking Ratio	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*	*0.48/student*
Student Parking Need	**33**	**37**	**39**	**39**	**39**	**62**	**93**	**171**	**239**	**282**	**322**	**331**	**338**	**343**	**346**
Faculty FTE															
Existing Faculty	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Research Leader Faculty					1	1	2	2	3	3	4	4	4	4	4
Other Basic Science/Clinical Research Faculty			2	2	6	8	12	14	31	34	46	48	49	50	50
Clinical Education Faculty			1	3	6	13	18	32	35	40	43	43	43	43	43
Community Clinical Physicians (1st/2nd Year)						4	5	5.5	6.3	5.5	4.7	4	3.2	2.4	2
Community Clinical Physicians (Clerkships)								10.5	12.7	22.5	24.3	24	24.8	24.6	25
Total FTEs	14	14	17	19	27	40	51	78	102	119	136	137	138	138	138
FTE Parking Ratio	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*	*0.48/FTE*
FTE Parking Need	**7**	**7**	**8**	**9**	**13**	**19**	**24**	**37**	**49**	**57**	**65**	**66**	**66**	**66**	**66**
Staff *(Assume 4/FTE)*	56	56	68	76	108	160	204	312	408	476	544	548	552	552	552
Staff Parking Ratio	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*	*0.48/staff*
Staff Parking Need	**27**	**27**	**33**	**36**	**52**	**77**	**98**	**150**	**196**	**228**	**261**	**263**	**265**	**265**	**265**
Annual SOM Parking Space Needs (FTE, Staff and Student)	**66**	**71**	**80**	**84**	**104**	**158**	**215**	**358**	**484**	**567**	**648**	**660**	**670**	**674**	**677**
Annual Visitor Parking Needs	**17**	**18**	**20**	**21**	**26**	**39**	**54**	**90**	**121**	**142**	**162**	**165**	**167**	**169**	**169**
Ambulatory Care Parking Needs by Phase											**500**	**500**	**750**	**750**	**1250**
Total SOM Parking Space Needs	**83**	**88**	**100**	**106**	**130**	**197**	**269**	**448**	**605**	**709**	**1,310**	**1,325**	**1,587**	**1,593**	**2,096**

NOTES:

Data from "Table 1. UCR School of Medicine Student Enrollment and Faculty Projections", included in document "SOM proposal PART III-Chapters 1-2 Rev", provided by UCR
Does not include MOB Parking (Strictly SOM)
Assume parking to be sized to accommodate need at later end of phases

Table 4-8: Parking Adjustments to SOM Master Plan

Parking Supply, School of Medicine Refined Plan

			Total
PM 1	7-story garage	202 spaces per floor	1,410
PM 2	7-story garage	233 spaces per floor	1,630
		Total Parking Spaces	3,040

Parking Demand Scenarios (March 18th Program)

HIGH (1 space per person)		
No Mode Split, Ambulatory Parking Ratio of 5/1,000	*Required*	3,863
	Shortfall	823
Requirement: Two 9-floor parking structures	***Additional spaces***	***870***
HIGH (1 space per person)		
10% Mode Split (SOM buildings only), Ambulatory Parking Ratio of 4/1,000	*Required*	3,451
	Shortfall	411
Required: Two 8-floor parking structures	***Additional spaces***	***445***
HIGH (1 space per person)		
35% Mode Split (SOM buildings only), Ambulatory Parking Ratio of 4/1,000		3,046
Required: Two 7-floor parking structures (as shown on plan)		

LOW (0.48 spaces per person)		
Mode Split (SOM buildings only), Ambulatory Parking Ratio of 5/1,000		3,021
Requirement: Two 7-floor parking structures (as shown on plan)		
LOW (0.48 spaces per person)		
Mode Split (SOM buildings only), Ambulatory Parking Ratio of 4/1,000		2,771
	Surplus	269
Requirement: One 7-floor parking structure, One 6-floor structure	***Less spaces***	***212***

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Parking Structures and Surface Parking

Using the preceding analysis of campus parking demand, a study of parking options was presented to UCR, with options of surface parking and structured parking. Parking demands of Ambulatory programs have been assumed as 5 spaces per 1,000 gross square feet (gsf). Such surface parking would have required the use of much of the undeveloped portions of the forty acre SOM site as the campus developed. The land coverage of surface parking was deemed to be too extensive and not meeting the campuses sustainability goals. (Prior to initiating design of the SOM campus, parking and circulation requirements will need to be reviewed using input and direction obtained from the LRDP Amendment and EIR process.)

The two parking structures identified on the Refined Building Plan drawing, PM1 and PM2, update the CAMPS and WCIDS structures that were labeled PMOB and PM, respectively. UCR made the decision to build PM 1 in the first phase of the campus development, accommodating all of the demand for Phase 1 in one multi-story structure of over 1,400 spaces. The capacity of both structures was calculated using a ratio of 345 gsf per structured parking space, which includes allowances for ramps and drive aisles.

The first phase of Ambulatory uses, in building M6, could be considered in a separate Phase 1B. This use could be served with a 500-car surface parking lot south of the core of Phase 1 Research and Education buildings. When the Ambulatory building in Phase 2 is built, the second parking structure of over 1,600 spaces would be needed, replacing 350 spaces of the former surface lot. This would provide excess capacity at the time that the SOM campus would absorb in future development. It is possible that these Ambulatory Care users could fund the construction of the garages, to be repaid through the collection of parking fees. This could potentially result in an earlier construction timetable for PM2.

As a result of direction from the May 15th Workshop, PM2 was moved to the west, allowing more stacking distance for cars using the structure and removing such a large building from the main entrance to the SOM off MLK Jr. Blvd. Correspondingly, the two Ambulatory buildings, M and M5 were moved east. Details of drop-offs and other internal site planning can be considered at a later stage but a critical element to emphasize is that the future design of these two buildings should suit their location at such a prominent entry to the SOM campus.

The two large parking structures in the Refined Building Plan could be up to 9 stories, or 90 feet tall. Correspondingly, there could be an effect on the adjacent streetscape and neighboring buildings. Good design can mitigate the scale and impact of the garages. At street level, the parking structure could include shallow ‘liner buildings’, up to 40 feet deep, for certain uses such as a campus Police station, retail uses such as a café or a pharmacy associated with the Ambulatory Care buildings. These liner buildings would provide a more engaging street presence for the large parking structures. The corresponding loss of parking spaces would need to be accommodated elsewhere, presumably by expanding the structure.

4.6 Phasing

Phase 1
The first phase of the new School of Medicine will establish the school with a critical mass of research laboratories and educational facilities (See Figure 4-6). An initial Research building complex (M2a and M2b) will be located along the NW Mall directly south of the Support Yard, taking advantage of the adjacent service tunnel. A related office building for researchers and administrators (M3) will be located in the same development parcel. The M2 and M3 program elements may be connected with at-grade breezeways or sky bridges, to be determined in a future design phase.

The Medical Education building (M4) will also be built in this phase. This building is to be located in a prominent site at the end of the SW Mall, providing a symbolic link back to the East Campus and the original Citrus Experiment Station. The form shown in the plan is a purely conceptual arrangement of the program square footage but the eventual design should honor the building's iconic location and if possible, include north and south wings to embrace a central courtyard for special events and a main entry. This building will be a 5-story signature building (see 2007 UCR Design Guidelines).

Phase 1 Landscape
The first phase of surface improvements will include the establishment of the SOM's landscape structure. The most important component of this is the first section of the Mall open space, a 200-foot wide space identified in CAMPS and outlined in the Regulating Plan included in UCR's 2007 Design Guidelines. This first section will extend from Cranford Avenue, west to the central Limited Access spine that bisects the SOM's forty acres. The Medical Education Building (M4) will sit in a prominent location in this Mall, anchoring the west end of the SW Mall and providing an iconic architectural landmark. To the west of this building, the 200-foot wide mall will include a network of paths, at minimum 8 feet wide. The mall will be planted in a drought-resistant turf variety, recognizing that it will be used actively by the SOM community. Pockets of native shrubs and grasses may be included within the mall. Shade trees should frame the mall and may be included within the mall itself. The design of the mall should be undertaken in conjunction with the design of Phase 1 buildings for the SOM. The buildings on either side of this Mall, particularly M3 and M1, should be designed to provide a strong frame and enclose the mall as an outdoor room.

Other landscape improvements will include a network of paths throughout the SOM campus to connect all buildings with common space and with sidewalks, which will be part of all new streets. Individual building projects will include landscape improvements such as plazas, courtyards, paths, structural landscape and turf within development parcels, to be defined at the Detailed Project Program stage of each project.

Phase 1B
The first Ambulatory Care Building, M6, will be built in a distinct phase, independent of the Phase 1 Medical Research and Education buildings. This building can be served by a surface parking lot for 500 cars, reflecting the high ratio of 5 parking spaces per 1000 gsf that such

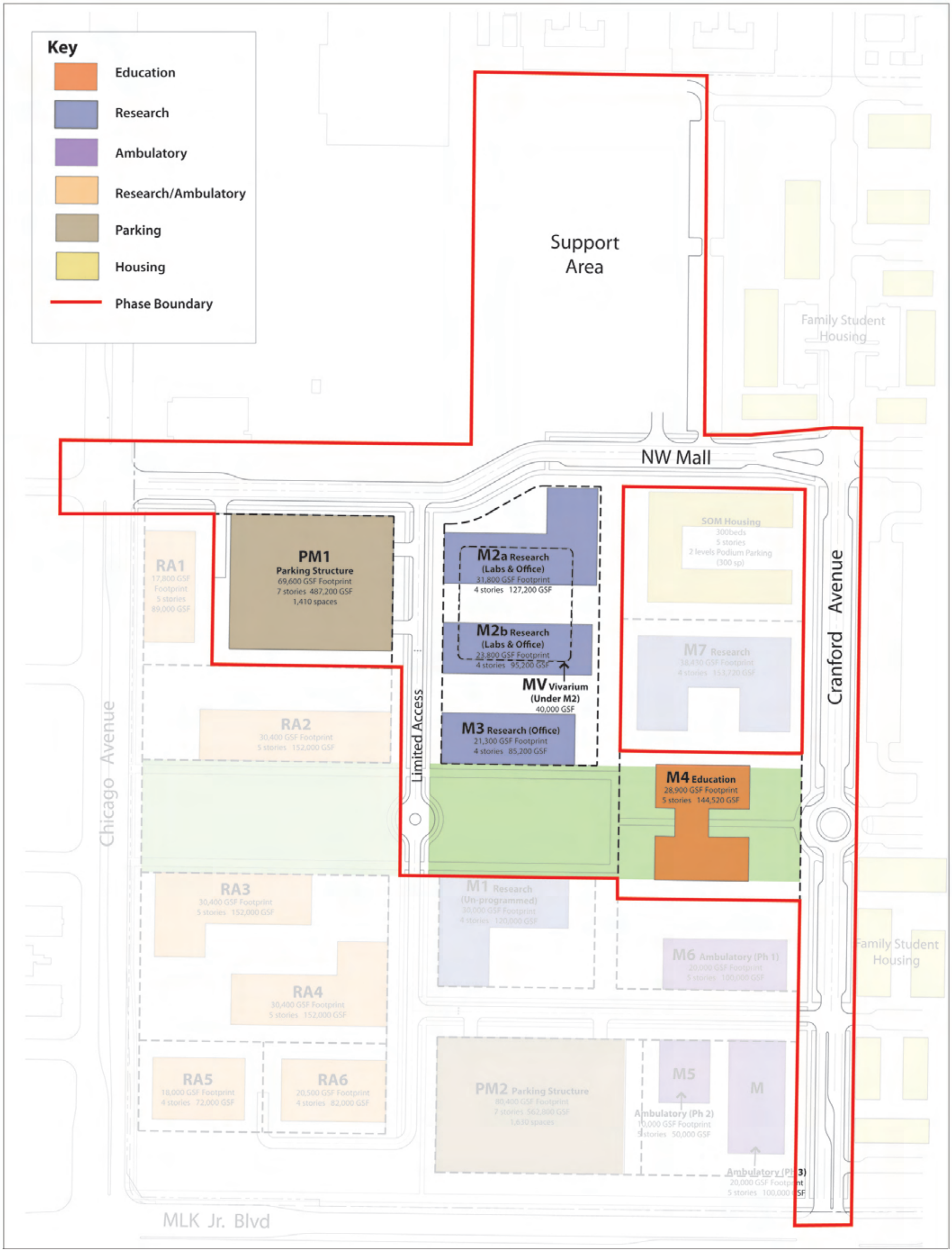

Figure 4-6: Phase 1

facilities require. When future Ambulatory Care buildings are constructed in later phases, the two surface lots will be replaced incrementally by the PM2 parking structure and the future Ambulatory Care buildings (M and M5) and the un-programmed Research building M1 (See Figure 4-7).

Phase 2

Subsequent phases of the School of Medicine development will feature more research facilities and ambulatory care clinics for practical application of medical education. The campus will grow to occupy the area with buildings lining vehicular streets and enclosing a quadrangle of open space. In Phase 2, a new Research building (M7) will be built along Cranford Avenue to the north of the Medical Education building. A second Ambulatory care building of 50,000 gsf will be built adjacent to a new Parking Structure, PM2, necessary to accommodate the amount of parking generated by Ambulatory uses (See Figure 4-8).

Phase 3 and Future Phases

The final phase of SOM construction will add a third component of Ambulatory Care, (labeled M on the plan), west of M5 and the PM2 parking structure (See Figure 4-9).

The timing of SOM Housing construction is undetermined but could be constructed in early phases if demand and funding is identified. A Research building, M1 is not programmed currently but will occupy a prominent location south of the SOM campus' main mall.

The area of the SOM adjacent to and east of Chicago Avenue is not specifically programmed at this stage. The buildings shown on the plan will complement the School of Medicine's campus vision and circulation system, but will be occupied by medical research offices and other support uses which are purely speculative. Such uses thrive in the vicinity of medical schools and hospitals and could serve as incubators for technology related to biotechnology and genetic research. Parking for these uses is included in overall campus counts but may need to be accommodated closer to each individual building site.

Phasing should take into account the orderly disposition of the citrus research groves that currently sit on much of the forty acre site. UCR will be able to continue research on approximately 9 acres on the western half of the SOM site if a parking structure (PM1) is constructed in Phase 1. However, the level of disruption inherent in the series of major construction projects proposed for the SOM campus may preclude any effective continued research in these groves. The landscape legacy of the groves could be expressed with planting designs placed within SOM campus open spaces but would negate the use of the trees for research.

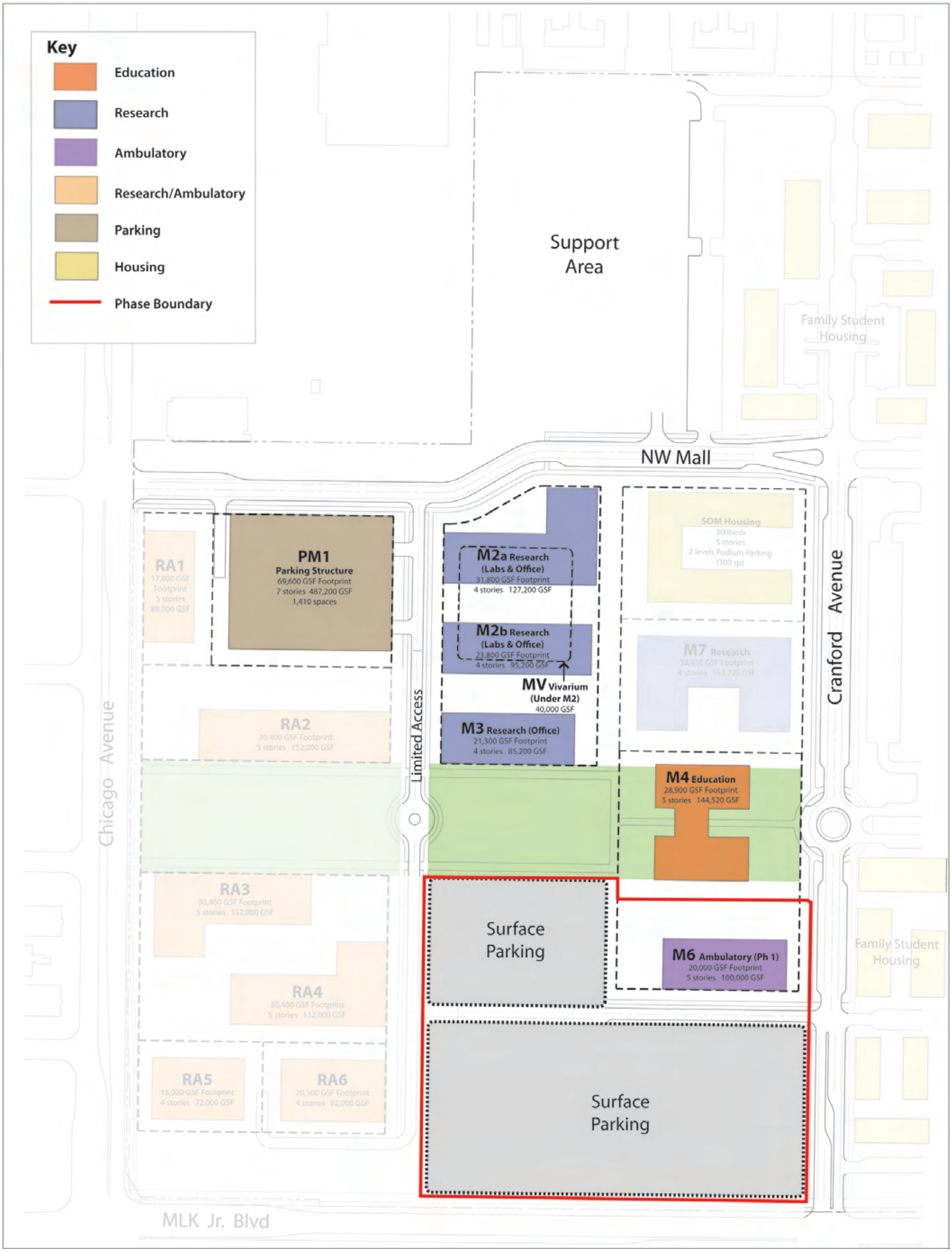

Figure 4-7: Phase 1B

0 240

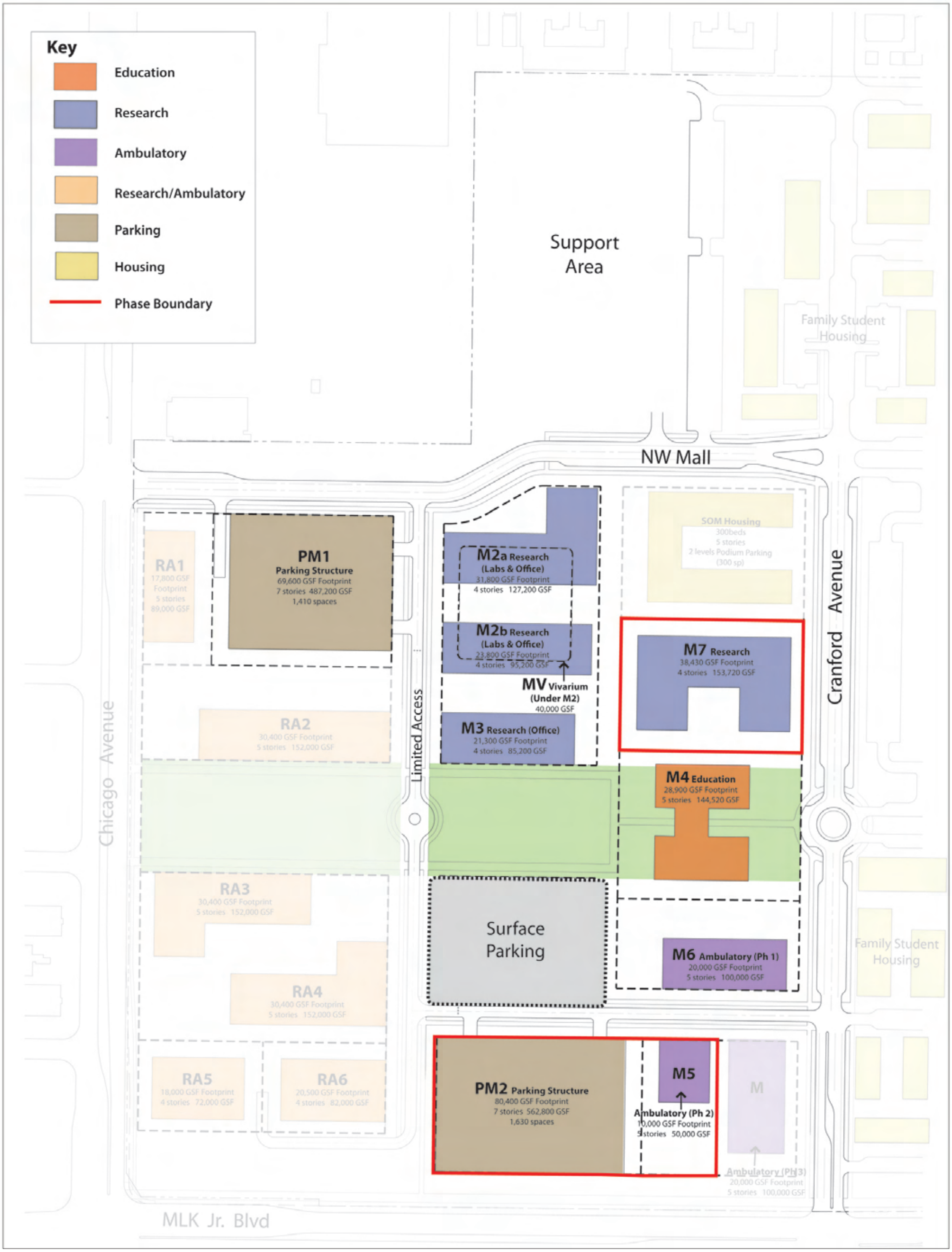

Figure 4-8: Phase 2

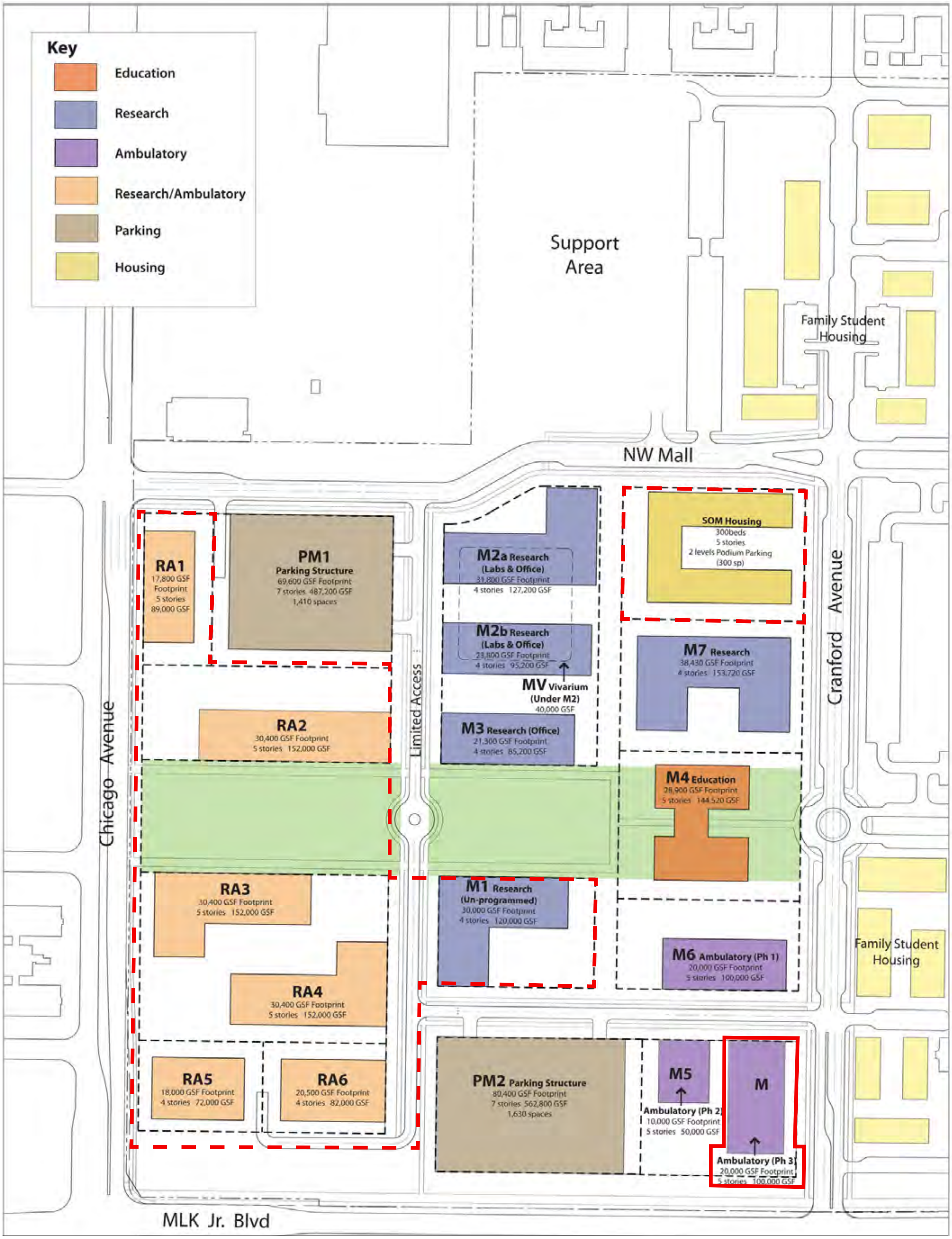

Figure 4-9: Phase 3 + Future

5.0 SUSTAINABILITY

The Detailed Project Program (DPP) for the School of Medicine Infrastructure Phase 1 was tasked with minimizing the water, electrical use, and gas use created from the expansion of the University. As part of this task, the University was presented opportunities broken down into two separate sections. These sections are as follows:

- Opportunities at the Central Plant. This is implemented through the infrastructure DPP.
- Opportunities at the Campus Buildings. This can only be utilized as a guide for building design outside the scope of the School of Medicine infrastructure.

A significant section is not within the scope of this DPP. This section will be the plan to make the campus carbon neutral and will need to incorporate the technologies and potential space for these technologies outside the boundary of the SOM and the West Campus. A preamble to this need is discussed further in this report.

University of California Policy on Sustainable Practices

As stated in the University of California Policy Guideline for Sustainable Practices, "The University of California is committed to improving the University's effect on the environment and reducing the University's dependence on non-renewable energy." The University of California has signed the American College and University Presidents Climate Commitment (ACUPCC) climate neutrality pledge, also known as the "President's Climate Commitment". The following are the policies in place and need to be reviewed prior to design of any infrastructure, central plants, or buildings:

- American College and University Presidents Climate Commitment - http://www.presidentsclimatecommitment.org/html/commitment.php
- University of California Policy on Sustainable Practices - http://www.ucop.edu/ucophome/coordrev/policy/PP032207policy.pdf
- University of California Policy Guidelines for Sustainable Practices - http://www.ucop.edu/ucophome/coordrev/policy/PP032207guidelines.pdf
- Chancellor's Committee on Sustainability - Overview of the Chancellor's Committee on Sustainability - http://sustainability.ucr.edu/publications/ccsoverview.pdf
- Chancellor's Committee on Sustainability – Charge and Bylaws - http://sustainability.ucr.edu/publications/ccscharter.pdf
- The University of California Annual Sustainability Reports - http://www.universityofcalifornia.edu/sustainability/reports.html

It is not the intent of this report to rewrite or reiterate any of the documents noted above; however several key factors are noted below that need to be considered during the development of the infrastructure and the buildings:

- LEED Certification: All new building projects are to be LEED Certified at a Silver Level minimum with an aspirational goal of LEED Certified at a Gold Level.

- The requirement of outperforming California Energy Code (CEC) Title 24 requirements by 20% has been modified to include an aspirational target of thirty percent.
    - Acute care facilities are exempt from this requirement. (not governed by the CEC Title 24 regulations)
- Laboratories will include LEED Certification as a requirement as well as Laboratories for the 21st Century (Labs 21) Environmental Performance Criteria.
- The University will create a combination of strategies to reduce the consumption of non-renewable energy.
- The University will strive to achieve a level of grid-provided electricity purchases from renewable sources that will be similar to the State's Renewable Portfolio Standard.
- It is worth noting that the CUP and its sustainable features can be utilized as part of the LEED process for future buildings, especially with respect to Energy credits and Refrigeration credits. Credit Interpretation Rulings (CIRs) are available through the USGBC.

West Campus Sustainable Strategies and Opportunities
During the process of this DPP, many strategies and opportunities were proposed by the project team and considered by the UCR team. As discussed above, the format was split into two sections:

- Opportunities at the Central Plant.
- Opportunities at the Campus Buildings.

The focus of the analyses was on the following opportunities:

- Building siting and planning
- Water Use Reduction
- Energy reduction.
- Renewable Energy Opportunities
- Educational Opportunities

Other aspects of sustainable design were left out as they are either well described through prescriptive means in the LEED scorecard and manuals or cannot be manipulated to this location, some examples are as follows:

- Site Selection – The site has already been selected and a new site is not debatable.
- Indoor Air Quality – IAQ requirements are relatively prescriptive in Codes, LEED documentation, etc.
- Storm Quantity and Quality – This is covered under separate sections of this DPP.

Table 5-1 was utilized as tool in the discussions of opportunities:

Table 5-1 Sustainability Matrix
UC Riverside – West Campus
School of Medicine

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Solar PV Generation (PV Farm)	Solar PV farm generation utilizes photovoltaic panels to provide energy in a large open field area. Could be applied to roofs of each building.	Large.	No impact to Buildings, but can impact useable area for campus growth and planning	Not Flexible, system cannot be modified and should be assumed to be fixed for 25-30 years.	High ($8 to $10 per Watt). System prices are coming down. Potential for beneficial Power Purchase Agreements (PPA). Can reduce Demand charges significantly (UC Riverside does not have Demand charges). Payback will be slow due to favorable UC Riverside Energy Rate.	No energy cost. High carbon footprint reduction	Low	Panels must be cleaned periodically	None	Mature
Building Integrated PV	Solar PV farm generation utilizes photovoltaic panels to provide energy while shading the Building fenestration.	No ground space requirements, however.	Impacts the facades of the buildings and limits architectural aesthetics.	Not Flexible, system cannot be modified and should be assumed to be fixed for 25-30 years.	High ($8 to $10 per Watt). System prices are coming down. Potential for beneficial Power Purchase Agreements (PPA). Can reduce Demand charges significantly (UC Riverside does not have Demand charges). Payback will be slow due to favorable UC Riverside Energy Rate. Provides shading and reduces HVAC system costs.	No energy cost. High carbon footprint reduction	Low	Panels must be cleaned periodically	None	Mature
Solar Thermal Water Heating	Solar thermal systems provide heating hot water and/or domestic hot water utilizing either manufactured or site built solar collectors.	Medium. System will provide the same amount of energy production as photovoltaic at 40% of the area.	System can be centrally located or can be located at each building. System would most efficiently be installed at each building with its own storage tank and heat exchanger.	Not Flexible, system cannot be modified and should be assumed to be fixed for 25-30 years.	Medium ($80 to $100 per square foot of panel). System prices are coming down. Potential for beneficial Power Purchase Agreements (PPA).	Very low energy cost, only the circulating pump requires energy. High carbon footprint reduction.	Low	Panels must be cleaned periodically	None	Mature

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Outside Air Pre-Heating	Air handling penthouses provided with manufactured Solar Wall type outside air pre-heating panels.	Equal to façade of the building's penthouse.	Will limit aesthetic nature of the penthouse. Would require penthouse to be on the roof.	Not Flexible, system cannot be modified and should be assumed to be fixed for the life of the penthouse.	Medium. Dependent on building orientation.	Very low energy cost, only the circulating pump requires energy. High carbon footprint reduction.	Low	Panels must be cleaned periodically	None	Mature
Wind Income										
Wind Turbine Farm	System incorporates large industrial wind turbines centrally located to support wind generated electricity.	Large. Needs to be coordinated with aviary flight patterns.	No impact to Buildings, but can impact useable area for campus growth and planning	Not Flexible, system cannot be modified and should be assumed to be fixed for 25-30 years.	Medium ($2,500 per kW). System prices are increasing due to demand. Potential for beneficial Power Purchase Agreements (PPA). Can reduce Demand charges significantly (UC Riverside does not have Demand charges). Payback will be slow due to favorable UC Riverside Energy Rate.	No energy cost. High carbon footprint reduction. Can balance solar generation by flattening load generation curve.	Low	Turbine generators will need periodic maintenance.	Acoustics will be a problem with wind generation and will need to be coordinated with the development of the site.	Mature
Building Integrated Wind Turbine	System incorporates small wind turbines into the roof of the new buildings. Systems are much smaller than large wind turbine farms.	Limited to building roof parapet exposed to the general wind direction. No aviary flight pattern issues.	Will have impact on roofline aesthetics for all buildings.	Can be removed relatively easily as they are typically anchored to the parapet. System function will be affected by surrounding buildings.	High. System cost is estimated at $6.50 per Watt.	No energy cost. Low carbon footprint reduction. Can balance solar generation by flattening load generation curve.	Low	Vibration to building mass has to be considered and coordinated.	Systems are much smaller than farm type wind generation and therefore should not pose an acoustical issue.	Emerging
Natural Ventilation	System utilizes engineered natural ventilation to provide adequate cooling for perimeter spaces through the utilization of simple natural ventilation through building architecture.	None to small.	Can impact building orientation, building width and depth, building façade systems. Systems will be mostly limited to classroom environments and office environments.	System can be flexible either by occupant control or direct digital controls.	Low if systems are kept simple.	Low if incorporated with isolation of mechanical systems.	Medium. System will require maintenance of façade systems and may require additional housekeeping.	Will require training of staff of when it is appropriate to have glazing open/close.	Acoustical considerations are high as surrounding area's acoustical generation will transmit directly to the occupied space.	Mature. Follow CIBSE flow chart for natural ventilation.
Ground Water										

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Open Well Geothermal Heat Rejection	System utilizes ground water of aquifers as a heat exchange medium for chiller condenser heat rejection utilizing an open piping system.	Small. Will require a pumping system, filtration system, and heat exchanger system.	No Architectural impact.	System is not flexible as piping is installed underground. System operation is flexible.	Medium to Low dependent on depth of aquifers and size of aquifers.	Can reduce cooling tower energy cost significantly. Pumping costs have to be considered and modeled.	Low. There will be sediment treatment; however cost of maintenance should be significantly less than cooling towers.	System has to be monitored to make sure that temperatures of aquifers are not dramatically changed and that temperatures into condensers meet chiller manufacturer requirements.	Can reduce cooling tower noise generation significantly.	Mature.
Central Plant										
Geothermal Closed Loop Heat Exchange System	System utilizes the earth and any ground water as a heat exchange medium through a closed loop system of pipes.	Large area required to accommodate heat transfer without heating up system temperature over time.	No Architectural impact on buildings.	System is not flexible as piping is installed underground. System operation is flexible. System can be sized as a hybrid system.	High. Estimated at $3,000 per Ton.	Low. Can reduce cooling tower energy cost significantly as well as water utilization for cooling tower evaporation significantly.	Low. Limits chemical treatment, fan servicing, etc. required for cooling tower systems.	No major operational issues.	Can reduce cooling tower noise generation significantly.	Mature.
Heat Recovery Templifiers	System utilizes electricity through a heat pump cycle to generate domestic hot water. System will accept the heat rejection from the chiller plant rather than cooling towers.	Small.	No Architectural impact on buildings.	System is flexible.	Medium.	Low energy cost as UC Riverside has favorable energy costs. Creates an opportunity for heat recovery within the central plant.	Medium. System has the same components as a chiller and will require the same level of maintenance.	No major operational issues beyond standard chiller plant operation.	Can reduce cooling tower noise generation when load is matched to chiller load.	Mature.
Chilled Water Thermal Storage	System utilizes chilled water storage tank(s) to thermally store produced chilled water for demand load reduction. Thermal storage is required by the Utility to support the favorable electricity rate.	Although the physical foot print is not overly large, the storage systems will be approximately 40-50 feet tall, equal to or higher than some of the buildings. It would be recommended to have a minimum of two units.	No Architectural impact to the buildings, but the system will be very noticeable as the terrain is relatively flat and the system is tall.	Once the system is built it will not be very flexible and will be hard to start small and expand as the campus expands.	Medium. System first cost is mostly in the tank system and controls. Much of the central plant will remain unchanged.	The system does not reduce energy cost for the campus, thermal storage is required to maintain the current energy rates provided to the Campus ($0.065 per kWh)	Low. There are not many components to maintain. Understanding of loading and unloading of the chilled water storage system is important to maintain capacity. Understanding the system's thermal stratification is important to proper operation.	System will require operational maintenance and training, however the system is used elsewhere on campus and staff does understand how to operate it.	There is no acoustical impact.	Mature.

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Ice Thermal Storage	System utilizes ice storage tank(s) to thermally store produced ice water for demand load reduction. Thermal storage is required by the Utility to support the favorable electricity rate.	The ice storage units are approximately 10 to 12 feet tall but do take up a significant footprint area. However, the equipment can be installed below grade and is recommended below grade for additional insulating purposes. This system will require a little more central plant space to accommodate the heat exchangers and additional pumps.	No Architectural impact to the buildings, the system can be hidden below grade so as to not have any visual impact.	The system is very flexible and can be sized for additional build out with additional modules added as the system capacity needs to grow.	Medium. System first cost is mostly in the tank system, controls, and heat exchangers. Much of the central plant will remain unchanged. Total installed chiller capacity will be reduced.	The system does not reduce energy cost for the campus, thermal storage is required to maintain the current energy rates provided to the Campus ($0.065 per kWh)	Low. There are not many components to maintain. Understanding of loading and unloading of the storage system is important to maintain capacity.	System will require operational maintenance and training; however the system is widely utilized throughout the country and well understood.	There is no acoustical impact.	Mature.
Phase Change (PCM) Thermal Storage	System utilizes phase change material to create thermal storage within tank(s) to thermally store produced chilled water for demand load reduction. Thermal storage is required by the Utility to support the favorable electricity rate. PCM's are substances that release latent energy during a phase change. PCM's have higher melting points than ice. PCM's are good conductors unlike ice which is a good insulator. Therefore the system requires less energy to produce the thermal storage. There is no expansion in PCM systems therefore putting less stress on the heat exchangers.	The storage units come in different shapes and sizes but do take up a significant footprint area. The footprint should be less than ice as the system is a better conductor. The equipment can be installed below grade and is recommended below grade for additional insulating purposes. This system will require a little more central plant space to accommodate the heat exchangers and additional pumps.	No Architectural impact to the buildings, the system can be hidden below grade so as to not have any visual impact.	The system is very flexible and can be sized for additional build out with additional modules added as the system capacity needs to grow.	Medium. System first cost is mostly in the tank system, controls, and heat exchangers. Much of the central plant will remain unchanged. Total installed chiller capacity will be reduced.	The system can reduce energy cost for the campus dependent on the type and temperature requirements of the PCM, thermal storage is required to maintain the current energy rates provided to the Campus ($0.065 per kWh)	Low. There are not many components to maintain. Understanding of loading and unloading of the storage system is important to maintain capacity.	System will require operational maintenance and training; the system is not widely used and needs further investigation for viability.	There is no acoustical impact.	Emerging. Has been used at IBM semiconductor factory in Canada as well as College of the Desert in Palm Desert, CA.
Boiler Stack Economizers	Direct or indirect stack condensing economizer cools stack flue gases below dew-point. Sensible and latent heat recovery Capable of heating large volumes of water to 140-180F	Requires additional footprint around boiler and a heat recovery water storage tank and distribution.	Additional space requirements	Can be sized to allow additional boilers to be connected if water demand is present	Moderate with 2 year payback depending on hot water use and system size	Offset by waste heat recovery improving boiler combustion efficiency from 85% with normal economizer up to 95%	Moderate periodic shutdown and cleaning	Additional controls for system optimization	None	Mature technology in new application

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Variable Primary Pumping with variable tertiary pumps	Variable primary pumping deletes the secondary pumps and provides variable speed pumps at each chiller thereby reducing pressure drop with reduced load. Tertiary pumps at each building will provide chilled water distribution for the building and will shut down for buildings not requiring distribution at night.	The central plant will be reduced in size since all the secondary pumps will be removed from the plant.	None	No different than primary/secondary pumping. Pumping system will not be oversized for a distribution system that is not fully completed at the beginning of the development. Chilled water delta T will be kept high through the plant regardless of load.	Reduced from primary/secondary pumping. Tertiary pumping will add some cost at each building.	Reduced energy cost from standard primary/secondary chilled water plant.	Lower at the plant, however there will be pumps at each building that need to be maintained.	Chillers will shut down on high head if not receiving adequate chilled water flow during turn down. Minimum flow requirements have to be met at all times and controlled.	There is no acoustical impact.	Mature.
Chemical Free Tower Treatment	Utilizes a chemical free treatment system such as Dolphin for the cooling towers.	No space savings.	None	None	First cost is higher than chemical treatment system, but cost is coming down as additional competitors are entering the market.	Reduced water costs where blow down can be reduced.	Reduced allowing for a four to five year payback or less.	No handling of chemicals for the cooling towers. The proper system has to be mated to each cooling tower. System needs flow for operation.	There is no acoustical impact.	Mature.
Cogeneration	System that utilizes natural gas to drive generators which provide electricity for the campus. During the process waste heat is created which can be used in the central plant for domestic and heating hot water or potentially absorption chillers.	Generators are large and require a significant amount of footprint.	No Architectural impact to the buildings, but the system will affect the size of the central plant and yard area.	Provides flexibility in managing energy costs for the campus related to inflation of energy prices. Allows for demand reduction should demand rates be imposed on the college.	Very high first cost.	Large energy savings and very large carbon footprint reduction if sized properly for utilization of complete waste heat.	Systems are expensive to maintain.	Plant engineers will have to be very knowledgeable in the system operation and understand when the system should be running and at what capacity.	Generators are large and will require acoustical attenuation.	Mature.
Potable Water Heat Exchange	The campus will utilize an immense amount of water due to the nature of laboratory, healthcare, educational, and residential uses. This system would use the domestic water as a heat rejection source through a heat exchanger for the chillers.	Additional space would be required for the heat exchangers.	None.	Provides flexibility in managing the load, utilizes a required system for dual purposes, additionally will pre-heat the water so as to reduce domestic hot water needs.	Low dependent on location of incoming water supply.	Reduction in cooling tower fan energy, reduction in cooling tower pumping energy, reduction in water usage, reduction in chemical treatment.	Low, only requires the maintenance of double wall heat exchangers.	None.	None.	Mature.

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Non-Potable Water Heat Exchange	The campus will utilize an immense amount of non-potable irrigation water. This system would use the domestic water as a heat rejection source through a heat exchanger for the chillers.	Additional space would be required for the heat exchangers.	None.	Provides flexibility in managing the load, utilizes a required system for dual purposes, additionally will pre-heat the irrigation water so as to reduce evaporation of irrigation system.	Low dependent on location of incoming irrigation water supply.	Reduction in cooling tower fan energy, reduction in cooling tower pumping energy, reduction in water usage, reduction in chemical treatment.	Low, only requires the maintenance of single wall heat exchangers.	None.	None.	Mature.
Variable Speed Central Plant	Central plant with variable speed primary pumps, variable speed chillers, variable tertiary pumps, and variable speed cooling tower fans.	None, except if chillers are higher voltage than 460V, additional floor space will be required for the VFD's.	None.	Provides flexibility in load management and chilled water delta T.	Low additional cost as VFD's have become very common. VFD's for high voltage chillers may impose a much higher cost for the VFD than 460V chillers.	Large reduction in chiller plant energy usage during low load situations.	Maintenance may be reduced as there will be less wear and tear of equipment operating at low capacity and/or cycling.	Plants must try to maintain the same manufacturer of VFD's throughout the campus. We would recommend sole sourcing VFD's to maintain ease of operation.	None.	Mature.
High Efficiency Boilers	Boilers should be selected for 85% minimum efficiency rather than the standard 80% efficiency. Boilers sizes should accommodate turn down ratios to match multiple stages of heating to increase performance at low loads.	None.	None.	Provides increased load flexibility.	Low	System energy savings will not be significant, however part load operation should improve.	No impact to maintenance.	No impact to operations.	None.	Mature.
Building Systems										
Air Handling System Energy Recovery	System utilizes either run around coils or enthalpy wheels or heat pipes to transmit energy from the exhaust air stream to the outside air stream to save energy during extreme outdoor conditions.	System will utilize more space in the mechanical penthouse to provide exhaust air plenum systems to house the run around coils or heat pipes. If enthalpy wheels are utilized (not in lab, healthcare buildings) systems can get very tall and wide.	May require larger mechanical penthouses.	System can be sized for increase in system capacity, however is difficult to augment to changes in building use.	Low to Medium	Typically run around coils and heat pipes are between (20% cooling/40% heating for runaround loops)(45% to 55% for heat pipes) percent effective and can conserve energy during the peak cooling and heating times of the year. Systems have to be sized correctly to not reduce energy use through pressure drops created by the system coils/wheels.	Maintenance cost is limited to cleaning of coils similar to air handling coils.	Systems need to be installed within clean air systems and are not recommended for vivariums. Enthalpy wheels cannot be used where there is a chance of air transfer from the exhaust air stream to the outside air stream.	None	Mature, however systems can get creative with process cooling heat rejection to pre-heat outside air coils, etc.

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Demand Based Ventilation	System utilizes CO2 as a measurement of indoor air quality and reduces outdoor air capacities when indoor air quality is acceptable.	Same as conventional.	None	Diligence is required in maintaining system intent during remodels and space changes.	Medium as system requires a lot of control hardware and software.	Can reduce loads significantly in high outside air systems such as classrooms and medical office buildings.	Maintenance of system is mostly limited to sensors and controllers.	Set-points have to be agreed upon and maintained and system ventilation effectiveness has to be considered throughout as one poorly designed zone can throw off the system.	None	Mature
Variable Volume Lab Systems	Utilizes variable volume hoods to minimize airflow with sash closure and with night setbacks	Required space and access for the terminal boxes/valves and may reduce penthouse depending on assumed diversity.	Access required throughout for terminal devices. Proper specification of hoods and alarms are required.	Future renovations will have an increase in first cost due to the terminal units required and controls required.	High as system requires many control terminals and sophisticated controls for reduction in airflow and space pressure balance.	Can significantly reduce energy if used properly by the staff and users.	Maintenance is increased due to the number of control devices. Experience has shown that maintenance staff has to do a full sweep on a nightly basis.	Needs strict adherence by users and understanding of their impacts on research projects.	Noise has been a concern in the past due to throttling of systems, pressure differentials, and sash closures.	Mature.
Indirect Evaporative Cooling	This system will allow pre-cooling of air using indirect evaporative cooling media. The system doe not entrain water in the system and therefore does not affect humidity or cause mold growth issues. The system can be used on either the supply or exhaust side of the system	The system takes significantly more penthouse space	Penthouse growth and increased structural support for mechanical equipment	No different than standard air handling systems except cost is increased if equipment has to be replaced	High	Can significantly reduce energy and chilled water requirements from the central plant	Maintenance is added for extra filtration, replacement of media, and water treatment	System has more complicated controls that need to be understood by the operations staff	Will increase the static pressure of the mechanical systems and therefore potentially require noisier fans	Mature
Chilled Beams	System utilizes radiant overhead cooling with high temperature chilled water. System can be completely passive (passive beams) or semi-passive (active chilled beams).	Requires adequate plenum height for natural air movement. Can reduce floor to floor height of buildings.	Will affect the reflected ceiling plan and lighting layouts of the space.	Can be difficult as each beam is specifically chosen for its load.	Competitive pricing if there can be a trade off with the mechanical system and with the building envelope height.	Dependent on energy model and reduction of free cooling from economizers. System can reduce energy cost where long hours of non-economizer cooling are required as water transport is a much better medium for cooling than air.	Maintenance could be potentially reduced; however it does require cleaning of the beams on a yearly basis. Less air handler systems to maintain.	System operating water temperatures have to be such that condensation cannot occur. Any latent load has to be taken care of by the central air system as chilled beams only take care of sensible loads.	Some active beams can have high pressure drops and therefore create acoustical issues.	Mature.

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Radiant Slabs (Heating and Cooling)	System utilizes radiant cooling through the thermal mass of the concrete slabs. Piping is installed within the slab (usually a topping slab with high density EPS insulation board).	Reduces system ductwork space requirements. Space needs to be provided for the radiant manifolds. Two pours of the concrete slab are required.	Can reduce plenum height requirements significantly. Slab cannot be covered with insulating materials such as carpet, wood, etc.	Difficult	Low	Significantly reduces energy use since air transport is only required for ventilation and latent loads. Especially helps reduce energy in buildings with high thermal mass and high floor to floor heights.	Low as system has no moving parts. Heat exchanger would require cleaning periodically.	System operating water temperatures have to be such that condensation cannot occur. Any latent load has to be taken care of by the central air system as chilled beams only take care of sensible loads.	System makes no noise, so sometimes white noise may be required to be added to the system.	Mature.
Displacement Ventilation	System utilizes displacement of air rather than traditional overhead mixing	Can reduce ductwork sizes but needs location for low level larger diffusers	Major impact is the need for chases to allow for low level duct distribution. Systems are now available that can be installed in ceilings and soffits but further investigation is required with the architecture of the building.	System is flexible and requires duct modifications for room changes similar to overhead distribution systems. However, system can be interrupted by location of furniture, windows, etc. which can create thermal plumes.	Low	Can reduce energy via two main methods. First a higher supply air temperature is used (65F versus 55F). This allows for more economizer hours. Second, the system only cools/heats the occupied zone and not the full height of the spaces. This reduces airflow.	System has the same maintenance costs of overhead systems, however additional cleaning of low level grilles may be required.	Operating staff would have to understand the principals of displacement ventilation. Changes to the building would have to be done by engineers who understand the design implications of the system.	Reduced noise due to low velocity air distribution at the grilles.	Mature.
Water Fixtures	Standardization on low flow type fixtures for potable and non-potable fixtures. Urinals – 0.125 GPM or waterless. Waterclosets – Dual flush or 1.28 GPF Lavatories – 0.5 GPM	Same as conventional	None	Same as conventional	Almost no impact	High reduction in water use and domestic hot water heating. Systems noted can reduce water use for these fixtures in standard buildings by approximately 40%.	If waterless urinals are utilized maintenance costs have to be considered.	Same as conventional	None	Mature
Grey Water System	System utilizes grey water (waste water not including feces) for landscaping irrigation, non-potable fixtures, and cooling tower make-up. System can be either installed for the campus or provided by the Water Utility	System will need additional piping routed throughout the campus, purple pipe system	Underground storage tank with vault utilized for treatment equipment	Can be designed to be modular	High. Can be offset by reduced System Development Charges	High reduction in water use, in concert with approach above for fixture selection, will reduce water use for campus by a total of approximately 50% or greater	Grey water management and maintenance of the system if installed by the University is required. Typically this would be provided by a third party maintenance company.	Monitoring of the system is required at all times to insure safe grey water is distributed	None	Emerging

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Black Water Treatment System	System utilizes black water (waste water including feces) for landscaping irrigation, non-potable fixtures, and cooling tower make-up. System would have to be installed by the Campus	System will need additional piping routed throughout the campus, purple pipe system	Underground storage tank with vault utilized for treatment equipment, system would be significantly larger than the grey water system	Can be designed to be modular	Very High. Can be offset by reduced System Development Charges	High reduction in water use, in concert with approach above for fixture selection, will reduce water use for campus by a total of approximately 70% or greater	Black water management and maintenance of the system if installed by the University is required. Typically this would be provided by a third party maintenance company. System would be considered a licensed sewage treatment system and would be required to be permitted by the Department of Environmental Quality	Monitoring of the system is required at all times to insure safe black water is distributed. There will still be a sludge discharge to the sewer system. May need to make sure that all the effluent flow is able to be utilized (share with existing East Campus?)	None	Emerging and needs a lot of coordination with outside agencies
Building Lighting	Utilization of low LPD light fixtures to minimize energy use.	Same as conventional	None	Same as conventional	Premium for energy efficient fixtures and LED's.	Lighting is a major use of power in buildings. Energy costs reductions can be dramatic. This is a point where a statement can be made with regard to reduction below T24 mandated LPD.	Same as conventional	Same as conventional. If LED's are utilized maintenance can be reduced with longer life technology.	None	Mature to Emerging depending on system.
Daylighting Controls	Utilization of daylighting controls to minimize artificial lighting requirements.	Same as conventional	Architect has to work with engineer to maximize daylighting both in building orientation and glazing systems or light shelves or skylights.	Same as conventional, however some rezoning may be required based on extent of renovation.	Medium but payback on well designed system can be fast.	High levels of energy reduction based on correct architectural design.	Low if system is installed correctly. A good dimming daylighting system would be recommended to make the system less perceptible to the user.	System would require constant commissioning to make sure that the system is operating correctly.	None	Becoming mature but systems still need some investigation.
Lighting controls	Advanced lighting controls such as security integration to delete night lighting and bi-level switching of exam rooms.	Same as conventional	None	Same as conventional	Low increase	Can reduce night lighting significantly. Especially useful in exam room type situations where high levels of lighting are required for patients but not required when patients are not being examined.	Same as conventional	Added controls always require extra education by the user and extra commissioning of systems.	None	Mature

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Variable Volume Diffusers	System uses variable volume technology at the diffuser rather than at the zone. System can significantly reduce VAV box pressure and provide better thermal control of rooms.	Same as conventional	None	Same as conventional, however system needs to be designed by engineers understanding the system	Little to no change from conventional if design properly	System saves energy by reducing air pressure drop at VAV boxes and reduces energy by reducing reheat. Especially useful in MOB type situations with many enclosed rooms on a sing zone. System also provides the same velocity at low airflow as at high airflow allowing for better air distribution at low load conditions.	Same as conventional	Same as conventional	None	Mature, however only a handful of manufacturers have perfected the design.
Thermal Mass	Building envelope, slabs, walls designed with high levels of thermal mass.	None	Architect has to set parameters for the use of thermal mass and coordinate benefits with engineer with a goal to reduce peak loads on the buildings.	Can create issues with flexibility due to the type of materials used to create thermal mass.	Undetermined	Can reduce cooling and heating loads quite significantly. Reduction in energy use has to be determined on a project by project basis. Thermal mass can help increase the possibilities of other technologies such as radiant heating and cooling and should be utilizes as part of an energy conservation measure.	No added maintenance cost.	No operational issues, however staff may need to get trained on ways to take advantage of the thermal mass such as night purge, etc.	Thermal mass can create issues with deletion of soft absorptive surfaces. Architect would have to coordinate with issue on a project by project basis.	Mature.
Glazing	Use of highly efficient glazing systems such as ultra efficient low-e clear glass, fritted glass, integral shading within glazing, switchable glass, etc.	None	Will affect the aesthetics of the building and has to be blended with daylighting strategies.	Same as conventional	Can increase first cost, but when cost transfer is considered can be cost neutral.	Significant reduction in energy use and peak load reduction. System should be aimed to reduce energy use by itself (with inherent mechanical savings) of 10% below Title 24.	Same as conventional with the exception of integral shading devices and switchable glass	Same as conventional with the exception of integral shading devices and switchable glass	May decrease acoustical transfer from outside.	Emerging to mature dependent on system used.
High Performance Envelopes	Building envelopes with high performance designs. These types of system may include exterior insulation to limit thermal bridging through metal members and studs or green roofs that can mitigate load and increase insulating value.	None with the exception of green roofs that would have to be determined on a project by project basis.	To be determined on a project by project basis	Same as conventional	Can range from none to high depending on strategy. Insulating the exterior is low cost and green roofs are high cost.	Many measures can reduce the peak load as well as ongoing energy use. Will have less impact than glazing and thermal mass.	Dependent on system chosen	Dependent on system chosen	May decrease acoustical transfer from outside.	Emerging to mature dependent on system used.

Option	Description	Space Requirements	Architectural Impact	Future Flexibility	First Cost	Energy Cost / Carbon Footprint	Maintenance Cost	Operational Issues	Acoustical Impact	Technology Maturity
Relaxed Temperature Constraints	Utilizing the building program to accommodate relaxation of constraints. This can be done two ways. First is relaxation for transitional spaces (i.e. corridors, hallways, lobbies, elevator vestibules, etc.) Second is through demand based relaxation as the temperature outside gets higher start increasing the indoor temperature and vice versa for heating.	Can reduce mechanical equipment sizes and penthouse.	Can reduce mechanical equipment sizes and penthouse.	If systems are undersized, can create issues with future flexibility for new spaces without temperature relaxation.	Mostly in programming of system and administering the occupants use.	Can significantly reduce both peak loads and ongoing energy use.	Ongoing diligence on maintaining system operational parameters.	Will require some education of users.	None	Not Applicable

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5.1 Building Siting and Planning

Several iterations were made at planning the buildings at the School of Medicine to strike the balance between:

- Building Orientation
- Building Height and Spacing
- Building Water Use
- Building Function

Some of the decisions made were:

- Building Orientation – Maximizing the East/West orientation of the building to minimize the solar exposure from the East and the West. This allows maximum utilization of daylighting, minimizes solar load, minimizes glare, and maximizes the opportunities for building integrated (South Façade or Penthouse) photovoltaic or solar thermal panels.
- Building Height – A solar analysis was conducted to determine the building spacing as well as building height to determine what spacing and height would be most beneficial in terms of daylighting during the Summer Solstice, Equinox, and Winter Solstice. Buildings were reviewed at 60 and 90 feet of separation and at 4 stories and 6 stories tall. The studies revealed that the most efficient building height is less than six stories tall and the most beneficial separation is larger than 90 feet. In addition the building heights were kept to 4 stories or less for Research buildings to limit effects of fire codes and hazardous storage capabilities. Results of the solar shading analysis are shown below in Figures 5-1 through 5-6.

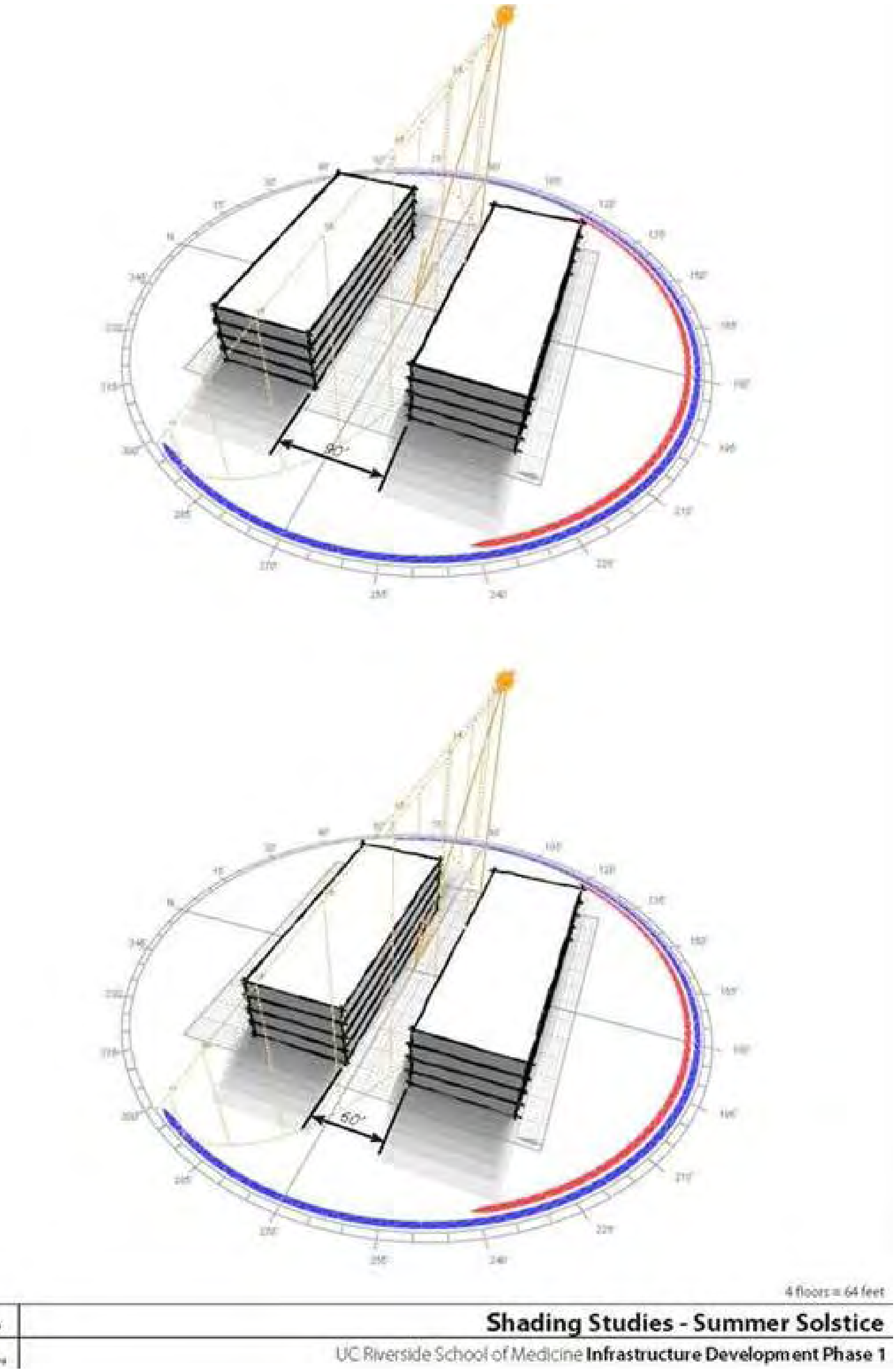


Figure 5-1: Four Story Summer Solstice

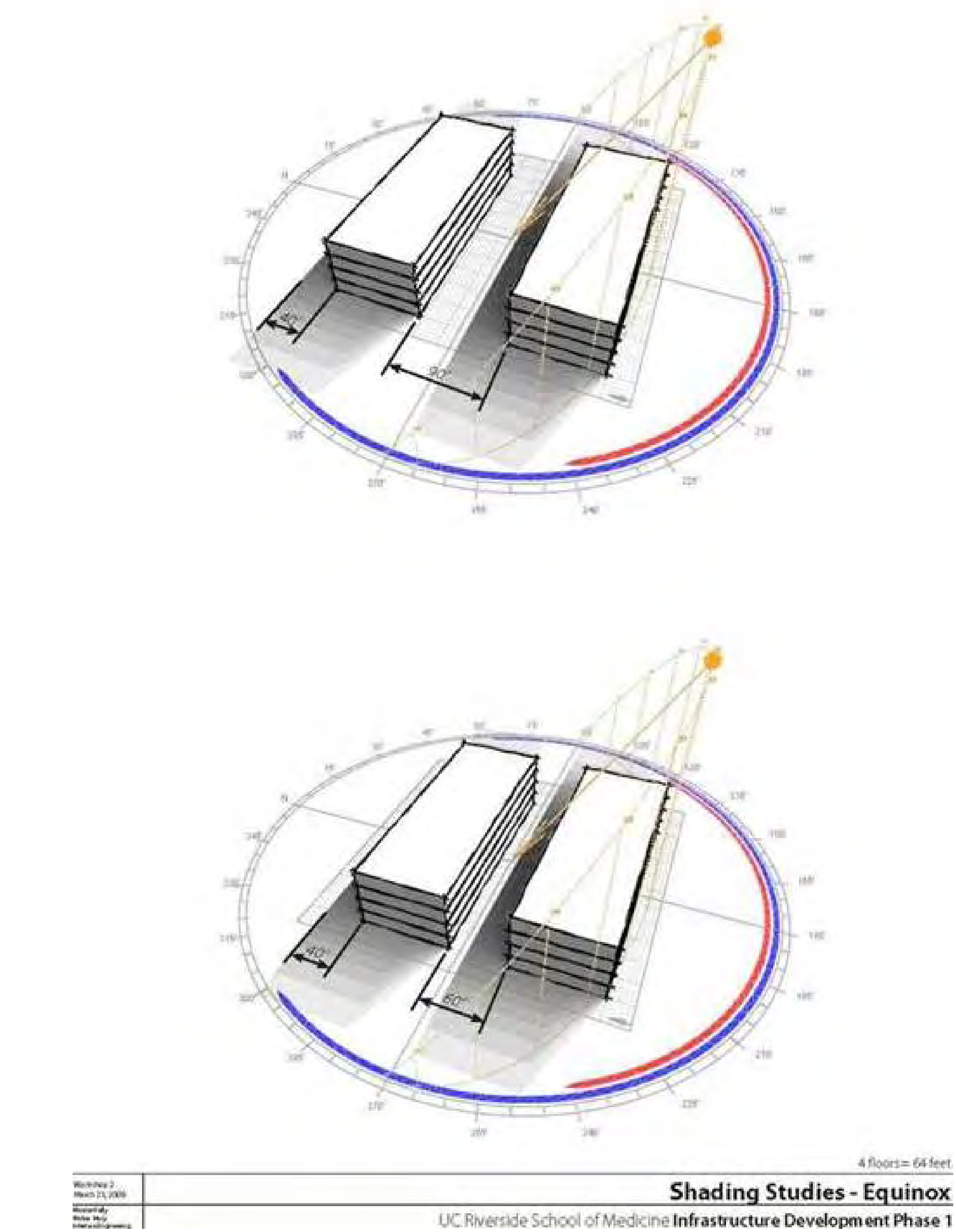


Figure 5-2: Four Story Equinox

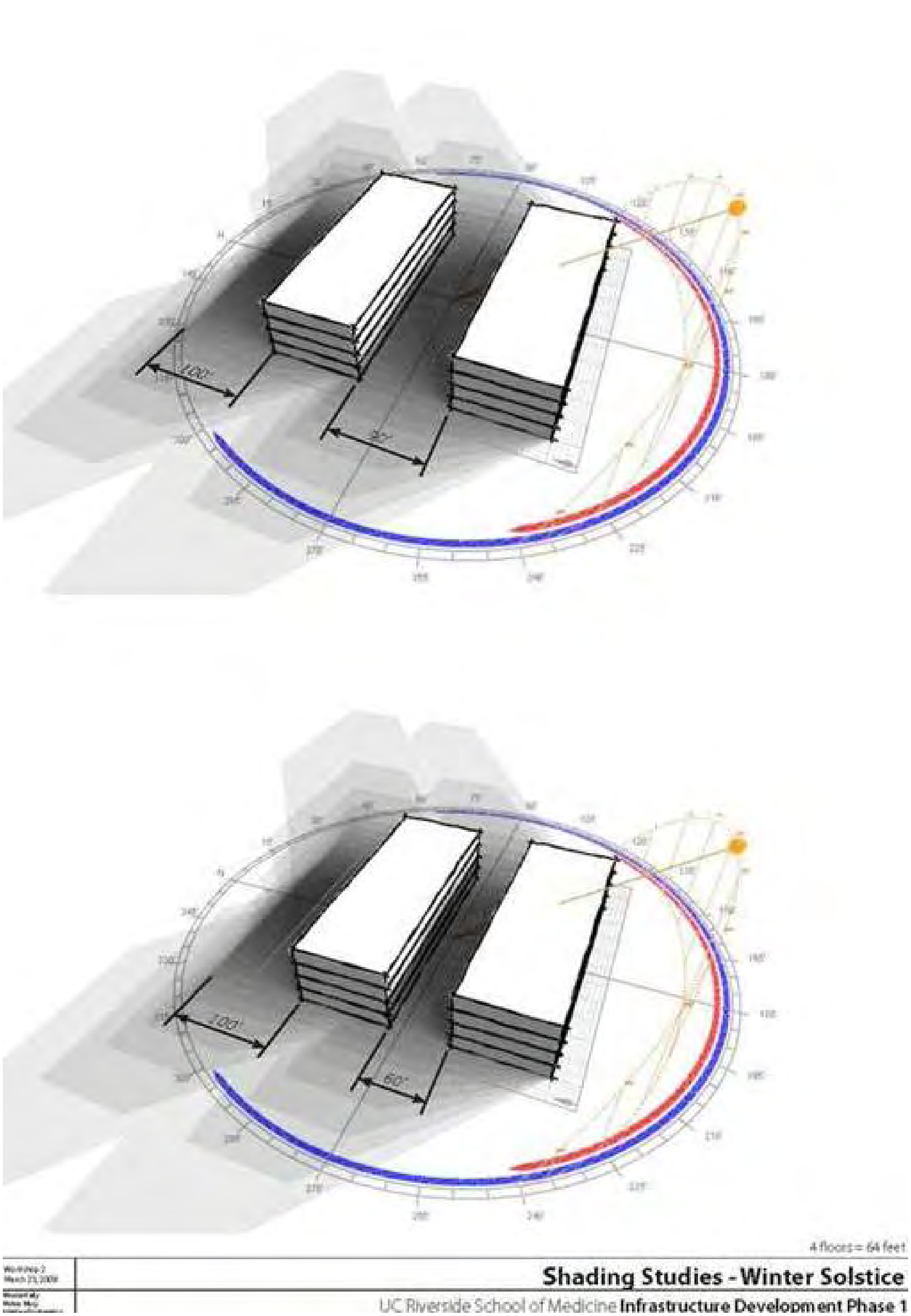


Figure 5-3: Four Story Winter Solstice

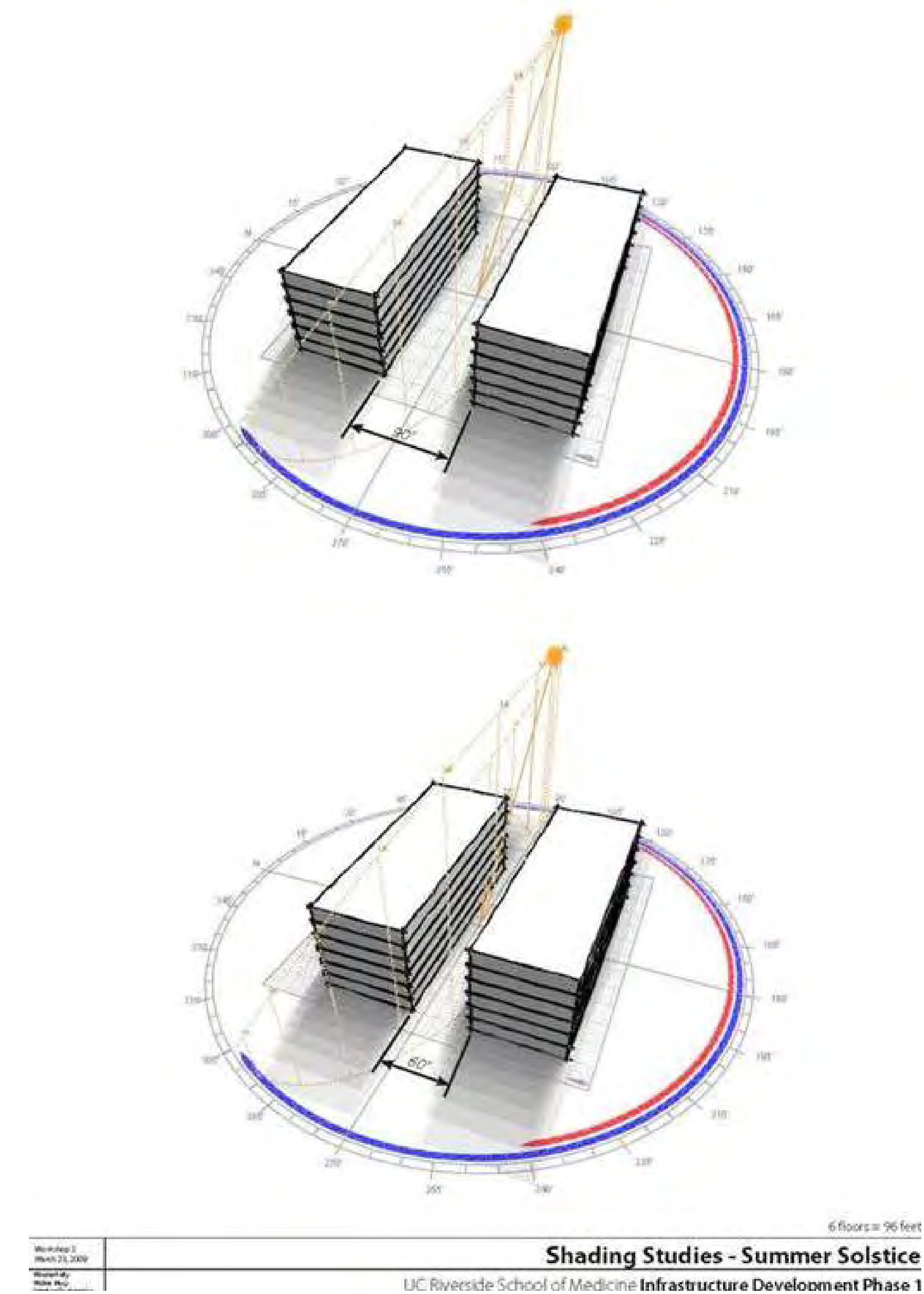


Figure 5-4: Six Story Summer Solstice

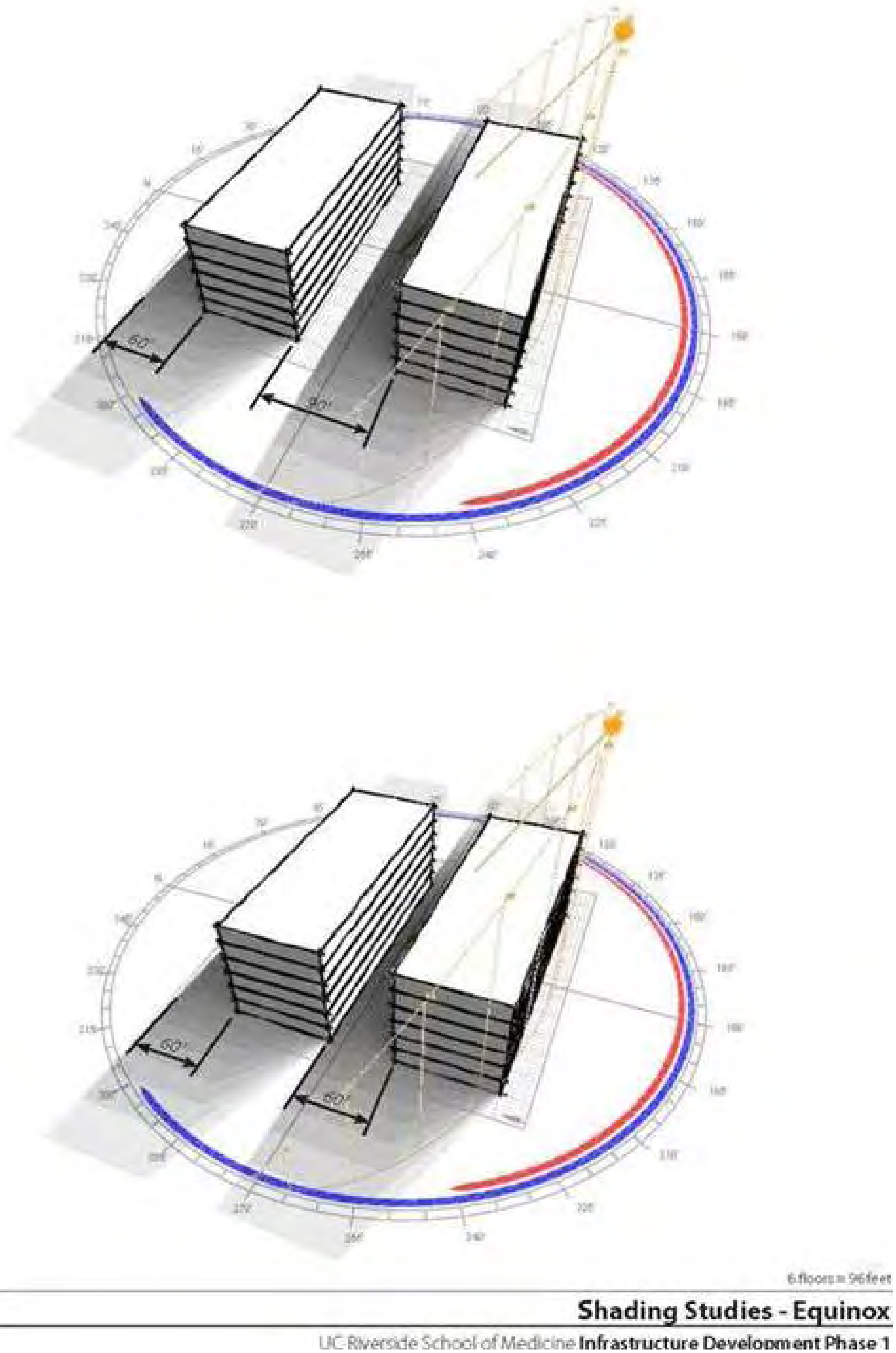


Figure 5-5: Six Story Equinox

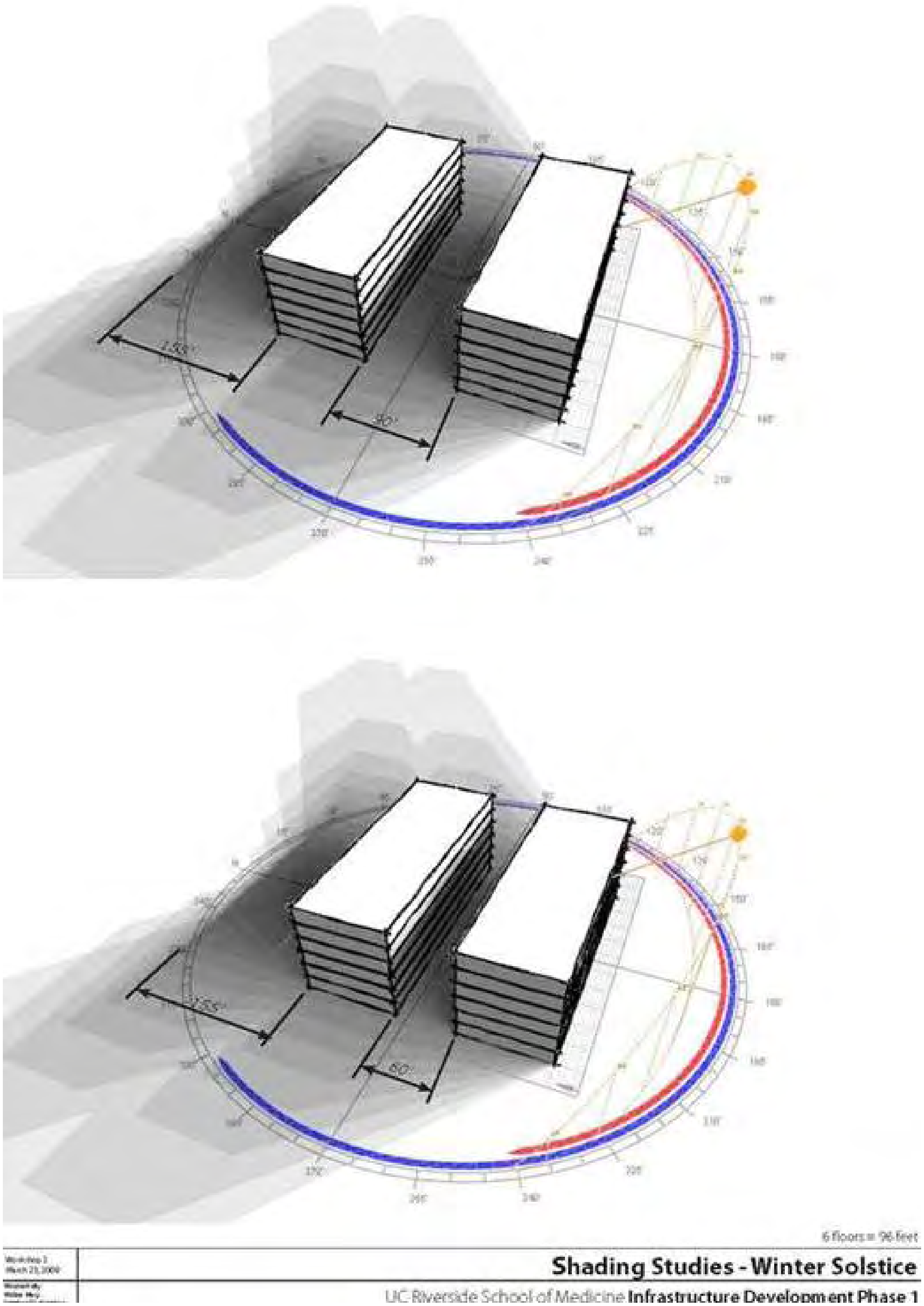


Figure 5-6: Six Story Winter Solstice

- Building Water Use – Water use has become so critical to the State of California and is considered the next “Energy Crisis”. As part of this plan UCR will maximize its ability to reduce plumbing fixture water use. To make this a reality, the issue of too low of a flow had to be addressed. The strategy of locating high water use buildings upstream of low water use buildings was utilized. This strategy allows the use of low flow plumbing fixtures, but still gets adequate flow through the systems to keep solids moving throughout the sanitary sewer conveyance system. The DPP has placed housing and research functions upstream of the education and ambulatory functions in the final buildout (high flow upstream of low flow).

- Building Function – See Section 4 for discussions relative to building location due to function.

5.2 Water Use Reduction

California is facing another drought year, which makes for three in a row. The year 2007, brought Southern California its driest year on record while the Sierra snowpack was the lowest in nearly 20 years. Our water crisis is a result of the following:

- The Delta, a key natural estuary and the pathway through which more than 25 million Californians and 2.5 million acres of productive farmland receive their water, is in an ecological crisis that threatens people as well as the environment.

- California’s population is growing rapidly, but our statewide water storage and delivery system has not been significantly improved in 30 years.

- Our statewide water reserves are extremely low and would not be able to meet public demand during a major disruption to the state’s water delivery system.

- Aging Delta levees are at risk of a natural disaster that could cripple water deliveries for an extended period of time.

- California is facing severe drought conditions again, with multiple such years back to back.

- Significantly reduced supplies and growing water uncertainties already are causing some California farmers to fallow prime agricultural lands, hurting one of our state’s most important industries.

- Climate change is reducing our mountain snow pack – a critical source of natural water storage – and may usher in longer droughts and more severe floods.

With the large growth proposed at UC Riverside in the West Campus, water use needs to be a prime target of the campus's sustainability strategy. Multiple options are available and specifically the following have been discussed and are recommended to be implemented:

- The utilization of ground source heat rejection in lieu of cooling towers or in conjunction with cooling towers (hybrid system). This strategy and associated savings is discussed in more detail under the Central Plant portion of the sustainability documentation.

- Reduction in water use through plumbing fixtures. The goal for the campus is recommended to be 40% at each building. The Central Plant should be included in this water conservation strategy. The following is a guide of plumbing fixtures that will achieve this goal in most instances:
  - Water closets – 1.28 gallons per flush.
  - Urinals – 0.125 gallons per flush.
  - Lavatories – 0.5 gallons per minute.
  - Showers – 1.0 gallons per minute.

- HVAC efficiencies can also be integrated into the water management solution. Building cooling coil condensate can be stored and reused for pre-cooling chilled water as well as for landscape irrigation.

- Lab buildings can utilize distilled water (a byproduct of the reverse osmosis system) to flush non-potable fixtures.

- As part of the development of this DPP, discussions were held regarding the use membrane bio reactors as part of a black water treatment system strategy. The concept would reduce potable water demand significantly and is under consideration. The strategy is to utilize a membrane bio reactor to clean the effluent from the residential sectors of the campus for re-use at the School of Medicine. The determination on the use of this system requires much further study and analysis. It is recommended that the University investigate the opportunities for the system installation. Since UC Riverside does not pay a development charge, the cost benefit of this system is not as well realized by UC Riverside as it would be for others.

- A recycled water system ("purple pipe system") is being considered by the City. UC Riverside will plan for the future connection to such a system.

5.3 Energy Use Reduction

The desire for energy use reduction is clear from UC Riverside as a good citizen and from the UC system as a mandate. The calculations that we have made indicate the following anticipated energy use for the Campus if no measures are taken (See Table 5-2).

Definitions:

- Energy Use or Consumption (Building): Energy consumption on-site not including waste energy at power plants or through transmission of power.
- Energy Use or Consumption (Source): Energy consumption of site including waste energy at power plants and transmission of power.
- Energy Intensity: Building energy consumption on a square foot basis.

Table 5-2 Building Energy Consumption (Phase 1 and Phase 1-B)

Building #	**Building Type**	**Gross Square Feet**	**Assignable Square Feet**	**Gas Use (kBTU)**	**Electrical Use (kWh)**
M2a and M2b	Research (Labs)	222,116	144,375	80,705,625	11,405,625
M3	Research (Office)	84,615	55,000	1,804,000	951,500
M4	Educational	144,000	83,500	3,181,350	918,500
M6	Ambulatory Care	100,000	65,000	6,194,500	1,488,500
MV	Vivarium	40,100	22,060	20,793,756	1,122,854
	Housing	57,000	57,000	2,872,800	769,500
	Total	647,831	426,935	115,552,031	16,656,479

This breaks down to the following energy use intensity:

- Gas intensity of 270.65 kBTU per square foot
- Electrical intensity of 39.01 kWh per square foot

These intensities are average and have been compared against other UC campuses. These intensities can be utilized and spread out to determine what overall anticipated site energy use should be expected upon complete build out.

During the workshops for this DPP, all the opportunities shown in the Sustainability Matrix in this chapter were discussed. Although many of the options fall under the building design, the following were decided to be included in this DPP.

- Solar Thermal Water Heating
- Geothermal Heat Exchange (open or closed loop)
- Heat Pump Technologies for Heating Water (Templifier)
- Chilled Water Thermal Storage Systems (discussed in separate area of the report)

The following solutions were determined to not be included in the DPP:

- Solar Outside Air Pre-Heating: It was determined that there was not enough of a need for air pre-heating during sunny times in Riverside.
- Ice Thermal Storage: It was determined that chilled water thermal storage would provide a more economical means of thermal storage from a first cost and an energy cost.
- Phase Change Thermal Storage – It was determined that this form of storage was too much of an emerging technology and not well proven yet in the United States.

All other opportunities described in the matrices are applicable to further design development of the central utility plant, but did not require further research as they are relatively self explanatory. Life cycle cost models can be provided for each opportunity during the design development of the central plant.

5.4 Solar Thermal Water Heating

The domestic hot water system was analyzed for the Phase 1 buildout of the campus. The driving factor for utilization of solar thermal as a renewable energy source for heating of domestic potable water as part of the Infrastructure plan was to incorporate domestic water heating as part of the central plant. Previously this was not a consideration for the central plant in the WCIDS.

The anticipated load for the domestic hot water system was calculated to be approximately 15,222 gallons per day upon full build out of Phase 1 of the SOM development. This equates to an annual fuel consumption of gas for domestic water heating requirements of 54,300 Therms. The recommendation is to provide the following:

- Solar fraction equal to 75%
- Glazed solar thermal collector area equal to approximately 7,500 square feet or 200 4-foot by 10-foot collectors
- Storage tank capacity equal to approximately 15,000 gallons

Fuel consumption savings are estimated to be 28,035 Therms per year (approximately $19,000 per year), reducing the domestic hot water fuel consumption from 36,810 Therms to 8,775 Therms. The reduction in CO_2 would be from 193 Tons of CO_2 to 48 Tons of CO_2, a reduction of 145 Tons of CO_2 emissions.

5.5 Geothermal Heat Exchange

Geothermal heat exchange is being considered as a heat rejection source for the cooling plant and a heat absorption source for the domestic hot water heating system. The geothermal heat exchange can take one of two forms:

- Closed Loop – A closed loop system will be a network of vertical bores. Each bore would have a depth of approximately 400-600 feet deep and would provide a heat rejection capacity of 2-3 Tons per bore. Water is circulated through the closed loop network of piping and exchanges heat from chiller condensers with the earth. Heat is also extracted from the system to support either domestic water or heating hot water through a reverse cycle chiller (Templifier). A preliminary study showed that a total of 2,200 bores can be installed on the site without any impact to the facilities. A total of 750 bores can be provided on the corporation yard footprint and another 1,450 bores can be provided on the sports field.
- An open loop geothermal heat exchange system utilizes water from an aquifer as the heat rejection and heat absorption source. The campus has an existing aquifer system that could be utilized as the heat exchange source. This system will require multiple geothermal supply wells that will take supply water from the aquifers and multiple geothermal return wells that will return water back to the aquifers.

The initial build out of Phase 1 will be a central plant capable of approximately 2,000 Tons of cooling. The recommendation is to provide a geothermal heat exchange system to maximize the bore capacity (or similar capacity available from an open loop system). The total capacity available from the system would be approximately 4,400 Tons. Since the site is limited and aquifer capacity is yet unknown, we feel that this will be a viable solution until further information is available. The complete chiller plant build out of 6,500 Tons will include cooling towers that will aid in heat rejection required beyond the 4,400 Ton capacity available through the geothermal heat exchange system. The 4,400 Ton geothermal system would provide heat rejection for a larger portion of the year than just a straight ratio of cooling capacity (4,400/6,500) of 67%. We would anticipate that it would provide 70-75% of the final buildout annual heat rejection energy and water reduction. The geothermal system would provide 100% of the of the heat rejection source for Phase 1. It would also provide 100% of the heat extraction for the system Templifier which will produce domestic and heating hot water.

The installation of a 4,400 Ton geothermal exchange system would replace approximately 8,800,000 gallons of water (10,700 CCF; $12,840) use from conventional cooling tower evaporation and blow down. It is anticipated that final build out water reduction will equal approximately 15,000,000 gallons of water (20,000 CCF; $24,000). The system will also offset approximately 350,000 kWh ($25,400) of electrical energy utilized for cooling tower fan energy annually for Phase 1 and approximately 780,000 kWh ($56,500) after completion of the final buildout. In addition to electrical energy savings attributable to cooling tower reduction, there is energy reduction attributable to the reduction in chiller compressor energy. This reduction occurs due to the reduced condenser water temperature (average of 60ºF versus 75ºF) experienced with a geothermal system. The reduced condenser water temperature in turn lowers the chiller compressor head pressure, thereby reducing the compressor work. Chiller manufacturers publish an increase in chiller efficiency of approximately 1-2% per degree of condenser water temperature drop. This additional energy reduction would save approximately 150,000 kWh ($11,000) for Phase 1 and approximately 330,000 kWh ($24,000) for the complete build out.

A full analysis of the capacity of a geothermal heat exchange system was beyond the scope of this DPP. Prior to design being initiated, it is recommended that additional studies of soil conditions, thermal conductivity, and hydrological surveys be completed to determine capacity and type of system to be installed. A full study is necessary and recommended.

Although, as a closed system, this represents a very large installation, it is by no means the largest installation. Ball State University has just approved and started on a geothermal closed loop bore system with 3,750 bores of 400 foot depth.

Additional benefits of this system are the following:

- The system is a 100-year system and has no major equipment requiring replacement with the exception of valves and pumps.
- There is no open water treatment system required on closed loop systems eliminating the typical cooling tower water treatment maintenance and costs.
- The cooler water temperatures increase the energy performance of the chillers with entering water temperature design in the 55ºF to 60ºF range if properly designed.
- Utilizing Phase 1 data only and with an assumption of cooling tower replacement within 25 years (includes 3% inflation cost for purchasing of new cooling towers and 3% average annual increase in energy and water costs) the geothermal system would have a return on investment of approximately $990,000 by the end of the 25th year. The turning point in the payback occurs upon the expense for the new cooling towers to replace the original system, again assumed at 25 years within its life cycle. This estimation is conservative in that the approximate increase in water cost as provided by UC Riverside is anticipated to be 10% per year for the foreseeable future as well as the fact that only Phase 1 savings is calculated within this 25 year period.

5.6 Heat Pump Technologies For Heating Water

A heat pump heating system is being considered for the campus for the following reasons:

- Favorable electricity rates versus gas rates.
- High levels of coincident heating (domestic hot water and heating hot water) and cooling throughout the year.
- Augmentation of the solar thermal domestic hot water system with a heat pump during night hours will reduce the storage tank requirements of the solar thermal system.
- During low domestic hot water needs or during times when the solar thermal system is at peak capacity, it provides a place to dump load. The dumped load will increase the coefficient of performance of the heat pump allowing the COP to go from approximately 4.0 to 6.0.

Due to the favorable electricity rates that the campus enjoys, heat pump heating (templifiers) provide an economical means of heating water. The analysis is as follows assuming 1x10^6 BTUH output requirement:

<u>On Site Boiler:</u>

Average Boiler Efficiency = 80%
Output Required = 1x10^6 BTU
Input Required from Fuel (Gas) = (1x10^6/0.8) = 1.25x10^6 BTU input

Templifier Heat Pump

Average COP = 5*
Output Required = 1x10^6 BTU
T&D Network Efficiency = 95%
Power Plant Efficiency = 35%
Input Required from Electricity = (1x10^6/5) = 200,000 BTU
Conversion to kW = 200,000 BTU x 0.000293 = 58.6 kW
kW Required with Transmission Losses = 58.6 kW/0.95 = 61.7 kW
kW required with Power Plant Efficiency = 61.7 kW/0.35 = 176.3 kW
Fuel Input Required at Power Plant = 176.3kW/0.000293 = 601,706 BTU

* Manufacturer uses 7.0 as COP, we have decided to be conservative and are using 5.0 as the COP. This can be dramatically improved with solar heating integration.

Total reduction of fuel input at power plant of 52%. This analysis does not yet include the energy savings of the heat rejection source (cooling towers) which the templifier will use for heat extraction. With an approximate requirement of 8,390 x 10^6 BTU (6,500x10^6 BTU heating plus 1,890x10^6 BTU Domestic Hot Water after Solar Thermal use) of gas input per year, if the templifier is sized for 25% of the total heating capacity and 100% of the total domestic hot water heating, green house gases can be reduced by approximately 213,850 lbs ((6,500 x 25%+1,890) x 52% savings x 117lbs CO2/1x10^6BTU).

5.7 Renewable Energy Opportunities

As part of the vision to get the campus to carbon neutrality, renewable energy sources have to be considered for the energy production of the campus.

Although carbon neutrality is not part of this scope of work, the team has looked at two alternatives in a broad brush attempt to assign production requirements and size the renewable energy systems.

The anticipated energy required to power the campus as it grows to its complete buildout is as follows (See Figures 5-7, 5-8, and 5-9):

Figure 5-7: Campus Energy Growth

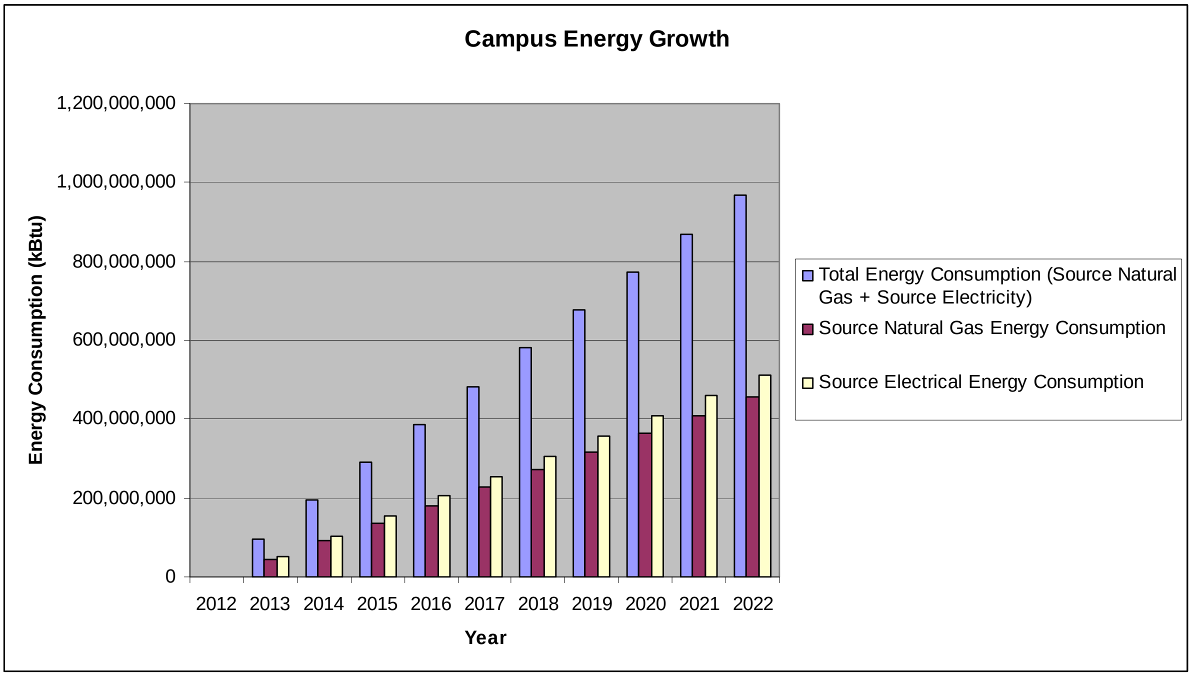


Figure 5-8: Campus Natural Gas Consumption Growth

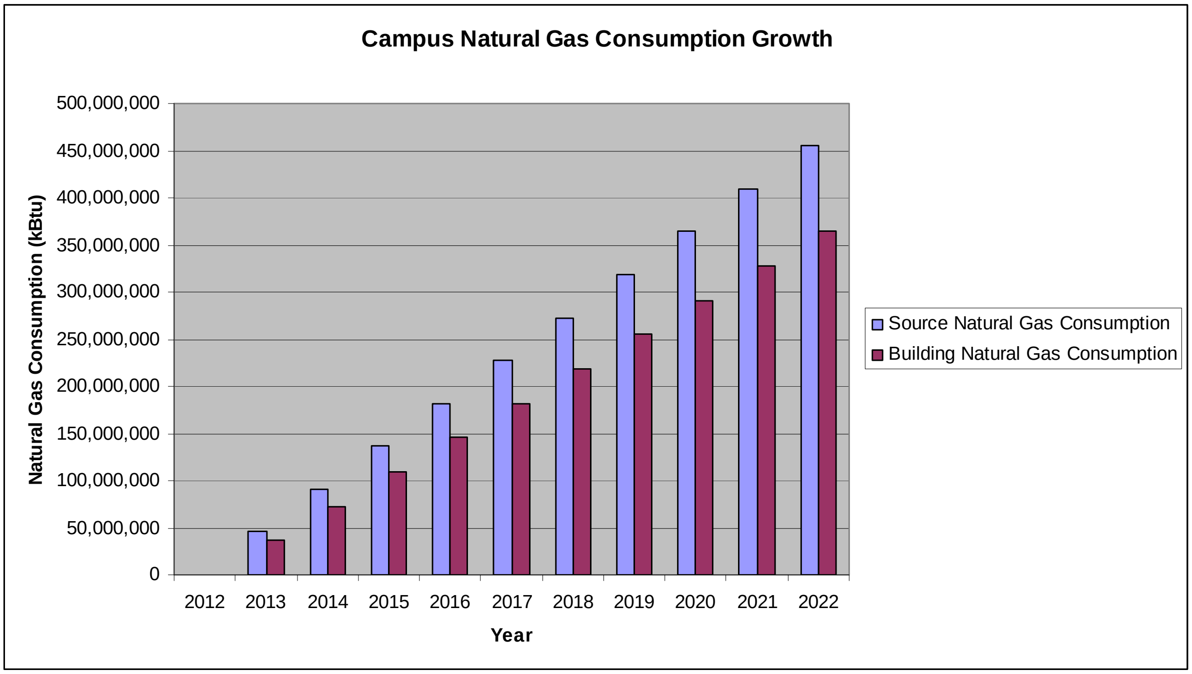
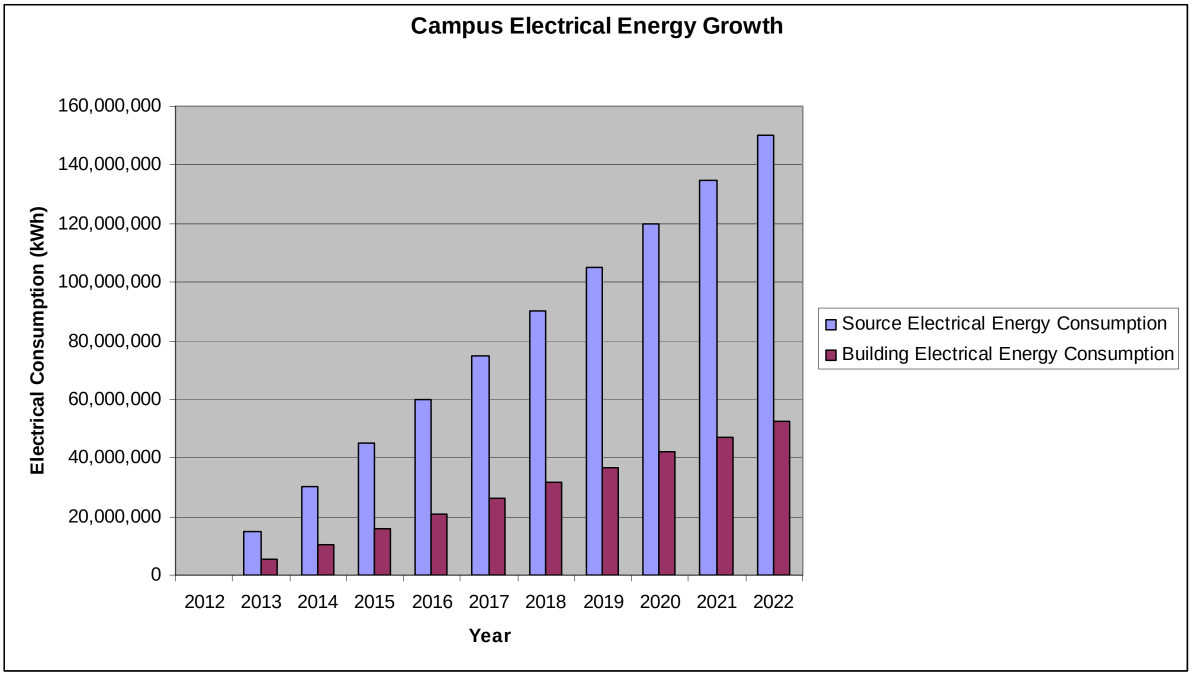


Figure 5-9: Campus Electrical Energy Growth



Prior to applying the renewable energy requirements (solar and wind) we have de-rated the proposed energy utilization of the campus by 30% to meet the aspirational target noted previously. The graphs are then modified as follows (See Figures 5-10, 5-11, and 5-12):

Figure 5-10: Campus Energy Consumption (30% Reduction)

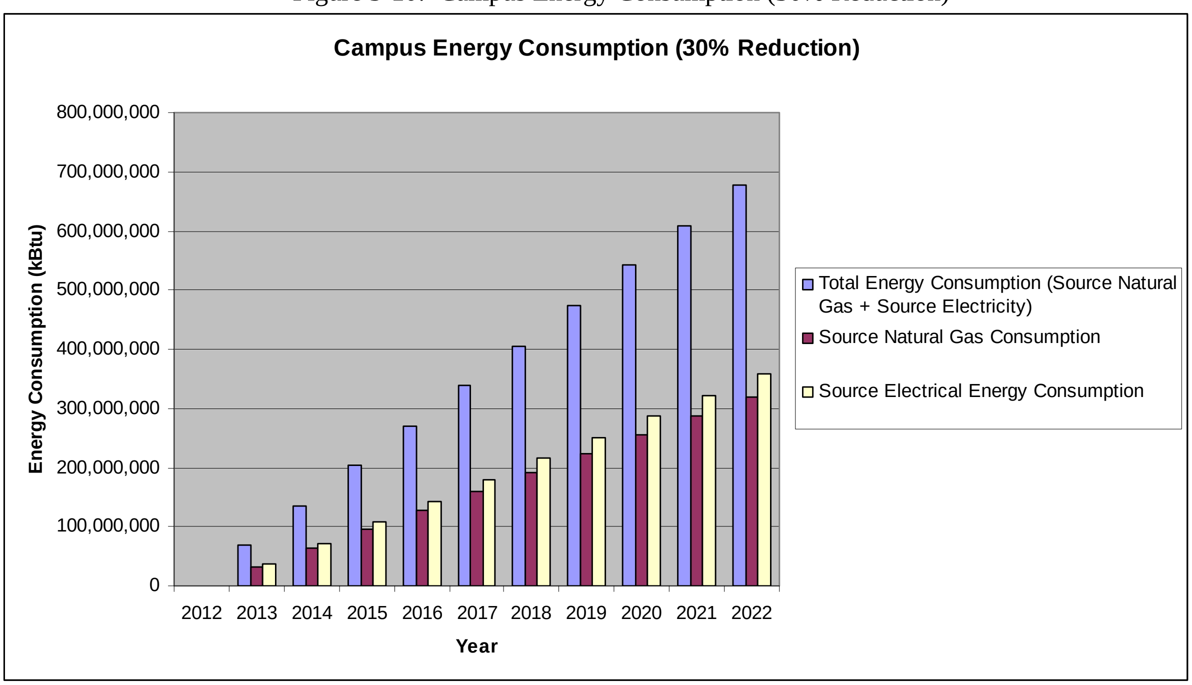


Figure 5-11: Campus Natural Gas Consumption Growth (30% Reduction)

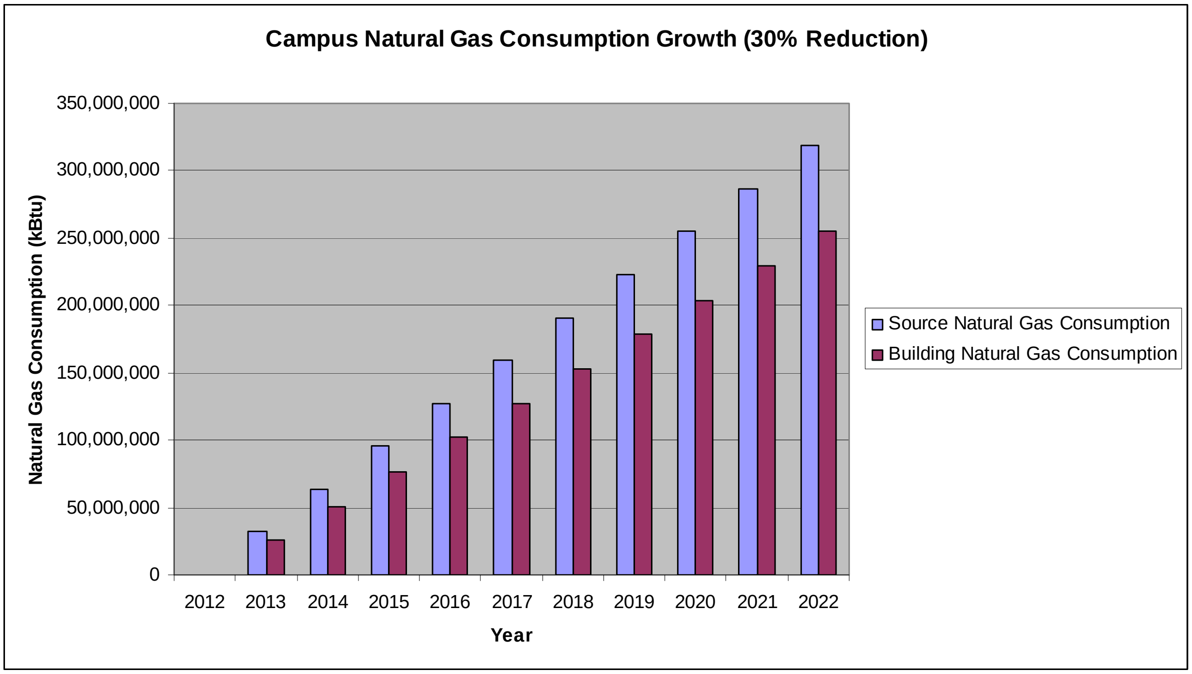
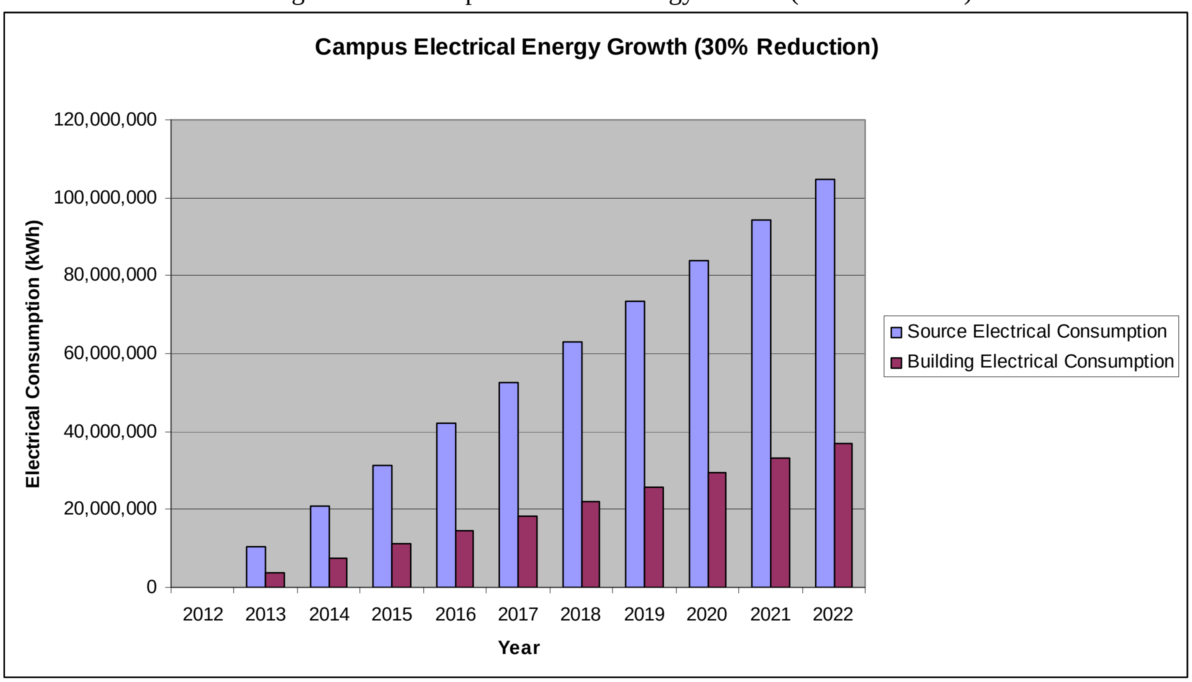


Figure 5-12: Campus Electrical Energy Growth (30% Reduction)



Solar PV Installation
To offset the total electricity and gas consumption (building electrical energy consumption and source natural gas consumption with a 30% reduction for energy conservation) the total PV installation would be as follows:

Phase 1
Total Offset: 39,658 MWh
PV Installation Required: 26 MW
Area Required (10W/sf): 2,600,000 square feet
Roof Area Available: 100,000 square feet (assuming only 60% of the roof area is useable)
Additional Area Required: 2,500,000 square feet
CO2 reduction: 24,945 tCO2 (4,990 cars offset)

Complete Buildout
Total Offset: 130,028 MWh
PV Installation Required: 86.7 MW
Area Required (10W/sf): 8,670,000 square feet
Roof Area Available: 325,000 square feet (assuming only 60% of the roof area is useable)
Additional Area Required: 8,345,000 square feet
CO2 reduction: 81,500 tCO2 (16,300 cars offset)

Wind Farm Installation
To offset the total electricity and gas consumption (building electrical energy consumption and source natural gas consumption with a 30% reduction for energy conservation) the total wind farm installation would be as follows:

Phase 1
Total Offset: 39,658 MWh
Wind Farm Installation Required: 115,000 kW (115 Siemens 1,000kW Wind Turbines)
Area Required: 1,150,000 square feet
CO2 reduction: 24,945 tCO2 (4,990 cars offset)

Complete Buildout
Total Offset: 130,028 MWh
Wind Farm Installation Required: 380,000 kW (380 Siemens 1,000kW Wind Turbines)
Area Required: 3,800,000 square feet
CO2 reduction: 81,500 tCO2 (16,300 cars offset)

5.8 Educational Opportunities

As part of the development of the West Campus, educational opportunities are important to embrace with regards to sustainability and with regards to engineering training. Part of the education process is the visibility of installed systems as well as data available from the systems installed. Samples of such concepts are:

- Building integrated wind turbines. These systems are small in scale and can be incorporated into the roof plan of the Central Plant as well as other buildings. The systems can educate the campus in wind energy, the effects of wind speed on the power curve and the wind curve of installed devices.
- LCD panels indicating energy saved from energy recovery devices.
- Pressure monitors indicating pressure losses in piping systems for analysis by fluid dynamics students and faculty.
- LED lighting systems throughout the site to educate about new lighting technologies.
- PV panels, solar thermal panels with energy monitors and hot water production monitors to show the faculty and students the benefits of renewable energy.
- Signage at plantings utilized to reduce water consumption.

These are only a small sampling of what can be done to incorporate the sustainable elements of the campus into the education of the campus. As a result, the University can work to leverage the educational benefits with outside suppliers and providers (such as fuel cell manufacturers) to help financially support the installation of such devices.

5.9 Recommendations

The following recommendations are appropriate for incorporation into the Phase 1 infrastructure for the SOM Campus:

- **Solar Thermal Heating:** We feel that the system can appropriately be located on the roof of the central utility plant and storage can be incorporated within the mechanical rooms. Further study should be undertaken to determine delivery methods for the solar thermal system (i.e. self financed, opportunities for rebates and incentives, third part financed and installed, etc.)
- **Geothermal Heat Exchange:** This system is very viable for the campus and although it will save energy utilization, the true benefits will be in water reduction from evaporation as water is becoming a scarcer resource in California. However, the investigation of this system's viability is well beyond the scope of this DPP and will require a full study during the design of the infrastructure including test bores for thermal conductivity and soil properties, drilling ease, qualities of the aquifers as a heat exchange medium, locations for potential wells, effect of heat transfer over time to the earth within the confined area proposed, etc. This study can be completed coincident to the design of the central plant. However, due to the water shortage and the space available for implementation of the geothermal heat exchange system, we recommend that the University budget for the use of such a system.

- **Heat Pump Heating:** This will be a very viable system from first cost, energy cost, and reduction of greenhouse gases. The requirement for simultaneous heating and cooling will benefit this system as it will also utilize energy recovery through the transfer of energy from the chilled water heat rejection into the templifier heat extraction. We recommend to provide space in the central plant for one templifier in Phase 1 and two templifiers in total.
- Sample methods of sustainable energy reduction and water use reduction have been addressed in the tables above. It is critical to the future energy use of the campus to incorporate as many reasonable techniques as possible into the buildings as they are the energy users. We anticipate that if many of these techniques are utilized the growth of the central utility plant can be minimized.

6.0 POTABLE WATER

This section summarizes the evaluation of the domestic water distribution system concepts for the proposed School of Medicine (SOM) and the future West Campus developments.

The existing water distribution infrastructure in the vicinity of the SOM used for this analysis was based on the information provided in the West Campus Infrastructure Development Study (WCIDS). The information was further verified and supplemented by the system mapping provided in the City of Riverside's CADME database. Based on the CADME data, the City of Riverside (City) has a number of existing domestic water supply pipelines surrounding the proposed West Campus development, including a 16-inch line in Iowa Ave, a 20-inch line in Cranford Ave, 10-inch and 42-inch lines in Chicago Ave, and parallel 12-inch and 18-inch lines in University Ave. With the exception of the 42-inch line in Chicago Ave. which is part of the City's "Gravity Zone", the lines serve the City's "1200 Zone". Currently, the only existing domestic water demand within the proposed West Campus development is at the International Village Housing, at the east end of the West Campus. This facility is supplied by an existing water line in Everton Place which is connected to the 12-inch line in University Ave. The University's existing East Campus water distribution system does not currently serve the West Campus.

6.1 Basis of Design/System Criteria

Design Criteria

For the first phase of development at the SOM, water will be supplied from a connection to the City's water distribution system. In order to provide system redundancy, a standby connection will be included that will serve as a backup to the primary connection. This secondary connection point will be normally closed with automatic pressure sensing valve operation to activate the connection.

The design criteria used for this study is closely matched with the WCIDS design criteria as summarized in Table 3.6.1. In order to properly size the proposed SOM water distribution system, the Peak Hour Demand condition and the Maximum Day Demand plus Fire Flow condition are included in the hydraulic capacity analysis. A summary of the key analysis criteria from the WCIDS are as follows:

- Maximum Day Demand = 1.7 x Average Day Demand
- Peak Hour Demand = 2.0 x Maximum Day Demand
- Minimum Pressure at Peak Hour Demand = 50 psi
- Minimum Pressure at Maximum Day Demand plus Fire Flow = 20 psi
- Maximum Pressure in the water main pipeline = 150 psi

The hydraulic capacity analysis was conducted using a water distribution model developed for the WCIDS using H_2ONet software. The water distribution model setup generally matches the settings used in the WCIDS. The main modification was the addition of a minor loss coefficient of 4.0 for all pipe segments to account for the headlosses from pipe fittings and valves. In addition, based on discussions with the City, the connection points to the City water distribution system were revised. The following lists the proposed connection points and the boundary conditions provided by the City.

- 12-inch pipe along University Ave at Cranford Ave:
  - Static Pressure = 118 psi
  - Residual Pressure at 1,500 gpm = 110 psi
- 20-inch pipe along Cranford Ave at Martin Luther King Jr. Blvd:
  - Static Pressure = 115 psi
  - Residual Pressure at 3,200 gpm = 99 psi

A unit flow factor method similar to the WCIDS was used to estimate the design flow for the hydraulic analysis for the SOM. The WCIDS utilized unit flow factors based on the planning area land use and the factors were verified with other methods for a sensitivity check. The peak flow unit flow factors with units of gallons per minute per land use acre (gpm/ac) were listed in Table 3.6.1 of the WCIDS and the factors with units of gross square footage per gallons per minute (GSF/gpm) were listed in Table 3.4.2, summarized as follows:

WEST CAMPUS DEVELOPMENT WATER DEMANDS PER THE WCIDS		
PLANNING AREA	**UNIT FLOW FACTOR (gpm/ac)**	**UNIT FLOW FACTOR (GSF/gpm)**
Family Student Housing	6.2	880
Apartments	7.3	880
International Village	5.6	NA
Academic Buildings	2.0	1,622
Ambulatory Care	15.6	NA
Medical School	NA	1,622
Campus Support Facilities	1.5	NA
Recreation Fields	2.0	1,622
Greenhouses & lath houses	NA	300

As the building program for the SOM was further developed since the WCIDS to include more detailed building areas, the projected water demand factors for the SOM were revised to be unit flow factor in terms of building gross square footage. The SOM will include some high water demand facilities such as Ambulatory Care, Medical Research, and the Vivarium. In the WCIDS, the unit flow factor for Ambulatory Care was about eight times higher than the academic buildings. This increase agrees with the order of magnitude data presented in University of California, Berkeley 2020 LRDP Draft EIR (Section 4.13 – Utilities and Service Systems). For our analysis, the unit flow factor for Medical Research and Vivarium were based on the Ambulatory Care in order to reflect their similar high water demand. The flow factors used in this updated analysis are shown below in Table 6-1.

Table 6-1 SCHOOL OF MEDICINE WATER DEMANDS PER W&K		
BUILDING USE	**UNIT FLOW FACTOR FOR SOM (GSF/gpm)**	**NOTES**
Ambulatory Care	203	8X Academic Demands
Education	1,622	
Graduate Housing	880	
Medical Office Buildings	1,622	
Parking Garage	NA	
Research	203	8X Academic Demands
Vivarium	203	8X Academic Demands

Design Flow Estimate

The design flow was estimated using the building gross square footage as the base unit, as opposed to the land use acreage used in the WCIDS. The demands for all buildings were determined using the GSF unit flow factors listed in the table above. The flow projection estimated the Peak Hour Demand and the Maximum Day Demand for each building in the SOM. In addition, based on the building gross square footage and the building type data, the fire flow requirement per the California Fire Code was determined. The fire flow estimate is based on the assumption that each building will be equipped with an automatic fire sprinkler system.

Note that in the fire flow projection, it was determined that minimum fire flow demand for all buildings will be 1,500 gpm, except for the graduate student housing, which will have a minimum fire flow demand of 2,000 gpm.

Data for two model cases were determined using the updated building sizes as shown in the following two tables.

TABLE 6-2 Domesitc Water Demand Calculation

Type	Bldg #	Use	Demand Applied to Water Node I.D. No.	Total Bldg Area Per Updated Values (GSF)	Phase	UNIT FLOW FACTOR FOR SoM (GSF/gpm) per W&K	Peak Hour Water Demand per GSF Method (gpm)	Model Case 1: Domestic PHD (gpm)	Domestic MDD (gpm)
M	M1	Research	J86	120,000	4	203	591.9	236.7	118.4
M	M2a	Research	J82	127,200	1	203	627.4	250.9	125.5
M	M2b	Research	J82	95,200	1	203	469.5	187.8	93.9
M	M3	Research	J86	85,200	1	203	420.2	168.1	84.0
M	M4	Education	J70	144,500	1	1,622	89.1	35.6	17.8
M	M5	Ambulatory Care - Ph 2	J88	50,000	2	203	246.6	98.6	49.3
M	M6	Ambulatory Care - Ph 1	J70	100,000	1	203	493.2	197.3	98.6
M	M	Ambulatory Care - Ph 3	J88	100,000	3	203	493.2	197.3	98.6
M	M7	Research	J70	153,720	2	203	758.2	303.3	151.6
H	H	SoM Housing	J80	176,500	1	203	870.5	348.2	174.1
R	RA1	Research/Ambulatory (RA)	J84	89,000	4	203	439.0	175.6	87.8
R	RA2	Research/Ambulatory (RA)	J86	152,000	4	203	749.7	299.9	149.9
R	RA3	Research/Ambulatory (RA)	J200	152,000	4	203	749.7	299.9	149.9
R	RA4	Research/Ambulatory (RA)	J86	152,000	4	203	749.7	299.9	149.9
R	RA5	Research/Ambulatory (RA)	J200	72,000	4	203	355.1	142.0	71.0
R	RA6	Research/Ambulatory (RA)	J88	82,000	4	203	404.4	161.8	80.9
M	MV	Vivarium	J82	40,100	1	203	197.8	79.1	39.6
P	PM1	Parking Garage	J82	487,200	1	NA	0.0	0.0	0.0
P	PM2	Parking Garage	J68	562,800	4	NA	0.0	0.0	0.0
		Totals Based on Larger SoM Buildings =>		**2,941,420**			**8,705.2**	**3,482.1**	**1,741.0**
		Old Values from WCIDS =>		**1,885,000**			**1,292.0**	**516.8**	**258.4**
		Ratios (New SoM #'s / Old SoM #'s per WCIDS) =>		**1.56**			**6.74**	**6.74**	**6.74**

Notes:
1) Maximum Day Demand (MDD) = 1.7 x Average Day Demand (ADD)
2) Peak Hour Demand (PHD) = 2.0 x Maximum Day Demand (MDD)

TABLE 6-3 Fire Flow Demand Calculation

Type	Bldg #	Use	Total Bldg Area Per Updated Values (GSF)	Phase	Building Type for Fire Flow Calc.	Fire Flow per Table B105.1 of CA Fire Code (gpm)	Fire Flow 75% Reduction per CA Fire Code (gpm)	Design Fire Flow - FF (gpm)	Model Case 2: MDD + FF (gpm)
M	M1	Research	120,000	4	IA & 1B	4000	1000	1500	1,618.4
M	M2a	Research	127,200	1	IA & 1B	4000	1000	1500	1,625.5
M	M2b	Research	95,200	1	IA & 1B	4000	1000	1500	1,593.9
M	M3	Research	85,200	1	IA & 1B	4000	1000	1500	1,584.0
M	M4	Education	144,500	1	IA & 1B	4000	1000	1500	1,517.8
M	M5	Ambulatory Care - Ph 2	50,000	2	IA & 1B	4000	1000	1500	1,549.3
M	M6	Ambulatory Care - Ph 1	100,000	1	IA & 1B	4000	1000	1500	1,598.6
M	M	Ambulatory Care - Ph 3	100,000	3	IA & 1B	4000	1000	1500	1,598.6
M	M7	Research	153,720	2	IA & 1B	4250	1062.5	1500	1,651.6
H	H	SoM Housing	176,500	1	IIB	8000	2000	2000	**2,174.1**
R	RA1	Research/Ambulatory (RA)	89,000	4	IA & 1B	4000	1000	1500	1,587.8
R	RA2	Research/Ambulatory (RA)	152,000	4	IA & 1B	4250	1062.5	1500	1,649.9
R	RA3	Research/Ambulatory (RA)	152,000	4	IA & 1B	4250	1062.5	1500	1,649.9
R	RA4	Research/Ambulatory (RA)	152,000	4	IA & 1B	4250	1062.5	1500	1,649.9
R	RA5	Research/Ambulatory (RA)	72,000	4	IA & 1B	4000	1000	1500	1,571.0
R	RA6	Research/Ambulatory (RA)	82,000	4	IA & 1B	4000	1000	1500	1,580.9
M	MV	Vivarium	40,100	1	IA & 1B	4000	1000	1500	1,539.6
P	PM1	Parking Garage	487,200	1	IA & 1B	6000	1500	1500	1,500.0
P	PM2	Parking Garage	562,800	4	IA & 1B	6000	1500	1500	1,500.0

Notes:
1) Fire flows were determined using a 4 hour flow duration. The minimum fire flow for this duration is 4,000 gpm per Table B105.1 of Appendix B of the 2007 CA Fire
2) Assume that all buildings in the School of Medicine will have fire sprinklers, therfore allow a 75% fire flow reduction per section B105.2 exception note
3) Minimum allowable fire flow is 1,500 gpm per section B105.2 exception note of the California Fire Code

The water demands were input into the hydraulic capacity analysis model by development phasing increment to test the system capacity under Phase 1 and Final SOM development conditions. For the final West Campus buildout condition, the demands provided by the WCIDS were used for the areas outside the SOM. These values were shown in Appendix A-10 of the WCIDS.

6.2 SOM Infrastructure Phase 1

Based on the WCIDS, the West Campus water distribution system at the final buildout condition will have a 12-inch and 8-inch pipeline connection to the East Campus system. However, during the interim development conditions, the West Campus domestic water supply will be from temporary 14-inch connection points to the City's 12-inch and 20-inch domestic water distribution system. The new water distribution system to support the SOM development will include two connection points to the City of Riverside's water distribution system:

- Primary Connection Point
  - University Ave at Cranford Ave (University Ave Connection)
    Connect to 12-inch line in University Ave.
- Standby Connection Point
  - Cranford Ave at Martin Luther King Blvd (Cranford Ave. Connection)
    Connect to 20-inch line in Cranford Ave.

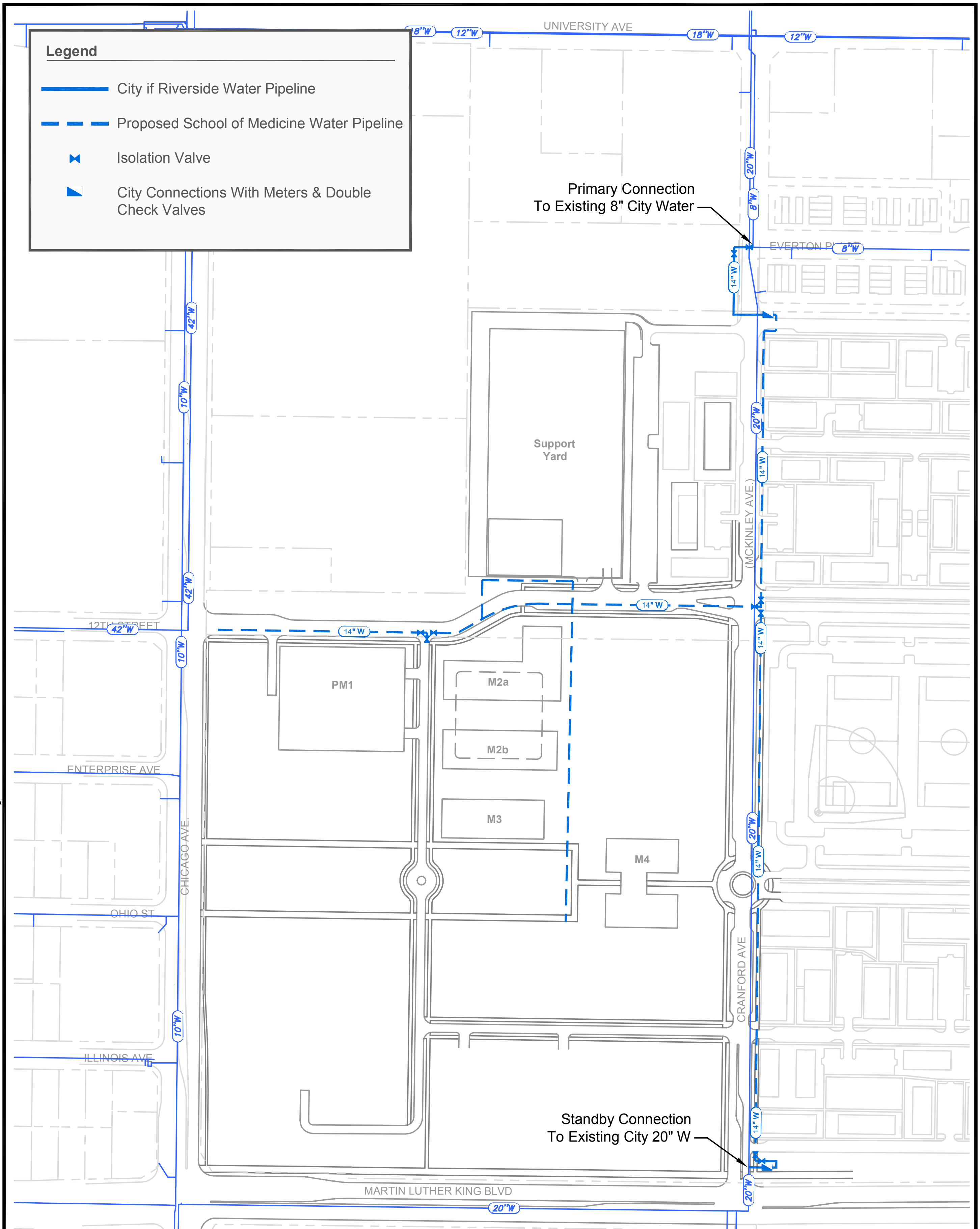
At the University Ave Connection, the City has an existing 8-inch pipeline along Cranford Ave between University Ave and Everton Pl. The hydraulic analysis for the water distribution system indicated that for the Phase 1 SOM development, the existing 8-inch pipe provides sufficient capacity to the Campus. Therefore, during the Phase 1 condition, the SOM water distribution system will connect to the existing 8-inch pipe on Cranford Ave and Everton Pl.

The Phase 1 onsite water distribution system will consists of a 14-inch pipe system along Cranford Ave, Northwest Mall, and the proposed utility tunnel alignment. The main pipe system will then be supported by a series of local distribution pipelines to serve each building. Figure 6-1 shows the layout of the 14-inch main pipeline system for the Phase 1 SOM development.

The proposed water distribution system for the Phase 1 development follows the general final system configuration proposed in the WCIDS. The main differences are as follows:

- The WCIDS includes a City water distribution system connection point at Chicago and Martin Luther King Blvd. In our current configuration, this City connection point is replaced with two potential City connection points at University Ave and Cranford Ave, and at Martin Luther King Blvd and Cranford Ave.

- The WCIDS proposed a network of 8-inch and 10-inch pipelines. Due to the new connection points to the City domestic water source, the revised water demand projection within the SOM, and the inclusion of the minor loss coefficient for the pipelines in the hydraulic analysis, the proposed water distribution system is a uniform 14-inch system. Note that the primary constraint of selecting 14-inch pipe instead of a small pipeline is to satisfy the minimum 50 psi pressure under the SOM Final Builtout Peak Hour Demand Condition.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 6-1 PH1 DOM WATER.dwg 06-23-09 11:51:48AM PScheetz

WINZLER & KELLY
WALKER·MACY
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Figure 6-1
Phase 1 - Domestic Water

UC Riverside School of Medicine **Infrastructure Development**

A hydraulic analysis was prepared for the Phase 1 development. The hydraulic analysis models the proposed 14-inch water distribution system under both the Peak Hour Demand condition and Maximum Day Demand plus Fire Flow condition. In both analyses, only the City water supply from the University Ave Connection was considered.

During the Peak Hour Demand condition, the entire Phase 1 development maintains at least 50 psi of minimum pressure. For the fire flow condition, the system can provide at least 20 psi fire flow pressure, as shown in Table 6-4 below.

TABLE 6-4
PHASE 1 MODEL RESULTS

Location	Model ID	MDD Demand	MDD Pressure	Fire-Flow Demand	Residual Pressure
	Node	gpm	psi	gpm	psi
Cranford/Everton	J40	0.00	111.94	1,500.00	73.84
Cranford/MLK	J68	0.00	112.18	1,500.00	69.96
Cranford between NW Mall & MLK	J70	116.50	113.48	1,500.00	72.17
Cranford/NW Mall	J80	174.10	112.62	2,000.00	50.28
NW Mall/N-S Corridor	J82	258.90	117.57	1,500.00	76.07
NW Mall/Chicago	J84	0.00	119.95	1,500.00	77.51
N-S Corridor between NW Mall & MLK	J86	0.00	115.62	1,500.00	73.24

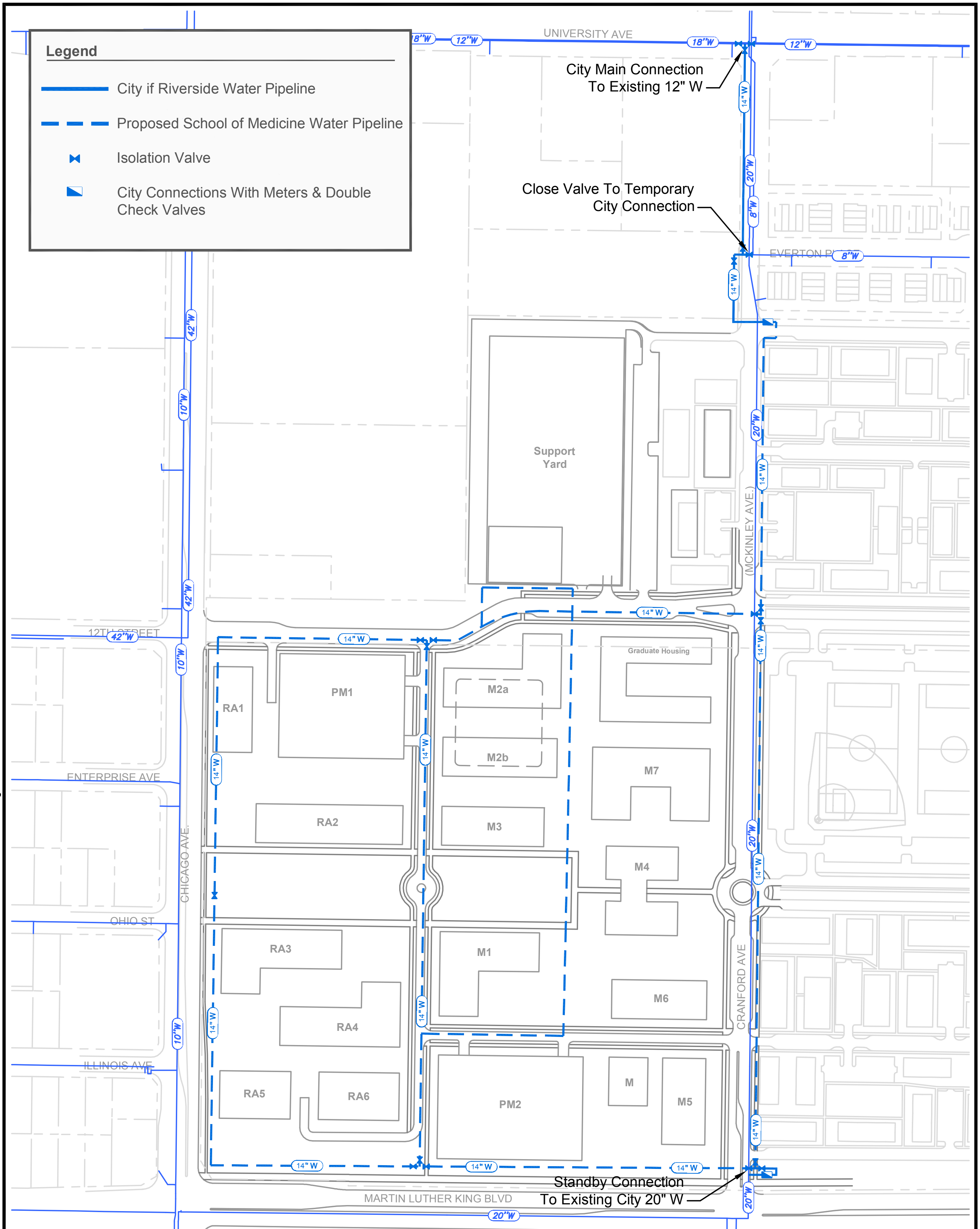
Note that the proposed water distribution system for the Phase 1 development represents a system with minimum segments of new pipelines that would satisfy the aforementioned hydraulic capacity requirements. The proposed system lacks the complete looping configuration needed for system redundancy (i.e., supply from the southern portion of the site). As part of the final development condition, the SOM will have a main loop system for system redundancy and recirculation.

6.3 SOM Infrastructure – Full Buildout

The water distribution system for the Full Buildout of the SOM development will build upon the Phase 1 infrastructure already in place. At the University Ave Connection, the existing 8-inch City pipeline will no longer have sufficient capacity to support the Final Phase condition. The 14-inch University pipeline along Cranford Ave from the Phase 1 improvement will need to be extended north along Cranford Ave to connect to the existing 12-inch City water pipeline at University Ave. A potential alternate option would be to convert the Cranford Ave. Connection from a standby status to normally open. Further coordination between the University and the City will be needed to finalize the configuration of the City connections in the future.

The SOM onsite water distribution system during the final development phase will continue to expand southwest to cover the final developments. The expansion will results in a 14-inch main loop system within the SOM as shown schematically in Figure 6-2.

A hydraulic analysis was prepared for the Full Buildout development. The hydraulic analysis models the proposed 14-inch water distribution system under both the Peak Hour Demand condition and Maximum Day Demand plus Fire Flow condition. In both analyses, only the City water supply from the University Ave Connection was considered.



North

0' 75' 150' 300'

Figure 6-2
Final - Domestic Water

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 6-2 FINAL DOM WATER.dwg 06-23-09 11:51:41AM PScheetz

During the Peak Hour Demand condition, the entire Full Buildout SOM development maintains at least 50 psi of minimum pressure. This Peak Hour Demand condition defines the need for a 14-inch system. For the fire flow condition, the system can provide at least 20 psi fire flow pressure, as shown in Table 6-5 below.

TABLE 6-5
FULL BUILDOUT MODEL RESULTS

Location	Model ID	MDD Demand	MDD Pressure	Fire-Flow Demand	Residual Pressure
	Node	gpm	psi	gpm	psi
Chicago/MLK	J200	220.90	103.09	1,500.00	69.85
Cranford/Everton	J40	43.70	101.10	1,500.00	73.54
Cranford/MLK	J68	24.20	99.28	1,500.00	66.50
Cranford between NW Mall & MLK	J70	295.60	100.67	1,500.00	68.16
Cranford/NW Mall	J80	214.50	100.06	2,000.00	54.65
NW Mall/N-S Corridor	J82	271.50	104.66	1,500.00	71.95
NW Mall/Chicago	J84	87.80	107.01	1,500.00	73.87
N-S Corridor between NW Mall & MLK	J86	502.30	102.65	1,500.00	69.57
N-S Corridor/MLK	J88	228.80	100.49	1,500.00	67.59

6.4 West Campus Infrastructure – Additional Evaluation Items

An additional preliminary hydraulic analysis was conducted for the future West Campus buildout condition. The objective of the analysis was to gauge the potential impact from the revised SOM water distribution planning analysis to the overall West Campus development. The main deviation between the WCIDS and the revised SOM water distribution planning analysis are as follows:

- The projected design flows from the SOM were increased.
- The City water distribution system connection points were changed.
- The proposed University pipeline system for the SOM was revised.

The preliminary hydraulic analysis for the future West Campus development indicated that the two proposed pipeline connections across Highway 215 to the East Campus water distribution system do not provide sufficient water capacity for the West Campus. The increased SOM projected design flow overloads the East Campus system. Additional analysis is needed to evaluate potential options to provide sufficient water supply to West Campus, including improvements to the existing East Campus system, reevaluating pipe sizing for the West Campus water distribution pipeline system, and exploring potential options to provide permanent water supply from the City of Riverside domestic water system connections.

Furthermore, the boundary conditions for the West Campus hydraulic analysis, prepared as part of the WCIDS, should be verified. For example, the analysis model set the East Campus water supply source mainly from the City reservoir at Highway 215 and University Ave, with the University's water storage tank being depleted. In addition, if the University considers any permanent City water system tie in options, the University and the City need to coordinate on the available capacity for the City water pipeline on Cranford Ave and University Ave. For example, preliminary discussions with the City indicated that the existing 20-inch City water pipeline on Cranford Ave may not have sufficient capacity for both the West Campus developments and the downstream City water demands. An alternate option for the University may be to connect to the City's 42-inch water pipeline at Chicago Ave and 12th St. However, since that line is part of the City's "Gravity Zone", the University would need to provide a new booster pump station to bring up the service pressure for the West Campus system.

7.0 IRRIGATION WATER

This section summarized the evaluation of the landscape and irrigation water distribution system concepts for the proposed School of Medicine (SOM) and the future West Campus developments.

The SOM site is currently part of the University's Agriculture Research and Teaching Field. The field is identified as Field 5 in the 2008 West Campus Infrastructure Development Study (WCIDS). The field has a series of irrigation supply pipelines and feeder pipelines connected to a sprinkler pump station located along the future Cranford Ave. The pump station and the onsite pipelines provide the irrigation water needed to support the agriculture fields at the site.

The existing irrigation infrastructure surrounding the SOM used for our analysis was based on the information provided in the WCIDS. The information was further verified through interviews with UCR Agricultural Operations staff. Per these data sources, the irrigation supply, drain, and return lines were mapped using AutoCAD.

The existing irrigation supply for UCR is supplied by the Gage Canal via a series of storage reservoirs. The existing fields within the proposed West Campus development are served by an asphalt lined reservoir located east of the Gage Canal and south of Martin Luther King Blvd (MLK Blvd). The asphalt lined reservoir is connected to an unlined reservoir located directly west of the asphalt lined reservoir. These two reservoirs are connected by an inverted siphon to maintain hydraulic connectivity. The irrigation supply lines in West Campus are fed from the asphalt lined reservoir. Gage Canal water flows into the asphalt lined reservoir via a check dam, and then is pumped by an old low head pump to the main irrigation lines. The low head pump does not produce enough head to pressurize the existing downstream pipeline network. It provides just enough pressure to lift the water from the reservoir to a high point, then the main irrigation supply lines begin to gravity flow downstream. The main transmission pipeline from the reservoir to the proposed SOM site is 16-inch diameter and is believed to be a steel lined pipe that is about 80 years old. The 16-inch line connects to a diversion structure located at the intersection of MLK Blvd and Iowa Ave. Then the flow is diverted to a 16-inch line that runs north along Iowa Ave and a 14-inch line that runs west along MLK Blvd. The 16-inch line feeds Fields 1, 2, 3, and 6, and the 14-inch line feeds Fields 5, 6, and 9.

The 14-inch line on MLK Blvd connects to a series of 12-inch pipes at the intersection of Cranford and MLK. In the northerly direction along Cranford Ave, a 12-inch pipe gravity flows to a 15 hp booster pump that produces 25 psi pressure for the irrigation supply lines within Field 5 in the SOM site.

The University maintains a salvage reservoir located east of Chicago Ave and south of MLK. This reservoir collects field irrigation runoff from the network of perforated field drain lines in each field. Currently, these drain lines connect to parallel 12-inch and 14-inch main drain pipes that flow in a westerly direction across Field 5. The main drain pipes connect to a salvage pump station located just east of the Chicago Ave right-of-way near Enterprise Ave. This pump station's 7.5 hp and 5 hp pumps pressurize the collected return flow to a 12-inch pipe to the salvage reservoir to the south. The salvage reservoir drains back to the unlined reservoir adjacent to the asphalt lined reservoir by the Gage Canal to recycle the irrigation water supply.

Per the UCR Agricultural Operations staff, the irrigation supply pipes and pumps are very old and in need of replacement. The majority of the existing irrigation infrastructure is approximately 80 years old and requires constant maintenance to operate reliably. The system was not design to handle high pressures and the UCR staff strongly recommends that a new system be installed to supply future SOM landscape irrigation needs during the SOM development phasing.

7.1 Basis of Design/System Criteria

The design criteria for the SOM irrigation water system was mainly based on the WCIDS analysis. In the WCIDS, a hydraulic capacity analysis model in H_2ONet software was developed. In our analysis, we reran the model based on the current SOM phasing plan information to test whether the proposed irrigation system can support the irrigation demands to the remaining fields and the new landscaping in the SOM.

The hydraulic capacity analysis design criteria are as follows:

- Irrigation water supply will be provided from the asphalt lined reservoir;
- The irrigation water supply system will be a pressurized system from a new pump station at the asphalt lined reservoir;
- Minimum pressure for field irrigation supply = 25 psi; and
- Minimum pressure for landscape irrigation sprinkler supply = 60 psi.

This analysis assumed that the water will be supplied from the Gage Canal. The current Gage Canal water rights agreement for the University will be up for renewal in 2012-13. The City of Riverside (City) is currently exploring possibilities to provide irrigation supply to the West Campus from a future City recycled water system. Due to the uncertainty of the future recycled water connection, it was not included as a part of the analysis. The University should coordinate with the City to explore supplying future irrigation and non-potable water demands from the City's recycled water system during the design of the irrigation water system.

The Phase 1 SOM system will be designed to accommodate the future use of recycled water for irrigation as well as other non-potable building uses.

Design Flow Estimate

In the WCIDS, the peak design flow for the West Campus irrigation water demand was estimated to be 3,301 gpm. It was based on an assumption that irrigation demands represented 60% of the total West Campus water demand, with 1.6 peak day demand factor and 12 hours a day irrigation time on a peak day.

For the SOM, the projected landscape irrigation demand ranges from 12.5 mg/yr to 28.7 mg/yr. Based on the same peaking and application time parameters from the WCIDS, the peak design flow for SOM is approximately 175 gpm. It is about 68% lower than the 549 gpm peak design flow for SOM as estimated in the WCIDS. The deviation is mainly a function of using native and/or low water requiring landscaping for SOM. In addition, the WCIDS demand estimate approach is based on land use area, which also includes rooftops and roads. The irrigation demand estimate prepared for this study is based on actual planned areas of landscape. Therefore, the revised landscape irrigation demand is lower than the estimate from the WCIDS.

The southern half of the existing Field 5 within the SOM will remain during the Phase 1 SOM development. The University Agriculture Operations estimated the irrigation demand for half of Field 5 is approximately 648 gpm. This additional field demand will be included in the Phase 1 SOM irrigation system planning. Table 7-1

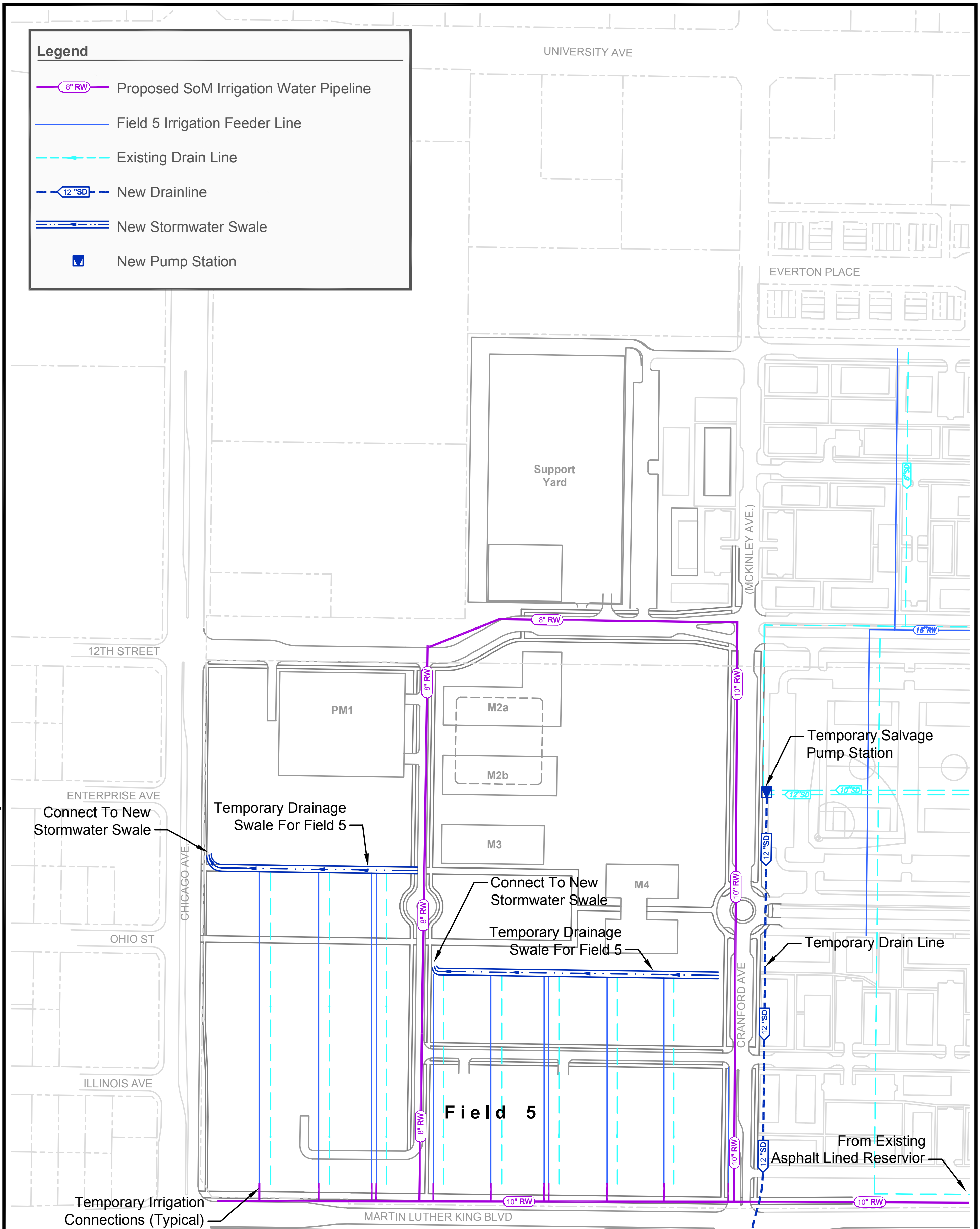
TABLE 7-1
SOM IRRIGATION DEMAND SUMMARY

Field 5 Peak Demand	**648 gpm**
Projected SOM Demand	12.5 - 28.7 Mgal/yr
SOM Demand for Analysis	28.7 Mgal/yr
Peaking Factor	1.6
Demand Duration	12 hrs
SOM Peak Demand	**175 gpm**
SOM Peak Demand (WCIDS)	549 gpm
Peak Demand Reduction	68%

7.2 SOM Infrastructure Phase 1

The new irrigation water distribution system to support the SOM development will include a new interim pump station and pipeline system from the asphalt lined reservoir to the SOM site. Due to their condition and age, the existing pipeline and pumping facilities will not be utilized in the future SOM irrigation system. Portions of the existing system will remain in service during the course of the West Campus development in order to serve the irrigation needs of the remaining fields within the SOM development area.

The new irrigation pipeline system for the Phase 1 SOM development includes a new 16-inch pipeline along Iowa Ave, from the asphalt lined reservoir to MLK Blvd. The 16-inch pipeline connects to a new 10-inch pipeline on MLK Blvd. The 10-inch pipeline on MLK Blvd flows from Iowa Ave to Cranford Ave. At Cranford Ave, the 10-inch pipeline connects to the SOM onsite irrigation pipeline system, as shown in Figure 7-1. The proposed irrigation water system for the Phase 1 development generally follows the final system configuration proposed in the WCIDS.



North

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Figure 7-1
Phase 1 - Irrigation Water

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 7-1 PH1 IRR WATER.dwg 06-23-09 11:51:36AM PScheetz

At the asphalt lined reservoir, a new booster pump station is needed to pressurize the proposed irrigation pipeline system. Since the proposed pump station is an inline booster pump station, the pump station should be equipped with variable speed drives to modulate the pumps to match the irrigation demands. Preliminary hydraulic analysis indicated that the pump station should be designed for approximately 800 gpm capacity at 235 feet of Total Dynamic Head for the SOM development. Note that this design parameter is only for the full SOM development. The pump station will need future expansion to provide sufficient demand for the entire West Campus landscape irrigation needs unless recycled water is made available from the City of Riverside.

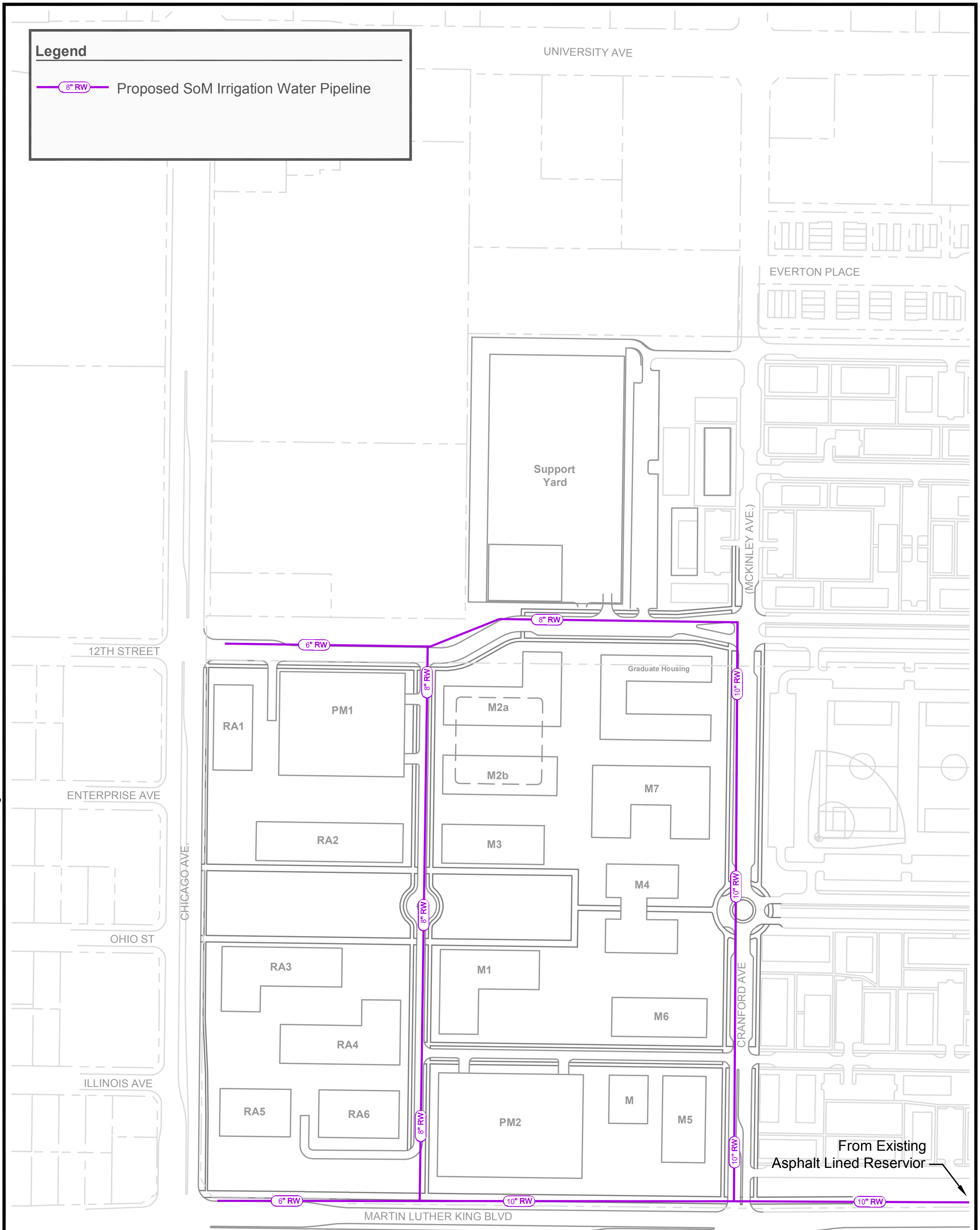
In addition, the southern portion of Field 5 would remain during the Phase 1 SOM development. Since the existing main feeder pipeline from the onsite irrigation pump station will be removed as part of the development, the remaining irrigation feed lines will connect to the new irrigation pipeline parallel to MLK Blvd. Since the proposed irrigation water pipeline system is pressurized, no onsite irrigation pump station is needed.

Due to the Phase 1 SOM development, the existing double drain line across Field 5 and the salvage pump station adjacent to Chicago Ave will be removed. Runoff from the remaining southern part of Field 5 will sheet flow north toward a series of temporary swales at the northern edge. The swales flow west towards Chicago Ave and discharge to a new swale parallel to Chicago Ave, which is a part of the proposed Phase 1 SOM storm drain system.

For the runoff in the double drain line from east of Cranford, a new temporary salvage pump station will be built adjacent at Cranford Ave. The salvage pump station will collect field drainage from east of Cranford and pump it south along Cranford Ave through a temporary 12-inch force main to connect to the existing irrigation drain return line south of MLK Blvd. The new salvage pump station will match the capacity of the existing pump station. In order to minimize the visual impact to the SOM, the new pump station will be located east of the Cranford Ave right-of-way, and will be a packaged submersible pump station with most of the pumping equipment housed in belowground vaults. The new temporary salvage pump station will remain in service until the Family Student Housing development east of Cranford Ave takes place in the future.

7.3 SOM Infrastructure – Full Buildout

The irrigation water distribution system for the full buildout of the SOM development will build upon the Phase 1 infrastructure already in place. At full buildout of the SOM development, the remaining fields at the southern portion of the site will be removed, along with the onsite sprinkler feeder lines and the temporary runoff swales. Additional landscape irrigation pipeline will be placed as shown in Figure 7-2.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 7-2 FINAL IRR WATER.dwg 06-23-09 11:51:30AM PScheetz

WINZLER & KELLY
WALKER·MACY
MILLER HULL ARCHITECTURE & PLANNING

North

0' 75' 150' 300'

Figure 7-2
Final - Irrigation Water

UC Riverside School of Medicine **Infrastructure Development**

7.4 West Campus Infrastructure – Additional Evaluation Items

For the future West Campus development conditions, the University should re-evaluate the landscape irrigation demand requirements. If the University implements campus-wide native and/or low water requiring landscaping, it will reduce the landscape irrigation demand requirements and potentially reduce the irrigation piping and pumping size. In addition, the University should coordinate with the City to explore the feasibility of connecting the University's landscape irrigation system to the City's recycled water system under consideration at this time. It may potentially reduce the scope of the new University irrigation system. For example, if the University's irrigation system connects to the City's recycled water system at MLK Blvd and Iowa Ave, the University can eliminate the new 16-inch pipeline along Iowa Ave, between MLK Blvd and the asphalt lined reservoir, as well as a new booster pump station at the asphalt lined reservoir.

8.0 SANITARY SEWER

This section summarizes our evaluation of the sanitary sewer analysis for the proposed School of Medicine (SOM) development at UC Riverside (UCR).

The existing sanitary sewer infrastructure surrounding the SOM used for our analysis was based on the information provided in the 2008 West Campus Infrastructure Development Study (WCIDS). The information was further verified and supplemented by the system mapping provided in the City of Riverside's CADME database, and sized using As-Built drawings from the City's electronic archives on their website. Per these data sources, there are two existing sets of sanitary sewer infrastructure adjacent to the SOM site. To the south a University owned and maintained 8-inch VCP sanitary sewer line flows in a westerly direction along Martin Luther King Blvd (MLK). At the intersection of MLK and Chicago Ave, this sewer line changes direction and flows northerly. Just beyond 12th Street at the northerly limits of the SOM project boundary the sewer line ties into the City owned and maintained public system, which is an 8-inch diameter PVC line. This 8-inch City sewer line provides service for properties both east and west of Chicago north of 12th Street. This 8-inch line flows northerly down Chicago and ties into a 10-inch PVC City's public sewer line at the intersection of Chicago Ave and University Ave. At this same location, an additional 8-inch PVC City's public sewer line ties into this sewer manhole from the east. This public line conveys wastewater originating from both public and UCR sources. An additional City owned and maintained12-inch PVC sewer line was constructed parallel to this 8-inch sewer line on University Ave. east of Chicago Ave; this 12-inch line flows in a westerly direction as well. Due to a diversion sewer manhole that was installed just west of Highway 215 in University Ave, the contributing UCR West Campus flows are split between the 8-inch and 12-inch parallel lines during peak events. The 12-inch line ties into another parallel line system in the intersection of University Ave and Chicago Ave at another diversion sewer manhole. This manhole releases flow to 10-inch and 15-inch lines, which continue to flow in a northerly direction.

The existing City sewer system does not have sufficient capacity to support the increased wastewater flows generated by the proposed West Campus development, which includes the SOM.

8.1 Basis of Design/System Criteria

The design criteria for the sewer system evaluation are based on Section 5.5.1 of the WCIDS. The hydraulic capacity design criteria are listed as follows:

- Pipes less than 15'' in diameter shall be designed to flow at 0.5 D or less at design flow.
- Pipes greater than or equal to 15'' in diameter shall be designed to flow at 0.75 D or less at design flow.
- Minimum pipe slope shall be 0.4%.
- Minimum design velocity shall be 2 feet per second (fps) and maximum design velocity shall be 10 fps for full build out conditions.
- Minimum design velocity shall be 1 fps for temporary, phased building conditions.
- Minimum pipe diameter shall be 8-inch.
- System was modeled assuming the pipe material is VCP (N=0.013).

A StormCAD hydraulic model was developed to estimate the hydraulic capacity of the proposed sewer collection system within the SOM.

In addition, the WCIDS includes a desirable pipe design depth criteria of 8 feet, with a minimum cover of 4 feet. During our pipe cover feasibility evaluation, we concluded that while we can maintain a minimum cover of 4 feet in most locations, the desirable pipe design depth criteria of 8 feet cannot be met at certain locations due to the invert elevations of the downstream pipeline connections and the existing ground elevations. The following lists the sewer manholes that need to have less than 4 feet of cover. The manholes noted below are shown on Figure 8-1.

- Sanitary Sewer Manhole A1
  - The City connection in Chicago Ave near 12th Street
  - Proposed cover at manhole = 3.8 feet
  - This cover is controlled by the depth of the existing UCR 8 inch sewer line

- Sanitary Sewer Manhole B4
  - A proposed manhole located in Cranford Ave. near the existing ground sag vertical curve
  - Proposed cover at manhole = 4.0 feet
  - The depth of the line here is controlled by the proposed crossing over the existing 66 inch county storm drain pipe located in Cranford Ave, the minimum 0.4% sewer line slope criteria, and the existing ground low point that is lowest near manhole B4.

- Sanitary Sewer Manhole D1
  - A new proposed manhole located along the proposed alignment of a new 15 inch pipe on Chicago Ave. This new pipe will replace the existing 8 inch UCR line.
  - Proposed cover at manhole = 3.8 feet
  - This cover is controlled by the depth of the existing UCR 8 inch sewer line
  - This manhole is required per the minimum manhole spacing requirement provided in the WCIDS sewer design criteria.

The topographic data used to determine the cover was provided by the City of Riverside's CADME system. Per the City staff, the aerial topography was generated from aerial photography taken in April 2008, and the vertical datum is NGVD 1929, RCS 1970. This data was compared with the City's sewer system as-built drawings to estimate the available cover. In summary, the cover in these locations must be less than or equal to 4 feet due to the following reasons.

- A limited number of connection points that provide adequate depth
- A controlled crossing with the county storm drain pipe that cannot be avoided
- Existing terrain topography
- Mandatory minimum slope criteria of 0.4%

Design Flow Estimate

The sanitary sewer (SS) design flows were determined for the SOM by using a land use calculation method for the planning areas outside the SOM in conjunction with a gross square footage (GSF) method for the buildings within the SOM planning areas. The contributing design flows outside the SOM were estimated as follows. This method is referred to as the land use method in this report, and this method is consistent with the flow estimate method in WCIDS.

1. Use the land use data for all proposed planning areas outside of the SOM to determine the design flow as noted in Chapter 5.2 of the WCIDS.
2. The Average Flow Factor, Q_a (cfs/land use acre) for Academic Buildings and Family Housing land use categories were used as recommended by the WCIDS.
3. The total land use design flow was determined for the entire West Campus Development using the average flow factors shown to the right; the WCIDS provided land use areas and the design flow equation in the analysis. The analysis yielded a total design flow of 4.26 cfs.

TABLE 8-1
Avg. SS Flow Factors
(cfs / Land Use Acre)

USES	INPUTS
Colleges & Univ., Qa =	0.00250
Family Housing, Qa =	0.00845

Flow Factors Assumed for Each Planning Area

Planning Area	Avg. Q (cfs/acre)
Academic	0.00250
Ambulatory Care	0.00250
Apartments	0.00845
Family Housing	0.00845
Graduate Housing	0.00845
International Village	0.00845
Medical School	0.00250
Recreation	0.00250
Support Facilities	0.00250

The land use method is mainly for the flow estimate outside of the SOM, and it does not account for any increases in building square footage within the SOM; therefore a revised flow estimate approach was developed to account for these increases. This revised approach uses the same design flow equation that was used in the land use approach. The difference is that it uses a gross square footage (GSF) of the buildings to determine the flow generated as opposed to land use area. Because the design flow equation utilizes average flow constants that vary by land use and is based on GSF, a conversion factor had to be applied to the average flow constants. This factor changes the average flow factor units from (cfs / Land Use Acre) to (cfs / GSF Acres). The process used to determine this factor is described below.

1. The total GSF for the West Campus = 233.5 Acres as noted in the WCIDS. This was estimated by tabulating and adding up the GSF for each building in the proposed West Campus development.
2. The land use area for the West Campus = 178.5 acres per Table 3.4.4 of the WCIDS.
3. The factor to convert the average flow factor units from (cfs/ Land Use Acre) to (cfs / GSF Acres) is (178.5 Land Use Acres / 233.5 GSF Acres). This yields a conversion factor of 0.76 for Land Use Acres / GSF Acres.
4. This conversion factor was applied within the design flow equation to convert the average unit flow factors from units of (cfs / Land Use Acre) to (cfs / GSF Acres). Note that it is not a unit flow factor, the 0.76 factor is to convert the unit flow factor to represent the design flow based on GSF, it is a scale of area unit, not flow unit.

Another difference to the approach taken in the WCIDS is the average flow factors applied to the GSF method for the SOM. One additional average flow factor was added because the two recommended uses in the WCIDS did not provide an acceptable level of accuracy for the proposed SOM. Refer to the table below for a list of the Average Flow Factors that were used in our land use design flow analysis. Note that these are still land use factors with units of (cfs / Land Use Acre). The conversion factor of 0.76 described above was applied to these land use factors when calculating the design flow.

1. A high unit flow factor was applied to land uses including Ambulatory Care, Recreation, Research, and the Vivarium. The WCIDS provided for an increase in water demand for high use facilities such as these, but did not provide a proportional increase in the sewer design land use flow factor. The City of San Bernardino Sewer Policies did not provide appropriate factors either. The high unit flow factor is set by increasing the sewer flow factor by 8 times compared to the flow factor for Colleges & Universities. This yielded a high unit flow factor = 0.02000 (cfs/land use acre). This increase agrees with the order of magnitude data presented in University of California, Berkeley 2020 LRDP Draft EIR (Section 4.13 – Utilities and Service Systems).

The design flow of the existing 8-inch UCR sewer line on Chicago Ave is estimated based on the 75% full capacity of the pipeline. The resulting inflow from this line is 0.8 cfs.

TABLE 8-2
Avg. SS Flow Factors for SoM
(cfs / Land Use Acre)

LAND USE	Avg. Q (cfs/acre)
Ambulatory Care	0.02000
Education	0.00250
Graduate Housing	0.00845
Parking Garage	0.00000
Research	0.02000
Vivarium	0.02000
LAND USE	**INPUTS**
Colleges & Univ., Qa =	0.00250
Family Housing, Qa =	0.00845
Misc. High Use, Qa =	0.02000

Final West Campus Design Flow Estimate

The GSF design flow calculation method was only applied to the SOM, which encompasses planning areas 24, 25, and 26. The goal was to determine the increased flows due to the increased building sizes for the SOM. To determine the final West Campus design flow values for input into the hydraulic capacity analysis, the following steps were taken.

1. Calculated the GSF average flow factor by taking the product of the land use average flow factors and the aforementioned conversion factor of 0.76.
2. Determined the GSF design flow by plugging the GSF average flow factor determine above into the peak design flow equation as follows:

$$Q_d = 3.6\,(Q_a)^{0.85}$$

3. The design flows calculated using the GSF method replaced the design flows calculated using the land use method.
4. The result of this calculation was a total wastewater design flow estimate, Q_d = 3.44 cfs for the SOM only. The land use design flow calculation for all other planning areas outside the school of medicine yielded a total wastewater design flow estimate, Q_d = 3.66 cfs. Therefore, the entire west campus design flow is Q_d = 7.11 cfs.
5. These design flows were allocated to manholes by probable building sewer service locations. This allocation process greatly increased the accuracy of the hydraulic model results.
6. Refer to the Appendices for the Final West Campus (Full Build Out) StormCAD Results

School of Medicine – Phase 1 Design Flow Estimate

As stated previously, the GSF method determined the design flow for the SOM on a building by building basis. This greatly facilitated our analysis of the phase 1 scenario.

1. The values for all the buildings to be built during phase 1 were added together and allocated to manholes.
2. The result of this calculation was a total wastewater design flow estimate, Q_d = 1.16 cfs for the SOM only. The land use design flow calculations for all other planning areas outside the school of medicine were not considered for this analysis because it was assumed that the SOM would be built first.
3. These values were entered into StormCAD and ran using the same pipe diameters and slopes that were required to make the Final West Campus meet the design criteria. This analysis is mainly to check the minimum pipe flow velocity requirements.
4. Refer to the Appendices for the Phase 1 StormCAD Results.

Design Flow Estimate Comparison with the WCIDS

Per the land use analysis method used for the SOM in the WCIDS, the total SOM design flow is approximately 0.6 cfs. The design flow generated by our study for the SOM using the gross square footage method in conjunction with the new high unit flow factor is 3.44 cfs. A significant factor which caused this large increase in design flow for the SOM was the application of the high unit flow factor. This factor is 8 times greater than the typical average flow factor for colleges and universities. This large increase is necessary to properly estimate the flows from the Ambulatory Care, Research, and Vivarium facilities. The land use design flow provided in this report for the planning areas outside the SOM were not generated using this high unit flow factor.

8.2 SOM Infrastructure Phase 1

The proposed sanitary sewer pipeline alignments and City connection points shown in the WCIDS cannot meet the minimum pipe cover requirements. The two main City connection points proposed in WCIDS were on Cranford Ave at Everton Place and MLK Blvd. The West Campus flows were divided equally in each direction.

The northern connection proposed at the intersection of Cranford Ave and Everton Place ties into an existing sewer manhole with an invert of 973.5 feet. The cover above the proposed pipe at this point was approximately 6.7 feet. As the sewer line heads upstream along its southerly alignment, the existing ground is flat. It causes the proposed cover to diminish quickly. Sufficient cover was lost approximately 460 feet upstream from this connection point, so the remaining 1000 feet of the pipeline to the south would not have sufficient cover.

The southern connection proposed at the intersection of Cranford Ave and MLK Blvd connects at an approximate invert elevation of 974.5 feet, as shown in sheet 12 of 64 of the Box Springs Drain Stage IV Improvement Plans (City As-Built No. D-319). In order for the WCIDS design to work, the proposed sewer line would have to travel upstream in a northerly direction along Cranford Ave for approximately 810 feet and maintain sufficient pipe cover. Assuming a minimum slope of 0.4% from the proposed southern connection at MLK Blvd, the resultant invert elevation would be approximately 978.0 at this proposed manhole located 810 feet upstream. Since the existing grade at this proposed sewer manhole location is approximately 974.4 per the aerial topography provided by the City of Riverside, the proposed sewer line at this critical location would be over 3 feet above the existing grade in order to adhere to the minimum slope criteria provided in the WCIDS. Therefore, the southern connection point at Cranford Ave and MLK Blvd is not feasible.

The critical pipe cover design constraint for this gravity sewer system was used to identify possible alternatives. The new sewer system for the proposed West Campus development utilizes two tie-in locations to the existing City sewer system. The primary connection point is at Chicago and 12th Street just outside the public right of way, and the secondary connection point is at Cranford Ave and Everton Place within the public right of way.

The first phase of the SOM development will only require the primary connection point at Chicago Ave near 12th St. The total flow that will be conveyed to the existing city system is 1.2cfs. This primary connection point will be made to an existing University 8-inch sewer line. This line flows into an 8-inch City owned and maintained sewer line immediately downstream of this connection. Both the short segment of pipe owned by UCR and the city line located in Chicago Avenue will need to be upsized. These lines will need to be upsized and operational prior to occupation of the SOM Phase 1 buildings.

The proposed sewer lines for SOM phase 1 development are shown in Figure 8-1. The StormCAD hydraulic modeling results have been included in the Appendices. In addition to the hydraulic capacity evaluation, we also checked whether the proposed pipelines could maintain adequate minimum flow velocities during Phase 1 development. Our analysis shows that the system maintains velocities greater than 2fps except for Pipes B3 and B4, which have velocities greater than 1.8 fps during Phase 1 peak dry weather flow conditions. During average dry weather flow conditions, Pipes A3, A4, and A5 maintain minimum velocities greater than 1.5 fps while Pipes B3, B4, and B5 maintain minimum velocities greater than 1 fps. Refer to Figure 8-1 for the pipe identification labels.

Although these pipelines have low velocity during the average dry weather flow, it is anticipated the pipeline will be scouring periodically during the peak dry weather flow and wet weather flow during this Phase 1 interim development condition. Also, it is important to note that the flow velocity is closely tied to the constructed slope of the pipe. Currently, the pipe slope has been set using the existing ground elevation data to calculate the cover above the pipe. It is possible that these velocities can be increased by raising the finished ground elevation at these critical locations during the SOM mass grading design phase. A higher finished ground elevation will allow the pipe slopes to be increased, therefore increasing the minimum flow velocities.

8.3 SOM Infrastructure – Full Buildout

The final phase of the SOM development assumes that the remaining buildings in the SOM will be built, as well as the remaining buildings proposed for the full West Campus development. The sewer lines built during Phase 1 will be utilized and the secondary connection in University Avenue will be made to convey wastewater flow from east of Cranford Ave.

The entire SOM development, the existing 8-inch UCR sewer line, and the majority of the remaining West Campus Development contribute to the primary connection point creating a total peak flow of 6.1 cfs. This is an increase of approximately 5.3 cfs flow to the existing city system at Chicago Ave and 12th St via the existing UCR 8-inch sewer line.

The secondary connection point is at an existing manhole at the intersection of Cranford Ave. and Everton Place. There is an existing 8-inch sewer line leaving this manhole flowing in a northerly direction, and a proposed UCR sewer line entering this manhole from the south. A total of 8 new family-student housing units will contribute flow to this connection point, thereby increase the flow to the existing system by 0.22 cfs.

The proposed sewer system for the final builtout condition is shown in Figure 8-2. The StormCAD results have been included in the Appendices. Our analysis shows that all pipes meet the adopted design criteria for this full build out condition.

The significant differences between this analysis and the results of the sanitary sewer analysis provided in the WCIDS are itemized below.

- The City connection point at MLK Blvd and Cranford Ave can not be used.

- The City connection point at Everton Place and Cranford Ave only receives an increased flow of 0.22 cfs from the contributing 4.5 acre area, as opposed to the 1.4 cfs flow increase generated by the 48 acre of tributary area noted in the WCIDS.
- The City connection point at the east end of Everton Place is likely receiving an increased flow of 0.5 cfs from the contributing 27 acre area, as opposed to the 0.13 cfs increase generated by the 7 acre area noted in the WCIDS. Note that it was not in our scope of work to determine the flow to this connection point, nor did we verify that this connection point provided for minimum cover. The 0.5 cfs flow estimate was calculated out of necessity for the SOM focused study.
- A new City connection point is set adjacent to the intersection of Chicago Ave and 12th St. The entire SOM development, the existing 8-inch UCR sewer line on Chicago Ave, and the majority of the remaining West Campus Development contribute to this point, creating a total peak flow of 7.1 cfs. This is an increase of approximately 6.3cfs of flow that reaches the existing City system via that existing UCR 8-inch sewer line.

8.4 West Campus Infrastructure – Additional Evaluation Items

The following is a list of improvement considerations for the existing City sewer system, as a result of this revised sewer study.

- The existing City sanitary sewer pipeline on Chicago Ave will need to be upsized. It is likely that a 15 inch diameter pipe will be required.
  - Option 1: The City can run a new parallel sewer line offset 10 feet to the east of the existing 42 inch water main resulting in an offset of approximately 17.5 feet from the centerline of Chicago Avenue.
  - Option 2: The City can upsize the existing 8 inch line that is currently offset approximately 35.5 feet west of the Chicago Avenue centerline.
- The City should verify their current plans to construct a new 18 inch sewer line on University Avenue between Canyon Crest Boulevard and Chicago Avenue based on the revisions identified in this sewer analysis.

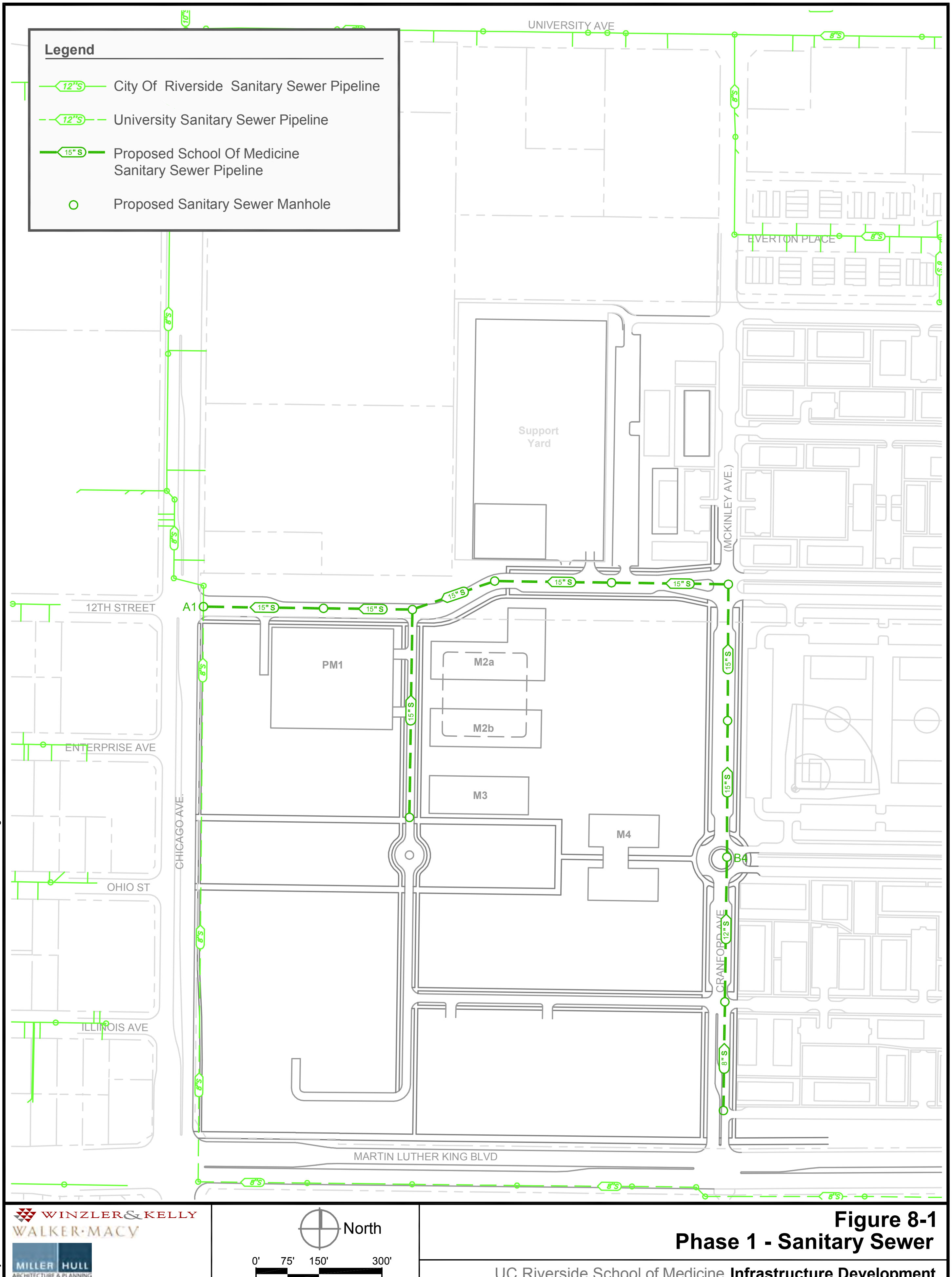


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Figure 8-1
Phase 1 - Sanitary Sewer

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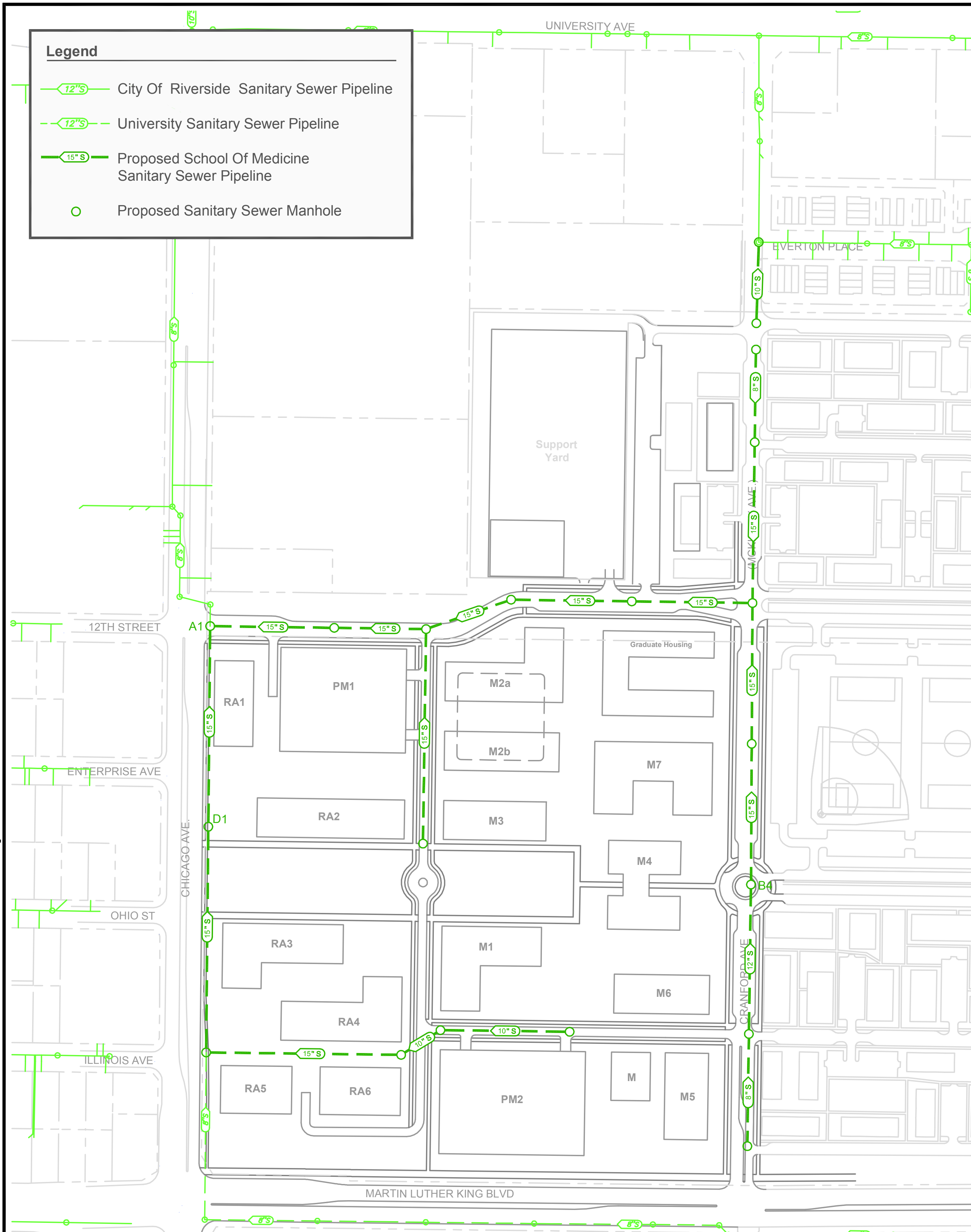

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 8-2 FINAL SS.dwg 06-23-09 11:51:18AM PScheetz

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North
0' 75' 150' 300'

Figure 8-2
Final - Sanitary Sewer

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9.0 STORM DRAIN

This section summarizes the evaluation of the storm water collection system concepts for the proposed School of Medicine (SOM) development.

The existing storm drain infrastructure surrounding the SOM used for our analysis was based on the information provided in the 2005 Long Range Development Plan (LRDP) Environmental Impact Report (EIR) and in the West Campus Infrastructure Development Study (WCIDS). The information was further verified and supplemented by the system mapping provided in the City of Riverside's CADME database, and As-Built drawings from the City's electronic archives on the City's website. Per these data sources, the storm drain pipelines at the vicinity of SOM were mapped in AutoCAD.

The SOM and the West Campus are located within the Box Springs watershed. The storm drain pipeline system adjacent to the SOM is maintained by the Riverside County Flood Control and Water Conservation District (District). There are also local stormwater collection pipelines smaller than 36-inch diameter that are maintained by the City of Riverside (City). This stormwater collection system analysis mainly focuses on utilizing the District's storm water collection pipelines to convey runoff from the SOM site.

There are three main District pipeline systems in the vicinity of the SOM:

- Line F is located at the east of the SOM site along Cranford Ave. This pipeline ranges from 66 inches to 72 inches in diameter. It flows south to Martin Luther King Blvd connecting to the District's Line E pipeline along Martin Luther King Blvd.

- Line E is located along Martin Luther King Blvd. It is a 75-inch diameter pipe and runs westerly down to the existing District stormwater retention basin at Kansas Ave.

- Line C is located at the intersection of Chicago Ave and 12th St. This 30-inch diameter pipe runs along 11th St, and then along 12th St. The pipeline ultimately connects to the storm drain pipeline on Sedgwick Ave. Currently, the SOM site has a concrete swale located adjacent to the future NW Mall alignment. This swale connects to a 24-inch lateral pipe at the Chicago Ave. and 12th St. intersection to Line C.

The existing topography data at the SOM site shows that the site generally slopes from Martin Luther King Blvd and Cranford Ave, northwest to Chicago Ave. and 12th St. Therefore, storm water surface runoff generally follows the surface grading and flows to the intersection of Chicago Ave. and 12th St. at the northwest corner of the SOM site.

This surface runoff pattern is different than the assumptions stated in the WCIDS. As a result, unless the SOM site will have significant surface re-grading, the majority of stormwater runoff from the SOM site will likely flow to Line C instead of Line E or Line F.

The District prepared a Master Drainage Plan in the 1970s to estimate the watershed design flow and to size the Line E, Line F, and Line C systems. The plan indicated that the District storm drain pipeline system has a 10-year storm design capacity. Runoff above a 10-year storm becomes overland flow on the street.

9.1 Basis of Design/System Criteria

The design criteria for the onsite storm drain system for the SOM site mainly follows the District's Hydrology Manual. The overall flood control design criteria are as follows:

- 10-year flood shall be contained within the street top of curb limits.
- 100-year flood shall be contained within the street right-of-way limits.

The future post development 10-year flow that exceeds the District's storm drain system design capacity must be detained onsite. The pipeline design capacity is defined based on the analysis result from the District's Master Drainage Plan. The specific pipeline design capacity data is documented in the City's storm drain pipeline record drawings. For example, the design capacity of Line C at Chicago Ave. and 12th St. is 32.5 cfs, based on the City's record drawing D465. The objective of our design is to ensure the future design flow from the SOM will not overload the District's storm drain system.

In addition, if under the base case condition as defined in the Master Drainage Plan, the 100-year flood extends beyond the street right-of-way limits, onsite detention is needed so that the future post development 100-year flood would not be greater than the existing base case 100-year flood. Note that in this scenario the onsite detention is not meant for detaining the full 100-year flow, rather it is designed to detain the excess flow that exceeds the existing base case 100-year flood condition. The base case condition is defined as the development condition used in the hydrology analysis in the District's Master Drainage Plan, rather than the existing land use which is agricultural research fields.

The following is the hydraulic design criteria for the onsite pipeline system. Most of the criteria are consistent with the WCIDS design criteria.

- Minimum design velocity = 2 fps under the 10-year design flow
- Maximum design velocity = 20 fps under the 10-year design flow
- Minimum pipe slope = 0.0010
- Minimum pipe size = 18 inches in diameter
- Pipe material = Reinforced Concrete Pipe (RCP), with the Manning's pipe friction loss coefficient (n factor) of 0.013

Design Flow and Detention Volume Estimate

The design flow estimate procedures for the discharge rate to the District's pipeline system, the overland flow release rate, and the onsite detention volume are outlined as follows:

10-Year Storm - Estimate the 10-year runoff from the proposed SOM development**:**

1. In order to estimate potential onsite detention volume, the analysis is based on the Synthetic Unit Hydrograph Method as defined in Section E of the District's Hydrology Manual. The

Synthetic Unit Hydrograph analysis is also developed for the existing base case condition, so it can be calibrated to match the peak flow estimate in the Master Drainage Plan. Note that the District's Master Drainage Plan used Rational Method for hydrology analysis.

2. Compare the estimated 10-year peak runoff from the proposed future development condition with the peak flow estimate from the existing base case condition in the Master Drainage Plan.

3. If the estimated 10-year runoff from the proposed future development condition is larger than the existing base case condition in the Master Drainage Plan, or the Line C pipeline design capacity, provide a pipe inlet restriction to the District's Line C pipeline system, and provide on-site detention basin to detain the excess peak flow from a 10-year storm.

100-Year Storm - Estimate the existing base case condition 100-year peak flow using both the Rational Method and the Synthetic Unit Hydrograph Method**:**

4. Calibrate the Synthetic Unit Hydrograph analysis to match the peak flow estimate using Rational Method. Then develop a Synthetic Unit Hydrograph analysis for the proposed future SOM development condition.

5. Subtract the pipeline capacities and the on-site detention basin attenuation (estimated in Step 3) from the future 100 year SOM peak flows. The result becomes the "100-year minus 10-year" runoff for street overland flow.

6. Prepare street overland flow analysis on 12th St, between Chicago Ave and Ottawa Ave. For the purpose of the hydraulic analysis, the beginning water surface elevation for the downstream boundary conditions will be set at the top of curb. If the hydraulic analysis shows that the SOM runoff will cause street flooding beyond the right-of-ways and in wider extensions in comparison to the existing base case condition, an on-site detention is needed to detain the excess flow above the existing base case 100-year flow.

Note that in the WCIDS, the design flow estimate is based on the Rational Method. Since the Rational Method can only estimate the design flow, not the design volume that is needed to size the detention basins, our analysis primarily used the Synthetic Unit Hydrograph Method instead of the Rational Method for flow estimates.

A summary of the design flow estimate for SOM is as follows:
- Base Case Condition 10-Year Peak Flow = 44 cfs
- SOM Builtout 10-Year Peak Flow = 30 cfs
- Base Case Condition 100-Year Peak Flow = 63 cfs
- SOM Builtout 100-Year Peak Flow = 52 cfs

Since the SOM Builtout flow is lower than the base case flow, no onsite detention is needed to attenuate the peak flow. However, the 100-year overland flow analysis indicated capacity deficiency along 12th St. In order to alleviate the overland flow capacity deficiency, approximately 0.5 ac-ft of onsite detention is needed. Please refer to the *UCR – West Campus Development Storm Drain Analysis Technical Memorandum* in Appendix 2 for the details of the analysis.

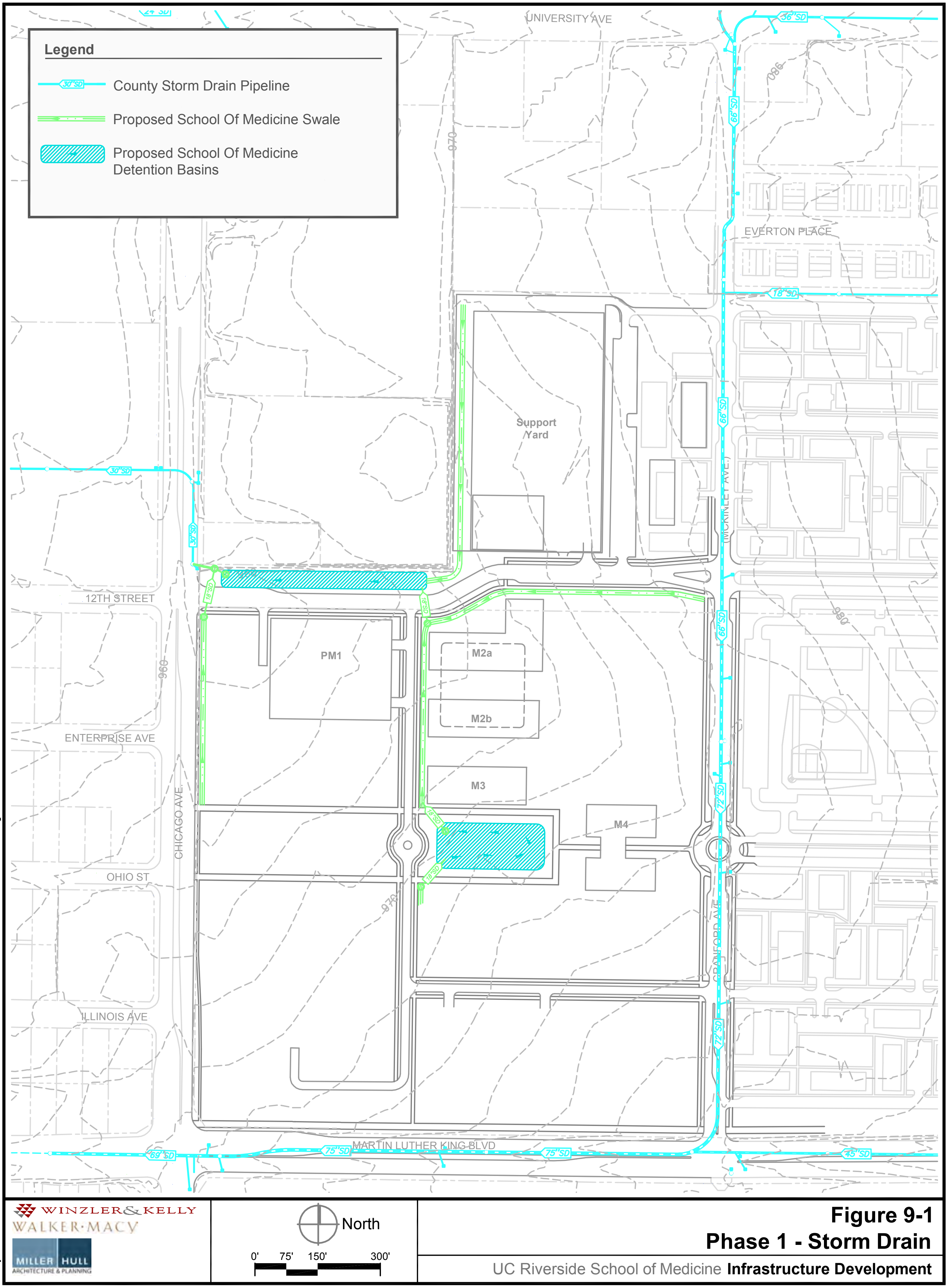
9.2 SOM Infrastructure Phase 1

The new storm water collection system to support the SOM development mainly consists of a combination of bioswales and retention basins as shown on Figure 9-1. The bioswales within the SOM site are dual purpose facilities for drainage and treatment. From the drainage standpoint, the bioswales collect storm water runoff in the campus either by overland sheet flow or via lateral pipe connections. The bioswale system routes the collected runoff downstream to the ultimate system discharge point at the District's 30-inch pipeline on Chicago Ave. and 12th St. From the treatment standpoint, the bioswales allow runoff from a low intensity storm event to filter through the vegetation layers for treatment and percolation.

In the Phase 1 SOM development, there are two retention basins located at the Central Mall and at the northern edge of the NW mall. The retention basins are mainly to detain excess flow that exceeds the District's pipeline system and overland flow capacity, as well as provide stormwater quality treatment. The basin at the northern edge of the NW mall will mainly serve as peak flow attenuation (up to approximately 0.5 ac-ft), and the basin at the Central Mall will mainly serve as stormwater treatment. The basins, especially the one at the Central Mall, are envisioned to be dual use facilities. During the dry period it is a natural open space with landscape features. During a high storm event the basins allow stormwater ponding and percolation.

The existing grading defines the stormwater overland flow pattern, from the southeast corner of the site towards the Chicago Ave. and 12th St. intersection at the northwest corner. As shown in Figure 9-1, two north-south bioswale systems are placed to intercept stormwater runoff from the eastern half and western half of the SOM site respectively. During the Phase 1 development condition, these two bioswales also convey runoff from the temporary drain bioswales in the remaining Field 5 at the southern portion of the SOM site. In addition, a north-south bioswale along the west side of the support yard is needed. This bioswale along with the bioswale systems in the main SOM site interconnects with the retention basins.

For some of the buildings such as M7 and M4, it is anticipated that storm drain lateral pipelines would be needed to route the stormwater runoff to the nearby bioswale or retention basin.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 9-1 PH1 SD.dwg 06-23-09 11:51:11AM PScheetz

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Figure 9-1
Phase 1 - Storm Drain

UC Riverside School of Medicine **Infrastructure Development**

9.3 SOM Infrastructure – Full Buildout

The storm water collection system for the full buildout of SOM development will expand upon the Phase 1 infrastructure already in place as shown in Figure 9-2. During the final Phase SOM development, the remaining field at the southern portion of the site will be removed along with the temporary runoff swales. The two north-south bioswales will extend further south to Martin Luther King Blvd, and an additional bioretention basin will be placed on the Central Mall, as shown in Figure 9-2. In addition, the new buildings will need additional lateral pipeline connections to the bioswale systems, as well as LID design features as described in the following section.

Note that this storm water collection system design concept is different than the WCIDS design concept. The WCIDS design concept mainly utilized the District's Line E and Line F systems for stormwater collection. However, as mentioned in previous sections, due to the existing site grading, it is more efficient to allow storm water to follow the natural routing path to the low point at Chicago Ave. and 12th St., connecting to the District's Line C system. Therefore, it is anticipated that only a small portion of the site adjacent to Cranford Ave. and Martin Luther King Blvd. may have stormwater release to Line E and Line F via surface sheet flow to the street catch basins.

Also, this analysis is based on the assumption that the SOM onsite storm drain system does not need to handle offsite runoff including stormwater runoff from the areas east of Cranford Ave. It is anticipated that stormwater runoff from east of Cranford Ave will either be collected by the storm drain systems on Cranford Ave, Iowa Ave, and Martin Luther King Blvd, or be detained by onsite detention basins located east of Cranford Ave. The University commissioned a separate storm drain system study to develop the planning level design concept for the overall West Campus stormwater collection system (See the *UCR – West Campus Development Storm Drain Analysis Technical Memorandum* in Appendix 2). The West Campus study validates the offsite runoff assumption used in this analysis.

9.4 Water Quality and LID Implementation

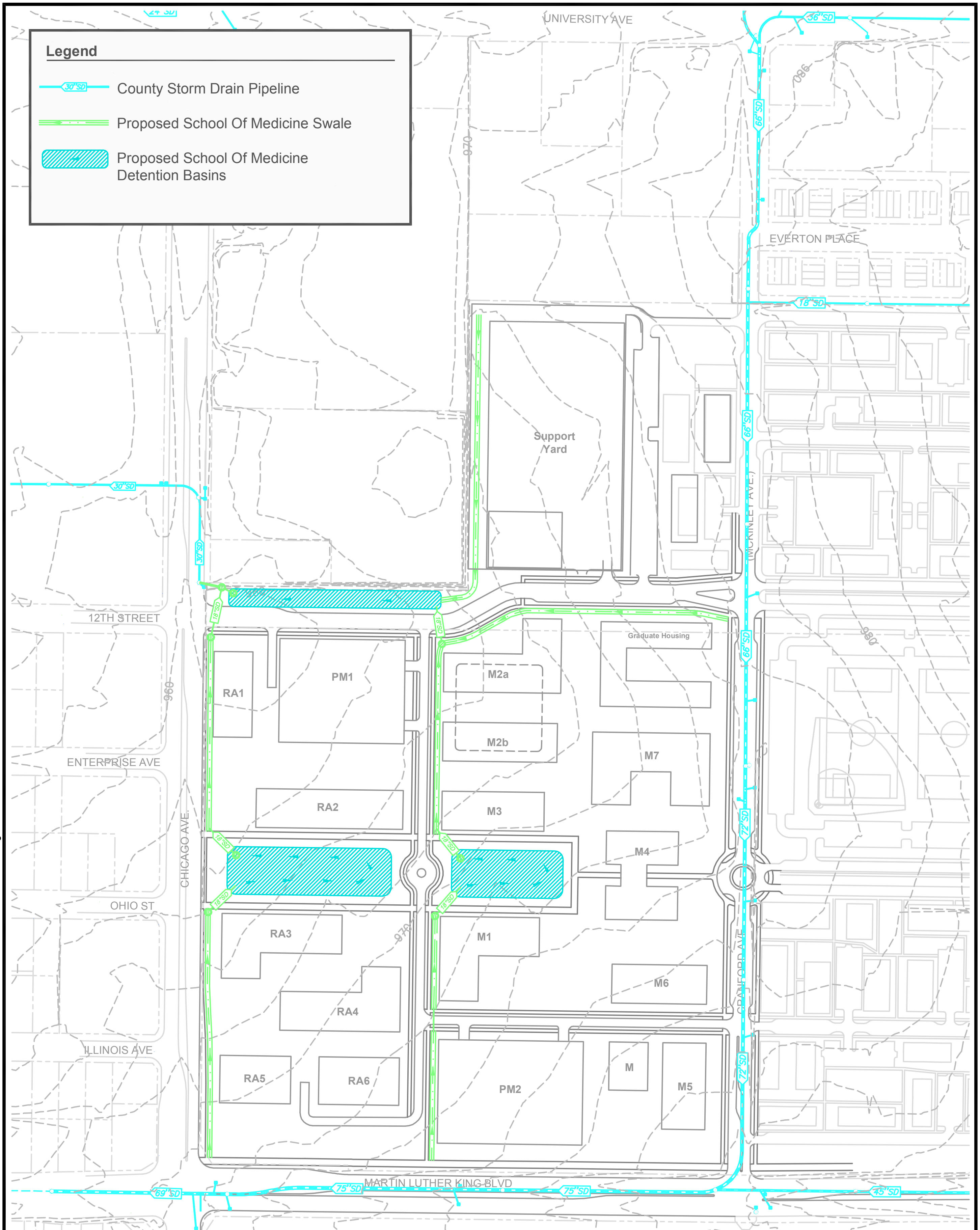
In addition to the aforementioned bioswales, retention basins, and lateral pipeline system, another main feature for the proposed SOM stormwater system is various Low Impact Development (LID) design concepts for each building and the surrounding open spaces. The overall objective of the LID design features is to minimize the change of the stormwater runoff pattern resulting from the development, and provides stormwater infiltration, treatment, and reuse functions as much as feasible.

In the SOM development, the single largest category of impervious area is building roofs. There are LID features such as green roofs that can mitigate the impervious surfaces at the roof tops. However, since the available roof space can be more beneficial to house solar panels, the green roof is not as cost efficient as solar panels. Instead, to minimize roof top runoff, each building can install a series of rain barrel systems at the roof drain pipes to promote stormwater infiltration. The rain barrel systems have a variety of design configuration. For example, the barrel could have a gravel layer at the bottom, open to the ground. During a storm event, stormwater collected from the roof drain will infiltrate into the ground via the gravel layer. During a larger storm event, excess stormwater that cannot infiltrate will then overflow to a bypass pipe connection between the rain barrels and the bioswale system for stormwater treatment, retention, percolation, and, if needed, discharge.

In addition to the rain barrels, in the open space throughout the campus, the landscape design should minimize the paved areas. It should include the use of pervious pavers for the walkways and access ways, condense and minimize asphalt pavement for roadways and parking spaces, and utilize landscaped areas wherever feasible to allow treatment, retention, percolation, and discharge, as necessary.

The effectiveness of the LID features greatly depends on the soil condition. Based on Appendix 5 of the Campus Storm Water Management Plan, the soil at the SOM site is mainly sands and silty sands, which are good for infiltration. As part of the LID implementation planning and design, the University should obtain additional geotechnical data, especially the soil permeability data and the groundwater table data, to evaluate the LID infiltration capacity.

Note that the design of the LID will need to be in compliance with the UCR Campus Storm Water Management plan as well as the City of Riverside's requirements for the project specific Water Quality Management Plan.



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North
0' 75' 150' 300'

Figure 9-2
Final - Storm Drain

UC Riverside School of Medicine **Infrastructure Development**

10.0 CENTRAL PLANT

The SOM Central Plant will provide chilled water and heating water to the SOM campus which will consist of several critical facilities including Medical Research Labs and a Vivarium in addition to the Education, Office, Ambulatory, Medical Office and Housing. The importance of the critical facilities dictate that the Central Plant be conservatively sized and allowed to expand to meet the phased development in a planned manner with expansion space and central systems sized for a conservative full build out.

Over time, plans change with respect to type of use, amount of square footage served, more energy efficient buildings, expansion of boundaries not anticipated at the planning level. It is important to implement conservative planning to allow the central plant and its distribution system to be developed at the beginning of the project so that the infrastructure will stand the test of time without major reconstruction projects to satisfy unanticipated changes in the plan.

The UCR Steering Committee has also provided some guidance with respect to what should be considered in the Central Plant (CP) and the Site Distribution system.

- Redundancy needs to be built into the CP and the distribution system to keep critical facilities in operation during interruptions in central services delivery.
- A proposed Medical Campus south of the SOM will not be included in the CP sizing.
- Process steam would be provided locally at buildings requiring it which would allow a heating hot water system to be developed at the CP in lieu of a central steam system.
- Medical gases would be not centralized but be located with the facility requiring them.
- Utility tunnels large enough for potential future loads need to be incorporated into the initial construction.
- A service tunnel system is desired for the critical facilities buildings.
- Housing outside the boundaries of the SOM will not be included in the load analysis
- Facilities design criteria from the Office of Statewide Health Planning and Development (OSHPD), if imposed on any of the planned SOM campus buildings, will be the responsibility of the individual building funding and design. OSHPD related construction reviews and costs will not be included in the Central Plant planning at this point.

The funded SOM Central Plant will require detailed modeling of the Campus building loads and the operational sequences of the central plant equipment to meet those loads. A comprehensive Energy, Loop Flow, Carbon Footprint, and Central Plant Equipment model will be developed and used as a tool for the Phase 1 development. This same model can then be used for plan updates and sequence of construction impacts on the Campus systems in place.

The Design Criteria described below will be updated in the next step of the design process.

10.1 Basis of Design/System Criteria

Cooling

The WCIDS developed cooling loads based on 20% and 45% better than Title 24 (T-24) required energy performance for each use type. The energy use target to outperform Title 24 by at least

20% and an aspiration of 30% will be pushed to the buildings being served and documented during their design process. The Central Plant must serve whatever the load ends up being with redundant capacity built in.

This project team reviewed the loads presented in the WCIDS and reviewed published ASHRAE and PG&E design criteria for each type load, completed a load calculation of the full build out SOM buildings complying with T-24 using low, medium, and high ventilation rate scenarios for the research, vivarium and medical facilities, and also compared loads from projects completed by the project team to the WCIDS loads.

The range of ventilation rates utilizing 100% outside air will dramatically change the building loads as indicated in the "Calc" column in Table 10-1. The calculated loads by building type are then reviewed for heat recovery opportunities in the high air change facilities. Applying a run around heat recovery system to the laboratory facilities resulted in a 20% decrease in energy consumption for those facilities and 5% overall. Heat recovery is more difficult in laboratory facilities due to contamination issues. The results are indicated in the "HR" column of Table 10-1.

These load comparisons based on square feet per ton of peak cooling load by type of facility are presented in Table 10-1.

TABLE 10-1
COOLING LOAD CRITERIA COMPARISON

Building	Use	WCIDS SF/TN	ASHRAE SF/TN	Calc SF/TN	Calc HR SF/TN	EXP SF/TN	PG&E Study SF/TN	W&K Team SF/TN
M4	Ed/Off	350	185	333-249		400-300	240-185	250
MV	Vivarium	300		236-149		250-109		150
H1	SOM Housing	450	550	544-382		550-450	450-400	450
RA1-6	Research/ Ambulatory	300		250-151		280-200		250 *
M1-7	Research Lab	300		236-151	264-168	280-200		200
M5-6	Ambulatory	300	220	264-249		280-230	275-220	230

* For the future Research/Ambulatory (RA) buildings, a less conservative "low" ventilation rate scenario was used and thus is not as conservative as the rest of the SOM demand calculations. The previous designation for these buildings was Medical Office Building (MOB) which had a low demand factor.

The project team then used the conservative values from the bracketed information for the SOM Central Plant sizing design basis. The largest differences from the WCIDS load factors were in the critical facilities such as the Vivarium and Research Labs which have a high air exchange rate of 100% outside air. The WCIDS represented loads close to the least conservative ventilation rates and load factors mentioned above.

The resulting loads for the Full SOM Campus shown in Table 10-2 were calculated from these load factors in addition to a building square footage factor based on increasing buildings beyond Phase 1 an additional story above the programmed level with a maximum height of five stories.

This results in an overall factor of 6.8% that could also accommodate changes in use in some of the future buildings beyond Phase 1 of the SOM.

TABLE 10-2
DIVERSIFIED PEAK LOADS- CHW W/TES

Design Year	SF Millions w/o parking	CHW Tons	CHW / w HR Tons	CP Size Tons
WCIDS 2020	1.885	4,129	3,118	3,850
W&K 2020 SOM	1.891	6,147	5,840	
W&K 2020 SOM max	2.020	6,528	6,200	6,000
W&K 2017 SOM Phase 1 max	0.492	1,907	1,811	2,000

This methodology presents a conservative requirement for Central Plant size and space allocation and loop pipe sizing. The resulting load basis was compared with WCID sizing.

The Heat Recovery or "HR" column represents the 45% better than T-24 value from the WCIDS whereas the W&K values represent a 5% across the board allowance for heat recovery from some of the 100% outside air facility uses that would allow heat recovery reduction from calculations by the project team.

The major differences in the resulting Central Plant size when compared to the WCIDS are attributed to:

- The conservative, but justified, approach is selecting and applying the load criteria; (The James H Clark Center at Stanford has a cooling 109 sf/ton connected chilled water load.)
- Much higher cooling requirements for high air change uses of outside air for the Medical Research Labs and Vivarium uses which represent more than 30% of the total square footage with air exchange rates from 6-15 air changes per hour for 60% of the space within the facility;
- 6.8% attributed to the potential increase in area or type of use;
- Use of a Diversity factor of 80% in lieu of 70% used in the WCIDS; and
- No load reduction recommended due to TES tank in current load analysis.

Heating

The methodology used for cooling was also used for comparing the WCIDS heating loads to calculated loads and to W&K Team experience loads from completed projects. The results are indicated in Table 10-3.

TABLE 10-3 HEATING LOAD CRITERIA COMPARISON						
Building	**Use**	**WCIDS BTUH/SF**	**Calc BTUH/SF**	**Calc w/HR BTUH/SF**	**EXP BTUH/SF**	**W&K Team BTUHSF**
M4	Ed/Off	18	32-43		20-30	30
MV	Vivarium	22	57-90		65-93	65
H1	SOM Housing	24	19-26		20-25	25
RA1-6	Research/ Ambulatory	22-24	39-80		40-60	35 *
M1,2,3,7	Research Lab	22	55-80	43-68	40-60	60
M5-6	Ambulatory	24	39-43		40	40

* For the future Research/Ambulatory (RA) buildings, a less conservative "low" ventilation rate scenario was used and thus is not as conservative as the rest of the SOM demand calculations. The previous designation for these buildings was Medical Office Building (MOB) which had a low demand factor.

The resulting Central Plant size is shown in Table 10-4

TABLE 10-4 DIVERSIFIED PEAK LOADS-HHW				
Design Year	**SF Millions w/o parking**	**HHW MMBTUH**	**HHW / w HR MMBTUH**	**CP Size MMBTUH**
WCIDS 2020	1.885	35	26	44
W&K 2020 SOM	1.891	77	74	
W&K 2020 SOM max	2.020	83	79	78
W&K 2017 SOM Phase 1 max	0.492	24	23	24

The heat recovery (HR) column reflects heat recovery in a portion of the 100% outside air lab space estimated at 5% overall using run around loop type heat recovery while it reflects the 45% better than T-24 load and sustainable recommendations in the WCIDS.

The major differences in Central Plant sizing when compared with the WCIDS include:

- The conservative, and justified, approach in selecting and applying the load criteria; (The James H Clark Center at Stanford has a heating connected load of 93 btu/sf.)
- The basic heating requirement difference in the load factor across the board;
- Much higher heating requirements for high air change uses of 100% outside air for the Medical Research Labs and Vivarium uses which represent more than 30% of the total square footage with air exchange rates from 6-15 air changes per hour for 60% of the space within the facility; and
- 6.8% attributed to the potential increase in area or type of use.

The Peak Heating load during the heating season is a factor of 6 or more of the average load. Central Plant size is based on a diversified peak load of 80% and a 20% allowance for Central Hot Water, Domestic Hot Water, and Process Hot Water in the Lab and Vivarium facilities. Central Plant sizing is a matter of capability for peak design day conditions with an allowance for diversity.

Chilled Water Plant Delta T

The WCIDS developed a 30° delta temperature (ΔT) design criteria for the chilled water Central Plant. It was felt by the project team that this was an admirable goal but may be difficult to reach. The WCIDS piping systems were sized for 25° ΔT to allow for some system variation and extra capacity.

The main advantages are:

- Lowers the volume of required chilled water
- Reduces pumping energy if all the load side buildings meet the criteria
- Allows smaller loop piping mains and lower initial capital cost
- Allows a smaller Thermal Energy Storage system
- Smaller pumps and ancillary equipment

The disadvantages of a 30° ΔT system are:

- The load side buildings would have increased air handler costs to a minor degree
- The coil selections on the load side buildings would be increased in size and cost
- There would be an increase in fan energy on the load side to a minor degree
- If the load side goals are not met the distribution system and thermal storage system would be undersized at some point
- Enforcement of load side design criteria over 20-30 years may be overshadowed by budget constraints
- In the future there is little flexibility other than operating at higher pressures if additional flow is required probably at a higher cost than today.

The following Design Criteria approach is recommended to UCR:

- Reduce load side energy use by design to 30% less than T-24.
- 30° ΔT for operation of the chiller system will be a goal
- Size the chiller plant for 20°-30° ΔT
- Size the loop piping for 7 FPS and 20° ΔT to allow future system capacity and redundancy
- Size the thermal storage system for 20° ΔT
- Develop standards for the load side designers that are reviewed by the future Central Plant design team and UCR Facilities Team
- Conduct a formal review of all future SOM building designs and their impact on the Central Plant system relative to the above criteria

Thermal Energy Storage (TES)

Thermal Storage for the chilled water system was recommended in the WCIDS. UCR has a unique power incentive for the entire campus from the City of Riverside. There are no demand charges for the entire campus as long as UCR includes a thermal storage system as part of their Central Cooling Plant system. The East Campus currently utilizes a series of TES Tanks buried into the hillside around the campus and central plants.

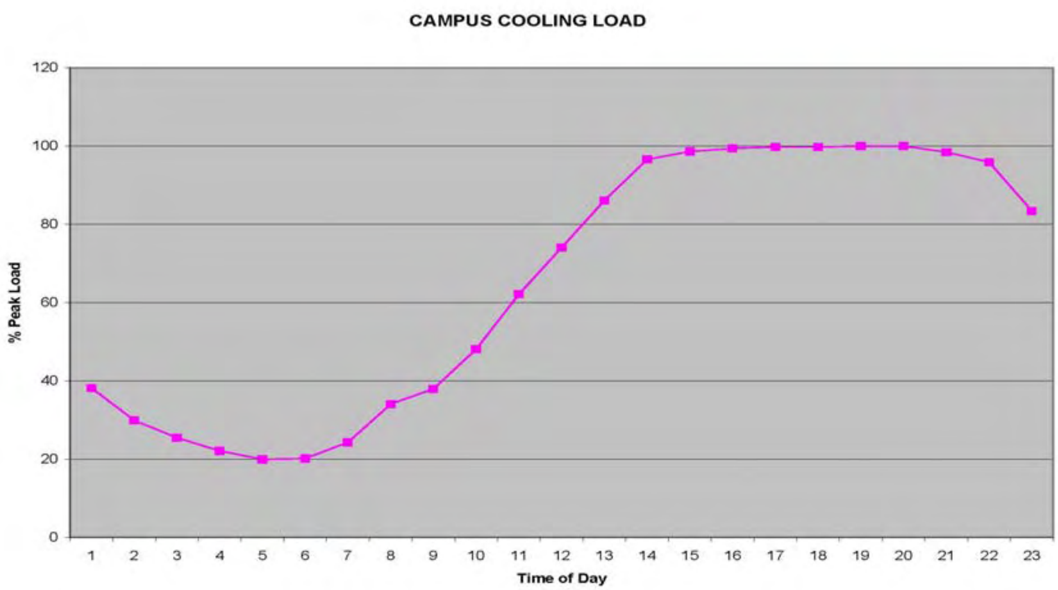
During a designated 6 hour peak the chillers must remain off line and campus cooling is accomplished from the TES tanks which are maintained at 38°F and operated at a 20° ΔT. This same concept will be incorporated into the SOM Central Chiller Plant scheme to allow the same kind of power agreement to be negotiated with the City. The campus rates are scheduled to increase to $0.0725/KWH in 2010 with no demand charges.

The project team has taken a closer look at Ice Thermal Storage versus Chilled Water Storage.

The purpose of TES whether it is chilled water or ice is to obtain the favorable electricity rates without demand charges to UCR. Indirectly, use of TES tanks affects the power supplier's generation capacity favorably during peak load conditions.

In Riverside the peak load lasts longer than the regulated six hours as shown in Figure 10-1 below.

Figure 10-1 Typical Peak Cooling Duration



The peak period lasts longer than the regulated 6 hours. It can last from 6 to 11 hours and occurs more than 300 hours per year. The impact of this is that the Central Cooling Plant cannot be downsized since it will have to meet the load during the unregulated time and recharge the TES storage system to be ready for the next cycle unless further modeling during the design process proves otherwise.

Critical facilities in the SOM require cooling systems to be there when needed without relaxing the cooling requirements.

Comparison of the technology was completed in the sustainability section of this study. UCR developed an interest in ice TES and the project team completed the following comparison of TES ice versus chilled water based on equivalent sizing criteria.

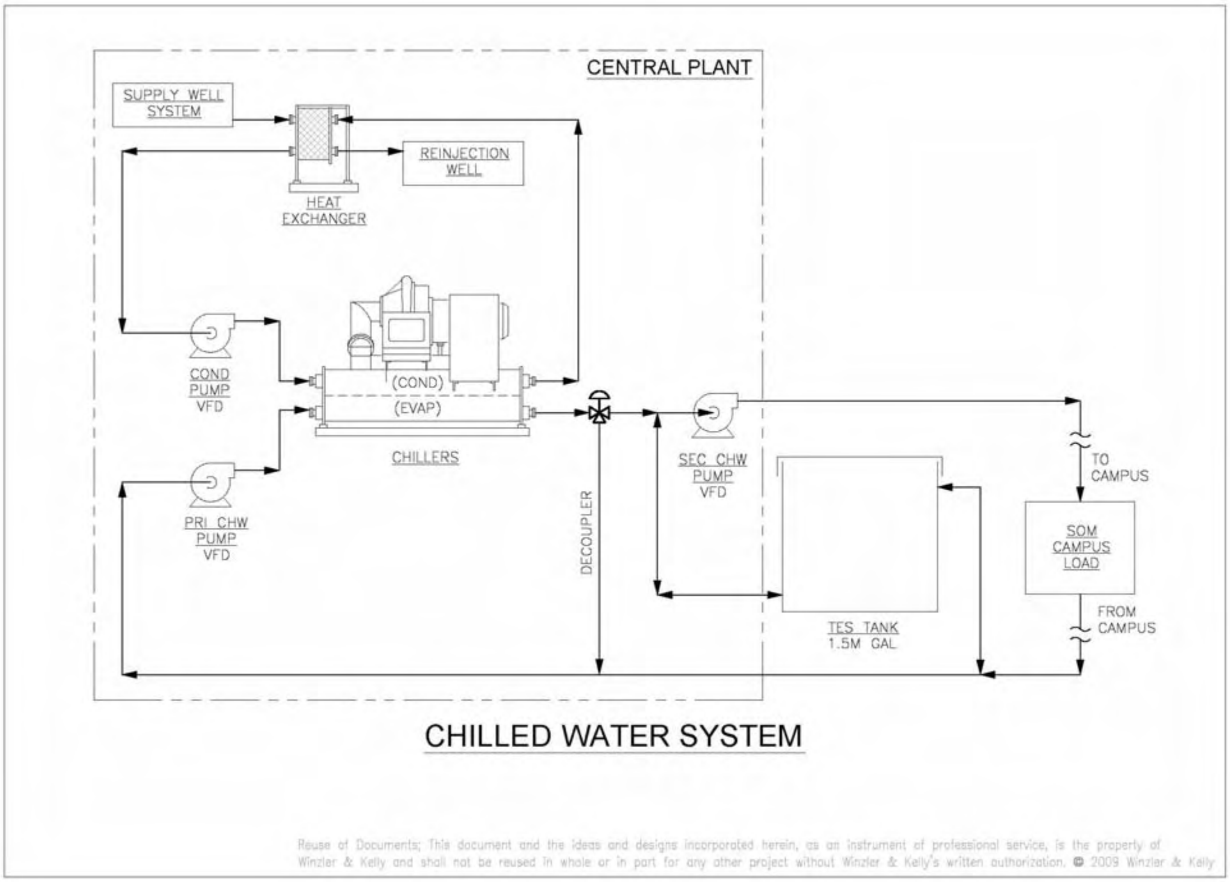
Using the loads developed in this load analysis, the TES chilled water system was sized as summarized in Table 10-5. Full build out and Phase 1 SOM were reviewed at both 25° ΔT and 20° ΔT operation of the Chilled Water system. The tanks were sized according to the ASHRAE Cool Thermal Storage Design Guide with a Factor of Merit of 0.9 to account for the usable water volume.

TABLE 10-5
TES CHILLED WATER STORAGE

	CHW -25° ΔT Ton-HRS 6 hours max /Gallons	**CHW -20° ΔT Ton-HRS 6 hours max /Gallons**	**Dimensions 20 ° ΔT Diameter x HT**
WCIDS	24,000 T-HR 1.6 MMG		65 ft by 60 ft
2020 SOM max	34,000 T-HR 2.1 MMG	34,000 T-HR 2.7 MMG	92 ft by 60 ft
2010 Phase 1	12,000 T-HR 0.8 MMG	12,000 T-HR 0.9 MMG	53 ft by 60 ft
2010 Phase 1- Alt	23,500 T-HR 1.5 MMG	19,000 T-HR 1.5 MMG	65 ft by 60 ft

The WCIDs used a design criteria of 25° ΔT whereas a 20° ΔT was used in this sizing analysis. If the 20° ΔT sized system is pushed to 25° ΔT then additional capacity is realized. For the ice to CCW comparison a 1.5 MMG TES Tank was used. The system simple schematic for a TES Chilled water system is shown in Figure 10-2.

Figure 10-2 Central Plant with TES



The Ice Builder system considered was a closed loop modular tank system using a special glycol chiller and modular ice on coil ice builders to develop the storage system using the phase change from liquid to solid. Additional equipment includes a system Heat Exchanger to isolate the glycol loop from the secondary loop to the SOM campus.

When equivalent tonnage systems for the Phase 1 SOM the following results were noted.

- The cost of a 1.5 MMG TES chilled water tank buried 50% into the ground versus a 3,000 ton ice TES system was about the same
- Chiller energy operating efficiencies were more favorable to the TES water system operating between 0.6-0.7 KW/ton versus 0.85-1.4 KW/Ton for the ice system
- The TES Ice had a smaller footprint on the site
- Taking into account additional pumping head requirements for the TES water system by adding backpressure control to alleviate concerns about losing water out of the system from buildings served that are higher than the tank, the TES Ice had greater head loss requirements through the ice builders and heat exchangers and a higher KW/ton operational cost resulting in an estimated annual difference of $250,000/yr.
- The TES Water was a less complicated system with respect to controls
- The TES Water had less maintenance due to the fact that there was less equipment
- The TES Water uses standard chillers and no glycol
- The TES Water system would have a lower carbon footprint due to less energy consumption
- The TES Water is similar to what is currently installed on the East UCR Campus

Based on this comparison UCR has selected the TES Water system sized at 1.5 MMG one half the future tank volume sized for full buildout of the SOM Campus

Backup Fuel

The boiler plant will utilize natural gas as the primary fuel. The SOM campus criteria for backup fuel for critical facilities is 14 days of average load.

Applied to the Phase 1 Heating Load at the Central Plant and from a sample building heating load model during the heating season, the backup average load can be assumed to be 40% of the peak load during the heating season. This results in a propane synthetic natural gas backup requirement of a 22,000 gallon facility consisting of a liquid propane tank and a synthetic gas vaporizer and generator that will produce synthetic natural gas with similar BTU content as the natural gas serving the boiler plant.

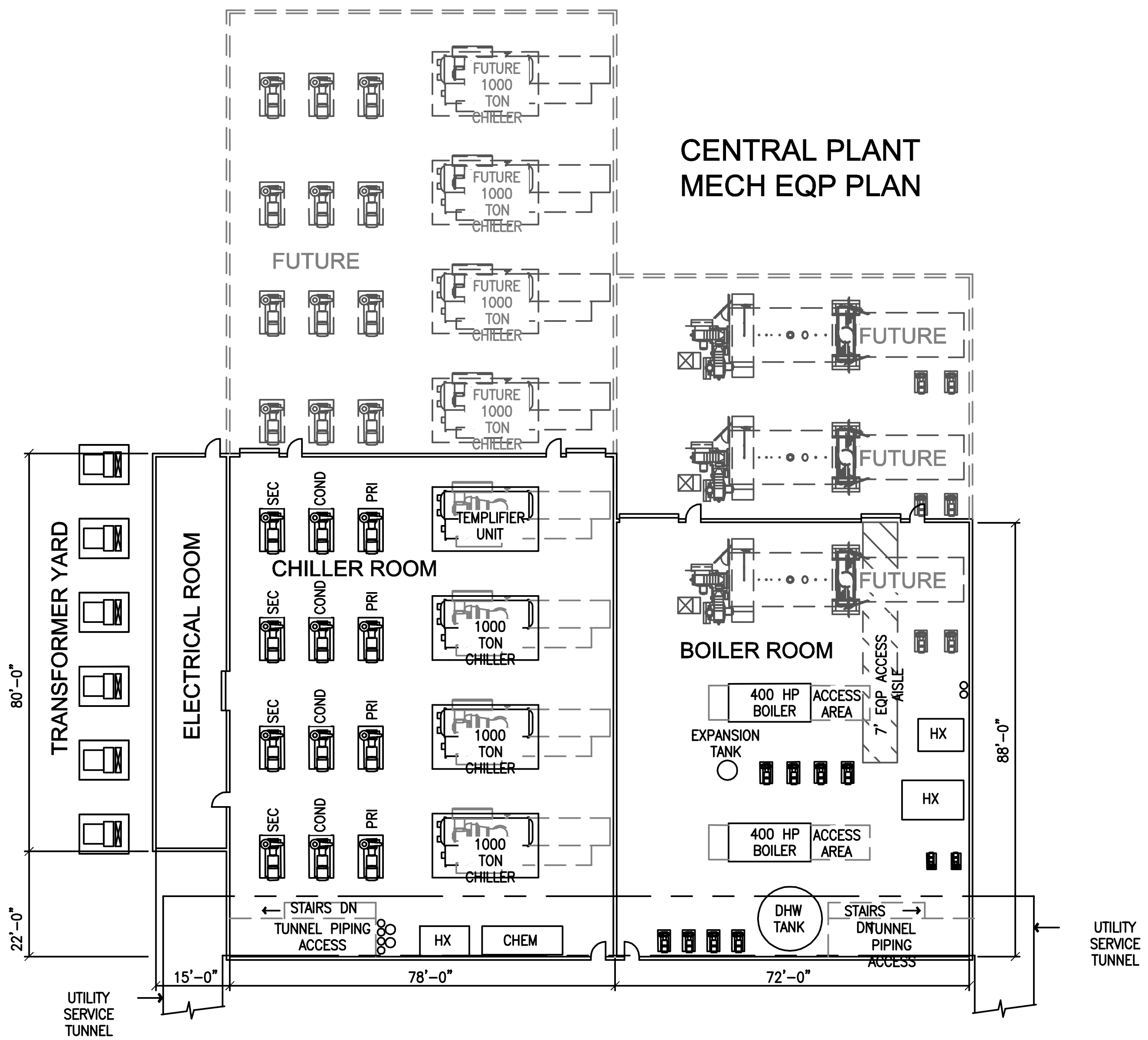
The tank size needs to be kept under 30,000 gallons to keep within the 50 foot setback requirements recommended by NFPA 58 for an underground tank of this size. In this case 30,000 gallons is a standard storage tank and a single tank would be required to provide the required backup for the central plant with additional reserve for future full build out of the SOM.

Underground versus above ground propane storage tanks were discussed. The State Fire Marshal has discouraged the use of above ground tanks so an underground system has been incorporated into the plan. Cathodic protection to avoid the risk of underground piping leaks over time has been incorporated into the design.

10.2 SOM Infrastructure Phase 1

Several schemes for organizing the central plant chiller plant and boiler plant were reviewed and developed during the Workshop sessions with the UCR Team. Key relationships were developed with respect to the site arrangement and the Central Plant Equipment which are reflected in the Support Yard Plan.

- The chiller plant and boiler plant need to be separated as required by code
- The chiller plant will have the largest electrical load and should be adjacent to the incoming electrical
- The incoming high voltage electrical and the transformers serving the CP and the emergency generators should be grouped
- The TES tanks should be as close as possible to the chiller plant to minimize piping costs
- If needed, cooling towers should be on the roof of the chiller plant to minimize Support Yard footprint, minimize piping, and allow air circulation
- Space for expansion for both the chiller plant and the boiler plant needs to be planned and designated as future Central Plant space. See Figure 10-3.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-3 CENTRAL PLANT.dwg 06-23-09 04:59:23PM PScheetz

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North

Figure 10-3
Central Plant Layout

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CHILLER PLANT

Chillers

The Phase 1 Chiller Plant is sized at 2,000 tons in 1,000 ton chiller increments with a 1.5 MG TES Tank. Centrifugal chillers capable of meeting the design criteria of operating between 20° and 30° ΔT will be selected.

The plant is arranged in a parallel chiller arrangement since chillers are available that can meet the 20°-30° ΔT criteria in a single stage arrangement. A large part of the time the plant will be recharging the TES tank and meeting the online demand. Chiller Plant optimization programs (CPOP) will be utilized to operate the chillers at peak efficiencies,

In the case of a 2,000 ton plant for Phase 1, two 1,000 ton chillers would be provided with an additional 1,000 ton online backup for a total of three. The size of the future chiller increment could be 1,000-1,500 tons and would fit into the full build out scheme depending on actual realized loads.

R-134a refrigerant is more compliant with sustainability guidelines with respect to ozone depletion as provided by most manufactures. R-123 as offered by Trane, the largest manufacturer, is also a low ozone depleting refrigerant but scheduled to be phased out in 2020.

The Central Plant chillers would be provided with Variable Frequency Drives and specified to meet the worst case design conditions at optimal full and part load efficiency values.

It is recommended that during the equipment selection process once the final load has been confirmed that the chiller plant equipment be packaged into a performance specification and provided by one manufacturer to provide the most efficient chiller/condenser cooling package for anticipated operating conditions with the TES system proposed for UCR.

Condenser Cooling

A conventional condenser cooling system consisting of cooling towers and an alternative geothermal system were considered. The geothermal system is preferred by UCR and is discussed in the Sustainability Section of this study. This system will be the base system and will depend on future hydrogeological studies that will determine the number, size, and location of supply and re-injection or alternative reuses of the condenser cooling water.

Should the hydrogeological site conditions eliminate the geothermal system option, the alternative condenser cooling system would utilize the cooling tower approach that would be grouped and sized to meet the individual chiller capacities. The wet wells would be connected to allow full tower surface area to be utilized during off peak conditions and fan use optimized with variable frequency drives.

A three cell tower for each 1,000 ton chiller would be specified and located adjacent to the chiller plant. Location of the cooling towers on the roof of the central plant was considered but not selected because construction costs for cooling towers located on the roof are increased due to structural seismic design and screening costs.

Tower overall height arrangement would be about 20 ft above grade.

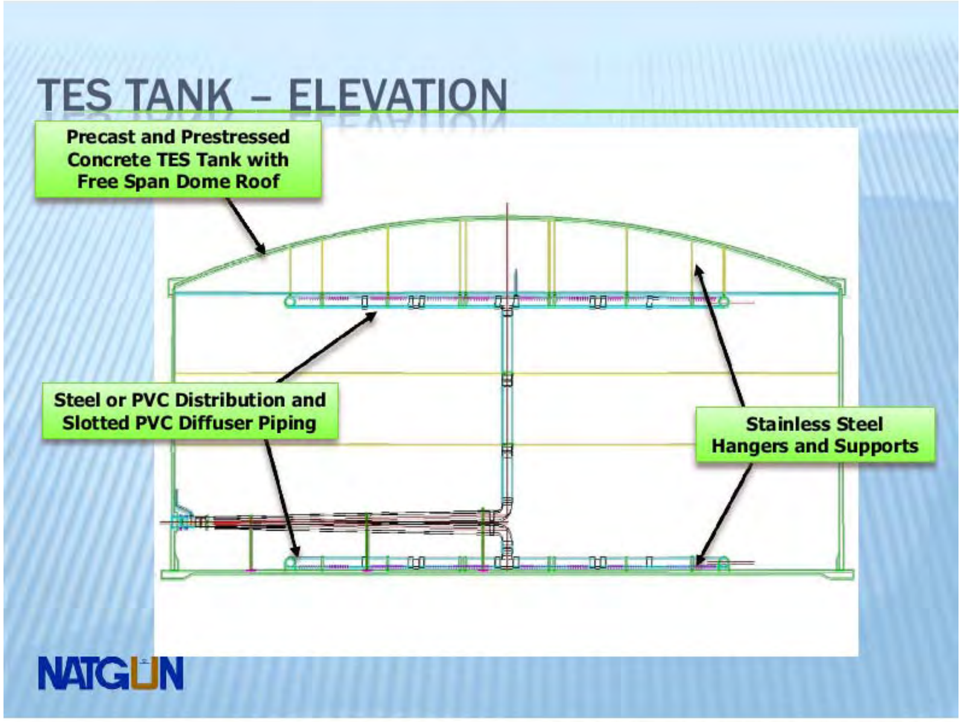
Support equipment would include: Chemical treatment; a makeup water system which may use recycled water if made available; and a well water filtration system which could either be a sand settling system or pressure filter self cleaning system such as an Amiad Filter for the full water flow stream.

TES

A chilled water TES system has been chosen after comparison with an Ice TES system for this campus. The Phase 1 TES tank is sized at 50% of the full build out facility. This amounts to a small increase in size from 0.9 MG to 1.5 MG so that at full build out equivalent tanks will stand side by side. The overall size is programmed to be 60 ft high by 65 ft in diameter with 100% above grade to minimize construction costs. Concerns about visual effects can be somewhat alleviated by tank location within the support yard site and Architectural Effice insulation systems that can dress up the appearance of the tank system.

Discussions with TES specialists design build contractors indicate that the optimum height can be lowered with an engineered supply and return diffuser. The thermocline layer at the top can be designed to be two feet or less so that minimal tank volume is lost during the TES use. A lower height would require a larger footprint on the support yard and it was determined that the 65 ft diameter fit nicely into the yard scheme. Figure 10-4

Figure 10-4 TES Tank



The TES tank could either be a pre-stressed domed roof concrete tank or an above ground glass lined steel tank. The costs are about the same and can be finalized in the final design. The piping from the tank to the chiller plant can be direct buried and should be sized for the full buildout of two tanks. The tank would be insulated with an Architectural effice to provide some relief from its physical presence and at the same time reduce heat loss from the exposed portion to a maximum of 2%. There also would be an opportunity for Solar Thermal or PV panel installation on the roof.

The TES tank elevation could be lower than the buildings served. This will require back pressure valves on the chilled water return system at each building that is higher than the tank, which amounts to the head difference between the highest building plus 10 feet of head, to insure that the system does not equalize through the TES tank resulting in loss of chilled water from the system. The energy penalty is minimized with a tank that is 60 feet above grade versus a completely buried tank. The annual energy savings for the recommended design is $6,000 per year in pumping costs when compared to a 30 ft high tank. A fully buried tank would have an annual penalty of $11,000.

The TES system was estimated to cost $1.10 per gallon for the 1.5MG tank. The unit cost for a 3MG tank would be $.80 gal if UCR decided to build the full build out tank during the initial Phase 1 construction.

Distribution System

The Central chilled water Plant will consist of constant flow primary pumps de-coupled from the variable flow secondary loop pumps with VFD’s. Building tertiary pumps with VFD’s will be considered in the final design when a detailed energy analysis would be conducted. The tertiary pumps would be provided in each building design which will give each building an opportunity to control the ΔT of the chilled water return within the campus goals.

At a 20° ΔT the flow would be about 1.2 gpm/ton or 1,200 gpm per chiller. The primary pumps would be paired with the installed chiller through a common header. An installed spare could then replace any of the other pumps when one is down for maintenance.

The secondary pumps would also be installed in a header arrangement to allow a spare to be installed replacing any main pump that was off line for maintenance. Secondary loop sizing would be based on 20° ΔT chilled water and 7 fps velocity plus or minus to allow for growth and reverse feeding of the loop if there was an interruption in part of the loop to allow feeding from the opposite direction. This feature for the technical portion of the campus which has many of the currently identified critical facilities was deemed an important feature. Main line isolation valves are recommended and desired by UCR to allow intentional reverse feeding in the case of failures and future construction tie-ins with minimal interruption.

Support equipment for the chilled water system includes: an expansion tank; an air separator; a packaged chemical feeder; and an automatic makeup water fill system.

Heating Plant

The SOM Heating Water system for Phase 1 is sized at 24 MMBTUH diversified peak load. Firetube boilers were compared with watertube boilers and were selected for the following reasons.

- Watertubes are cost competitive at the 40 MMBTU size but selecting smaller incremental boiler sizes allow better total turn down ratio for low load conditions using firetube boilers.
- Firetube can be more efficient with economizers.
- Equipment life, if maintained, is equivalent for both firetube and watertube boilers

The boilers would be required to meet the current and rapidly changing air regulations for NOx (5ppm or 9ppm depending on boiler size) and CO (50ppm). The boiler packages would have dual limited burner controls with 30ppm burners and Selective Catalytic Reduction (SCR) pollution control equipment installed on the exhaust stacks for boilers 600 HP and higher. The SCR's would require ammonia injection systems which would be accomplished with compressed gas cylinder size bottles piped to the SCR's. Boilers under 600 HP can meet the lower requirements without an SCR with burner controls and flue gas recirculation systems.

Selection of firetube boilers would limit the heating water delta T to 40°-50°F to limit the thermal shock on the boilers. Operating at a higher ΔT would require the addition of a blending loop to minimize the thermal shock and increase the loop circulation. A 40° ΔT loop is common for heating water systems.

The boiler size that was selected for the initial Phase was a single 400 Boiler Horsepower or 14 MMBTUH boiler which when coupled with the Templifier chiller heat recovery system would satisfy the Phase 1 load. An additional 400BHP would be installed as a standby since it would allow the full buildout plant to be two at 400 BHP and two future at 800 BHP if the load materializes. 80% of the capacity is for the HVAC heating water. An allowance for 20% for domestic hot water (DHW) and process hot water is included in the plant capability.

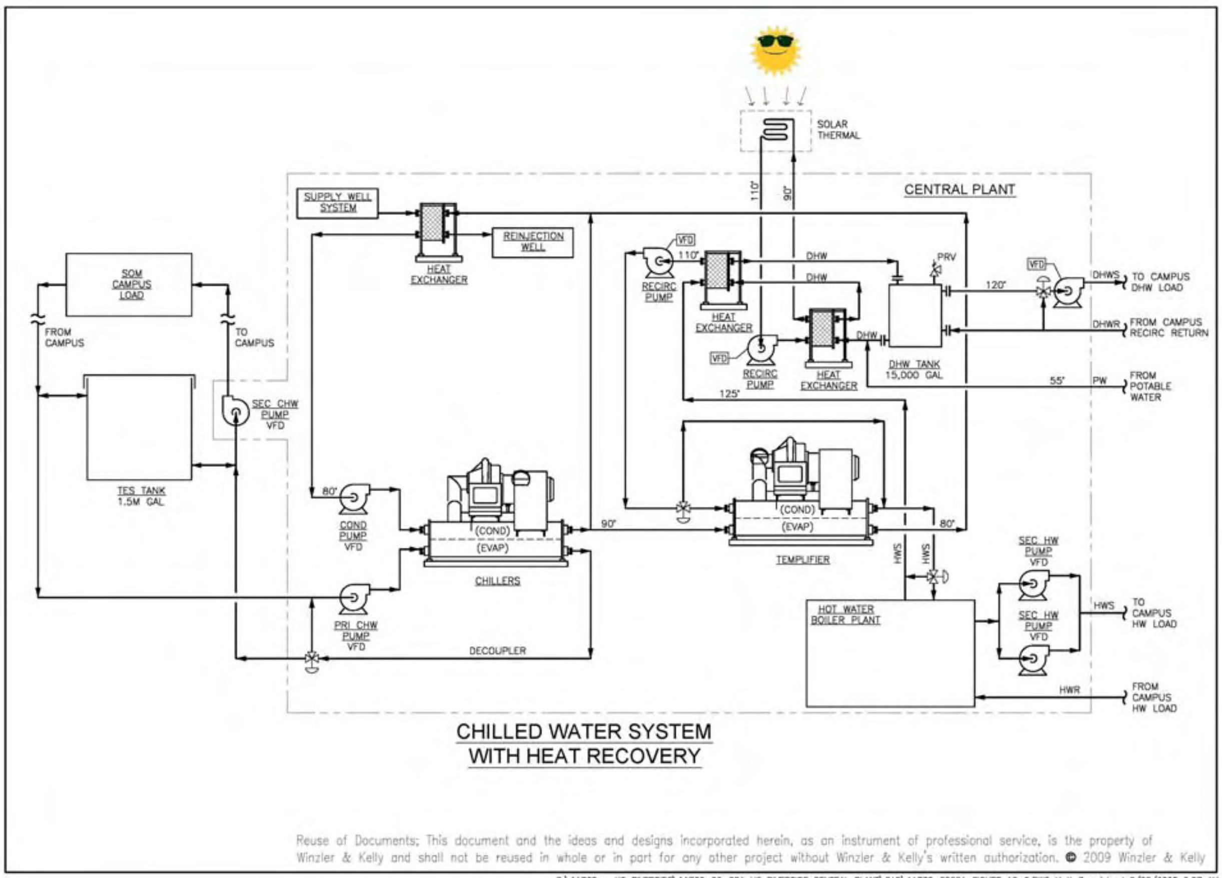
The heating water system would consist of a Primary Loop inside the boiler plant and a decoupled secondary loop for distribution to the SOM Campus. The initial secondary system flow will be 1,250 gpm expanding to 4,500 gpm at a ΔT of 40°F in the future at full buildout. Tertiary pumps at the buildings with VFD's to control the flow and ΔT of the return would be part of the building systems if determined to be cost effective in the Campus modeling that would be accomplished during design. The Secondary pumps would be VFD controlled to meet system delivery pressure of 20 psig at the furthest point in the loop. The building pumps would take over at that point. Primary pumps would be constant volume matched up with each boiler.

Hot Water

The SOM Domestic Hot water was determined to be centralized to take advantage of heat recovery inside the Central Heating plant from the chiller condensor water using a templifier and through the use of Solar thermal panels on the roof of the heating plant and nearby buildings.

Figure 10-5 schematically represents the combined facility taking advantage of heat recovery within the Central Plant. The chiller plant is shut down 6 hours a day and the templifer would also be shutdown during that time span as well. The solar system and the boiler system would be providing the heat required for DHW during that period.

Figure 10-5 Templifier/Solar Scheme



The Templifier would be sized for the full buildout and be used at partial load condition and increased in use as the campus grew to planned size. In this case, it would be sized for 15MMBTUH which is one of the largest templifiers available. The size is equivalent to a 1,500 ton chiller and would be located in the chiller plant since it contains the same refrigerant as the chillers. The hot water boilers would serve as the peak and backup to the templifier system.

The DHW system is sized at 500 gpm for full build out with a 15,000 gallon pressurized tank system located in the Central Heating Plant. Heating Loop pumps are sized for 500 gpm and will operate to supply loop pressure of 40 psig at the buildings. Small circulation supply pumps at each building will circulate DHW through the building at 50-75 gpm on demand and return a small amount to the loop for return to the Central Plant. The initial plant will include two full capacity pumps with VFD's to maintain loop pressure and enough return flow to keep the system hot. If the demand grows additional pumps can be added without changing the central heating.

Site Distribution

The site distribution of Central Utilities including: Chilled Water CCW, Heating Water HHW, Domestic Hot Water DHW, Natural Gas, and Power distribution will be through an Underground Tunnel system that is separate from the UCR requested Service Tunnel system (See Figure 10-6). A complete Loop starting at the central plant is desired to allow distribution in both directions and back feeding if there is a problem or a shutdown required in part of the system.

The pipe sizing criteria is conservative at 7 fps to minimize normal pumping energy costs but also allow back feeding without too much pressure loss at the far ends of the system when feeding from one direction.

The tunnel section is programmed at 10'8" by 10' 8" inside clearance dimensions for the planned pipe sizes. Figures 10-7 and 10-8 indicate tunnel cross sections at different locations in the system. Vaults will be planned at each building entry to allow piping and other utility transitions into a surface utility trench that will be worked into each new building plan for main entry into the buildings. The main tunnel is walkable whereas the branch building service trenches are not walkable from tunnel to building. This concept will keep any problem in the tunnel away from the buildings being served.

The tunnels will be cast-in-place which could have drainage trenches cast along the sides and sump pumps at the vault locations to take care of any leaks or water intrusion.

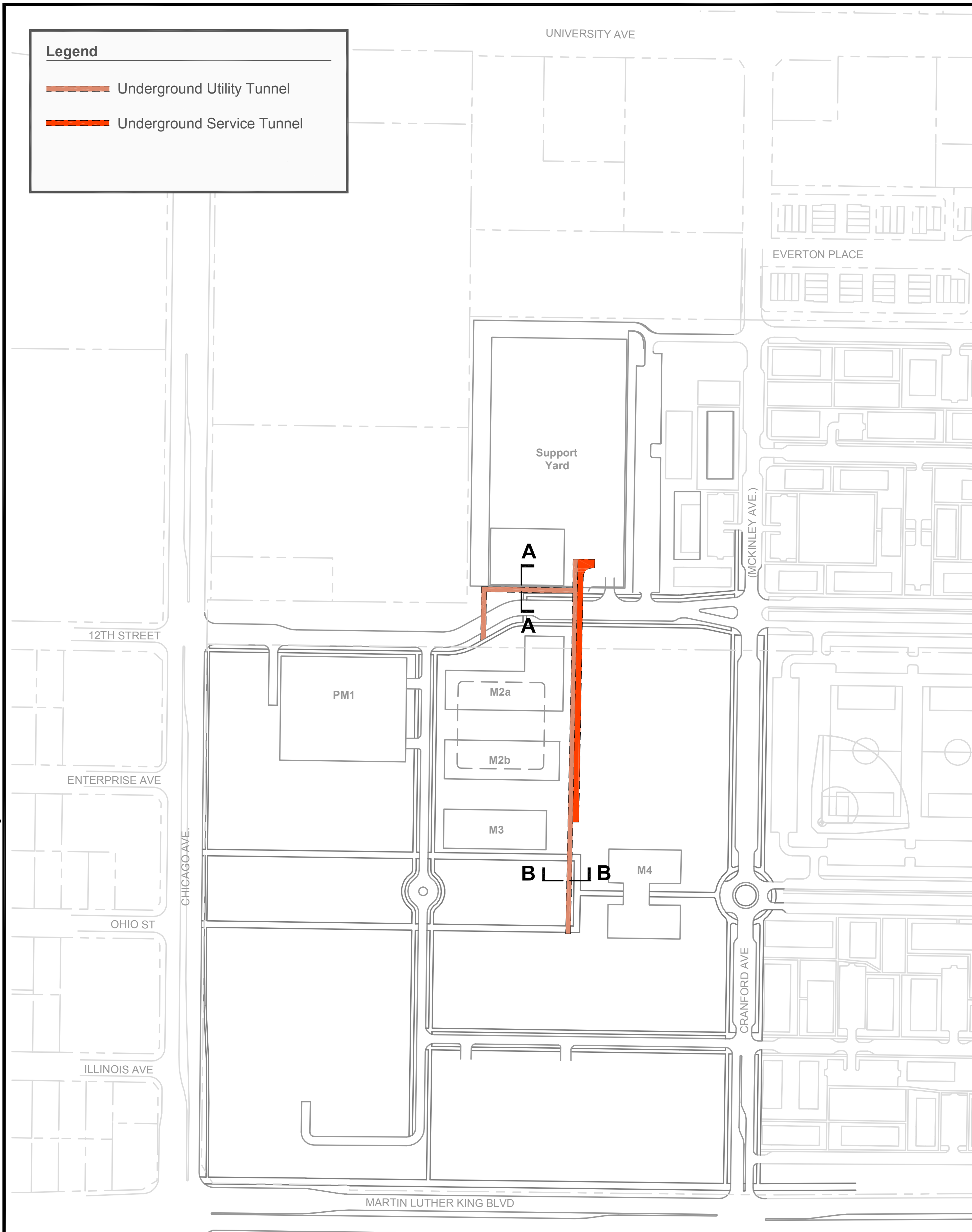
Additional design features would include: fire sprinklers as requested by UCR, lighting, and ventilation,

Figures 10-9, 10-10, and 10-11 indicate the Phase 1 loop sizes for CCW and HHW and DHW

10.3 SOM Infrastructure – Full Buildout

Central Plant

Central Plant full buildout size will ultimately be determined by the success of innovative energy conservation building construction techniques, LEED incentives and Central Plant Standards in the subsequent phases of construction of the SOM. The initial plant has been conservatively sized and experience and metering at each building will confirm demands for each facility type and their capability of reaching their design goals. If all conservation and sustainable goals are met the Central Plant may not see complete expansion as described below. However allocation of space and system distribution capacity will be there when and if needed without major reconstruction.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-6 PH1 TUNNEL.dwg 06-23-09 11:50:53AM PScheetz

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North
0' 75' 150' 300'

Figure 10-6
Phase 1 - Utility Tunnel

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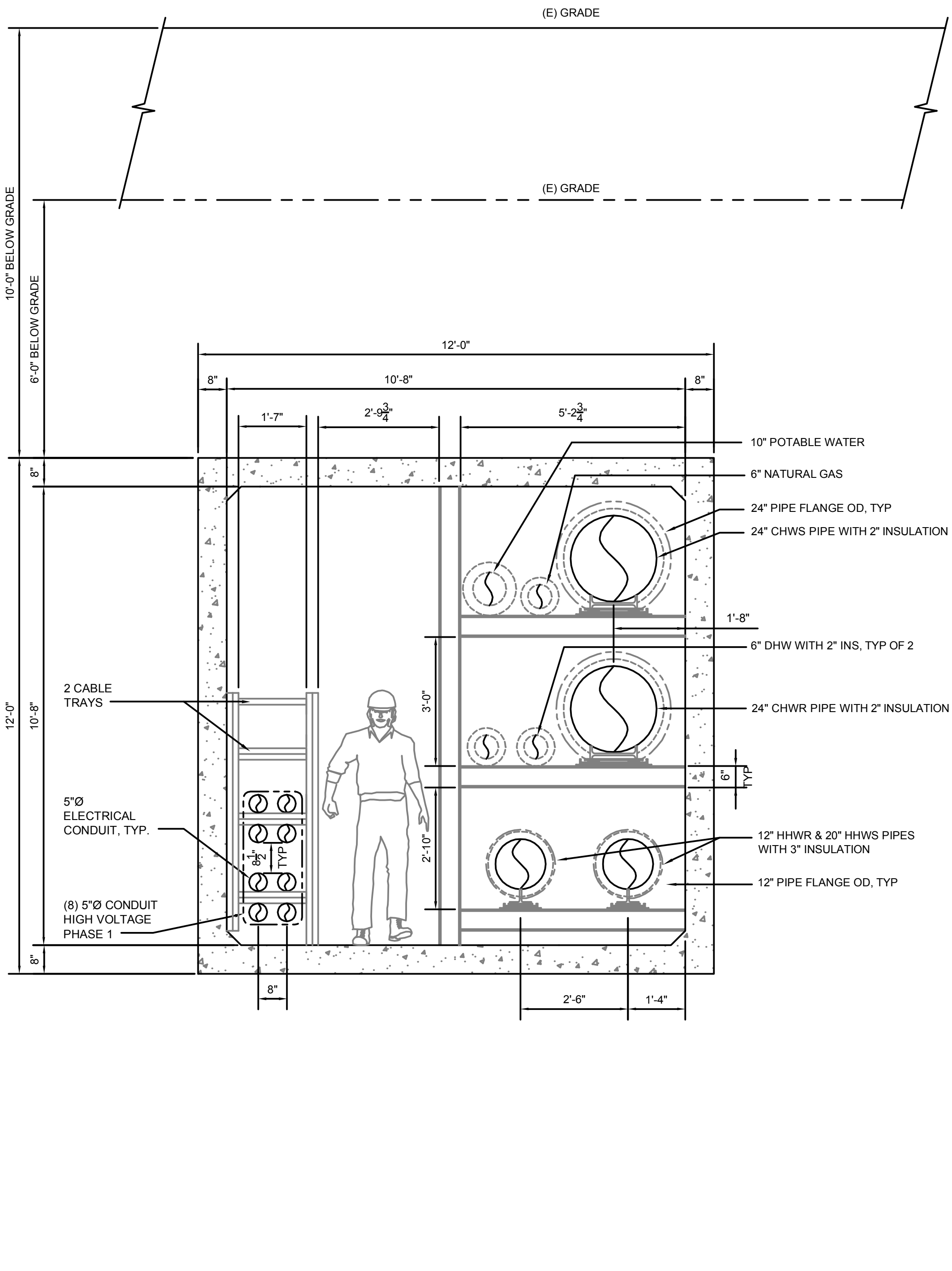

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-7 10-8 TUNNEL SECTIONS.dwg 06-23-09 11:50:47AM PScheetz

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Figure 10-7
Final - Main Tunnel Section A-A

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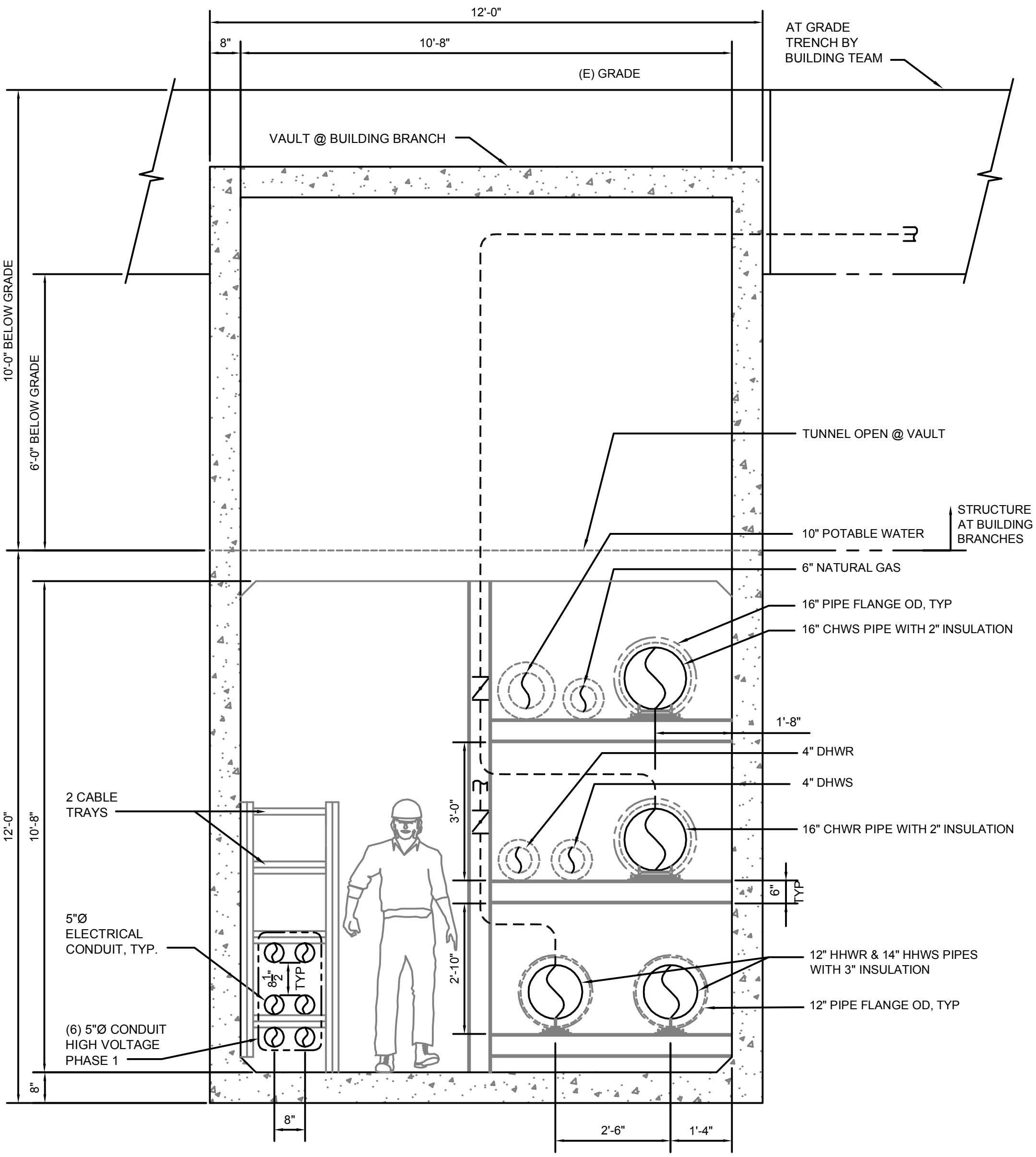

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Figure 10-8
Final - Main Tunnel Sections B-B

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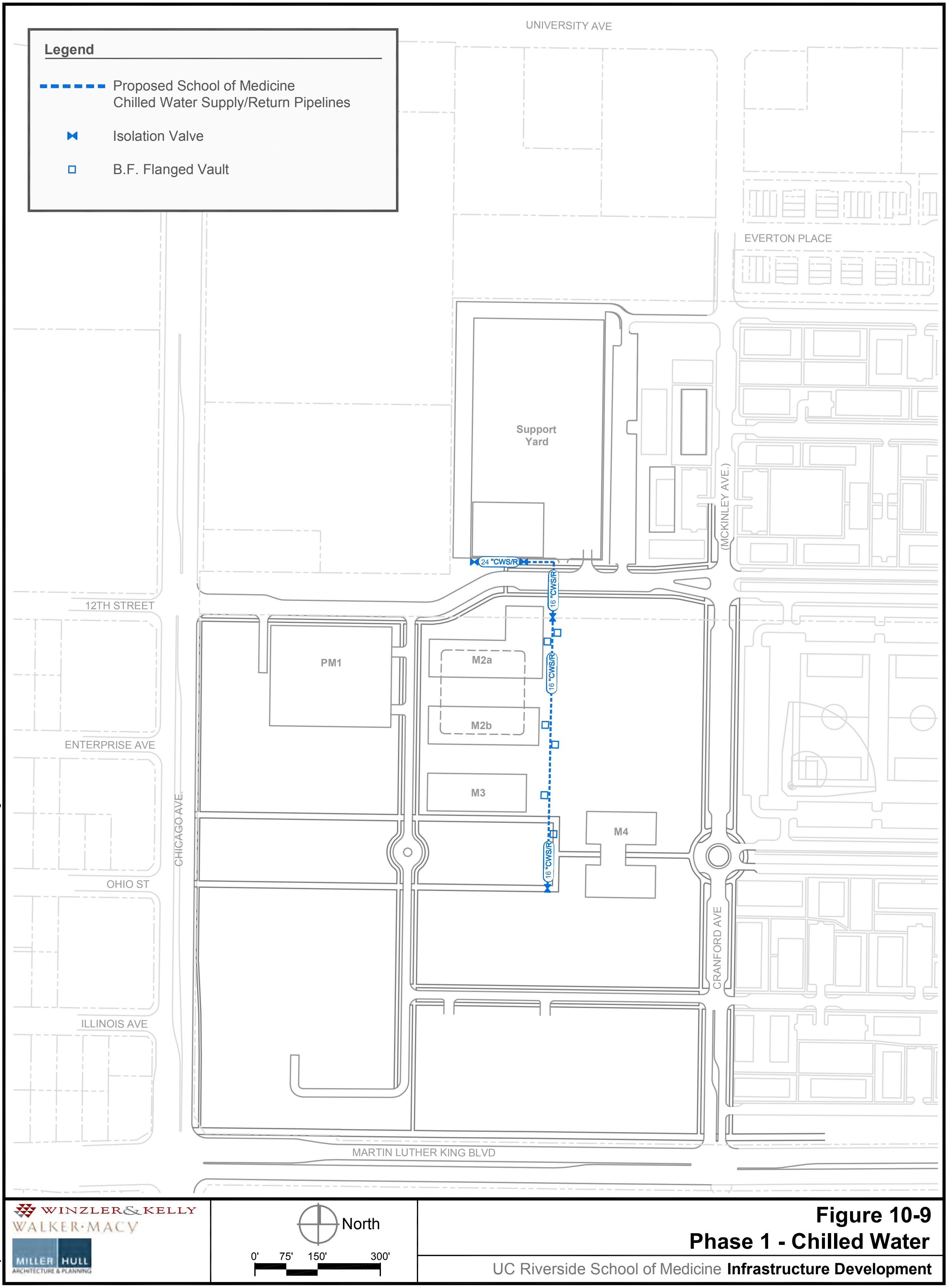

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Figure 10-9
Phase 1 - Chilled Water

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P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-9 PH1 CCW.dwg 06-23-09 11:50:39AM PScheetz

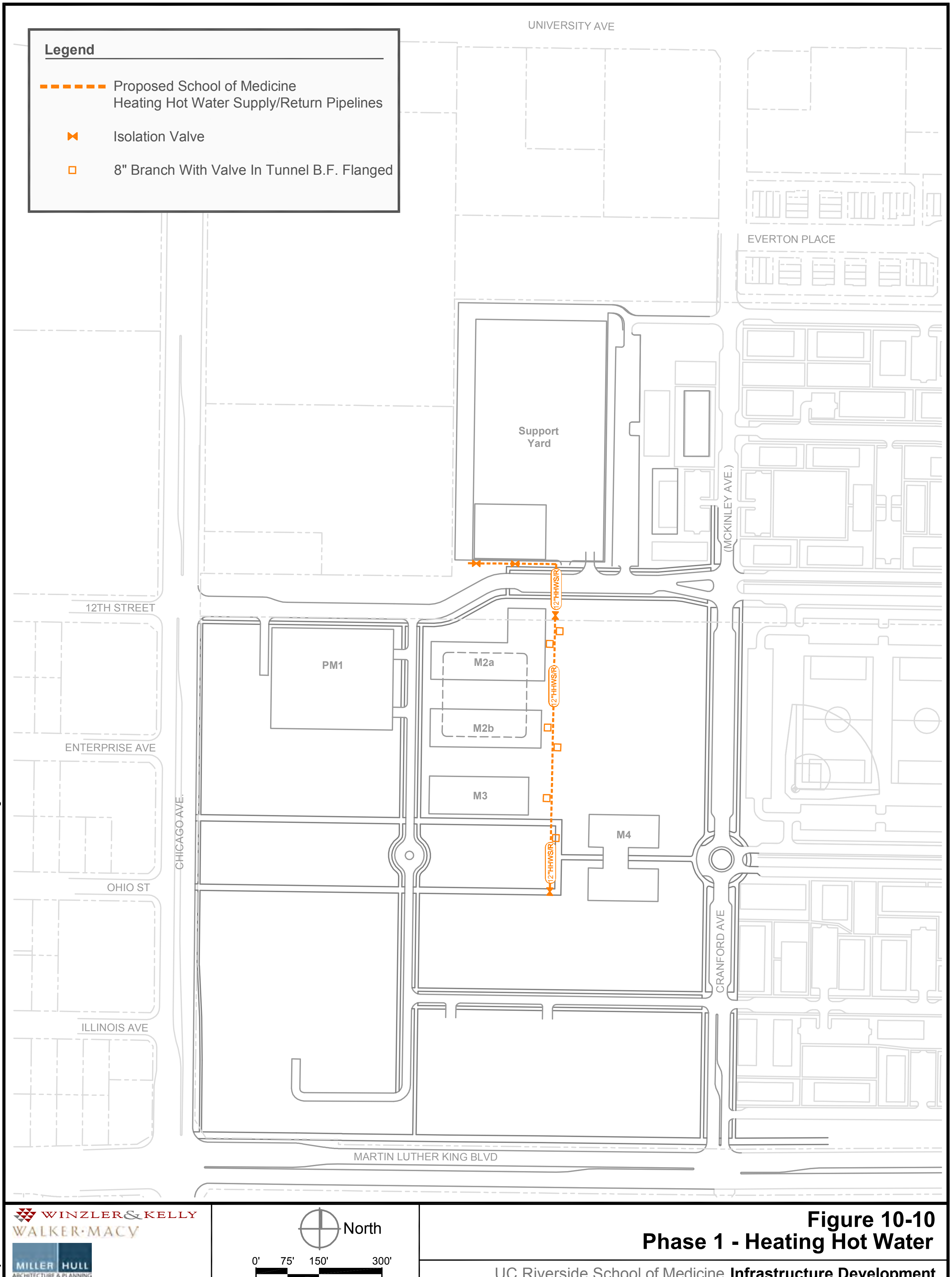

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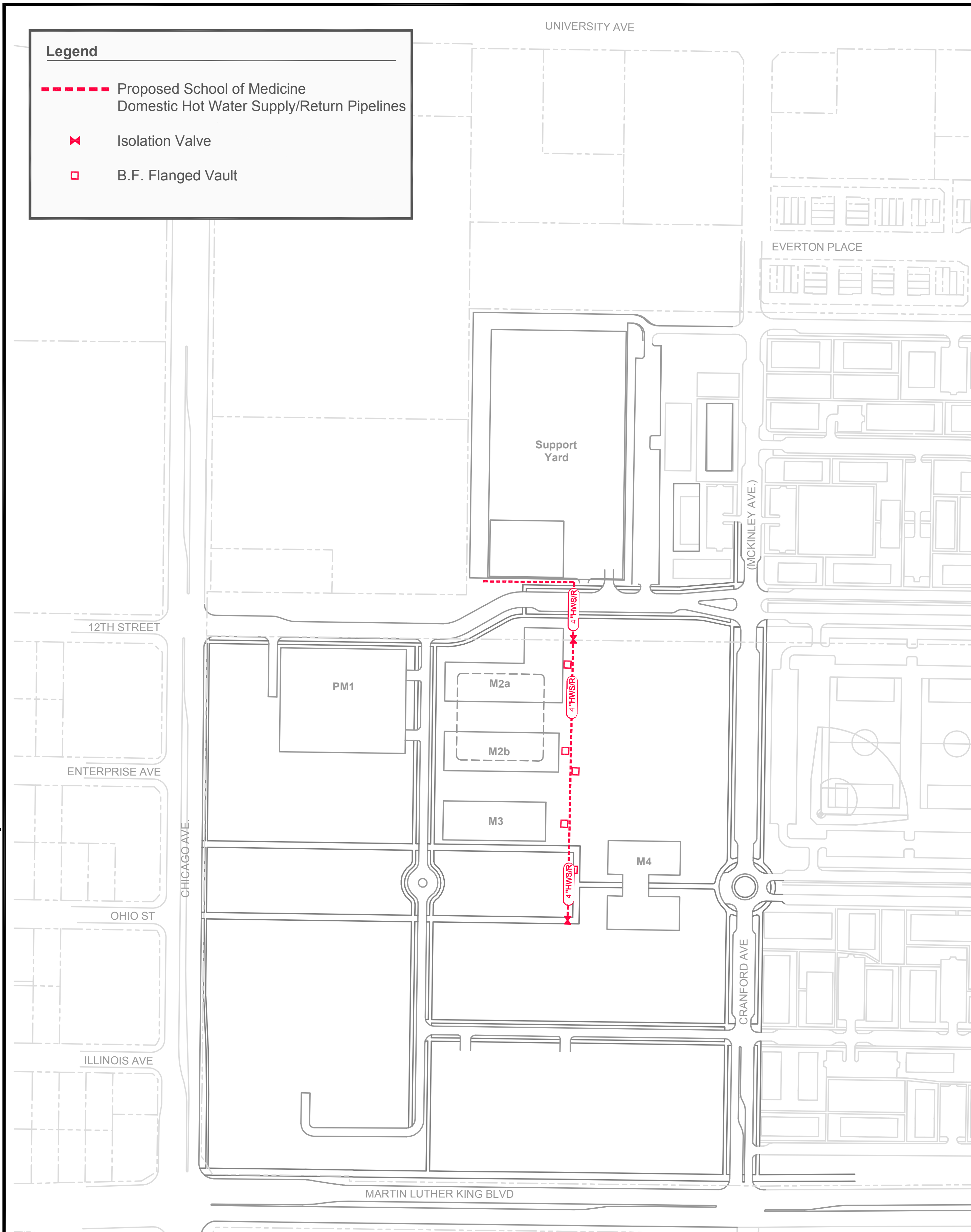
Figure 10-10
Phase 1 - Heating Hot Water

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-10 PH1 HHW.dwg 06-23-09 11:50:34AM PScheetz



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-11 PH1 DHW.dwg 06-23-09 11:50:29AM PScheetz

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North
0' 75' 150' 300'

Figure 10-11
Phase 1 - Domestic Hot Water

UC Riverside School of Medicine **Infrastructure Development**

Central Cooling Plant

The Central Chiller Plant will accommodate 6,000 tons of capacity with a standby chiller at 1,000 tons capacity. A single templifier will be installed for heat recovery of condenser water for the life of the plant. The boilers will be utilized as backup for the templifier since they are in the same hot water scheme.

If the recommended and desired geothermal system is used, water and energy conservation will be maximized and a closed piping system will serve the chillers for condenser cooling. Alternatively, if cooling towers are used they will be matched in size with the chillers and located adjacent to the central chiller plant at ground level. A combination of systems may be used depending on future hydrogeological studies and aquifer capabilities.

Distribution pumps, both primary and secondary, would be added in equivalent chiller increments as the need is developed over time.

Central Heating Water Plant

The central heating plant would be capable of expanding to the full 78 MMBTUH capacity by adding additional 800 BHP boilers as the load was justified. In all cases there would be an installed spare to allow peak demand to be satisfied in the case of a maintenance or unscheduled shutdown.

Distribution primary and secondary pumps would be incrementally added to match boiler capacity

Domestic Hot Water

The domestic hot water system would only need additional distribution pumps as the capacity increased. Heating capacity would be installed in the initial phase and the templifier and solar thermal collectors would be capable of keeping up with the load except during periods of demand shutdown for the chiller plant and seasonal abnormalties.

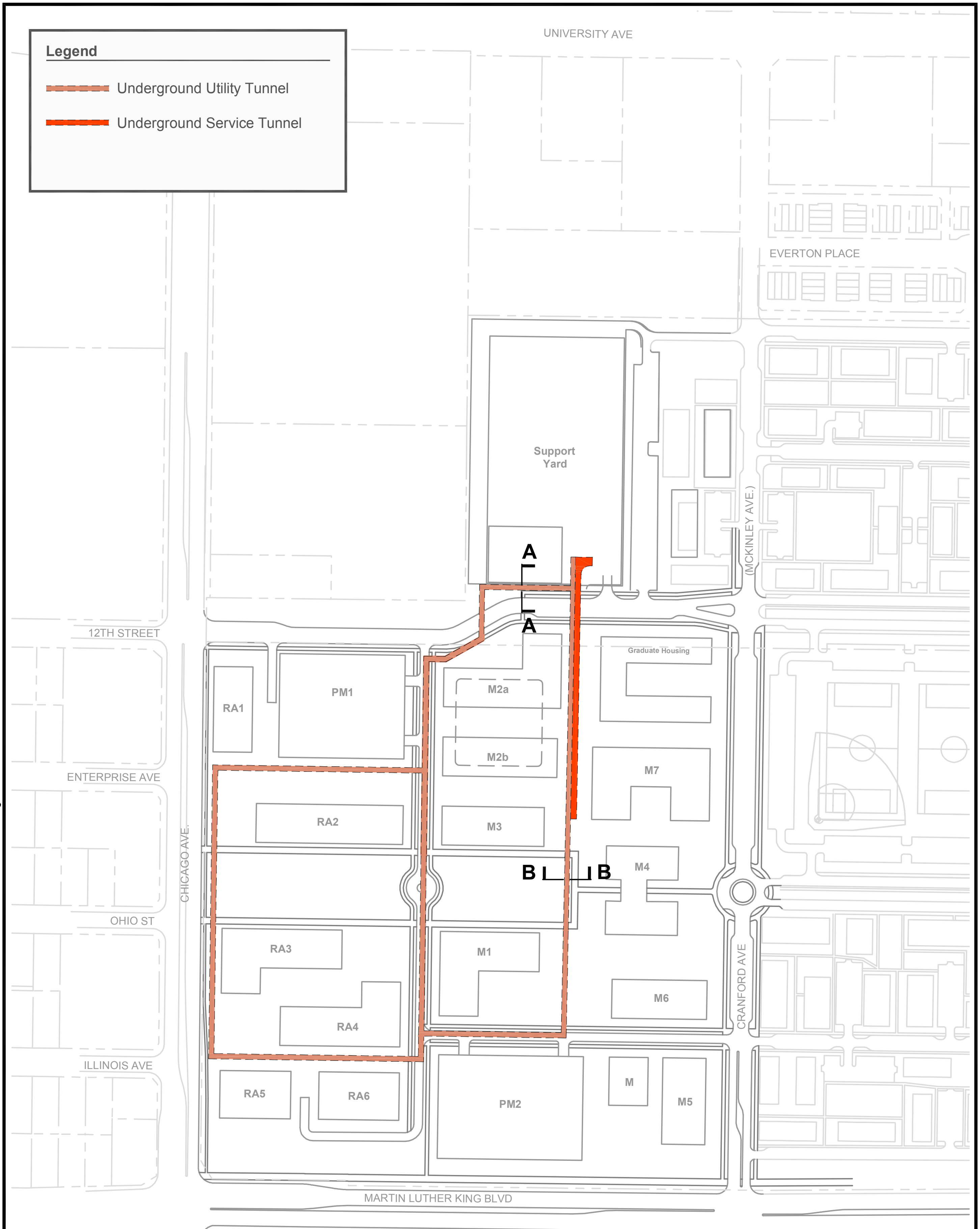
It is anticipated that only one additional pump would be needed in the future unless there are un-anticipated loads

Site Distribution

At full buildout the Phase 1 tunnel system is set to expand and shown in Figure 10-12.

In the future, piping sizes will be compared with the model developed during the Phase 1 design phase and decisions made on the proper size based on current thinking with respect to the plan.

As conceived at this stage the main sizes would remain on the large side to allow re-feeding capabilities from both directions.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-12 FINAL TUNNEL.dwg 06-23-09 11:50:24AM PScheetz

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MILLER HULL ARCHITECTURE & PLANNING

North
0' 75' 150' 300'

Figure 10-12
Final - Utility Tunnel

UC Riverside School of Medicine **Infrastructure Development**

11.0 NATURAL GAS

This section summarizes the evaluation of the natural gas distribution system concepts for the proposed School of Medicine (SOM) and the future West Campus developments.

The existing natural gas distribution infrastructure in the vicinity of the SOM used for this analysis was based on the information provided in the 2008 West Campus Infrastructure Development Study (WCIDS). Natural gas must be piped from the off-site Sempra Energy Utility (Sempra) system, through new gas meter assemblies, and then throughout the SOM where it is needed.

Section 10 established the heating loads and natural gas requirements domestic hot water (DHW) heating and heating hot water (HHW) at the Central Plant serving the SOM. DHW and HHW will be generated in gas-fired boilers at the Central Plant.

There will be other natural gas use in certain buildings on campus. This includes natural gas used in laboratories, medical facilities, and other science facilities.

11.1 Basis of Design/System Criteria

The design criteria used for this DPP is closely matched with the design criteria in Chapter 11 of the WCIDS. Higher heating loads were calculated in Section 10 of this DPP. The result was an increase in natural gas loads from 50,000 cfh to 120,000 cfh.

11.2 SOM Infrastructure Phase 1

For the first phase of development at the SOM, natural gas will be supplied from a connection to the Sempra distribution system at MLK Blvd. and Cranford Ave. (See Figure 11-1).

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 11-1 PH1 N GAS.dwg 06-23-09 11:50:20AM PScheetz

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Figure 11-1
Phase 1 - Natural Gas

UC Riverside School of Medicine **Infrastructure Development**

12.0 ELECTRICAL

This section summarizes the evaluation of the electrical distribution system concepts for the proposed School of Medicine (SOM) and the future West Campus developments.

Existing electrical infrastructure on the West Campus consists primarily of the University's main substation located next to the north end of parking lot 30, south-east of the I-215 freeway. There are additional 69kV and 12.47kV overhead lines crossing the West Campus that are owned by the City of Riverside Public Utilities.

The University currently obtains power for the East Campus from the City of Riverside Public Utilities (RPU) at the RPU's University Substation and distributes it throughout the campus on University owned and maintained distribution lines. A similar configuration is envisioned for the West Campus. However, certain issues need to be resolved with RPU before the final configuration for the electrical system can be finalized.

City of Riverside Public Utilities Subtransmission Project

The City of Riverside Public Utilities (RPU) has proposed a project to resolve infrastructure and capacity deficiencies in RPU's 69 kV subtransmission network that will directly impact the UC Riverside West Campus development plan. The project will consist of two new double-circuit sections of 69 kV subtransmission lines as well as upgrades to eight existing substations. The net result of the project will be the addition of approximately four miles of 69 kV subtransmission line and reconnection of existing lines to enhance the subtransmission connection between the Southern California Edison Co. 230 kV – 69 kV Vista Substation and four RPU 69 kV substations: Riverside, La Colina, Springs and University.

Proposed New Subtransmission Line Locations

The original RPU plan for the construction of the 69kV subtransmission lines within the West Campus development area would impact the character of the campus. One of the proposed overhead 69 kV double-circuit lines runs along Northwest Mall. The second proposed 69 kV double-circuit line section begins at the existing overhead crossing of the I-215 freeway and proceeds south adjacent to the I-215 freeway. The RPU plan also calls for continued use of the existing overhead pole line near the Gage Canal.

The University is in the process of working out alternatives to the original plan which include options for placing the lines underground or relocating them out of the West Campus development area. The University's concerns were presented in a May 19, 2009 public hearing letter:

- The campus vision is that existing and future utility lines or projects must:
  1. Consider the visual impact they will have on the campus environment;
  2. Reduce or eliminate conflicts with proposed campus development; and
  3. Not defer a solution to a future date or compound an existing problem that would be in conflict with 1 or 2.

12.1 Basis of Design/System Criteria

The design criteria used for this DPP closely follow the recommendations in the WCIDS design criteria except for the following items:

- Since sulfur hexafluoride (SF_6) gas is 20,000 times more potent than carbon dioxide (CO_2), its use in switchgear is not consistent with sustainability principles incorporated by UC Riverside in the design of new facilities. Accordingly, either vacuum or air circuit breakers are recommended for the new 12.47 kV switchgear.
- Based on Workshop discussions with the University, Standby Power generation will be centralized at the Support Yard for the following building types: Medical Research (M1, M2a, M2b, M3, and M7), Medical Education (M4), and the Vivarium.
- Adjustments to the electrical loads were made to reflect the updated building program.

Electrical Load Analysis

Electric power densities and demand factors for different building types that will comprise the new UC Riverside School of Medicine are presented in Table 12-1:

Table 12-1
ELECTRIC POWER DENSITIES AND DEMAND FACTORS

Load Type	Housing	Classroom Bldg w/Offices	Medical Research Offices	Ambulatory Care	Medical Research Labs	Research/ Ambulatory	Vivarium
Lighting, watts/SF	3.0	1.2	1.2	1.2	1.2	1.2	2.0
HVAC, watts/SF	7.0	7.5	8.0	10.0	9.0	9.5	9.0
Receptacles, watts/SF	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Appliances, watts/SF	3.0	0	0	2.0	0	1.7	0
Computers, watts/SF	0	2.0	2.0	2.0	2.0	2.0	0
Lab Equipment, watts/SF	0	0	2.0	6.0	2.0	5.5	2.0
Total, watts/SF	15	12.7	15.2	23.2	16.2	21.9	17.0
Total, VA/SF	15.8	13.4	16.0	24.4	17.1	20.8	17.9
Demand Factor	0.23	0.35	0.35	0.45	0.35	0.40	0.60
Demand Load, VA/SF	**3.63**	**4.69**	**5.60**	**10.98**	**5.99**	**8.32**	**10.74**

Table 12-2 develops Phase 1 electrical demand loads based on facility requirements as provided by UC Riverside and the above power densities and projected demand factors:

Table 12-2 PHASE 1 ELECTRICAL DEMAND				
Bldg #	**Facility**	**GSF**	**Load Density, VA/SF**	**Demand Load, kVA**
	Support Area			
	Central Plant Facility Loads	41,000	10.20	418
	Other Support Area Facilities	16,000	6.13	98
	Support Area -- Subtotals	**57,000**		**516**
	School of Medicine			
M2a	Medical Research Laboratory	127,200	5.99	762
M2b	Medical Research Laboratory	95,200	5.99	570
M3	Medical Research Laboratory	85,200	5.99	510
M4	Medical Education Building	144,500	4.69	678
MV	Vivarium Facility	40,100	10.74	431
PM1	Parking Structure	487,200	0.80	390
	School of Medicine -- Subtotals	**979,400**		**3,341**

Table 12-3 develops future electrical demand loads based on future facility requirements as provided by UC Riverside and the above power densities and projected demand factors:

Table 12-3 FUTURE ELECTRICAL DEMAND				
Bldg #	**Facility**	**GSF**	**Load Density, VA/SF**	**Demand Load, kVA**
	Support Area			
	Central Plant Facility Loads	41,000	10.20	418
	Other Support Area Facilities	16,000	6.13	98
	Support Area - Subtotals	**27,000**		**516**
	School of Medicine			
M1	Medical Research Laboratory	120,000	5.99	718
M2a	Medical Research Laboratory	127,200	5.99	761
M2b	Medical Research Laboratory	95,200	5.99	570
M3	Medical Research Laboratory	85,200	5.99	510
M4	Medical Education Building	144,500	5.60	809
M5	Ambulatory Care Facility – Phase 2	50,000	10.98	549
M6	Ambulatory Care Facility – Phase 1	100,000	10.98	1,098
M7	Medical Research Laboratory	153,720	5.99	920
M	Ambulatory Care Facility	100,000	10.98	1,098
MV	Vivarium Facility	40,100	10.74	431
	School of Medicine – Subtotals	**925,920**		**7,464**

Table 12-3 FUTURE ELECTRICAL DEMAND				
Bldg #	**Facility**	**GSF**	**Load Density, VA/SF**	**Demand Load, kVA**
	School of Medicine – Additional Floor			
M1	Medical Research Laboratory	0	5.99	0
M2a	Medical Research Laboratory	0	5.99	0
M2b	Medical Research Laboratory	0	5.99	0
M3	Medical Research Laboratory	0	5.99	0
M4	Medical Education Building	0	5.60	0
M5	Ambulatory Care Facility – Phase 2	10,000	10.98	110
M6	Ambulatory Care Facility – Phase 1	20,000	10.98	220
M7	Medical Research Laboratory	38,430	5.99	230
M	Ambulatory Care Facility	20,000	10.98	220
MV	Vivarium Facility	0	10.74	0
	School of Medicine – Additional Floor – Subtotals	**88,430**		**779**
	Medical School Parking Structures			
PM1	Parking Structure	487,200	0.80	390
PM2	Parking Structure	562,800	0.80	450
	Medical School Parking Garages – Subtotals	**1,050,000**		**840**
	SOM Housing			
	SOM Housing	176,500	3.63	641
	SOM Housing – Subtotals	**176,500**		**641**
	Research/Ambulatory Facilities			
RA1	Research/Ambulatory	89,000	8.32	740
RA2	Research/Ambulatory	152,000	8.32	1,265
RA3	Research/Ambulatory	152,000	8.32	1,265
RA4	Research/Ambulatory	152,000	8.32	1,265
RA5	Research/Ambulatory	72,000	8.32	599
RA6	Research/Ambulatory	82,000	8.32	682
	Research/Ambulatory Facilities – Subtotals	**699,000**		**5,816**
	Research/Ambulatory Facilities – Additional Floor			
RA1	Research/Ambulatory	17,800	8.32	148
RA2	Research/Ambulatory	30,400	8.32	253
RA3	Research/Ambulatory	30,400	8.32	253
RA4	Research/Ambulatory	30,400	8.32	253
RA5	Research/Ambulatory	18,000	8.32	150
RA6	Research/Ambulatory	20,500	8.32	171
	Research/Ambulatory Facilities – Additional Floor – Subtotals	**147,500**		**1,227**
	West Campus – Family Housing			
F1 through F20	Family Apartments	286,200	3.63	1,040
F21 through F32	Family Townhouses	106,458	3.63	387
F33 through F51	Family Apartments	288,372	3.63	1,048
F52 through F60	Family Townhouses	89,052	3.63	324
	West Campus – Family Housing – Subtotals	**770,082**		**2,798**

Table 12-3 FUTURE ELECTRICAL DEMAND				
Bldg #	**Facility**	**GSF**	**Load Density, VA/SF**	**Demand Load, kVA**
	Child Development and Community Centers			
	Child Development Center, North	14,800	4.10	61
	Community Center, North	5,200	4.10	21
	Child Development Center, South	14,800	4.10	61
	Community Center, South	4,800	4.10	20
	Child Development and Community Centers – Subtotals	**39,600**		**162**

Table 12-4 summarizes the projected future load of the UC Riverside School of Medicine including SOM Housing and West Campus Family Student Housing

Table 12-4 FUTURE DEMAND LOAD	
Load Description	**Demand Load, kVA**
Central Heating & Cooling Plant & Support Yard Facilities	516
School of Medicine	7,464
SOM Facilities, Additional Floor	779
SOM Parking Structures	840
SOM Housing	641
Research/Ambulatory Facilities	5,816
Research/Ambulatory Facilities, Additional Floor	1,227
West Campus Family Student Housing	2,798
Child Development and Community Centers	162
Total Projected Load	**20,243**

12.2 SOM Infrastructure Phase 1

Electrical Service Alternatives

Two alternatives for serving the new West Campus facilities at 12.47 kV from the RPU distribution system were considered:

Alternative A

Provide new 12.47 kV University-owned switchgear adjacent to the existing University Substation and extend the underground feeders across the West Campus to the School of Medicine. Multiple 12.47 kV feeders would follow the Northwest Mall to the School of Medicine Precinct.

Alternative B

Provide a new 69 kV – 12.47 kV substation located within the Support Area to serve loads of the School of Medicine precinct plus those of the Family Student Housing developments sited on the west side of Iowa Ave. Provide new 12.47 kV University-owned switchgear located within the Support Area and extend multiple feeders along the utility corridors of the School of Medicine and adjacent Family Student Housing.

Alternative A Description

A new University-owned lineup of medium-voltage 12.47 kV metal-clad, draw-out switchgear will be located adjacent to the existing 69 kV – 12.47 kV RPU University Substation.

The 12.47 kV switchgear will consist of two 12.47 kV main buses protected by two 12.47 kV main circuit breakers and connected by a tie circuit breaker. The two primary main breakers and tie breaker will be interlocked, either mechanically or electrically, to prevent closing of all three devices at the same time and paralleling the sources. The switchgear will be housed in a walk-in weatherproof NEMA 3R-rated enclosure.

Metal-clad medium voltage switchgear is currently available with three standard insulation media designs:

- Air circuit breakers
- SF_6 (sulfur hexafluoride) insulated circuit breakers
- Vacuum circuit breakers

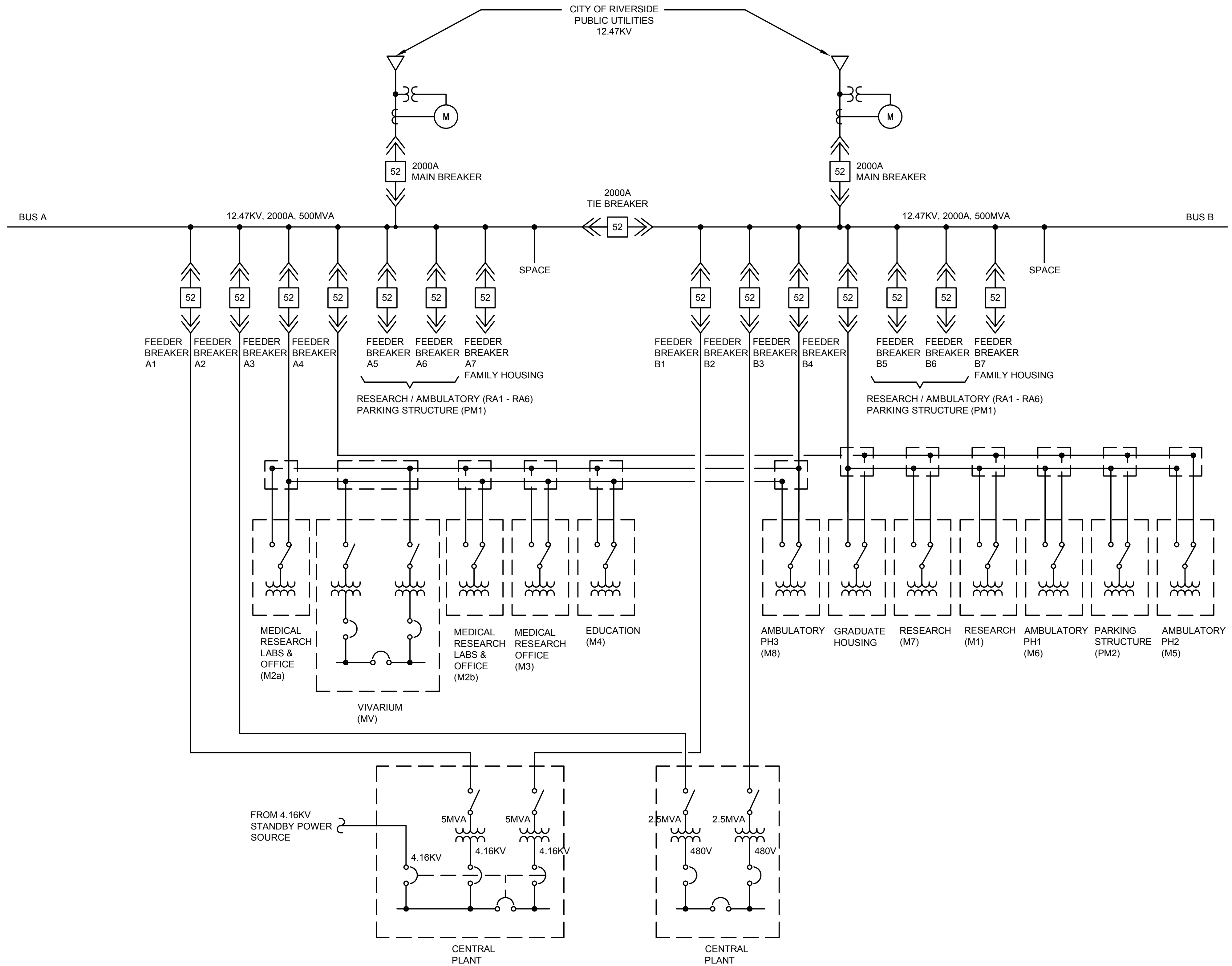
Since sulfur hexafluoride (SF_6) gas is 20,000 times more potent than carbon dioxide (CO_2), its use in switchgear is not consistent with sustainability principles incorporated by UC Riverside in the design of new facilities. Accordingly, either vacuum or air circuit breakers are recommended for the new 12.47 kV switchgear.

The 12.47 kV distribution system will be designed as a loop configuration, with every secondary unit substation transformer connected through a transfer switch to the 12.47 kV loop. Critical facilities will be served by double-ended secondary unit substations with two transformers.

The recommended medium voltage power distribution conductor is copper, insulated with TR-XLPE (tree-retardant cross-linked polyethylene) at the 133 percent level.

Cast-coil substation transformers are recommended for medical research laboratory, research/ambulatory, ambulatory and medical education facilities.

Refer to Figure 12-1 for a single line diagram of the proposed 12.47 kV distribution system and Figure 12-2 for a layout of the Alternative A distribution system.



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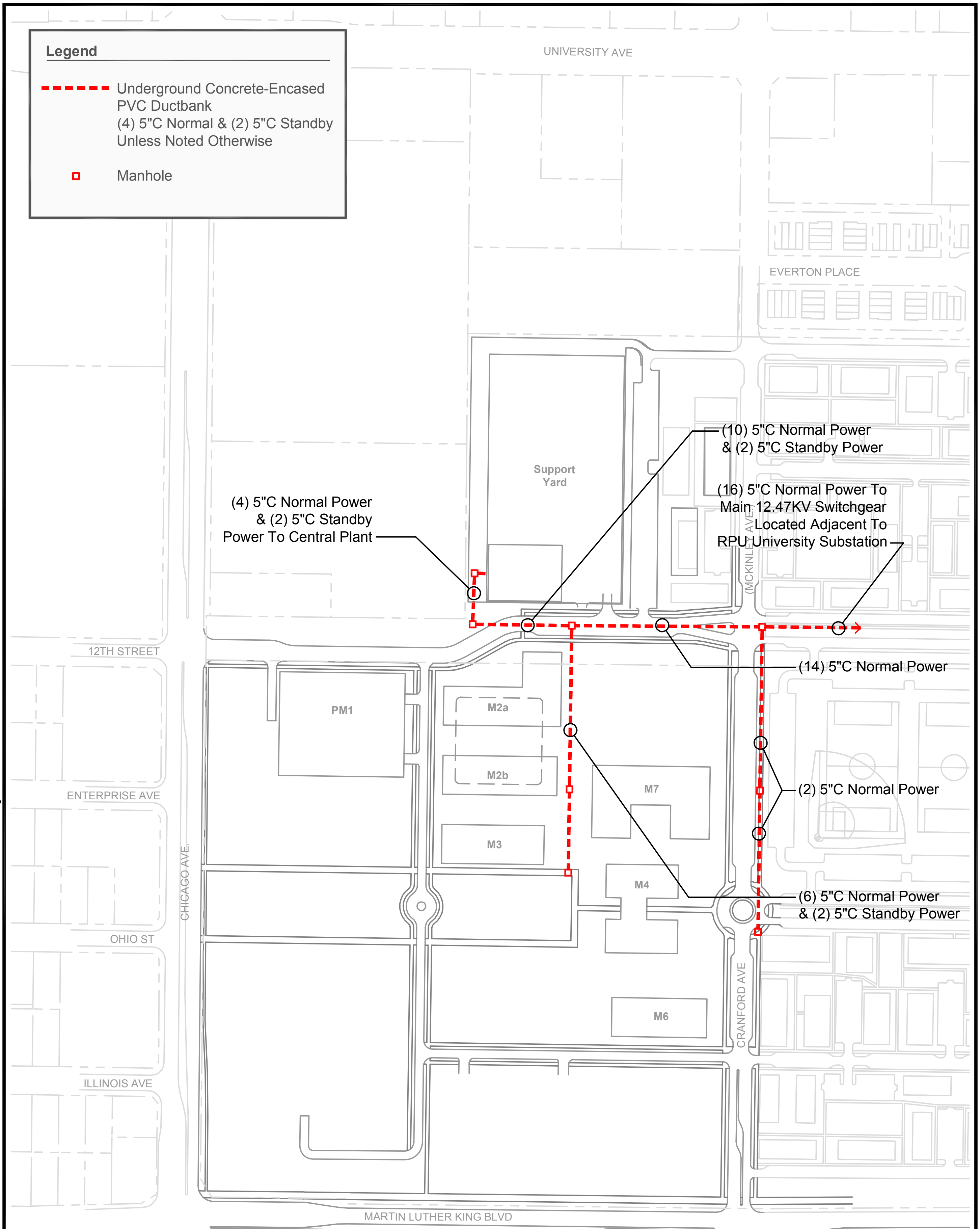
North
0' 75' 150' 300'

Figure 12-1

Proposed 12.47KV Normal Power Single Line Diagram Alternative A

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 12-1 PH1 ELEC-SLD.dwg 06-23-09 11:50:15AM PScheetz



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 12-2 PH1 ELEC-ALT-A.dwg 06-23-09 03:55:25PM PScheetz

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North
0' 75' 150' 300'

Figure 12-2

Phase 1 - 12.47 KV Power Distribution Plan Alternative A

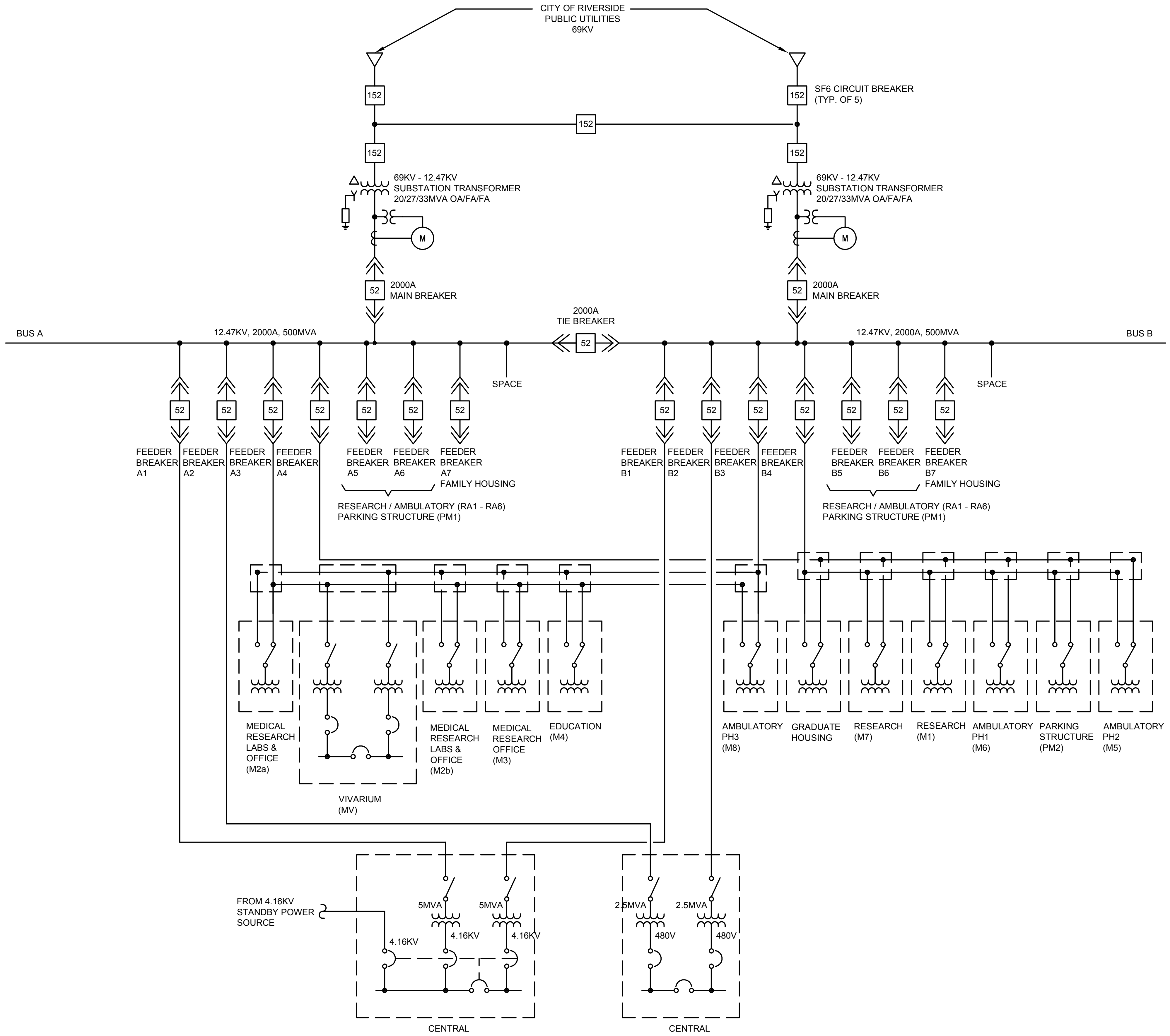
UC Riverside School of Medicine **Infrastructure Development**

Alternative B Description

A new 69 kV – 12.47 kV substation will be constructed within the northwest portion of the Support Area. The substation will be inserted into the proposed RPU 69 kV transmission line that will connect the SCE 240 kV Vista Substation located to the north with the RPU La Colinda Substation located to the south. The substation will contain two liquid-filled transformers, each sized to supply the total projected future load. The two 20/27/33 MVA transformers will be fed by an incoming circuit breaker arrangement consisting of five 69 kV, 1200A SF_6 breakers with two incoming breakers, a tie breaker and two transformer breakers. (Note: Vacuum or air circuit breakers are not available for 69kV switchgear.) The transformer secondaries feed a new lineup of medium-voltage 12.47 kV metal-clad, draw-out switchgear.

The 12.47 kV switchgear will consist of two 12.47 kV main buses protected by two 12.47 kV main circuit breakers and connected by a tie circuit breaker. The new 12.47 switchgear will be connected to the RPU distribution system in a loop configuration. Multiple 12.47 kV underground feeders will be routed along utility corridors to secondary unit substations located throughout the School of Medicine Precinct.

Refer to Figure 12-3 for a single line diagram of the proposed 69 kV – 12.47 kV substation and 12.47 kV distribution system and to Figure 12-4 for a layout of the Alternative B distribution system



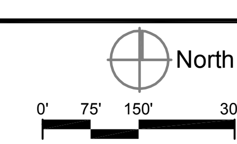


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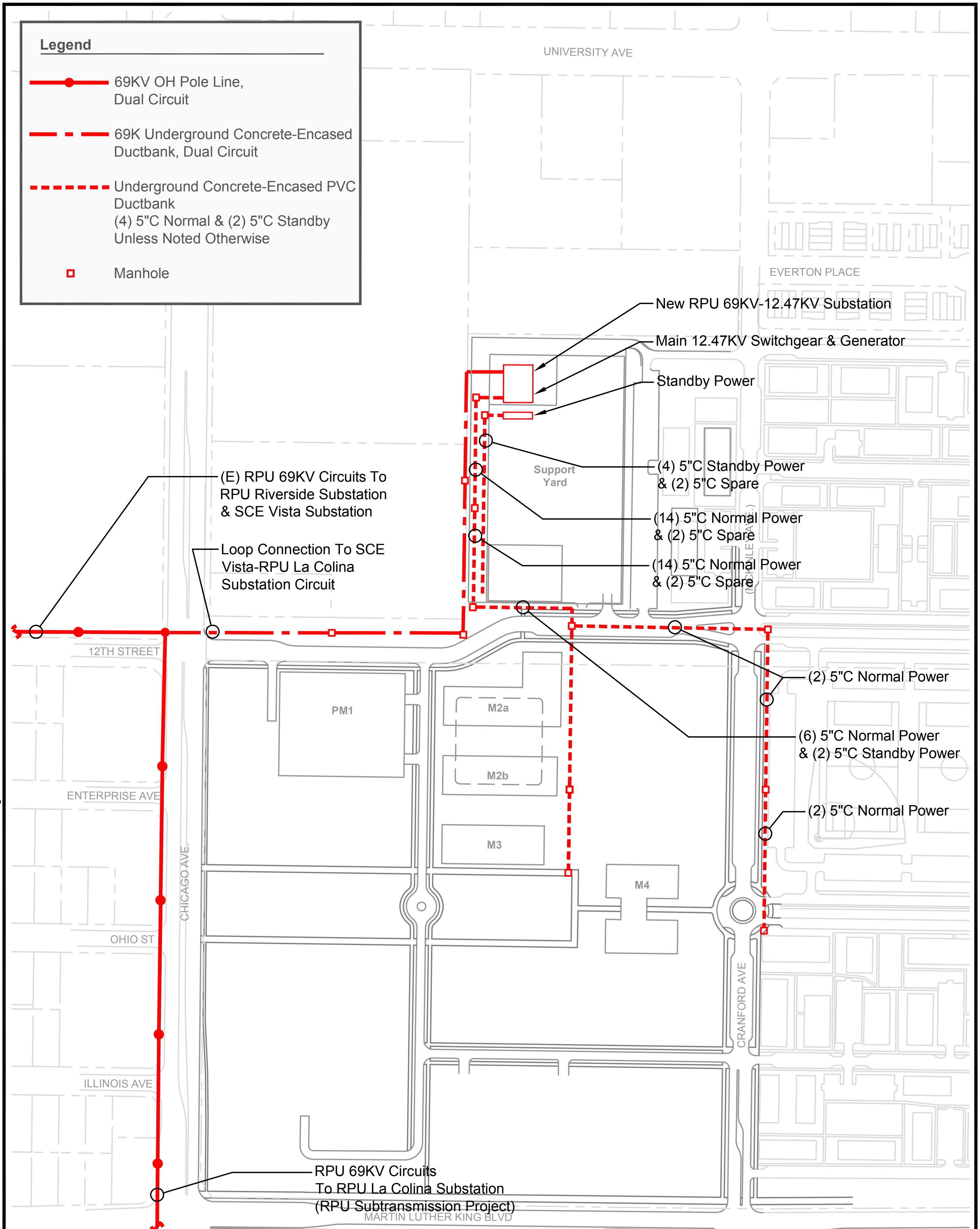
Figure 12-3
Proposed 12.47KV Normal Power Single Line Diagram

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 12-3 PH1 ELEC-SLD.dwg 06-23-09 11:50:06AM PScheetz



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 12-4 PH1 ELEC-ALT-B.dwg 06-23-09 11:50:02AM PScheetz

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North

0' 75' 150' 300'

Figure 12-4

Phase 1 - 12.47 KV Power Distribution Plan Alternative B

UC Riverside School of Medicine **Infrastructure Development**

Standby Power Supply and Distribution System

Standby Generating Plant

A diesel fueled standby generating plant is recommended to supply critical School of Medicine loads during public utility power outages. The plant would include three days of diesel fuel storage. Assuming three generating units operating at an average of 75 percent of maximum load will supply standby power requirements, a total of 20,000 gallons of diesel fuel storage will be required. An alternative would be to use a natural gas fired generating plant to eliminate the need for diesel fuel storage. The plant will be sized to supply emergency power for all of the SOM buildings, and full standby power for the central heating and cooling loads of the critical facilities as well as critical distributed loads.

The following facilities will be served by the standby power plant:

- Medical Research (M1)
- Medical Research Laboratory & Office (M2a)
- Medical Research Laboratory & Office (M2b)
- Medical Research Office (M3)
- Medical Education (M4)
- Medical Research (M7)
- Vivarium Facility (MV)

Phase 1

The projected total standby electrical load for the Phase 1 facilities, including emergency (life safety) power for all of SOM buildings, is 3,225 kVA. Applying the N+1 concept yields a requirement for three generating sets, each rated at 1,750 kW (2,188 kVA at 0.80 power factor.) The generating sets will be installed inside weather-protective and sound-attenuating enclosures. Due to the magnitude of the Central Plant loads and the School of Medicine precinct distributed standby loads, the recommended generator output voltage is 12.47kV.

Full Buildout

The projected total standby electrical load for the Full Buildout facilities, including emergency (life safety) power for all of SOM buildings, is 5,129 kVA. Applying the N+1 concept yields a requirement for an additional generating set for a total of four generating sets, each rated at 1,750 kW (2,188 kVA at 0.80 power factor.) The generating sets will be installed inside weather-protective and sound-attenuating enclosures. Due to the magnitude of the Central Plant loads and the School of Medicine precinct distributed standby loads, the recommended generator output voltage is 12.47kV.

Table 12-5 develops standby generating plant loads for Phase 1 SOM facilities and Table 12-6 develops standby generating plant loads for the future buildout of the School of Medicine.

Table 12-5
ELECTRICAL LOAD ANALYSIS
STANDBY GENERATING PLANT LOADS -- PHASE 1

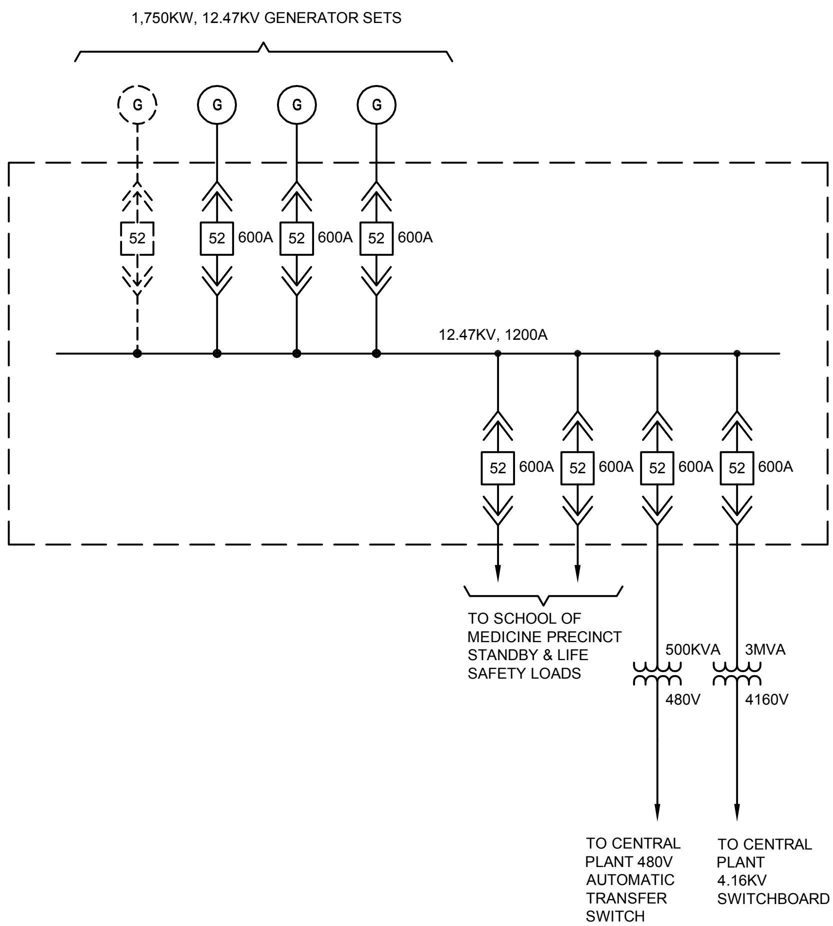
Bldg #	Facility	GSF	Load Density VA/SF	Connected Load, kVA	Demand Factor	Demand Load, kVA
	Central Heating & Cooling Plant					
	CW & HHW Production & Distribution					
M2a	Medical Research Laboratory	127,200	9.5	1,208	0.35	423
M2b	Medical Research Laboratory	95,200	9.5	904	0.35	317
M3	Medical Research Laboratory	85,200	9.5	809	0.35	283
M4	Medical Education Building	144,500	7.9	1,142	0.35	400
MV	Vivarium Facility	40,100	9.5	381	0.60	229
	Central Plant Facility Loads	27,000	17.0	459	0.60	275
	Central Heating & Cooling Plant - Subtotals	**519,200**		**4,904**		**1,926**
	SOM Distributed Loads					
M2a	Medical Research Laboratory (M2a)	127,200	7.6	967	0.35	338
M2b	Medical Research Laboratory (M2b)	95,200	7.6	724	0.35	253
M3	Medical Research Laboratory (M3)	85,200	7.6	648	0.35	227
M4	Medical Education Building (M4)	144,500	5.5	795	0.35	278
MV	Vivarium Facility (MV)	40,100	8.4	337	0.60	202
	SOM Distributed Load - Subtotals	**492,200**		**3,469**		**1,298**
	Standby Generating Plant Loads					**3,225**

Table 12-6 ELECTRICAL LOAD ANALYSIS STANDBY GENERATING PLANT FUTURE LOADS						
Bldg #	**Facility**	**GSF**	**Load Density VA/SF**	**Connected Load, kVA**	**Demand Factor**	**Demand Load, kVA**
	Central Heating & Cooling Plant					
	CW & HHW Production & Distribution					
M1	Research	120,000	9.5	1,140	0.35	399
M2a	Medical Research Laboratory	127,200	9.5	1,208	0.35	423
M2b	Medical Research Laboratory	95,200	9.5	904	0.35	317
M3	Medical Research Laboratory	85,200	9.5	809	0.35	283
M4	Medical Education Building	144,520	7.9	1,142	0.35	400
M7	Medical Research Laboratory	153,720	9.5	1,460	0.35	511
MV	Vivarium Facility	40,100	9.5	381	0.60	229
	Central Plant Facility Loads	27,000	17.0	459	0.60	275
	Central Heating & Cooling Plant -- Subtotals	**792,940**		**7,504**		**2,836**
	SOM Distributed Loads					
M1	Research	120,000	7.6	912	0.35	319
M2a	Medical Research Laboratory	127,200	7.6	967	0.35	338
M2b	Medical Research Laboratory	95,200	7.6	724	0.35	253
M3	Medical Research Laboratory	85,200	7.6	648	0.35	227
M4	Medical Education Building	144,520	5.5	795	0.35	278
M7	Medical Research Laboratory	153,720	7.6	1,168	0.35	409
MV	Vivarium Facility	40,100	8.4	337	0.60	202
	SOM Distributed Load -- Subtotals	**765,940**		**5,550**		**2,027**
	SOM Life Safety Loads					
	Ambulatory Care Facility (M5)	50,000	0.8	40	0.35	14
	Ambulatory Care Facility (M6)	100,000	0.8	80	0.35	28
	Ambulatory Care Facility (M)	100,000	0.8	80	0.35	28
	Research/Ambulatory Facility (RA1)	89,000	0.8	71	0.35	25
	Research/Ambulatory Facility (RA2)	152,000	0.8	122	0.35	43
	Research/Ambulatory Facility (RA3)	152,000	0.8	122	0.35	43
	Research/Ambulatory Facility (RA4)	152,000	0.8	122	0.35	43
	Research/Ambulatory Facility (RA5)	72,000	0.8	58	0.35	20
	Research/Ambulatory Facility (RA6)	82,000	0.8	66	0.35	23
	SOM Life Safety Loads -- Subtotals	**949,000**		**759**		**266**
	Standby Generating Plant Loads -- Future					**5,129**

Standby Power Distribution System

Standby power to the Central Heating and Cooling Plant will be supplied through two step-down transformers to feed (a) the 480-volt emergency switchboard through an automatic transfer switch and (b) the 4.16 kV switchboard through a circuit breaker interlocked with the two normal power main breakers and a tie breaker.

Two 12.47 feeders will distribute standby power to critical loads throughout the School of Medicine precinct. The feeders will be routed in utility corridors along with the normal power 12.47 kV feeders. Step-down transformers and automatic transfer switches will be required at each facility listed above to feed standby power switchboards at utilization voltage. Refer to Figure 12-5 for a single line diagram of the proposed standby power supply and distribution system.



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North
0' 75' 150' 300'

Figure 12-5

Proposed Standby Power Supply and Distribution Single Line Diagram

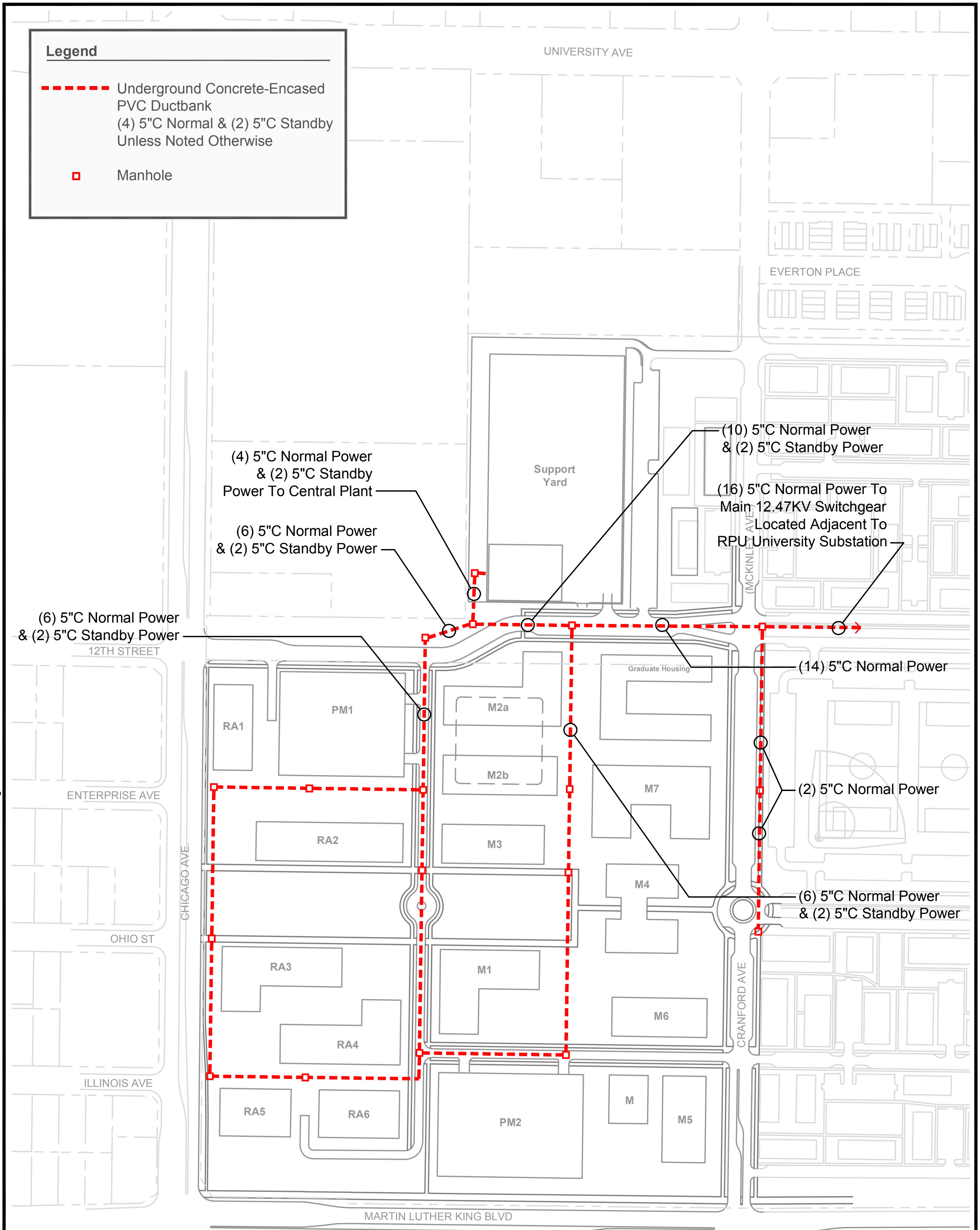
UC Riverside School of Medicine **Infrastructure Development**

12.3 SOM Infrastructure – Full Buildout

Additional electrical distribution to serve the future buildout of the SOM will follow the utility tunnel alignments as depicted in Figure 12-6 and Figure 12-7.

12.4 West Campus Infrastructure – Additional Evaluation Items

Depending on which alternative is selected, the phasing and layout of the electrical distribution system developed in the WCIDS may need to be reevaluated.



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North
0' 75' 150' 300'

Figure 12-6

Final - 12.47 KV Power Distribution Plan Alternative A

UC Riverside School of Medicine **Infrastructure Development**

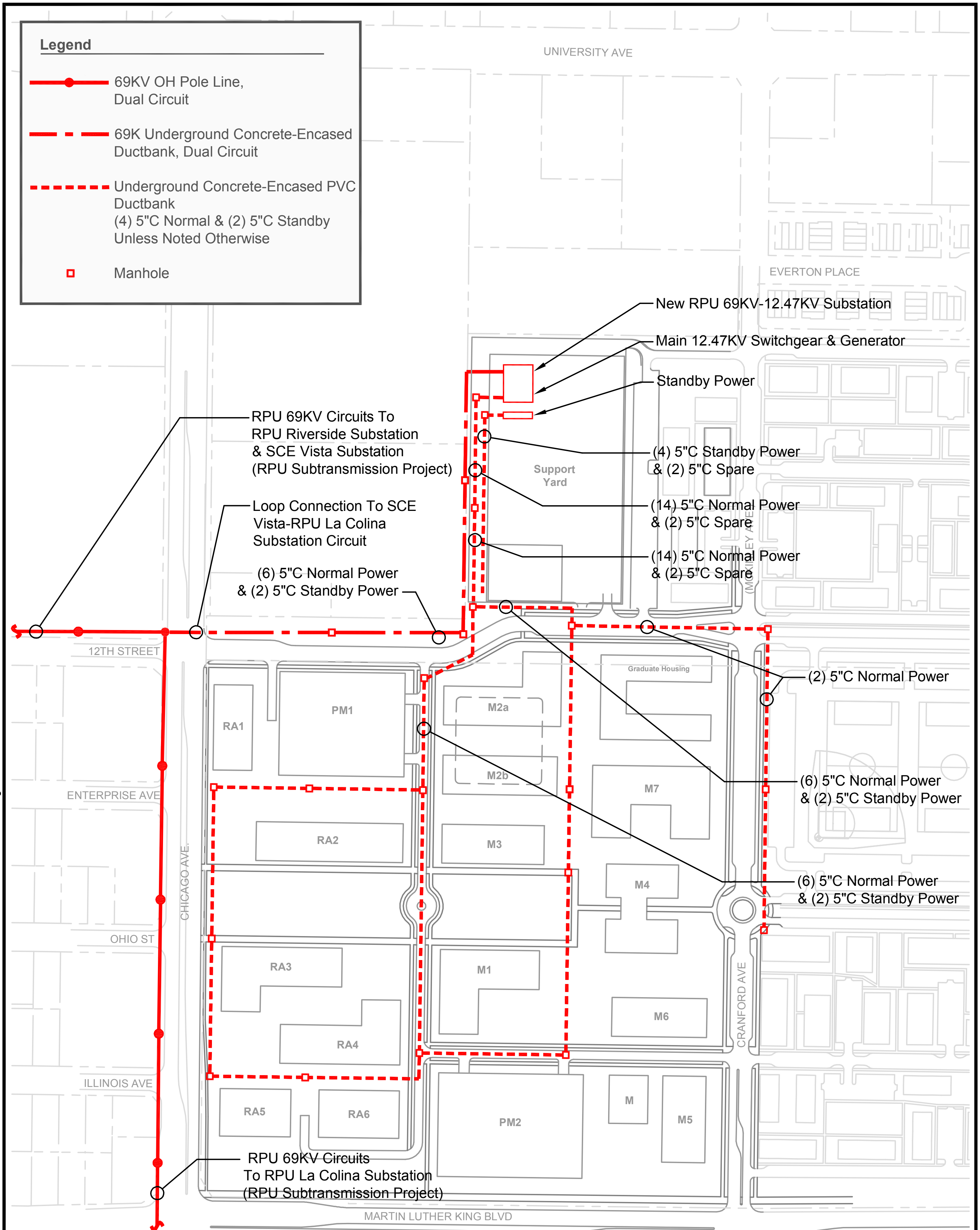

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Figure 12-7

Final - 12.47 KV Power Distribution Plan Alternative B

UC Riverside School of Medicine **Infrastructure Development**

13.0 ENERGY MANAGEMENT SYSTEM

This section summarizes the evaluation of the energy management system concepts for the proposed School of Medicine (SOM) and the future West Campus developments.

The design criteria used for this DPP is followed the design criteria in Chapter 10 of the WCIDS. As discussed in the WCIDS, the majority of the infrastructure associated with the Energy Management System is associated with building-related components

For the first phase of development at the SOM, the Energy Management System (EMS) will include the front end of the EMS system in the Central Plant, the Central Plant's EMS points, and the EMS backbone cabling in the SOM utility tunnels.

Additional elements for the first phase include Central Plant Optimization Programming. Optimization programming will control chillers, cooling towers, boilers and pumping to optimize the Central Plant energy efficiency and consumption.

14.0 DATA/TELECOMMUNICATIONS

The criteria defined in Chapter 14 – Data Telecommunications Systems of the 2008 West Campus Infrastructure Development Study (WCIDS) reflects the planning requirements based on a larger phased plan for the entire West Campus. The original report defines the infrastructure and technical systems criteria for the new West Campus system.

The overview provided in this report involves the infrastructure requirements for the School of Medicine only. However, it does incorporate infrastructure that would support common pathways with future West Campus requirements. The technical requirements, criteria and phasing aspects of the West Campus for areas outside of the School of Medicine were not updated for this overview.

The phasing plan and infrastructure requirements detailed in the WCIDS should be reviewed and updated based on a revised phasing plan for the West Campus. Connectivity requirements and locations will be affected by the revised phasing and will require updating when the final plan is developed.

Voice / Data Network Node

The current plan by the University Computing & Communications (C&C) department involves the design and implementation of a voice/data network node for the West Campus in the M4 building at the School of Medicine. Node (M4) will serve as one of the West Campus Node(s). The Node (M4) will primarily serve all eighteen of the School of Medicine Buildings i.e., M, PM, RA and SOM Housing (See Figure 4-3). Initial space requirements for the voice / data network node will be determined during the Medical Education Building (M4) DPP process. Other Node(s) are being considered for Family/Apartment Housing and Core Academic Buildings. Voice and data network equipment will not be part of the School of Medicine infrastructure development project.

Voice/Data Backbone

The current plan by University C&C department involves the design connectivity from the Voice/Data Node (M4) to the existing East Campus Voice/Data Network Node will involve Dark Fiber(s) by multiple Service Providers and/or University Campus Local Fiber. Conduit infrastructure from the voice/data network node (M4) to the service provider connection point is part of the School of Medicine infrastructure development project. Procurement of dark fiber connections is not part of the School of Medicine infrastructure development project.

Service Provider Connections

The current plan by the University C&C department involves the design and optional procurement of service provider connections for voice/data services. Conduit infrastructure from the voice/data network node to the service provider connection point is part of the School of Medicine infrastructure development project. Procurement of service provider connections is not part of the School of Medicine infrastructure development project.

School of Medicine Backbone

Individual building connections for the School of Medicine will require conduit pathway from each building to the West Campus voice/data network node. Pathways within the campus utility corridors are part of the School of Medicine infrastructure development project and will be provided within the utility tunnels. Conduit infrastructure from the voice/data network node (M4) to the utility tunnel and from each building to the utility tunnel will be provisioned separately for each building under the individual building scope. Connectivity (voice/data cable and services) will be provisioned separately for each building under the individual building scope.

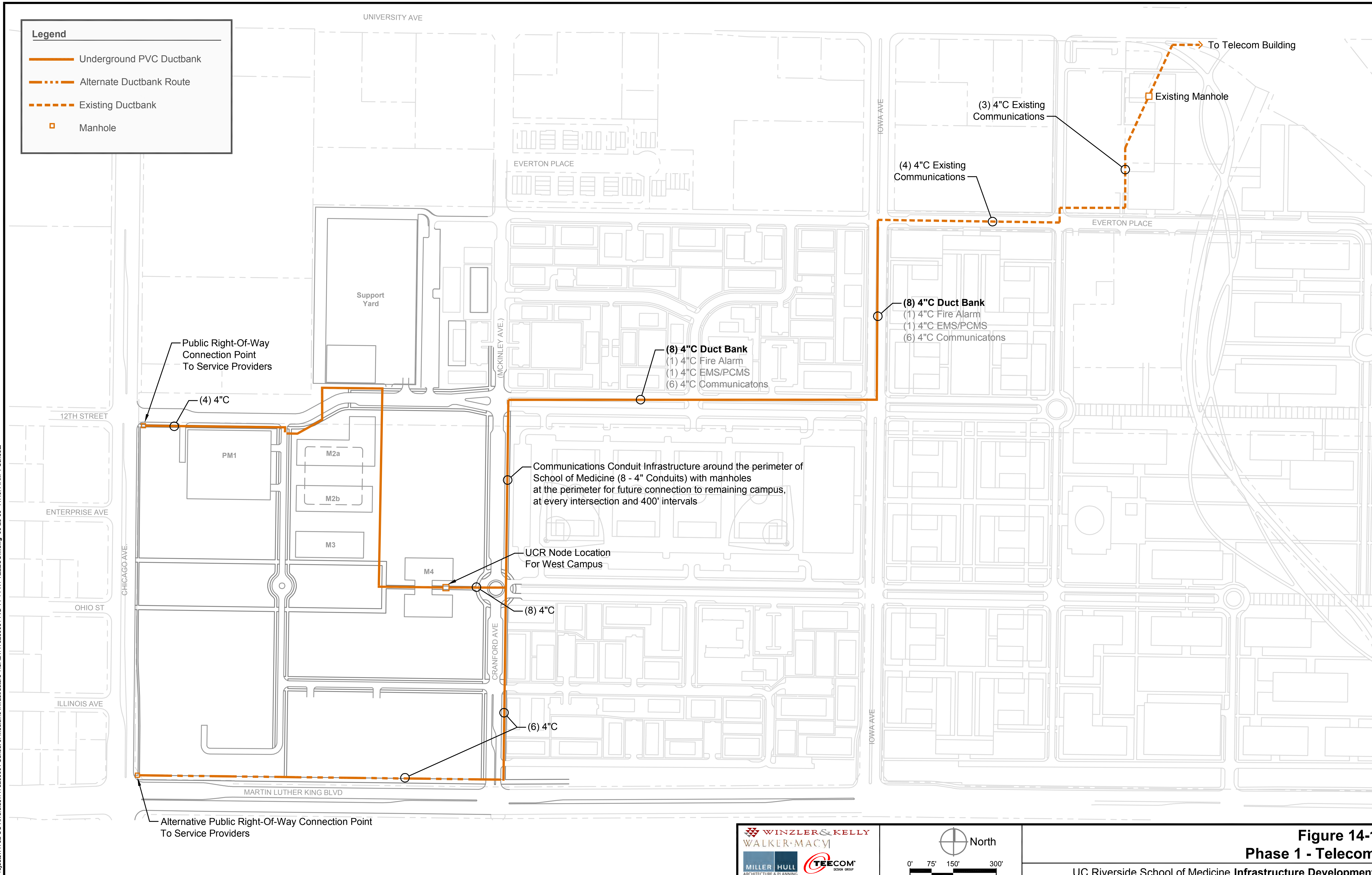

Figure 14-1
Phase 1 - Telecom

UC Riverside School of Medicine **Infrastructure Development**

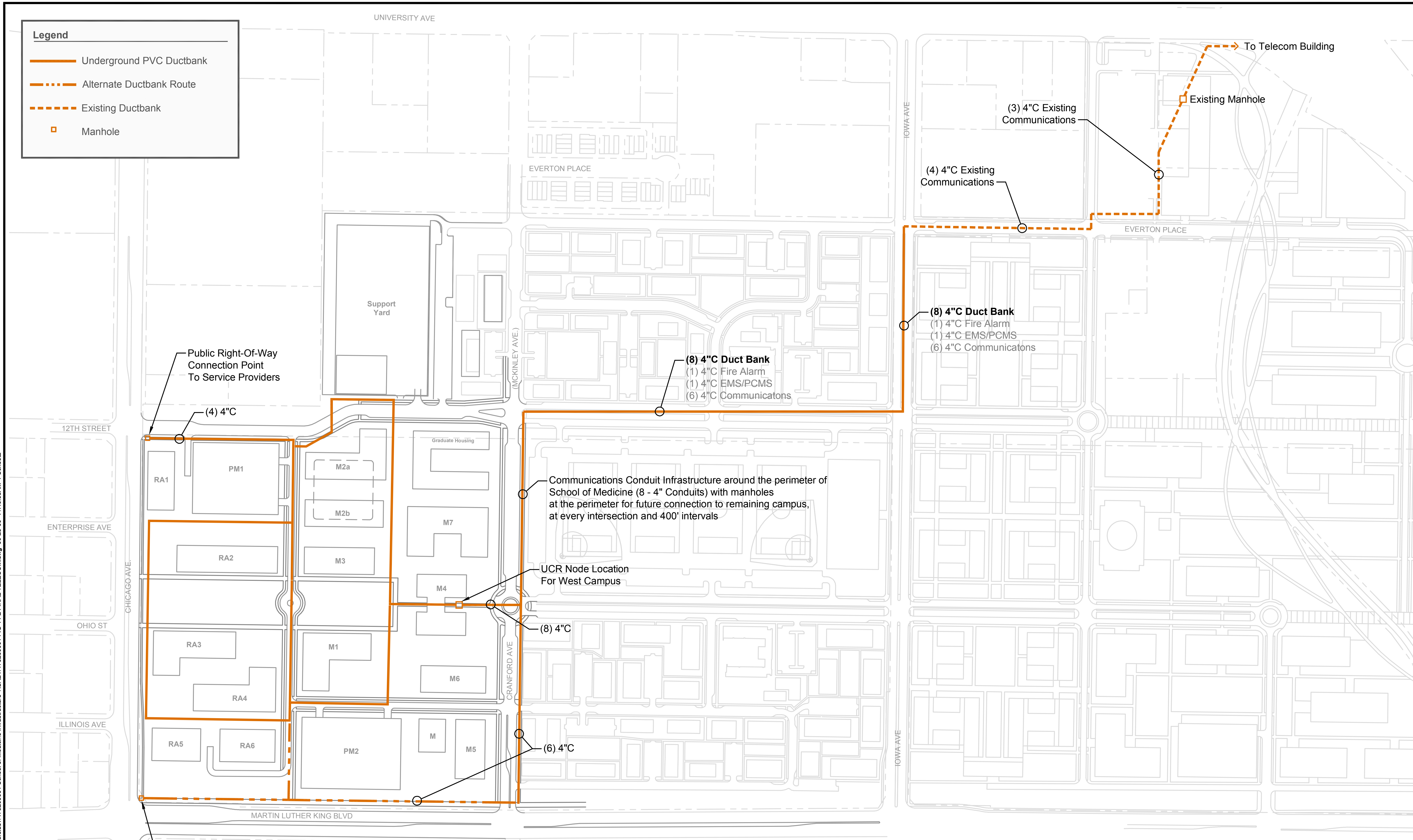

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Figure 14-2
Final - Telecom

UC Riverside School of Medicine **Infrastructure Development**

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15.0 FIRE ALARM

The criteria defined in Chapter 15 – Fire Alarm Systems of the 2008 West Campus Infrastructure Development Study (WCIDS) reflects the planning requirements based on a larger phased plan for the entire West Campus. The original report defines the technical fire alarm criteria of the existing system and the new West Campus system.

The overview provided in this report involves the infrastructure requirements for the School of Medicine only. The technical requirements, criteria and phasing aspects for the West Campus were not reviewed or updated for this overview.

School of Medicine

The current plan by the UCR Fire Alarm department for monitoring of buildings in the school of medicine requires connectivity to the existing dispatch location on the east campus. There are currently two UCR approved methods for fire alarm monitoring connectivity:

- Digital Dialer – Uses dial tone services provided by the University Computing & Communications (C&C) department (detailed in the communications overview in Section 14).
- Direct physical connection – Requires a physical conduit path and fiber optic connection from the West Campus to the existing East Campus dispatch location.

Optional connectivity options for fire alarm monitoring include the following:

- Wireless Mesh Technology – Requires procurement and deployment of a proprietary network.

Additional analysis will be required during the design process for the School of Medicine project to select a preferred method for fire alarm connectivity to the East Campus.

All infrastructure, service and equipment for the fire alarm monitoring are part of the School of Medicine infrastructure development project. This includes panels and equipment in the dispatch location and within the first School of Medicine building connected. This excludes any fire alarm devices within the buildings.

Fire alarm system costs for devices and ancillary panels within the School of Medicine buildings will be provisioned separately for each building under the individual building scope and budget.

Notes:

Fire alarm system equipment upgrades are necessary to facilitate the connectivity to the east campus. The following equipment costs were provided by Scott Corrin:

- Addition of components to the existing system – $10,000
- Expansion of the existing systems - $25,000
- Parallel components on the existing systems - $150,000
- Wireless Mesh Technology equipment and deployment – $200,000

Site EMS/PMCS Overview

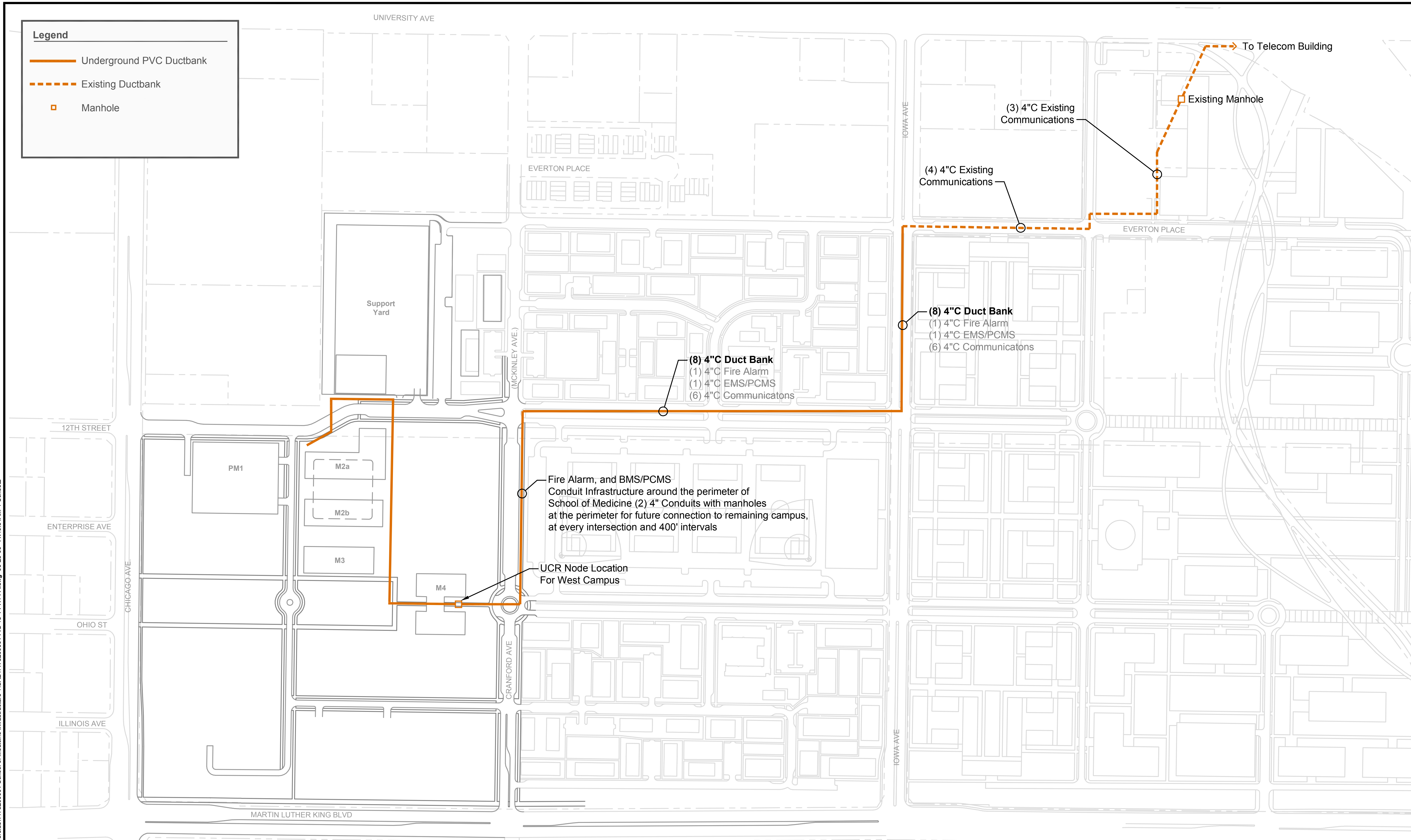
The Energy Management System (EMS) and Power Management Control System (PMCS) connectivity from the School of Medicine and the Central Plant will use network service provided by the University C&C department to facilitate connectivity to the existing East Campus EMS/PMCS network. Internet Protocol (IP) based service connections will be provisioned by the UCR C&C department using the voice/data network for the West Campus (detailed in the communications overview in Section 14).

Future direct connection between the East and West Campus for a dedicated EMS/PMCS network will be provisioned as a physical connection is built between the East and West Campus.

Site Emergency Phone

Emergency phones on the West Campus will use dial tone services provided by the University C&C department (detailed in the communications overview in Section 14). Conduit, cable and connectivity for individual phones will be provisioned as each phone location is identified during the planning of the SOM buildings.

Alternate service connectivity for remote phone locations will utilize a cellular device; these locations will require electrical power for service. Conduit and power for individual phones will be provisioned as each phone location is identified during the planning of the SOM buildings.



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TEECOM DESIGN GROUP

Figure 15-1
Phase 1 - Fire Alarm

UC Riverside School of Medicine **Infrastructure Development**

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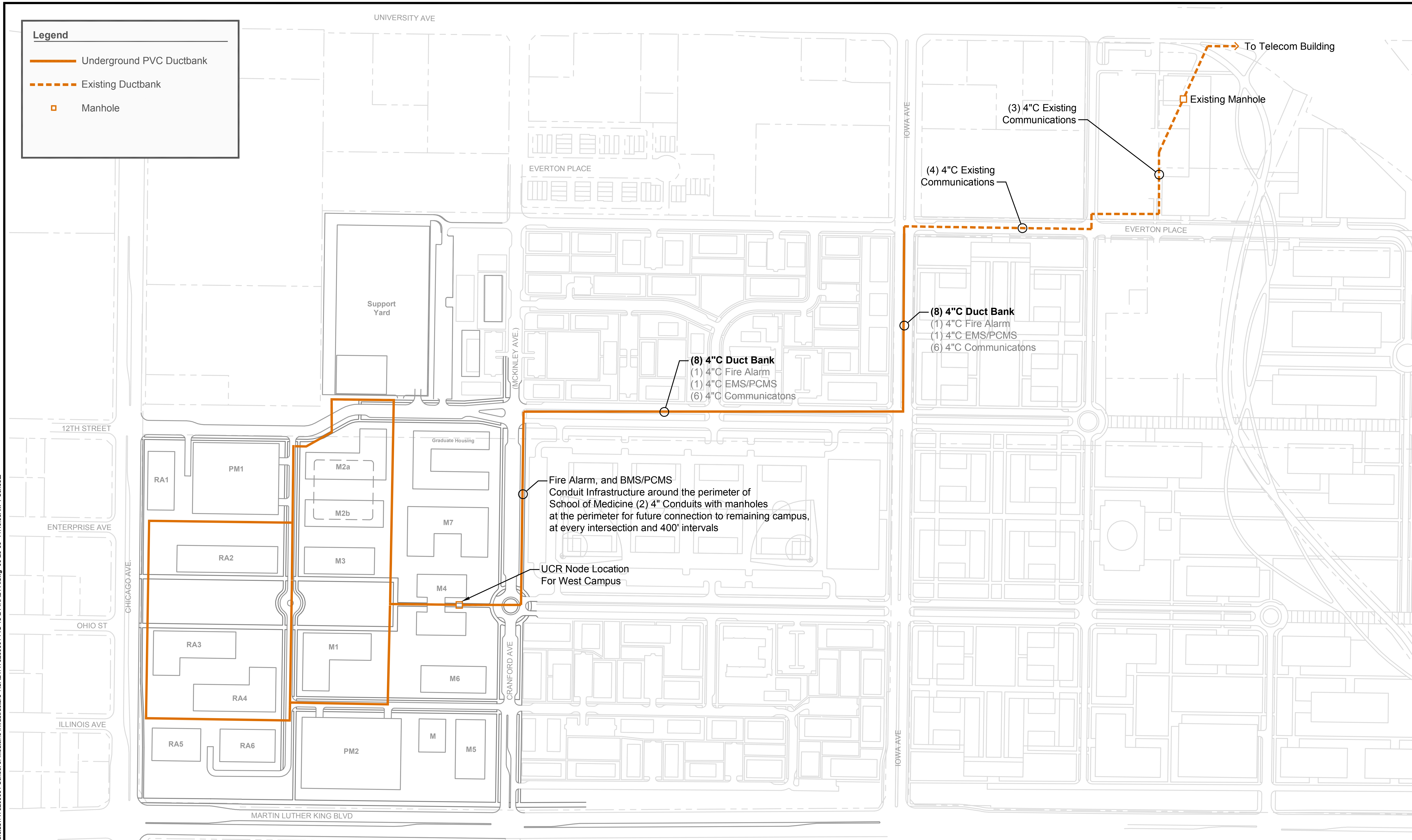

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TEECOM DESIGN GROUP

North
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Figure 15-2
Final - Fire Alarm

UC Riverside School of Medicine **Infrastructure Development**

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16.0 CIRCULATION AND LANDSCAPE

The WCIDS estimated improvements needed to campus and city streets to accommodate expected traffic from West Campus growth. It is recommended that a detailed traffic study be subsequently prepared based on the revised program. The EIR to be prepared to accompany the LRDP Amendment now underway will be a logical source of such a traffic study. The details of phasing and building uses in the latest (March 18, 2009) program revision will result in a more refined estimate of traffic impacts and mitigation measures.

With such refined estimates, UCR should also continue negotiations with the City of Riverside on future improvements to Chicago Avenue and MLK Jr. Blvd.

16.1 Circulation System

The School of Medicine campus presents a good opportunity for UCR to establish the first elements of the larger West Campus transportation system, which encourages several modes of travel. The design of the circulation system should also be carefully considered to include approaches to mobility through many alternatives, instead of simply private automobiles (See Figures 16-1, 16-2, 16-3, and 16-4).

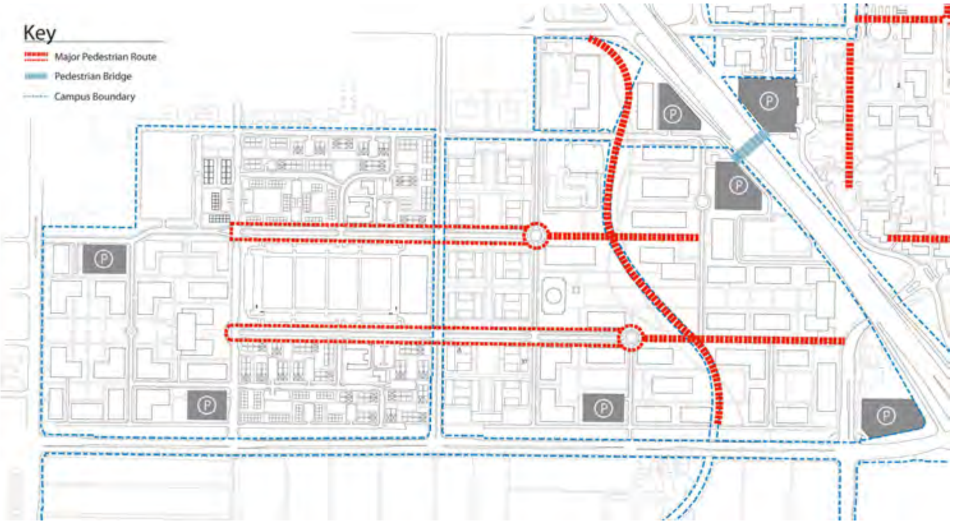
The following uses are the basis of the proposed circulation system for the West Campus:

Pedestrian

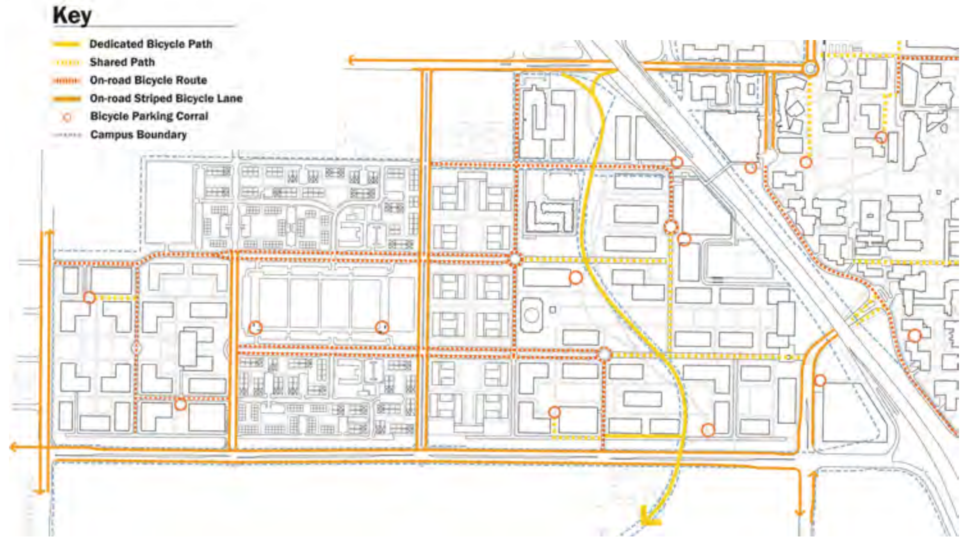
It will be critical to provide well-designed paths to encourage safe and comfortable pedestrian circulation. The other equally important provision for pedestrian circulation will be the inclusion of sidewalks, preferably not curb-tight, of at least 8-foot width, on all new West Campus streets. Crosswalks are essential, combined with curb bulbs that shorten the crossing distance. Service or emergency vehicles will not be permitted on most walkways, but to ensure complete fire access to the heart of the SOM, a north-south walkway over the proposed Utility Corridor should be at least 20 feet wide to allow for emergency use by fire and life-safety vehicles (and potential access for repair of service tunnels underneath). These vehicles can gain access to the walkways through the use of details such as removable bollards or gates. Materials will consist primarily of scored concrete. These Walks should also feature campus standard pole-mounted lights and pedestrian furnishing such as seating, bollards and trash cans. (See Figure 16-5)

Bicycle

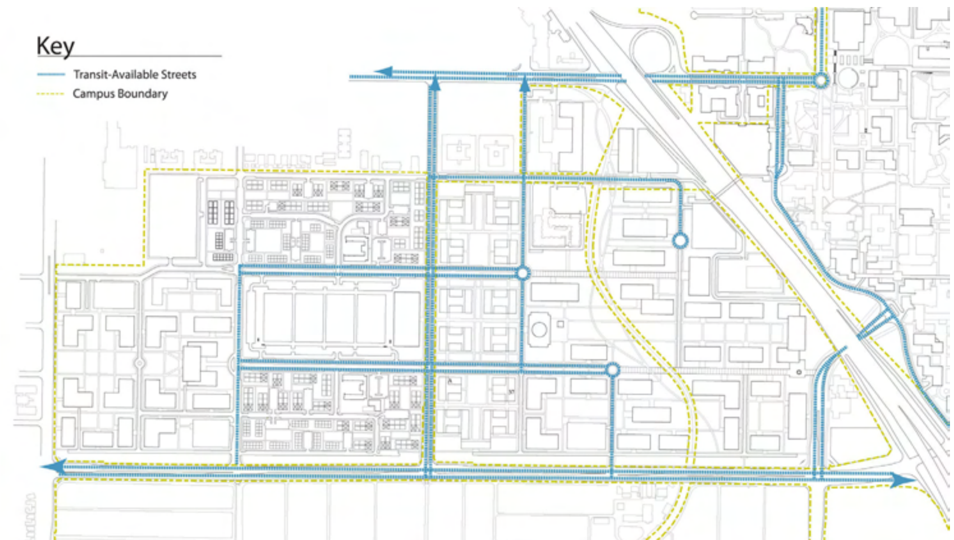
All streets on the West Campus will include painted bicycle lanes or will be designed for slow-enough speeds that cyclists can feel comfortable sharing vehicular lanes. With anticipated pedestrian traffic volume, it is important to avoid forcing cyclists to use sidewalks.
It will be important to connect the School of Medicine with the existing East Campus and the future West Campus core. The CAMPS proposes that the NW and SW Malls serve as this linkage. Given that the timing of improvements to these two streets may not occur immediately, depending on the development plan for Family Housing, it may be desirable to seek another route between the SOM and the East Campus. A 16 ft. wide shared pedestrian and bicycle pathway is proposed along the north side of MLK Jr. Boulevard. (See Figure 16-6) This will complement bike lanes along MLK when it is widened to 3 lanes in each direction, as is planned in the City of Riverside's Capital Improvement Plan. A wide shared pathway can provide a safe



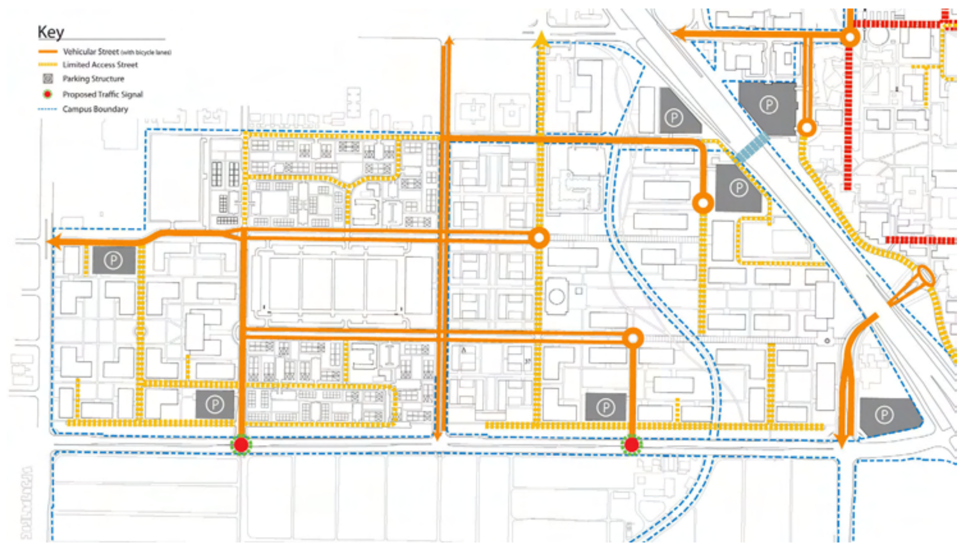
16-1: Pedestrian



16-2: Bicycle



16-3: Transit



16-4: Private Automobile

Figure 16-1 to 16-4: CAMPS Circulation Plans **(Not to Scale)**

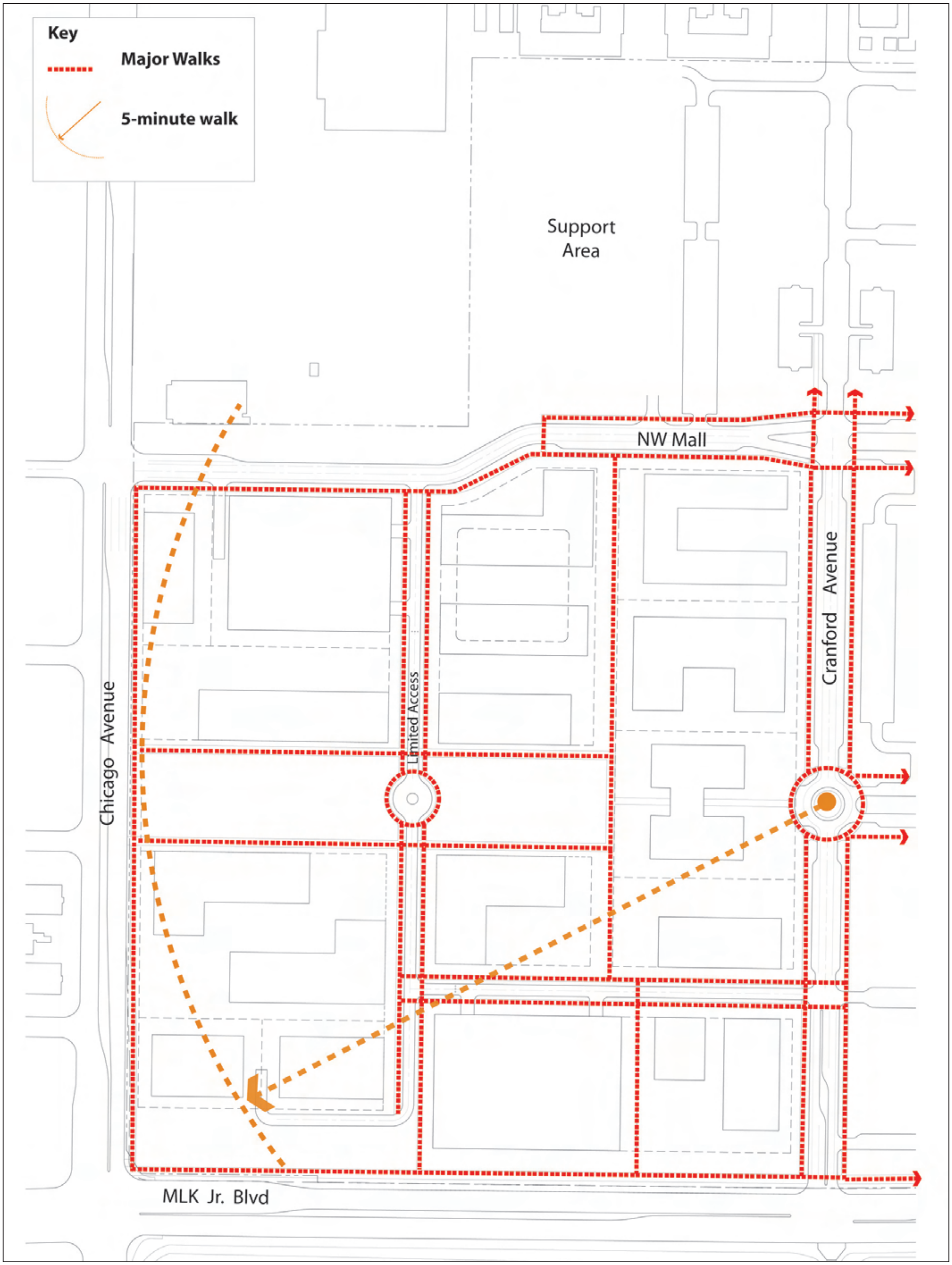


Figure 16-5: Pedestrian Circulation

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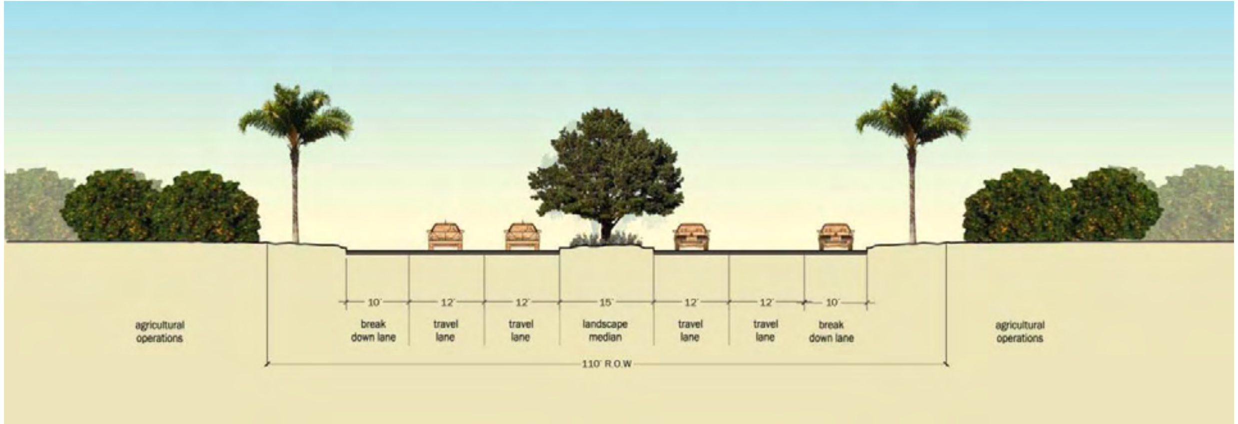
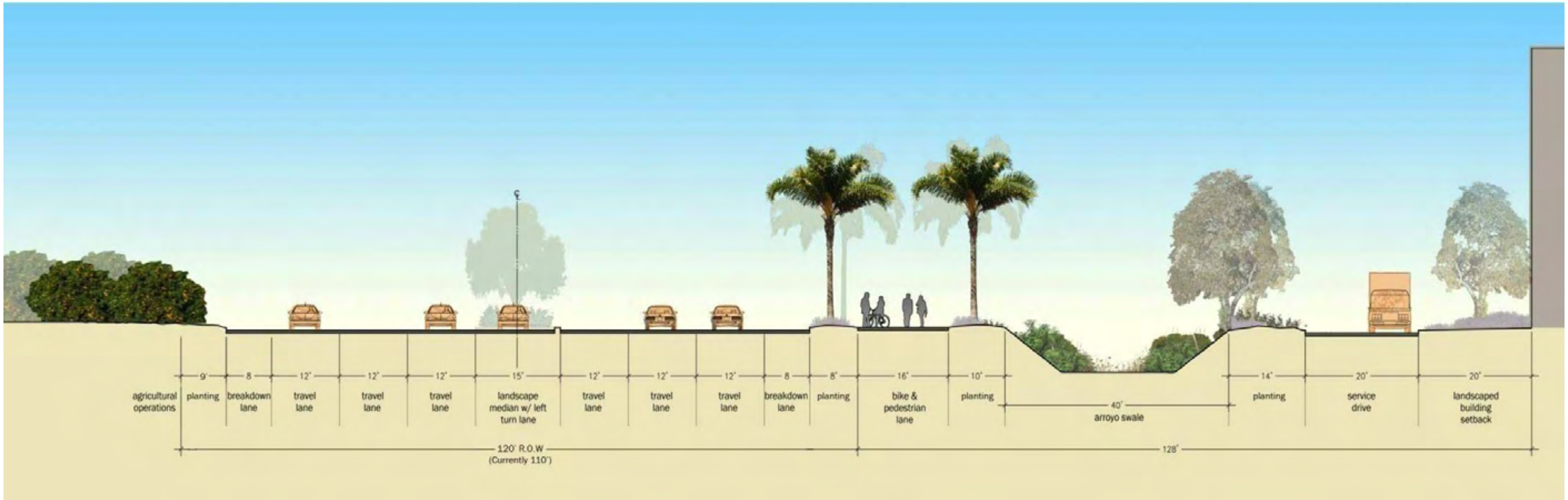


Existing Street Section



Proposed 3 Lane Street Section

Figure 16-6: MLK Cross-Sections **(Not to Scale)**

route, separated from automobiles, which can also become an important part of the campus public and social space. (See Figure 16-7)

Service

All academic buildings on the School of Medicine Campus will require some form of service access, from simple trash and recycling removal to the regular delivery of food and the management of scientific supplies, which can require extraordinary care. Advance planning for the West Campus may allow for greater efficiencies in service access. Deliveries can be centralized at the Support Yard and distributed to smaller vehicles, thus reducing the footprint of service yards associated with new buildings.

Transit

Cranford Avenue and NW Mall, as well as the Limited Access streets, can be considered as “transit-ready”. As buildings and housing units are developed and class schedules are established, UCR Transportation and Parking Services (TAPS) can refine planning for transit based on this general framework and also retain future flexibility in route selection as well as transit vehicle choice. In order to connect the School of Medicine with the academic cores of the West and East Campuses, transit shuttles should offer frequent headway, rapid and simple connections (down NW or SW Mall or MLK Jr. Blvd.) and access to programs with direct relationships to instruction and research. (See Figure 16-8)

Private Automobiles

The following street improvements are proposed for the West Campus and its surroundings (See Figure 16-9):

<u>Chicago Avenue</u>

Chicago Avenue is a major north-south arterial for the City of Riverside. The City’s Capital Improvement Plan includes a proposal to provide a consistent cross-section of a bike lane and two lanes in each direction on Chicago with new turn lanes at major intersections such as MLK Jr. Blvd. (See Figure 16-10) This improvement project should be revised to include changes to the proposed intersection of NW Mall and Chicago Avenue. This signalized intersection will align with 12th Street per discussions with the City.

The City of Riverside Public Works (represented by Engineer Kevin Marstell) was consulted on March 24, 2009 with UCR’s preliminary plans. Marstell indicated that the NW Mall intersection with Chicago is adequately spaced from University Avenue (they require at least 1,200 feet between major signals) and it aligns well with the existing 12th Street. Marstell’s superior, Rob van Zanten later indicated (April 17th phone call) that a traffic study will be needed to determine the eventual configuration of that intersection, in terms of lanes and turn pockets. Van Zanten assumed this would happen with the LRDP update for the SOM. A preliminary layout was prepared by the planning team to study potential impacts to the SOM campus capacity. (See Figure 16-11)

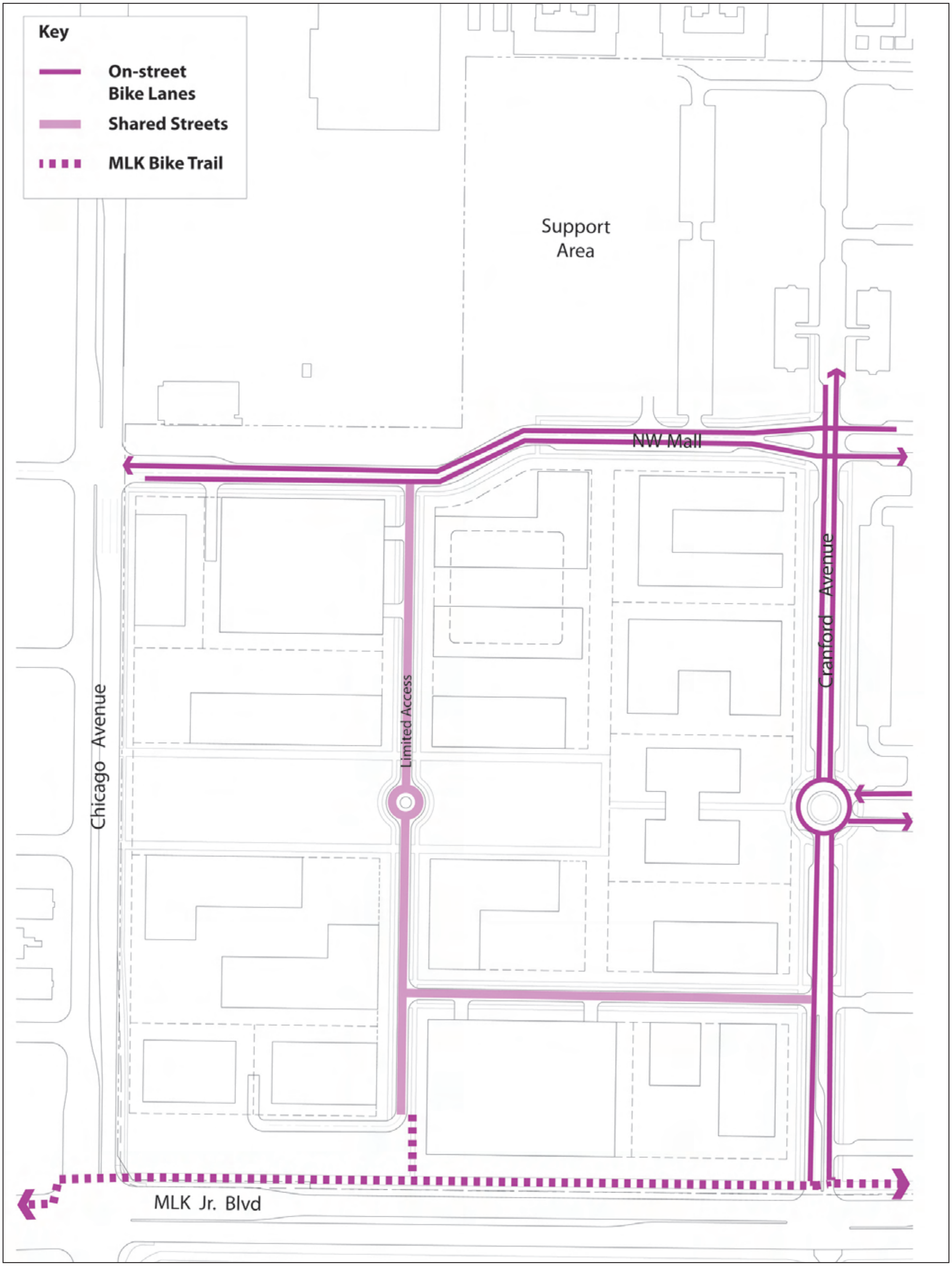


Figure 16-7: Bicycle Circulation

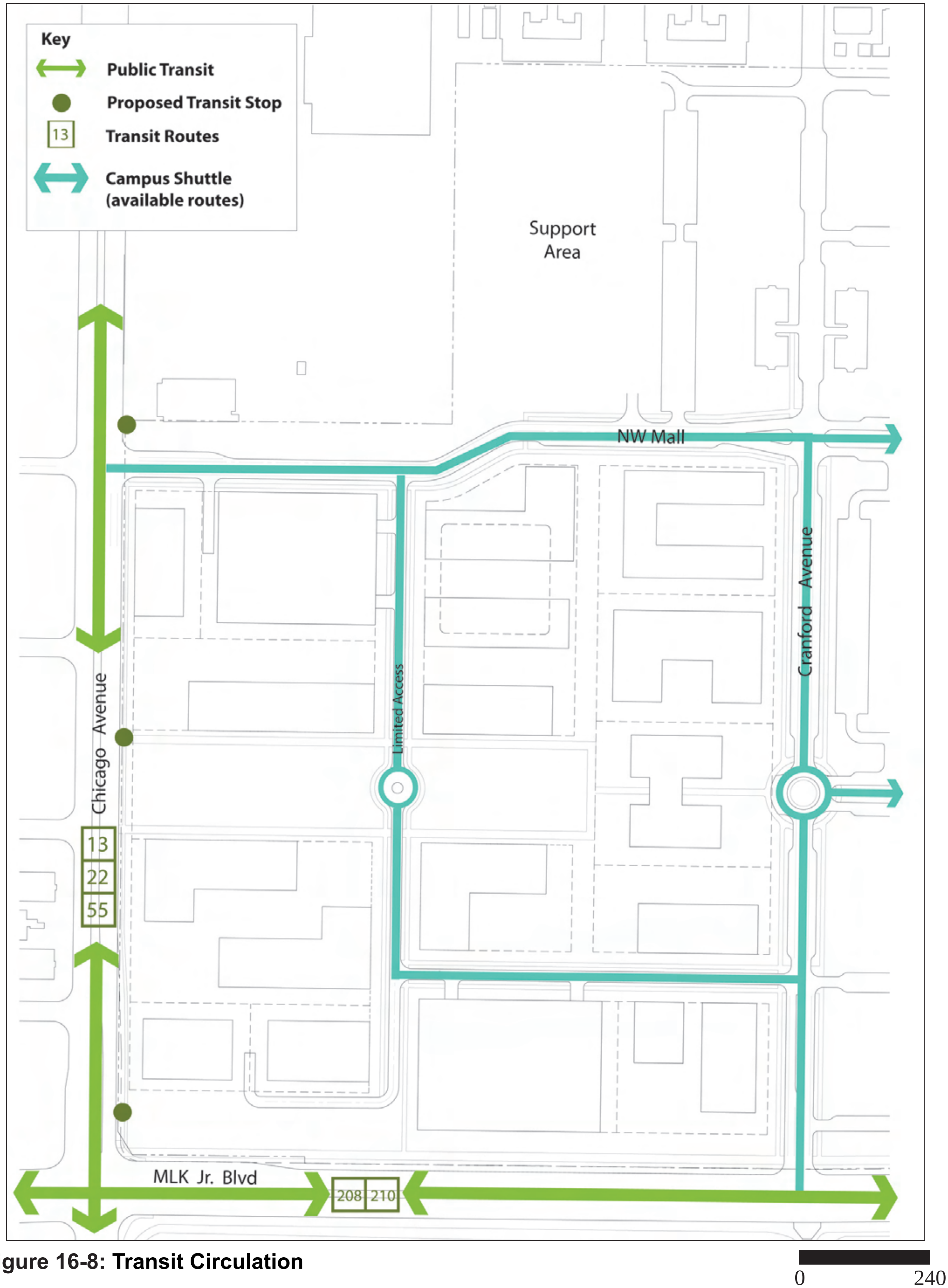


Figure 16-8: Transit Circulation

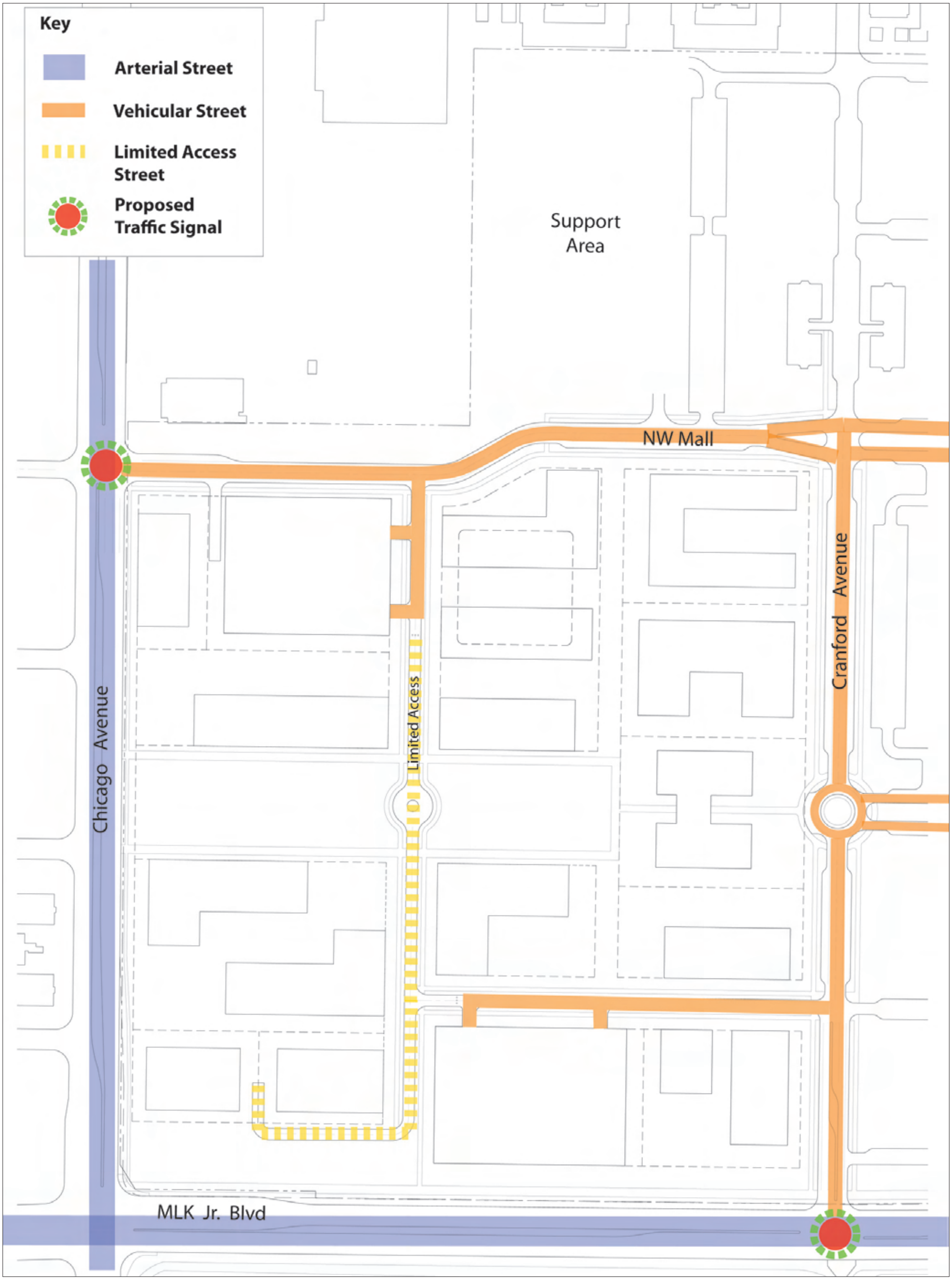


Figure 16-9: Private Auto Circulation

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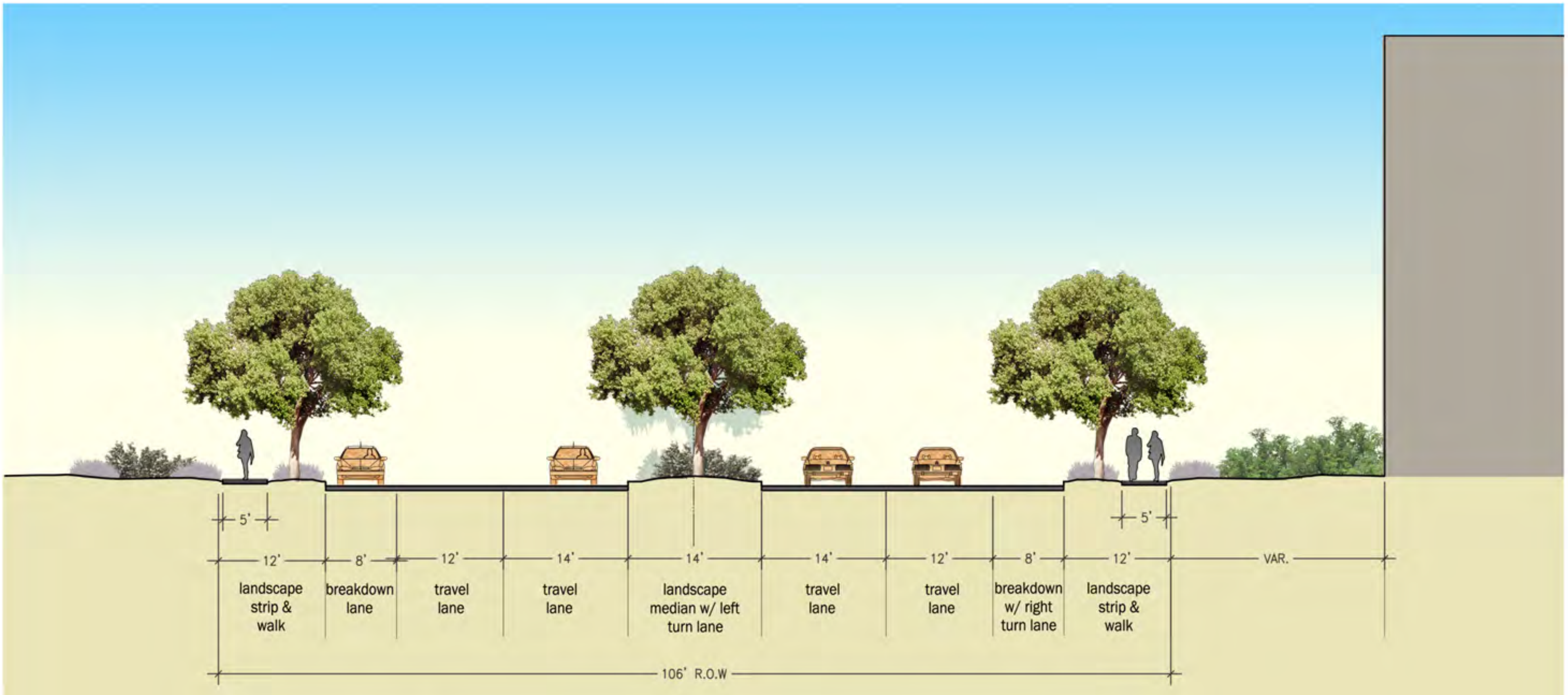

Based on information provided by City of Riverside

Figure 16-10: Chicago Avenue Plan and Cross-Section *(as proposed by City of Riverside)* **(Not to Scale)**

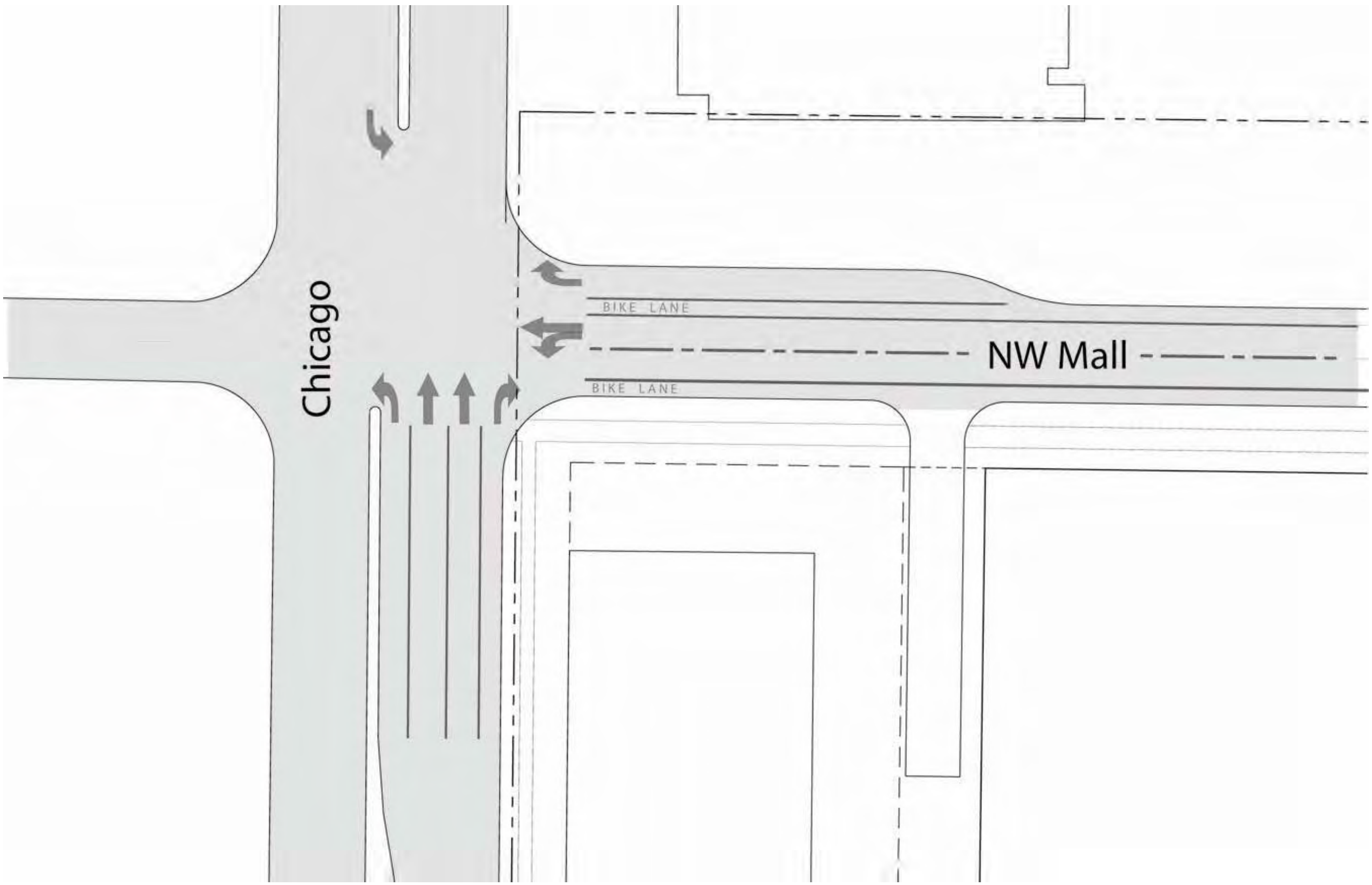

Figure 16-11: NW Mall and Chicago Intersection Detail **(Not to Scale)**

Martin Luther King Jr. Boulevard

MLK Jr. Boulevard is a regional arterial, designed to convey large volumes between a new full interchange at I-215/SR-60 freeway and the 91 Freeway approximately 3 miles to the west. The City's General Plan indicates a goal of eventually seeing a 6-lane road (3 lanes each way) between the 91 and 215 freeways, so MLK would eventually be widened east of Chicago. It is anticipated that widening the route by one lane, to three lanes in each direction, will require some acquisition of UCR property. This will affect the palm tree plantings on either side of the street, which serve as wayfinding elements and a recognizable transition between the city and campus. Widening may also affect the median, given that the City only has a 110 ft. ROW (and requires 120 ft. for a full street). As described earlier in this document, the revised plan for SOM suggests that a 16 ft. shared bicycle and pedestrian walkway be built along the north side of MLK to convey students, staff and faculty between SOM and the rest of the UCR campus which will complement on-street bike lanes along the eastbound lanes of MLK.

The City of Riverside Public Works also indicated that the Cranford Avenue intersection with MLK is an adequate distance from Chicago Avenue. Rob van Zanten also indicated on a April 17th phone call that a traffic study will be needed to determine the eventual configuration of that intersection, in terms of lanes and turn pockets.

There is also an open space buffer of at least 100 ft. established along the northern edge of MLK Jr. Blvd. per the 2005 LRDP that will include innovative stormwater treatment (infiltration, evaporation and conveyance), and will minimize traffic noise disturbance for academic buildings and housing on the West Campus.

Cranford Avenue and NW Mall

This category includes Cranford Avenue and the portion of the NW Mall west of Cranford Avenue. These two streets will become open to vehicular traffic. The recommended street section for this type of street is intentionally narrow to discourage speeds and cut-through traffic and foster pedestrian safety. Both streets should have ample sidewalks and street trees planted in roadside planting strips (parkways) and on-street parking as well as bicycle lanes. Bicycle lanes, if wide enough and well-marked, can be located adjacent to on-street parking without significant conflicts. (See Figure 16-12)

A significant proposed change has been made to the Cranford Avenue configuration since the CAMPS and WCIDS projects. A roundabout has been added to the west end of SW Mall. This will serve several functions. It will slow traffic on Cranford Avenue. It will further identify the end of the SW Mall as a prominent campus location and serve as a gateway to the SOM from the rest of campus. The roundabout should be correspondingly landscaped to emphasize the importance of the future iconic M4 building. Finally, the roundabout provides a convenient turnaround for traffic on the SW Mall, to avoid having to use Cranford Avenue and MLK to circulate within proposed Family Housing and Recreation fields.

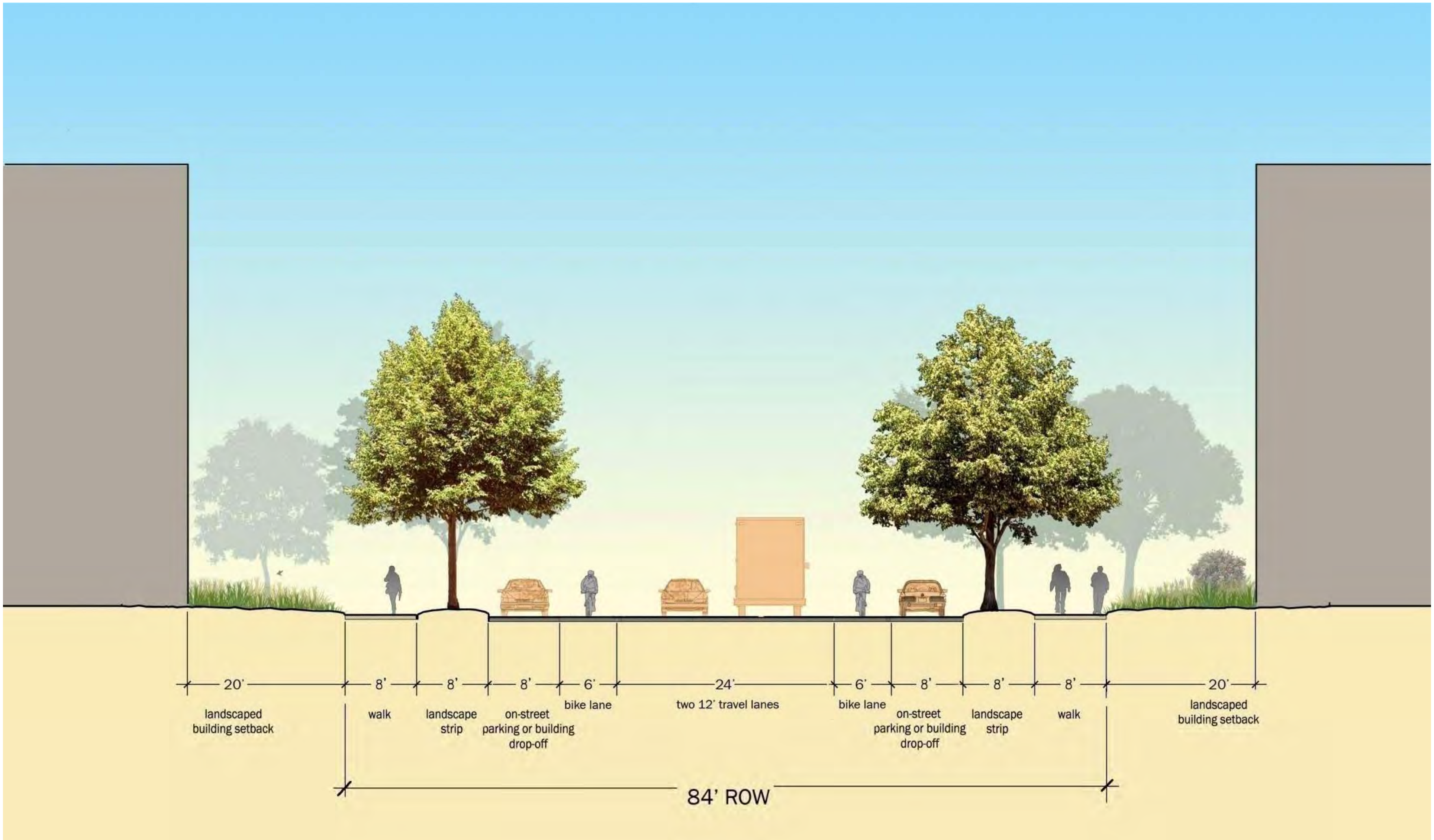

Figure 16-12: NW Mall and Cranford Avenue Cross-Section **(Not to Scale)**

On-street parking is recommended in certain locations, to further slow traffic and informally raise the parking capacity of the West Campus, although these spaces have not been included in the campus parking analyses. At major intersections, the on-street parking will be replaced with curb bulbs or ‘bump-outs’ to reduce the crossing distance for pedestrians. At these intersections, crosswalks should also include a raised pedestrian table to further slow automobile traffic. Travel lanes (one in each direction) should be no wider than 12 ft. and narrower if possible at crosswalks throughout SOM. The paving material will consist of asphalt with concrete curb and gutter. Turn pockets at intersections may be necessary at major arterials. Street lighting should be pole-mounted, pedestrian-scaled and oriented to sidewalks.

Service and Limited Access Streets

Service streets within the West Campus will be basic, narrow streets, up to 20 ft. wide. These streets will be paved with asphalt, concrete curbs and raised sidewalks but could also be surfaced with special unit pavers in recognition of their flexible role, especially in areas of heavy pedestrian or bicycle traffic. Trees within planting strips will also shade these streets. The streets will include pole-mounted campus-scale lighting.

Street, Walkway and Intersection Design

As described in the WCIDS, new West Campus streets should include the following standard features:

- Minimized vehicular travel lanes (12 ft. maximum, 10 ft. preferred). A clear zone of 20 feet is usually a minimum required for fire vehicles but there may be instances where streets can be narrower.
- Minimized curb dimensions to reduce cornering speeds (15 ft. radius maximum).
- On-street parking where appropriate.
- Where there is on-street parking, curb bulbs or extensions at major intersections to reduce crossing distances for pedestrians.
- Bicycle lanes, minimum 5 ft. width. 8’-wide lanes are generous and preferred if space allows.
- Street trees, in planter strips of a minimum 6 ft. width, separating driving surfaces from sidewalks (parkways) or in tree wells incorporated within wide sidewalks.
- Sidewalks should have an 8 ft. minimum width, with a minimum of 12 ft. preferred for highly-traveled areas.

Phasing of street improvements

The phasing of campus development is not confined to a location that is compact enough to warrant only building a portion of the campus vehicular streets in the SOM plan. Given the large amount of square footage intended for Phase 1 and its probable trip generation and corresponding parking counts, it is likely that both the NW Mall and Cranford Avenue will need to be built in Phase 1, together with intersection improvements where these two streets meet Chicago Avenue and MLK Jr. Blvd respectively. When these two streets are constructed, they should include all pedestrian and bicycle facilities shown in the LRDP and CAMPS plan, as well as associated improvements such as street trees and crosswalks. The narrower Limited Access street through the center of the SOM site can be built incrementally, with a first leg accessing the Mall open space and the remainder to be completed in Phase 3.

16.2 Plant Material and Irrigation

Range of irrigation types:
In order to predict potable water demand on the SOM campus, an analysis of potential irrigation considered a bracketed range of plant material types. (This analysis utilized the CAMPS version of the SOM plan because the final revised layout for SOM developed during the Phase 1 Infrastructure process was not yet confirmed at that time.)

The original CAMPS plan did not consider plant material types for the SOM. The WCIDS plan identified broad categories of landscape improvements for the SOM, with structural landscape slated for a 10-foot zone around future buildings and turf assumed as the predominant surface for the remainder of the campus.

This project allowed for a more detailed study of the potential SOM landscape, using the CAMPS site plan as a basis. **Four** categories of landscape were identified (See Figures 16-13, 16-14, 16-15, 16-16, and 16-17):

1. Turf – Type I (Malls)
2. Turf – Type II (Other areas)
3. Shrubs (also known as structural landscape)
4. Swales (for stormwater detention)

Irrigation Water Demand Brackets:
Irrigation of these four above areas was analyzed using three potential water use intensities (High, Moderate and Low). The factors considered for potential irrigation demand are plant species (how much water the plants need to survive), irrigation type (efficiency of irrigation system) and ratio of shrub to turf areas (turf requires more water than shrub areas).

High Water Use:

- All turf plantings are assumed to be Type I turf and have high water needs (0.70 Kc) and are irrigated with rotors (0.70 IE).
- All shrub species have medium to high water needs (0.60 Kc) and planting areas are irrigated with spray heads (0.62 IE).
- All swale species have medium to high water needs (0.60 Kc) and planting areas are irrigated with rotors (0.70 IE).

Moderate Water Use:

- All turf planting areas are a combination of Type I turf (0.70 Kc) and Type II turf (0.60 Kc--Type II turf has lower water needs than Type I) and are irrigated with rotors (0.70 IE).
- All shrub plant species have moderate water needs (.35 Kc) and planting areas are irrigated with MP rotator spray heads (0.70 IE).
- All swale plant species have moderate water needs (0.30 Kc) and planting areas are irrigated with rotors (0.70 IE).

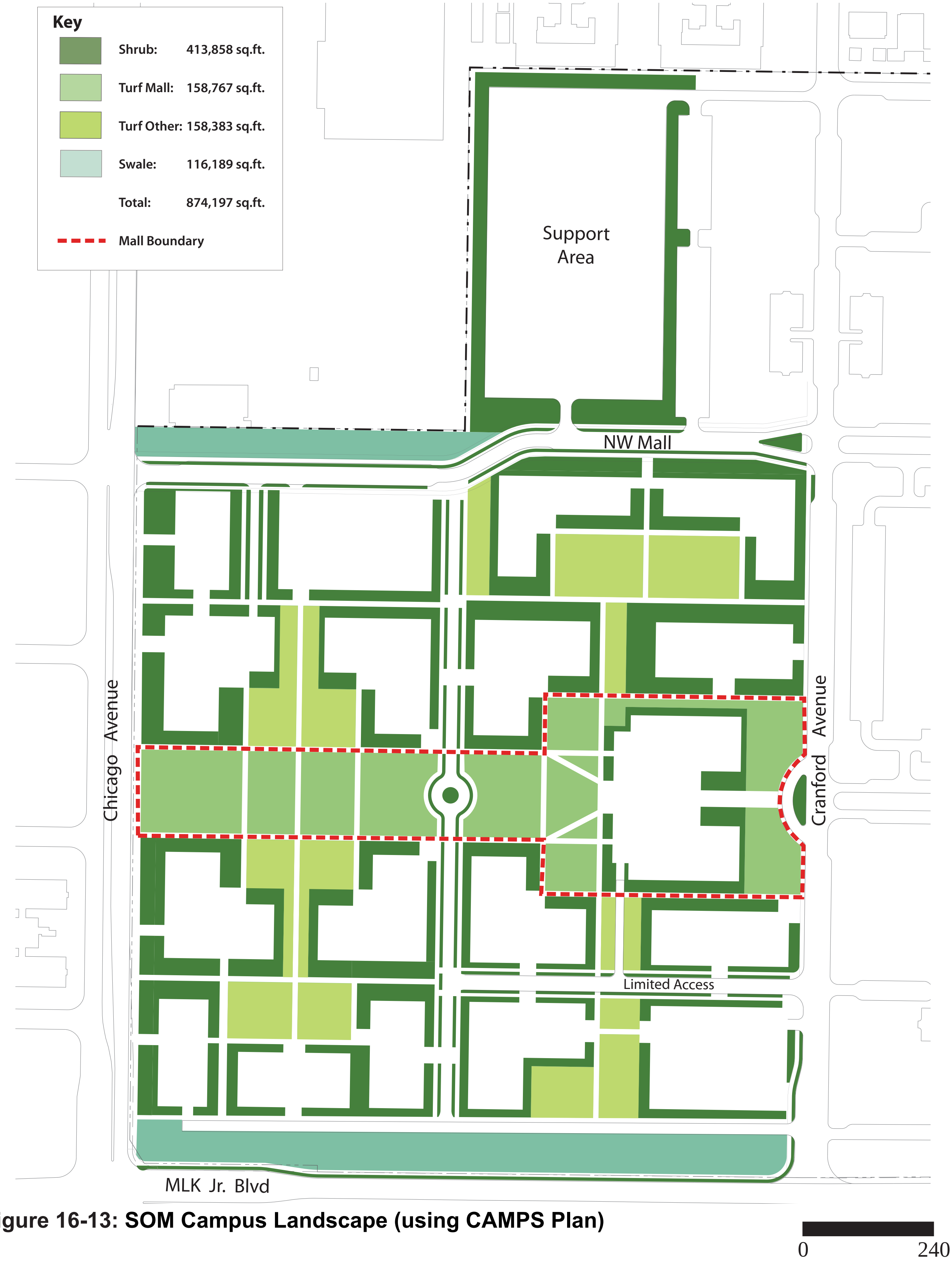

Figure 16-13: SOM Campus Landscape (using CAMPS Plan)

16-14 Turf on Library Mall

16-15 Biological Sciences Building Courtyard--Drought-tolerant Planting

16-16 Climate-Adaptive Shrub Planting

16-17 Psychology Building Courtyard--Drought-tolerant Planting

Figures 16-14 to 16-17: Landscape Types

Low Water Use:

- Turf A planting areas are a combination of Type I turf (0.70 Kc) and Type II turf (Type II turf has lower water needs than Type I) (0.60 Kc) and are irrigated with rotors (0.70 IE).
- Turf B planting areas are Type I turf (0.70 Kc) with Type II turf areas converted to shrub planting to further reduce water demand and are irrigated with rotors (0.70 IE).
- All shrub species have low water needs (0.10 Kc) and planting areas are irrigated with drip irrigation (0.90 IE).
- All swale species have low water needs (0.10 Kc) and planting areas are irrigated with rotors (0.70 IE).

***Parameters for Water Use Calculations**: **Kc** = Crop Coefficient (Plant water needs); **IE** = Irrigation Efficiency; **ETO** = Evapotranspiration Rate (set for Riverside, CA); Type I Turf = Marathon II grass; Type II Turf = Bermuda grass.*

Water Use Calculations:

Based on the above bracketing of water use intensity, the following levels of potential water demand were identified:

- **Total High Demand** **28,722,857 mil. gal/yr (100% (baseline)**
- **Total Moderate Demand:** **19,112,759 mil. gal/yr (66% of baseline demand)**
- **Total Low Demand A:** **12,499,088 mil. gal/yr (43% of baseline demand)**
- **Total Low Demand B (no Type II turf):** **8,369,510 mil. gal/yr (30% of baseline demand)**

Comparison with UCR Sustainability Action Plan:

Two main strategies for reducing potable water use for irrigation on the West Campus are stated in the ***Draft UCR Sustainability Action Plan***. One is to reduce the demand for water by reducing new turf areas and converting unnecessary turf areas to climate-adaptive, drought-tolerant plantings. The second strategy is to use reclaimed, gray and agricultural water for irrigation use. The first of the two strategies can be incorporated into the planning of the campus at this stage. The second of the two will require collaboration between the UCR, the City of Riverside and future campus design teams.

Short Term Goals, 0- 2 years (10% potable water use reduction): Convert unnecessary turf to drought-tolerant, California native or climate adaptive plantings. Design landscape areas with few grassy malls. Build pilot gray water systems in new construction to offset potable water used for irrigation.

- Both **Moderate** and **Low** water use intensity meet this goal by consolidating high water use to main mall only and using more drought-tolerant turf and/or drought-tolerant shrub planting in secondary locations.

Intermediate Goals, 2-5 years (20% potable water use reduction): Convert unnecessary turf to sustainable landscape. Work with City of Riverside to extend municipal reclaimed water lines to the campus.

- Both **Moderate** and **Low** water use intensities meet this goal by consolidating high water use to main mall only and using more drought-tolerant turf in secondary locations.

Long Term Goals, 5-10 years (100% potable water use reduction): Implement sustainable landscape design and water reuse strategies, including:

- Consolidate high water use to the main SOM Mall only, according to the '**Low**' water use intensity described above
- All secondary structural planting beds around buildings and along paths will be planted in drought-tolerant, climate-adaptive planting or xeriscape
- Landscape design will comply with the 2007 Design Guidelines (and future updates)
- Implement stormwater plan for SOM campus and integrate swales and detention basins into campus landscape while ensuring the beauty, function and viability of campus open spaces (see Chapter 9)
- Utilize non-potable Gage Canal water for irrigation until reclaimed water is available
- Full irrigation water use reduction may be dependent on access to municipal reclaimed water

17.0 SUPPORT YARD

The Support Yard site is a rectangular field. Overall dimensions are approximately 385 feet from the west property line to the proposed back of curb for the Family Student Housing parking area, and approximately 643 feet from the north property line to the proposed back of sidewalk on the north edge of NW Mall.

Neighboring parcels include an existing U.S. Post Office Corporation Yard and Shopping Center to the west, an existing apartment or condominium housing development to the north, planned Family Student Housing to the east, and street frontage to the proposed NW Mall along the southern edge. Vehicular service access to the Support Yard site is available along the south edge from NW Mall with limited access from the east as coordinated with the planned Family Student Housing development.

17.1 Basis of Design/System Criteria

Electrical Substation

The University and the City of Riverside Public Utilities (RPU) are continuing discussions regarding extending electrical service to the School of Medicine Campus. At the time of this printing, the University's preference is to place the 69kV line entering the SOM Substation underground in an easement along the west side of the Support Yard. The resulting footprint for the substation is 130 feet x 170 feet.

Due to the required footprint and infrequent access required, the SOM Substation was placed in the northwest corner of the site, farthest from the site vehicular access locations and away from daily activity areas within the Support Yard. RPU access to the substation occurs along gravel service drives located within the perimeter setbacks and easements.

Perimeter setbacks and easements

The placement of the SOM Substation establishes the following setback dimensions.

<u>West</u> – A 50-foot setback is provided from the west property line to include:

- An 8-foot high fence along the property line,
- 10-foot landscape buffer to include a vegetative swale to replace the existing stormwater surface channel that originates at the existing housing development and extends south along the west edge of the site,
- 40-foot easement to allow for potential overhead power lines serving the SOM Substation in lieu of the preferred underground power lines.
- This easement would also include a gravel service drive for RPU's access to the substation.

<u>North</u> – A 50-foot setback is provided from the residential use to the north. Although the University is not required to follow local zoning codes, this meets the City of Riverside setback requirements for an Industrial use adjacent to a Residential use.

- A 10-foot landscape buffer with evergreen trees is proposed within this setback, along the existing 8-foot high wall, to provide security and screening at the property line.

- This setback includes a gravel service drive for RPU's access to the substation from the east.

Remaining setbacks follow the standard setbacks used for the School of Medicine campus.

South – A 20-foot landscape buffer from the north edge of the sidewalk.

East – A 20-foot landscape buffer from the back of curb at the planned Family Student Housing parking area.

Propane Yard

A single 30,000 gallon buried propane tank will provide emergency fuel supply for the Central Plant. The buried propane tank requires a 50-foot clear zone measured from the pressure relief device and the filling or liquid-level gauge connection at the tank to a property line or important building. Locating the tanks along the NE corner of the site allows the clear zone to overlap with the north setback, and provides convenient access for delivery vehicles from the Family Student Housing parking area via Cranford Avenue. Adequate space remains in the Propane Yard for a second buried propane tank of the same size to be added as the School of Medicine campus grows.

Central Plant Facilities

The Chiller and Boiler Buildings are centrally located in the Support Yard to provide physical separation from the existing off-site buildings as well as the Family Student Housing and the School of Medicine campus. Central Plant Buildings open to a central yard to internalize activity, noise, and disruption. To minimize the cost of the underground utility tunnel, the Chiller and Boiler Buildings are located along the southern edge of the Support Yard, with area reserved to the north for phased expansion. A smaller scale building form containing the Central Plant offices and administration areas is located along the southern setback line to provide a smaller scale building along the public edge, and to provide pedestrian access to these spaces from outside of the Support Yard. Parking for staff and visitors is located on each side of the Support Yard access drive.

A main **Electrical Room** housing the main switchgear is located alongside the Chiller Building. Exterior elements in proximity to the Electrical Room include underground vaults and above grade transformers. Emergency generators will be located near the Electrical Substation, with 3-day diesel fuel supply.

Co-Generation was discussed, though it was concluded that space for a future Co-Generation plant would be provided at an East Support Yard adjacent to the freeway. Co-Generation is not planned at the School of Medicine Support Yard.

Thermal Energy Storage (TES) Tanks which store chilled water for peak demand cooling are planned within the Support Yard. A single 1.5M gallon TES Tank is required for the Phase 1 development. Tank dimensions are 65-foot diameter x 60-foot tall, and will be installed above grade. Piping from the Chiller Building to the TES Tanks will be direct buried. A second 1.5M gallon TES Tank is anticipated to be needed for full build-out of the School of Medicine campus.

A **Geothermal Well System** will be located within the boundary of the Support Yard site. Wells may be located below building slabs as well as in the open yard area. The geothermal system eliminates the need for cooling towers, and can be expanded over time as new buildings come on line within the School of Medicine.

A **Utility Tunnel** connects Central Plant services to the research buildings at the School of Medicine campus. The tunnel is routed along the southern edge of the Central Plant, beneath the Chiller and Boiler Buildings. For Phase 1, the east leg of this loop will be constructed to connect the Chiller and Boiler Buildings to the M4 Education building as shown previously in Figure 10-7. At full build-out, this tunnel system will create a completed loop as identified previously in Figure 10-14.

A **Receiving Dock** and **Service Tunnel** are provided within the Support Yard to facilitate the delivery and distribution of materials for the School of Medicine. The Receiving Dock will include several small storage areas, one with refrigeration capabilities, for temporary holding of materials before distribution, and an oversized freight elevator to transfer materials from the dock to the tunnel elevation. To minimize the length of the underground Service Tunnel, the Receiving Dock is located along the southern edge of the Support Yard. The Service Tunnel will parallel the Utility Tunnel beneath the NW Mall to allow service vehicles to deliver supplies and equipment to below-grade receiving areas at Phase-1 Research Buildings within the School of Medicine campus.

The concrete **Access Drive** for service and delivery vehicles entering the Support Yard from NW Mall is located at the southeast corner of the site. A solid sliding entry gate provides security. Outside the entry gate is space for visitor parking and a concrete drive apron large enough for a semi-truck. A 20-foot wide concrete drive lane continues through the site connecting the NW Mall and the Propane Yard, providing service access to the Central Plant facilities along the way.

A concrete 110-foot vehicle turnaround is provided within the open yard. The remainder of the yard area is gravel to reduce cost and reduce the need for additional storm water control.

Program Areas

In addition to the Central Plant infrastructure, the Support Yard has been planned to include other functional program elements to support the School of Medicine as the west campus grows. Information on the Phase 1 Support Yard Program elements are shown on Table 17-1 through Table 17-3. Program areas were provided by the University for the following groups: Skilled Craft, Grounds, Custodial, Environmental Health & Safety, Laydown and Trash.

Table 17-1 Support Yard Program – Phase 1

Detailed Space List					
Space #	**Space Name**	**Quantity**	**ASF each**	**Total ASF**	**GSF**
1	**CENTRAL PLANT - OPERATIONS**				
	Operations				
1.1	Chiller Building - Phase 1	1	8,240	8,240	
1.2	Boiler Building - Phase 1	1	6,660	6,660	
1.3	Electrical Room - Phase 1	1	1,200	1,200	
	CENTRAL PLANT - OPERATIONS SUBTOTAL			**16,100**	
			net/gross ratio	90%	1,790
			SUBTOTAL GSF		**17,890**

2	**CENTRAL PLANT - ADMINISTRATION**				
	Offices				
2.1	Supervisor	1	165	165	
2.2	Control Center	1	200	200	
	Open Office Area				
2.3	Reception	1	80	80	
2.4	Staff	2	64	128	
	Meeting Rooms				
2.5	Break Room / Conference Room	1	360	360	
	Support				
2.6	Document Room (files, drawings, O&Ms, layout table)	1	250	250	
2.7	Storage	1	200	200	
2.8	Lockers/Showers/Restrooms	2	200	500	
2.9	Telephone/Data - *non-assignable*	1	0	0	
	CENTRAL PLANT - ADMINISTRATION SUBTOTAL			**1883**	
			net/gross ratio	60%	1,257
			SUBTOTAL GSF		**3,140**

3	**RECEIVING**				
	Operations				
-	Loading Dock (included in Covered Outdoor Space)	1	0	0	
	Support				
3.1	Temporary Holding Storage Room	2	300	600	
3.2	Temporary Refrigerated Storage Room	1	300	300	
3.3	Freight Elevator - *non assignable*	1	0	0	
3.4	Elevator Machine Room - *non assignable*	1	0	0	
3.5	Restroom - *non-assignable*	1	0	0	
	RECEIVING SUBTOTAL			**900**	
			net/gross ratio	60%	600
			SUBTOTAL GSF		**1,500**

Table 17-2 Program Summary – Phase 1

Program Summary		
	Space Type	**GSF**
1	CENTRAL PLANT - OPERATIONS	17,890
2	CENTRAL PLANT - ADMINISTRATION	3,140
3	RECEIVING	1,500
	PROGRAM SUMMARY SUBTOTAL	**22,530**

Space #	**Space Name**	**GSF**
4	**COVERED OUTDOOR SPACE (GSF)**	
	Operations	
4.1	Loading Dock	1,200
4.2	Covered Truck Well	1,200
4.3	Trash / Recycling	600
	COVERED OUTDOOR SPACE SUBTOTAL	**3,000**
	SUBTOTAL OUTDOOR GROSS SQUARE FEET @ 50% (OGSF50)	**1,500**

GRAND TOTAL GROSS SQUARE FEET	**24,030**

Table 17-3 Non-Assignable Spaces – Phase 1

Non-Assignable Spaces *(included in gross area numbers)*					
Space #	**Space Name**	**Quantity**	**ASF each**	**Total ASF**	
	Central Plant Administration				
2.9	Telephone/Data	1	120	120	
	Receiving				
3.3	Freight Elevator	1	160	160	
3.4	Elevator Machine Room	1	160	160	
3.5	Restroom	1	60	60	
	NON-ASSIGNABLE SUBTOTAL			**500**	

A general layout of program functions has been completed in this report, based on information received from the University. Additional programming and adjacency studies will need to be completed during a future design phase.

- An addition to the south face of the Central Plant Building could accommodate the 3,000 g.s.f. identified for Custodial functions. The proximity to the Service Tunnel freight elevator and the option to create a public "front door" off of NW Mall make this a compelling site for the Custodial function.

- A15,000 s.f. area along the eastern edge of the Support Yard can accommodate additional lay down area during the initial development of the School of Medicine. As the need for lay down area decreases, this space can be adapted to include structures for the requested;
  Skilled Craft shops and covered vehicle areas (4,800 g.s.f.),
  Environmental Health & Safety (EH&S) facility (2,500 g.s.f.), and
  Grounds offices, service vehicles, and storage bins (5,900 g.s.f.).

- A 5,000 s.f. area to the south of the Electrical Substation can accommodate general materials lay down space.

The grouping of these functions separate from the Central Plant and along the concrete drive lane allows for frequent access and activity with minimal disruption to the Central Plant activities.

17.2 SOM Infrastructure Phase 1

The Phase 1 Infrastructure for the Support Yard will include the Central Plant and other support functions as shown in Figure 17-1.

17.3 SOM Infrastructure – Full Buildout

A preliminary analysis of the Support Yard at full buildout was conducted to determine the available space for allocation to future support functions. The results of that analysis are shown in Figure 17-2.

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Figure 17-1
Support Yard - Phase 1

UC Riverside School of Medicine **Infrastructure**

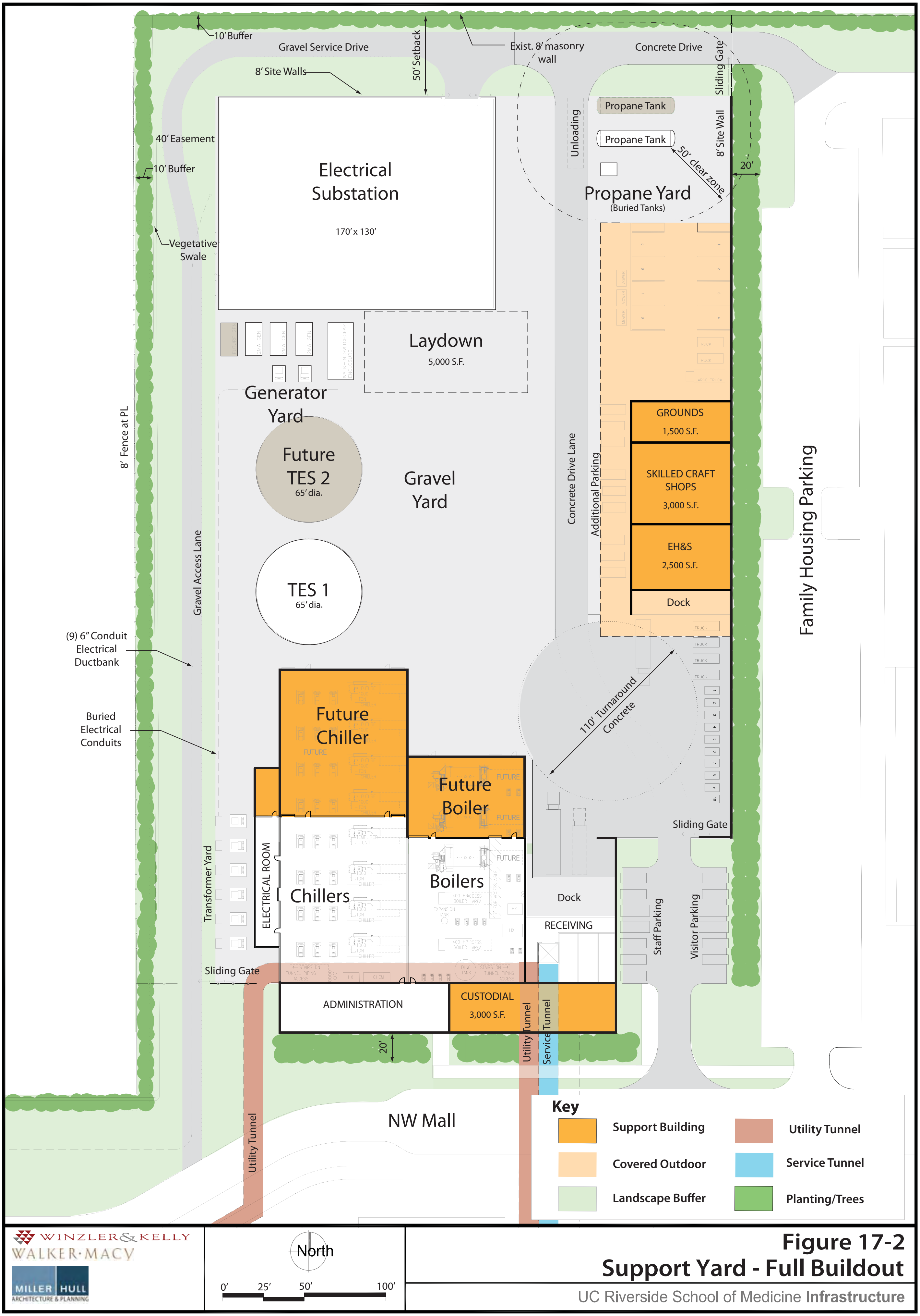


Figure 17-2
Support Yard - Full Buildout

UC Riverside School of Medicine **Infrastructure**

ROOM DATA SHEET

SPACE NUMBER **1.1**

SPACE NAME **Chiller Building – Phase 1**

ASSIGNABLE AREA (ASF) 8,240 s.f.
FUNCTION Central Plant
CRITICAL ADJACENCIES Control Center, Utility Tunnel
MIN. CEILING HEIGHT 20'-3" (underside of structure)

MATERIALS

Floor
- Sealed Concrete Floor

Walls
- Exposed structure

Base
- None

Ceiling
- Open to structure

Doors
- 3' x 7' pairs
- Upward acting doors, (2) 8' x 10" for equip. replacement

Windows
- High windows for day light
- Light shelf to deflect direct sunlight

SYSTEMS

Acoustics
- Attenuation within room

A/V Equipment
- None

Lighting
- Pendant, HID
- Multiple circuits at perimeter to optimize daylighting

Security
- Controlled Access, proximity reader

MEP / Telecom
- Ventilation, emergency purge ventilation
- Standby power
- Power, voice, wireless data
- Fire sprinkler and alarm systems
- Public Address system

EQUIPMENT

Fixed Equipment
- Chillers and support equipment

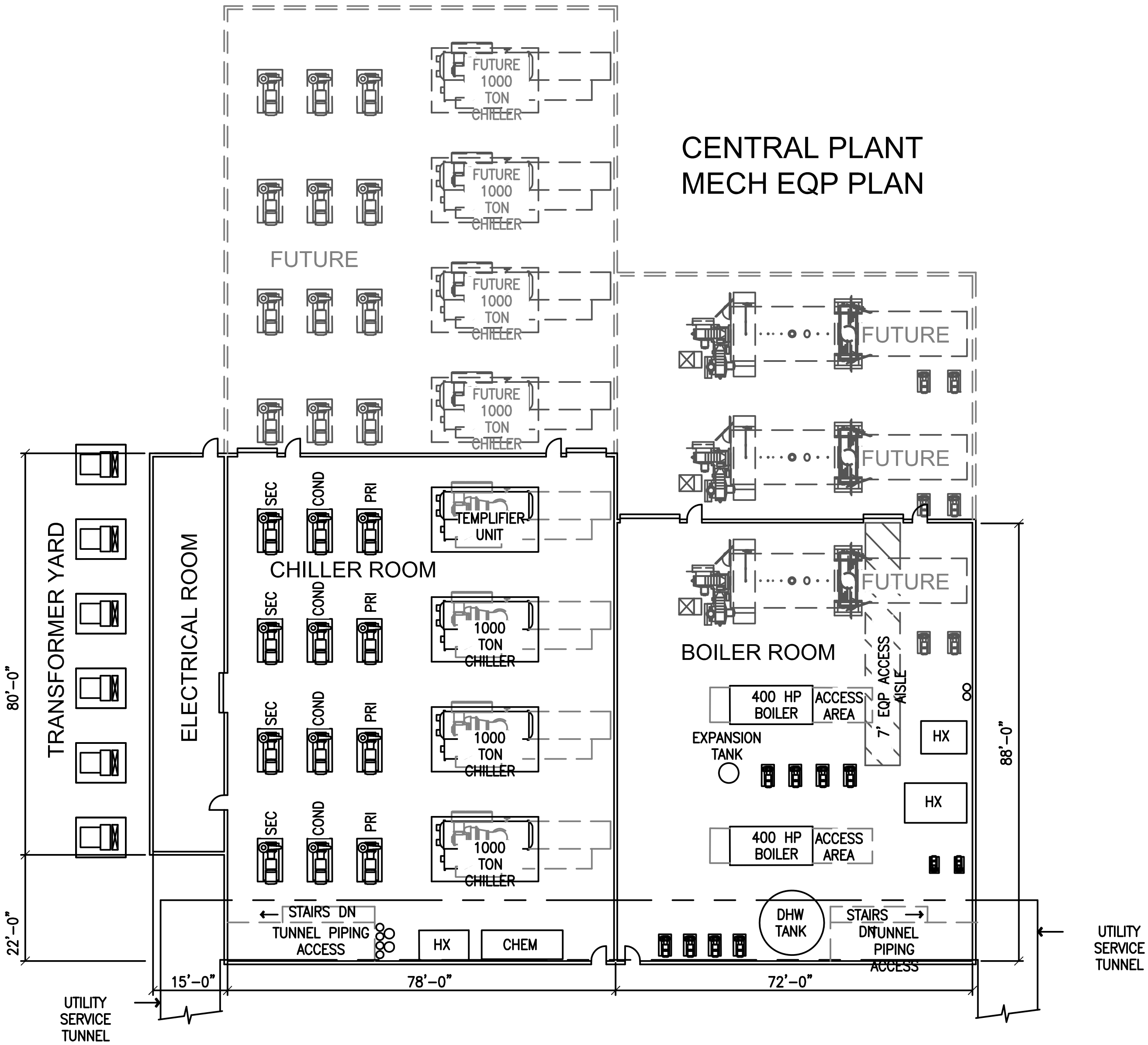
Movable Equipment and Furniture
- Portable hoist

NOTES

1. Housekeeping pads for equipment.
2. Access aisle for equip. replacement.
3. Minimum ceiling height for required clearances is noted. Coordinate with Boiler Room ceiling height.

DIAGRAM

Refer to Diagram.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-3 CENTRAL PLANT.dwg 07-15-09 05:57:30PM PYoung

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Central Plant
Chiller Building/Boiler Building/Electrical Room

UC Riverside School of Medicine **Infrastructure Development**

ROOM DATA SHEET

SPACE NUMBER	**1.2**
SPACE NAME	**Boiler Building – Phase 1**
ASSIGNABLE AREA (ASF)	6,660 s.f.
FUNCTION	Central Plant
CRITICAL ADJACENCIES	Control Center, Utility Tunnel
MIN. CEILING HEIGHT	28'-8" (underside of structure)

MATERIALS

Floor
- Sealed Concrete Floor

Walls
- Exposed Structure

Base
- None

Ceiling
- Open to structure

Doors
- 3' x 7' pairs
- Upward acting doors, (1) 12' x 10'; (1) 8' x 10', for equip. replacement

Windows
- High windows for day light
- Light shelf to deflect direct sunlight

SYSTEMS

Acoustics
- Attenuation within room

A/V Equipment
- None

Lighting
- Pendant, HID
- Multiple circuits at perimeter to optimize daylighting

Security
- Controlled Access, proximity reader

MEP / Telecom
- Ventilation
- Standby power
- Power, voice, wireless data
- Fire sprinkler and alarm systems
- Public Address system

EQUIPMENT

Fixed Equipment
- Boilers and support equipment

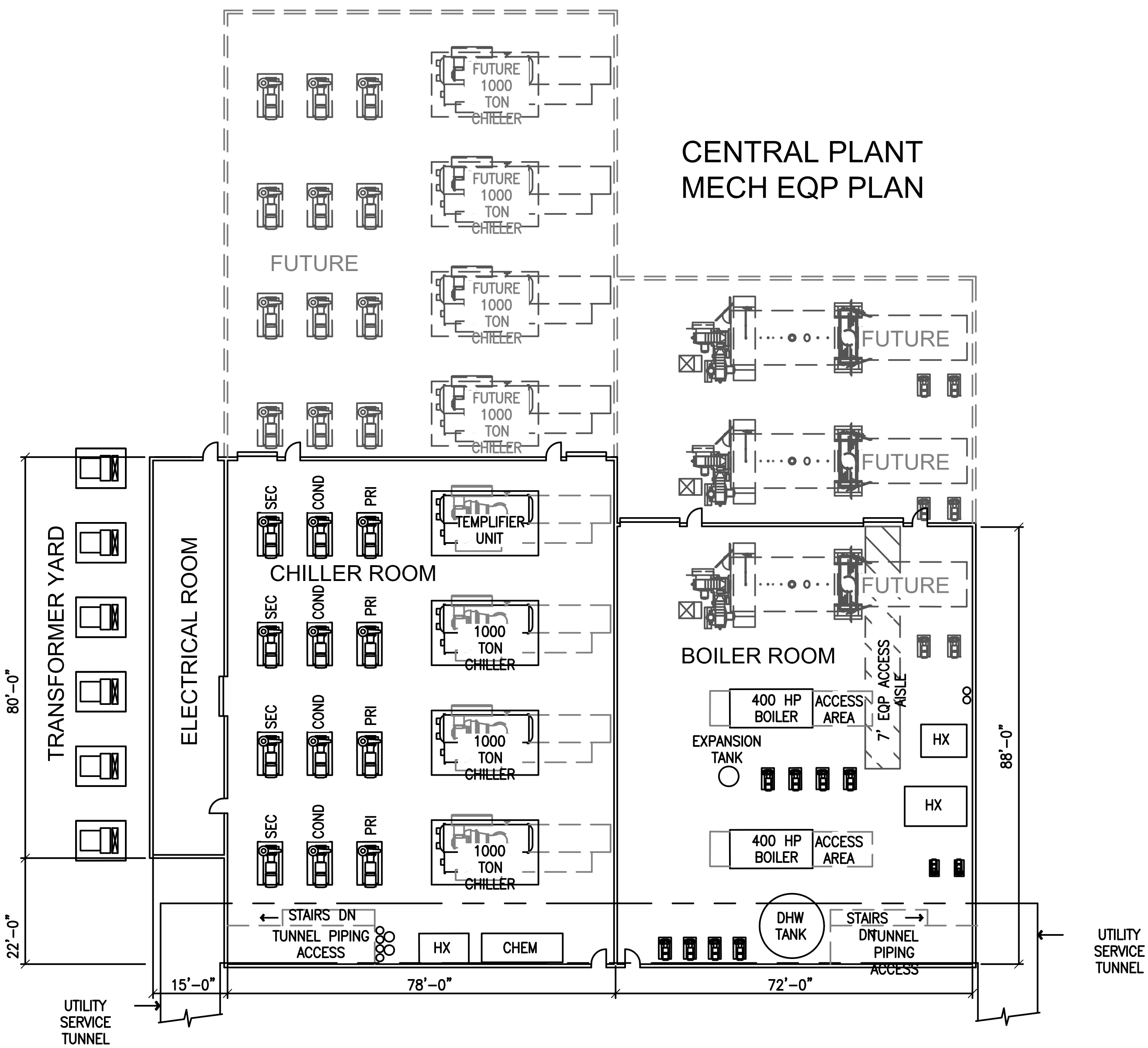
Movable Equipment and Furniture
- None

NOTES

1. Housekeeping pads for equipment.
2. Access aisle for equip. replacement.
3. Minimum ceiling height for required clearances is noted. Coordinate with Chiller Room ceiling height.

DIAGRAM

Refer to Diagram.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-3 CENTRAL PLANT.dwg 07-15-09 05:57:30PM PYoung

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North

Central Plant
Chiller Building/Boiler Building/Electrical Room

UC Riverside School of Medicine **Infrastructure Development**

ROOM DATA SHEET

SPACE NUMBER **1.3**

SPACE NAME **Electrical Room – Phase 1**

ASSIGNABLE AREA (ASF) 1,200 s.f.
FUNCTION Central Plant
CRITICAL ADJACENCIES Chiller Building
MIN. CEILING HEIGHT 12'-0" (underside of structure)

MATERIALS

Floor
- Sealed Concrete Floor

Walls
- Gyp. Board - Paint

Base
- None

Ceiling
- Open to structure

Doors
- 3' x 7' pairs

Windows
- None

SYSTEMS

Acoustics
- Attenuation from Plant

A/V Equipment
- None

Lighting
- Pendant, fluorescent

Security
- Controlled Access, proximity reader

MEP / Telecom
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

Fixed Equipment
- Electrical

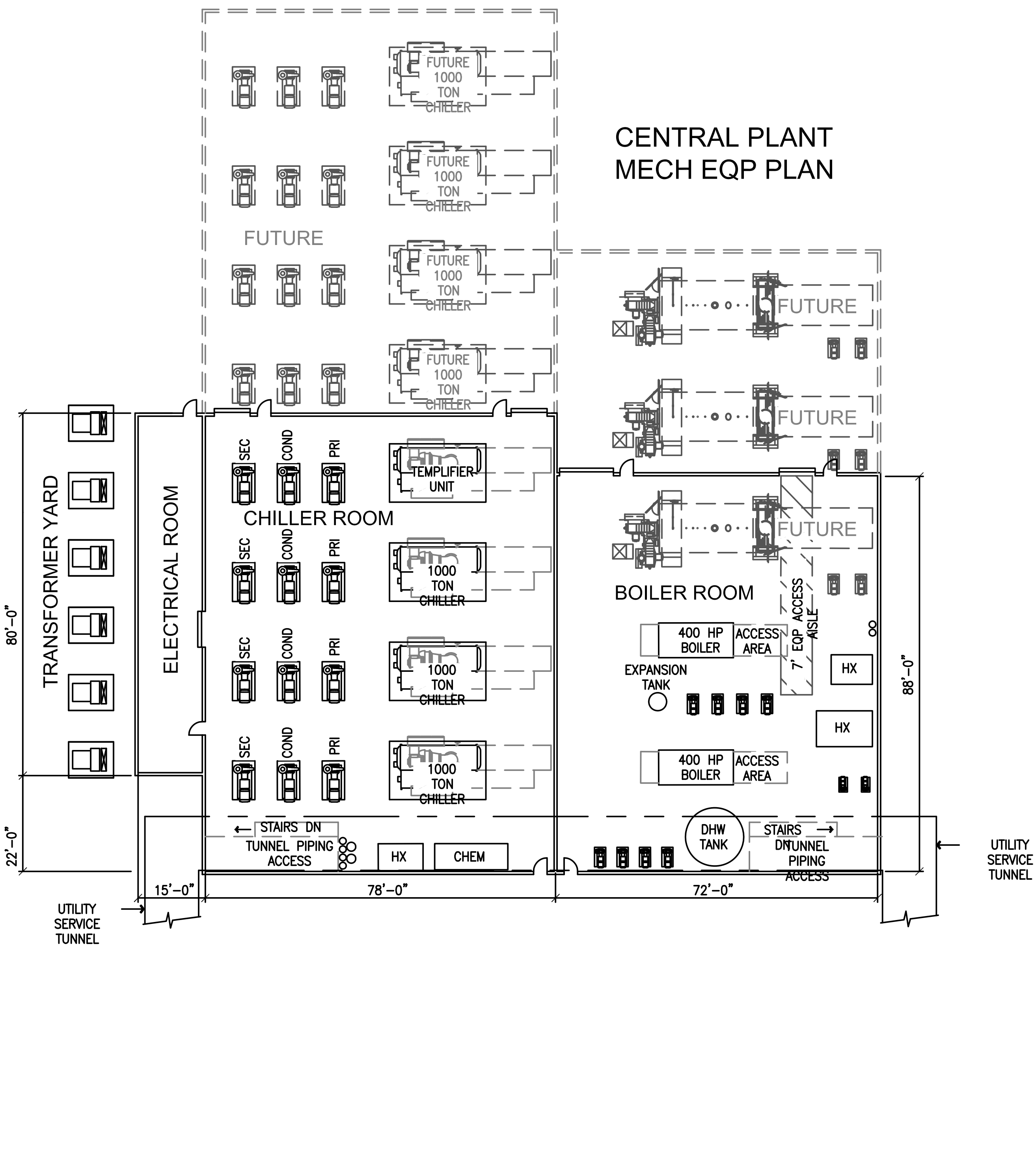
Movable Equipment and Furniture
- None

NOTES

1. Housekeeping pads for equipment.
2. Exterior exit (2nd means of egress)

DIAGRAM

Refer to Diagram.



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 10-3 CENTRAL PLANT.dwg 07-15-09 05:57:30PM PYoung

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Central Plant
Chiller Building/Boiler Building/Electrical Room

UC Riverside School of Medicine **Infrastructure Development**

ROOM DATA SHEET

SPACE NUMBER **2.1**

SPACE NAME **Supervisor**

ASSIGNABLE AREA (ASF) 1,65 s.f.

FUNCTION Office

CRITICAL ADJACENCIES Control Center

MIN. CEILING HEIGHT 9'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- 3' x 7'

Windows
- View window - operable

SYSTEMS

Acoustics
- Attenuation from Plant

A/V Equipment
- None

Lighting
- Recessed, fluorescent

Security
- Keyed access

MEP / Telecom
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

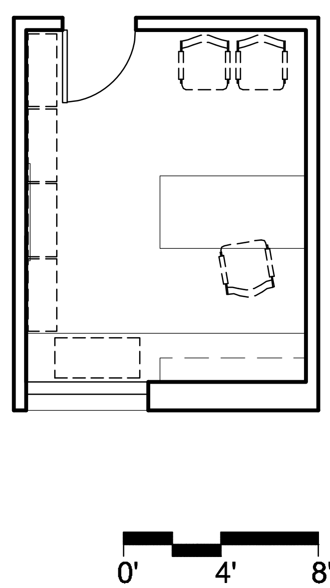
Fixed Equipment
- Louver blinds

Movable Equipment and Furniture
- Marker board, 4' x 4' min.
- Modular furniture (desk, credenza)
- Lateral file
- Bookcases
- Desk chair, (2) guest chairs
- Computer, printer
- Task lighting

NOTES

None

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER	**2.2**
SPACE NAME	**Control Center**
ASSIGNABLE AREA (ASF)	200 s.f.
FUNCTION	Central observation and control of Plant
CRITICAL ADJACENCIES	Chiller Building, Boiler Building, Document Room
MIN. CEILING HEIGHT	10'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- 3' x 7'

Windows
- View to Chiller and Boiler operations

SYSTEMS

Acoustics
- Attenuation from Plant
- Double pane, angled glass to Plant

A/V Equipment
- Monitors

Lighting
- Pendant, fluorescent

Security
- Controlled Access, proximity reader

MEP / Telecom
- Air conditioning
- Standby power
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

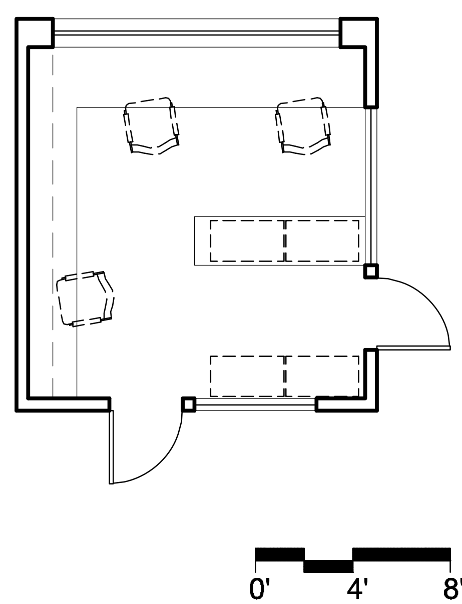
Fixed Equipment
- Perimeter worktop and storage cabinets
- Peninsula worktop w/ files below

Movable Equipment and Furniture
- Marker board, 4' x 4'
- Tack board, 4' x 4'
- (4) Lateral files
- (3) desk chairs
- Computers, printer
- Task lighting

NOTES

None

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER **2.3**
SPACE NAME **Reception**

ASSIGNABLE AREA (ASF)	80 s.f.
FUNCTION	Reception
CRITICAL ADJACENCIES	Building entry/lobby
MIN. CEILING HEIGHT	10'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- n/a

Windows
- n/a

SYSTEMS

Acoustics
- None

A/V Equipment
- None

Lighting
- Pendant, fluorescent

Security
- None

MEP / Telecom
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

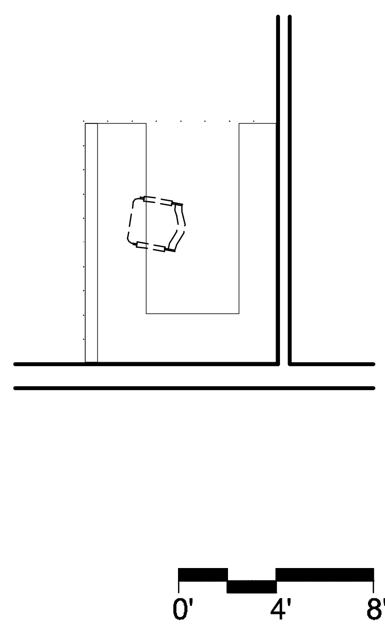
Fixed Equipment
- None

Movable Equipment and Furniture
- Modular furniture (transaction counter, desk, credenza)
- Desk chair
- Computer, printer
- Task lighting

NOTES

1. Part of a secure open office environment.
2. Small waiting area in adjacent entry/lobby.

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER **2.4**

SPACE NAME **Staff**

ASSIGNABLE AREA (ASF) 64 s.f.

FUNCTION workspace, 2 required

CRITICAL ADJACENCIES Proximate to Reception and Supervisor

MIN. CEILING HEIGHT 10'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- n/a

Windows
- n/a

SYSTEMS

Acoustics
- None

A/V Equipment
- None

Lighting
- Pendant, fluorescent

Security
- None

MEP / Telecom
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

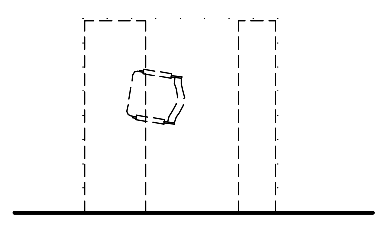
Fixed Equipment
- None

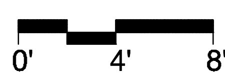
Movable Equipment and Furniture
- Modular furniture (desk, credenza)
- Lateral file
- Desk chair
- Computer, printer
- Task lighting

NOTES

1. Part of a secure open office environment.

DIAGRAM





ROOM DATA SHEET

SPACE NUMBER	**2.5**
SPACE NAME	**Break Room / Conference Room**
ASSIGNABLE AREA (ASF)	360 s.f.
FUNCTION	Staff break room, lunch room, doubles as a conference room
CRITICAL ADJACENCIES	Adjacent to the Central Plant (for conferencing)
MIN. CEILING HEIGHT	10'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- 3' x 7'

Windows
- View windows to exterior, operable

SYSTEMS

Acoustics
- Attenuation from Plant

A/V Equipment
- Wall Monitor

Lighting
- Pendant, fluorescent

Security
- Controlled Access, proximity reader from exterior

MEP / Telecom
- Kitchenette
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

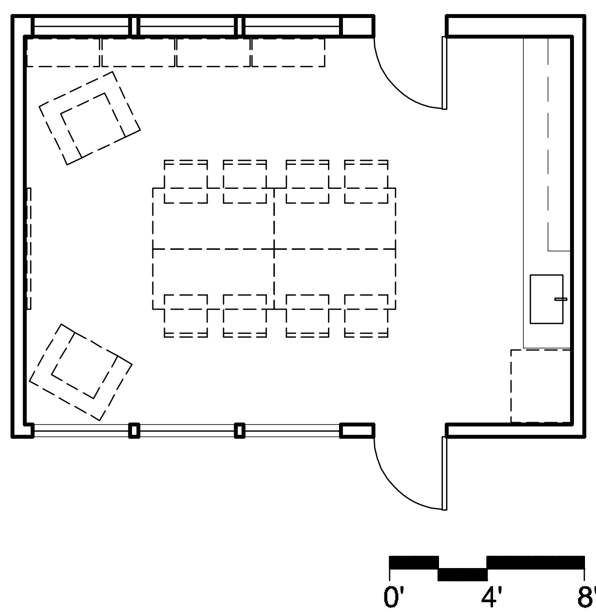
Fixed Equipment
- Counter with sink, upper cabinets
- Louver blinds

Movable Equipment and Furniture
- Refrigerator, microwave(s)
- (4) 60" x 30" tables join to become conference table.
- Soft seating
- Tack board, 4' x 4' min.
- Book case

NOTES

1. Direct access to exterior.

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER **2.6**

SPACE NAME **Document Room**

ASSIGNABLE AREA (ASF) 250 s.f.

FUNCTION Storage and workroom

CRITICAL ADJACENCIES Control Center, Central Plant, Staff workstations

MIN. CEILING HEIGHT 9'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- 3' x 7', sound seals

Windows
- None

SYSTEMS

Acoustics
- Attenuation from Plant

A/V Equipment
- None

Lighting
- Recessed, fluorescent

Security
- Keyed access

MEP / Telecom
- Air conditioning
- Power, voice, data
- Fire sprinkler and alarm systems

EQUIPMENT

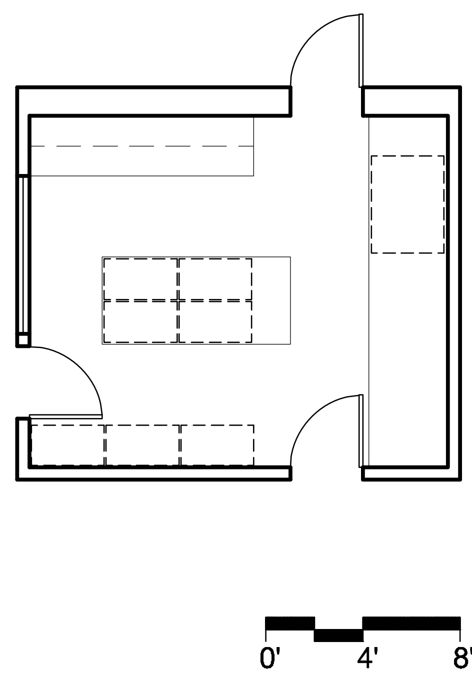
Fixed Equipment
- Perimeter casework, worktops and storage
- Central island worktop with file storage below. Standing height.

Movable Equipment and Furniture
- Marker Board, 4' x 4' min.
- Flat file, 36" x 48"
- Bookcases (O&M manuals)
- (3) lateral file cabinets

NOTES

1. Direct access to Plant and Control Center

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER **2.7**
SPACE NAME **Storage**

ASSIGNABLE AREA (ASF) 200 s.f.
FUNCTION Storage
CRITICAL ADJACENCIES
MIN. CEILING HEIGHT 9'-0"

MATERIALS

Floor
- VCT

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Acoustic Tile

Doors
- 3' x 7'

Windows
- None

SYSTEMS

Acoustics
- None

A/V Equipment
- None

Lighting
- Recessed, fluorescent

Security
- Key access

MEP / Telecom
- Air conditioning
- Power, data
- Fire sprinkler and alarm systems

EQUIPMENT

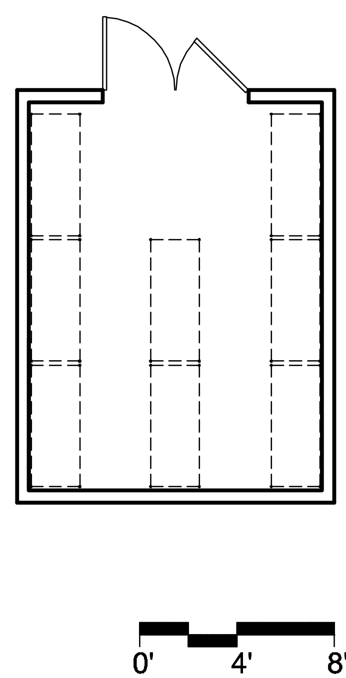
Fixed Equipment
- None

Movable Equipment and Furniture
- 5-tier adjustable storage shelving

NOTES

None

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER	**2.8**
SPACE NAME	**Lockers/Showers/Restrooms**
ASSIGNABLE AREA (ASF)	250 s.f., 2 required
FUNCTION	Central Plant employee use at shift change and restrooms
CRITICAL ADJACENCIES	Chiller Building, Boiler Building
MIN. CEILING HEIGHT	9'-0"

MATERIALS

Floor
- Ceramic Tile

Walls
- Ceramic Tile

Base
- Ceramic Tile, coved base

Ceiling
- Gyp. Board, paint

Doors
- 3' x 7', sound seals

Windows
- None

EQUIPMENT

Fixed Equipment
- Lavatory, plumbing fixtures
- Full height lockers, 6 each room
- Benches

Movable Equipment and Furniture
- None

NOTES

1. ADA compliant shower stall
2. Direct access from Central Plant

SYSTEMS

Acoustics
- Attenuation from Plant

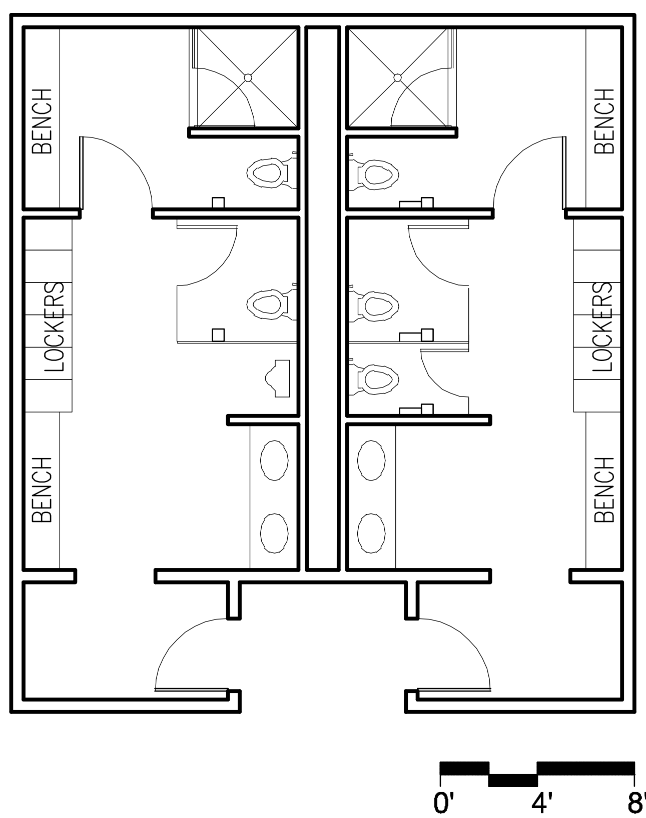
A/V Equipment
- None

Lighting
- Recessed, fluorescent

Security
- None

MEP / Telecom
- Air conditioning
- Power
- Fire sprinkler and alarm systems
- Dedicated exhaust fan

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER	**3.1**
SPACE NAME	**Temporary Holding Storage Room**
ASSIGNABLE AREA (ASF)	300 s.f., 2 required
FUNCTION	Convenience storage of received material before transport via Service Tunnel
CRITICAL ADJACENCIES	Loading Dock
MIN. CEILING HEIGHT	10'-0"

MATERIALS

Floor
- Sealed Concrete Floor

Walls
- Gyp. Board - Paint

Base
- 4" rubber

Ceiling
- Open to structure

Doors
- Pair 3'-6" x 8'

Windows
- None

EQUIPMENT

Fixed Equipment
- None

Movable Equipment and Furniture
- 5-tier adjustable storage shelving

NOTES

None

SYSTEMS

Acoustics
- None

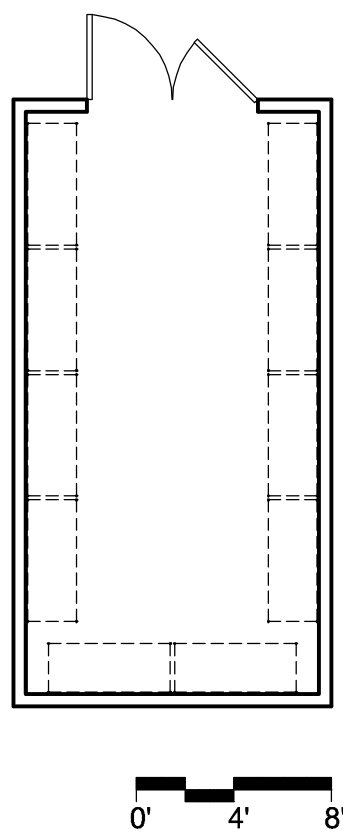
A/V Equipment
- None

Lighting
- Pendant, fluorescent

Security
- Controlled Access, proximity reader

MEP / Telecom
- Air conditioning
- Power, data
- Fire sprinkler and alarm systems

DIAGRAM



ROOM DATA SHEET

SPACE NUMBER **3.2**

SPACE NAME **Temporary Refrigerated Storage Room**

ASSIGNABLE AREA (ASF) 300 s.f.

FUNCTION Convenience storage of received material before transport via Service Tunnel

CRITICAL ADJACENCIES Loading Dock

MIN. CEILING HEIGHT 9'-0"

MATERIALS

Floor
- 4" recessed slab for insulated floor by Cold Room manufacturer.

Walls
- Insulated walls by Cold Room manufacturer.

Base
- None

Ceiling
- Insulated ceiling by Cold Room manufacturer.

Doors
- 3'-6" x 7', by Cold Room manufacturer

Windows
- None

SYSTEMS

Acoustics
- None

A/V Equipment
- None

Lighting
- By Cold Room manufacturer

Security
- Controlled Access, proximity reader

MEP / Telecom
- By Cold Room manufacturer.
- Remote Compressor
- Standby power (Cold Room)
- Power, data

EQUIPMENT

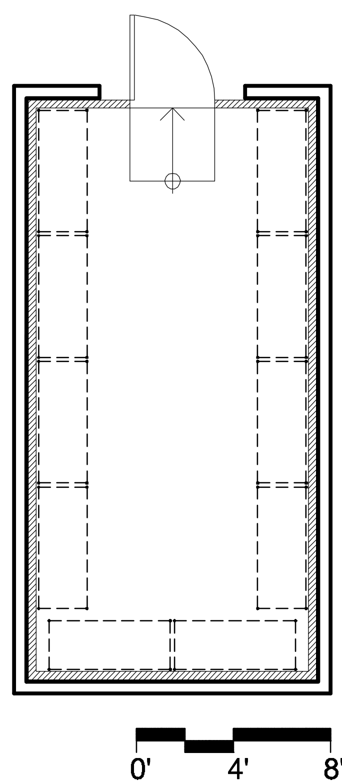
Fixed Equipment
- None

Movable Equipment and Furniture
- Stainless steel adjustable shelving.

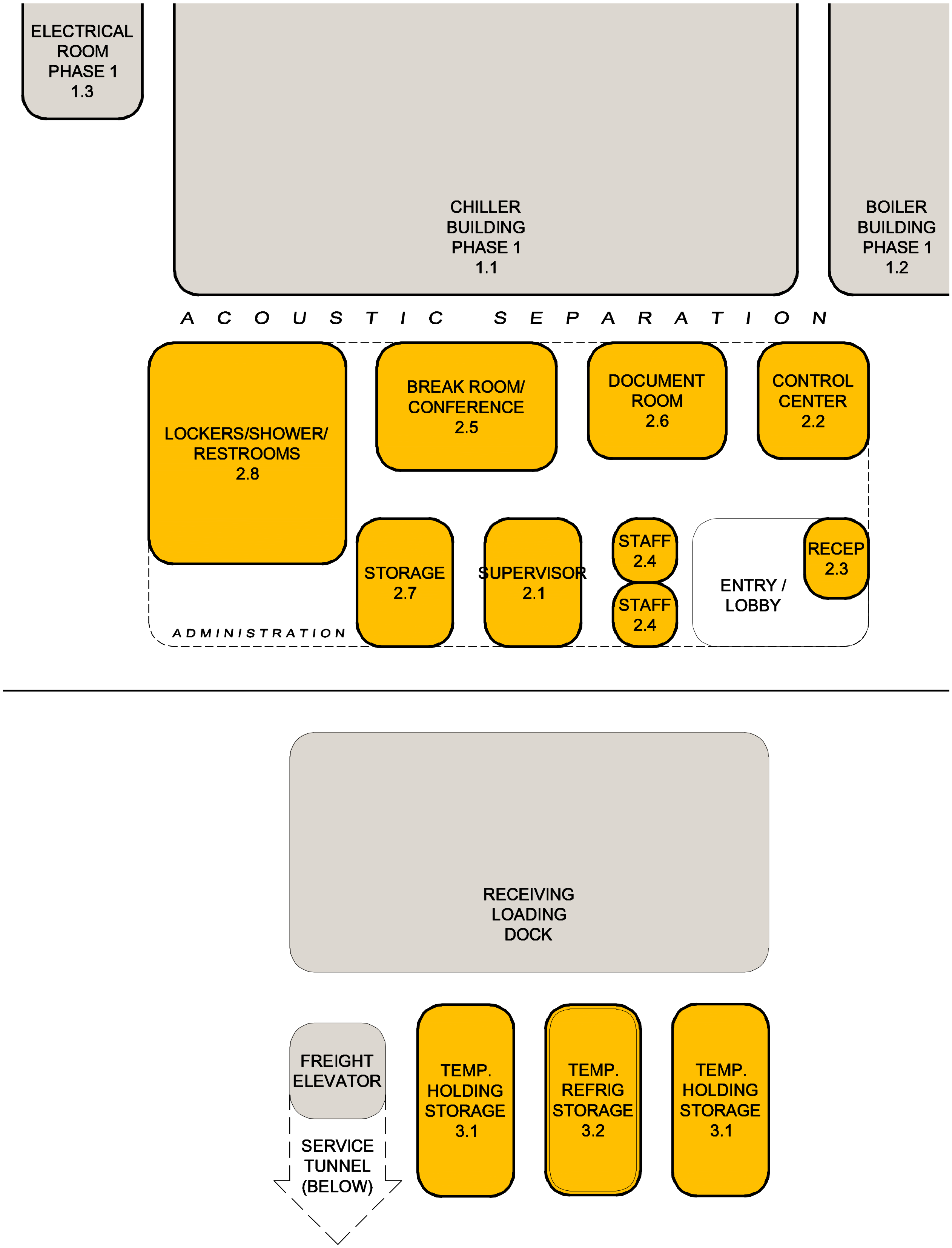
NOTES

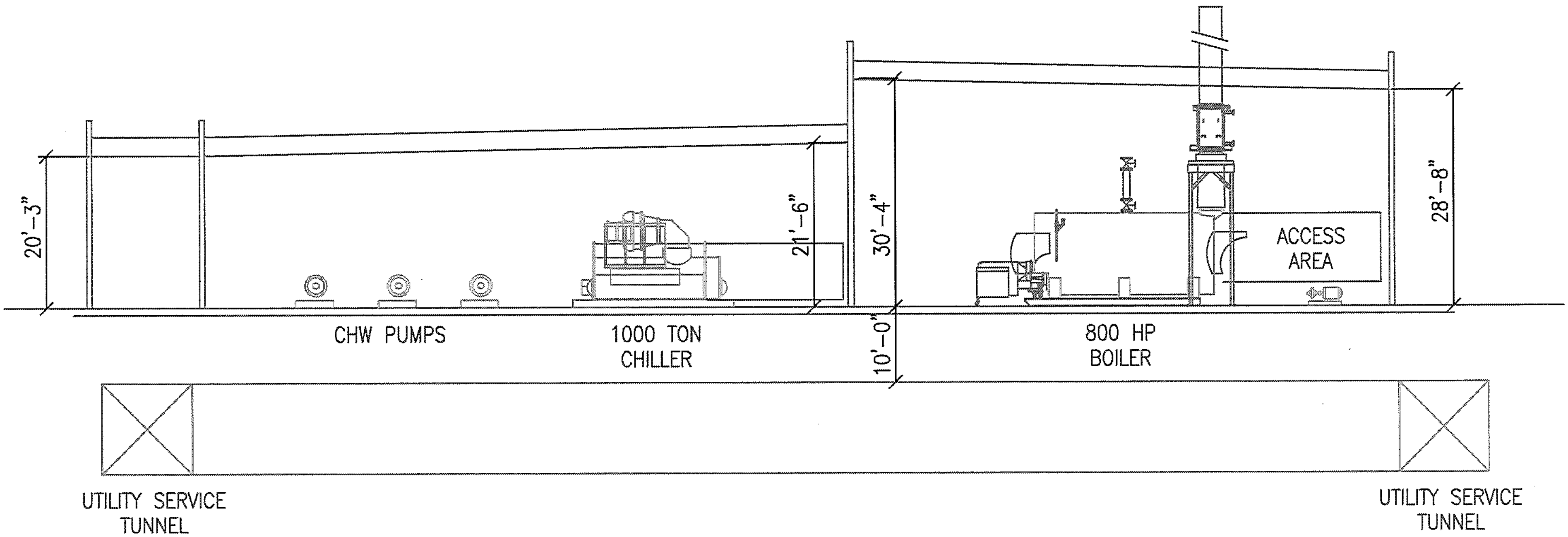
1. Prefabricated Cold Room unit.
2. Confirm required temperature range.

DIAGRAM



ADJACENCY DIAGRAM





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CENTRAL PLANT MECHANICAL EQUIPMENT ELEVATION

SCALE: NTS

18.0 IMPLEMENTATION PLAN

The recommendations developed in this Detailed Project Program (DPP) for the infrastructure needed to support the first phase of development of the School of Medicine (SOM) will require several steps to achieve. The following implementation plan outlines the general necessary steps.

Planning Studies, Investigations, and Models

Prior to proceeding with the Schematic Design, Design Development, and Construction Document phases of the design process, a number of planning studies, investigations, and models should be prepared. These include the following in the approximate order of execution:

- Traffic Study
  It is assumed that the traffic study is being conducted as part of the Environmental Impact Report update. The results of this study may have impacts on the configuration and road widths throughout the West Campus.
- Land Survey
- Comprehensive Grading and Drainage Plan
  The previous planning documents have established a conceptual layout for the West Campus roads and development parcels. The preparation of a comprehensive grading and drainage plan will be critical in coordinating the construction of the interface among the development phases (i.e., SOM, Family Student Housing, etc.) and the planned City of Riverside roadway projects. The grading and drainage plan will set roadway centerlines/cross sections and finished floor elevations of the development parcels.
- Hydrogeology Investigations
  In order to assess the feasibility of the geothermal heat exchange system proposed for the Central Plant, additional geotechnical and hydrogeologic investigations should be conducted to determine the site specific characteristics of the underlying aquifer. These include test bores for thermal conductivity and soil properties, drilling ease, qualities of the aquifers as a heat exchange medium, locations for potential wells, effect of heat transfer over time to the earth within the confined area proposed, etc. These investigations could occur concurrently with the design of the Central Plant.
- Central Plant Model
  A Central Plant Model would provide the design team with a valuable tool in designing the Central Plant facilities and distribution system. Ideally, the Central Plant model would be prepared prior to the distribution system design in order to optimize the sizing of distribution system elements. Input from the SOM building design teams would be used to further refine the model to fine tune the system operations for the Phase 1 buildings.

Additional Studies

As discussed in several sections of this DPP, some of the previous recommendations made in the 2008 West Campus Infrastructure Development Study (WCIDS) should be reevaluated due to changes made (i.e., new SOM 69kV substation, negotiations with the City of Riverside, new options for campus-wide systems, etc.) since the WCIDS was prepared.

Construction Sequencing
The infrastructure required to serve the SOM Phase 1 development will be implemented in phases. The first phase would involve construction of underground utilities and utility tunnels around the site. The second phase would involve construction of the central plant, support yard, and circulation improvements and would occur in conjunction with the SOM academic and research building design process.

The interim steps for the implementation would be as follows:

- Step 1 – Demolition and rough grading of the entire Phase 1 SOM development site.

- Step 2 – Construct underground utilities, utility tunnels, and service tunnel.

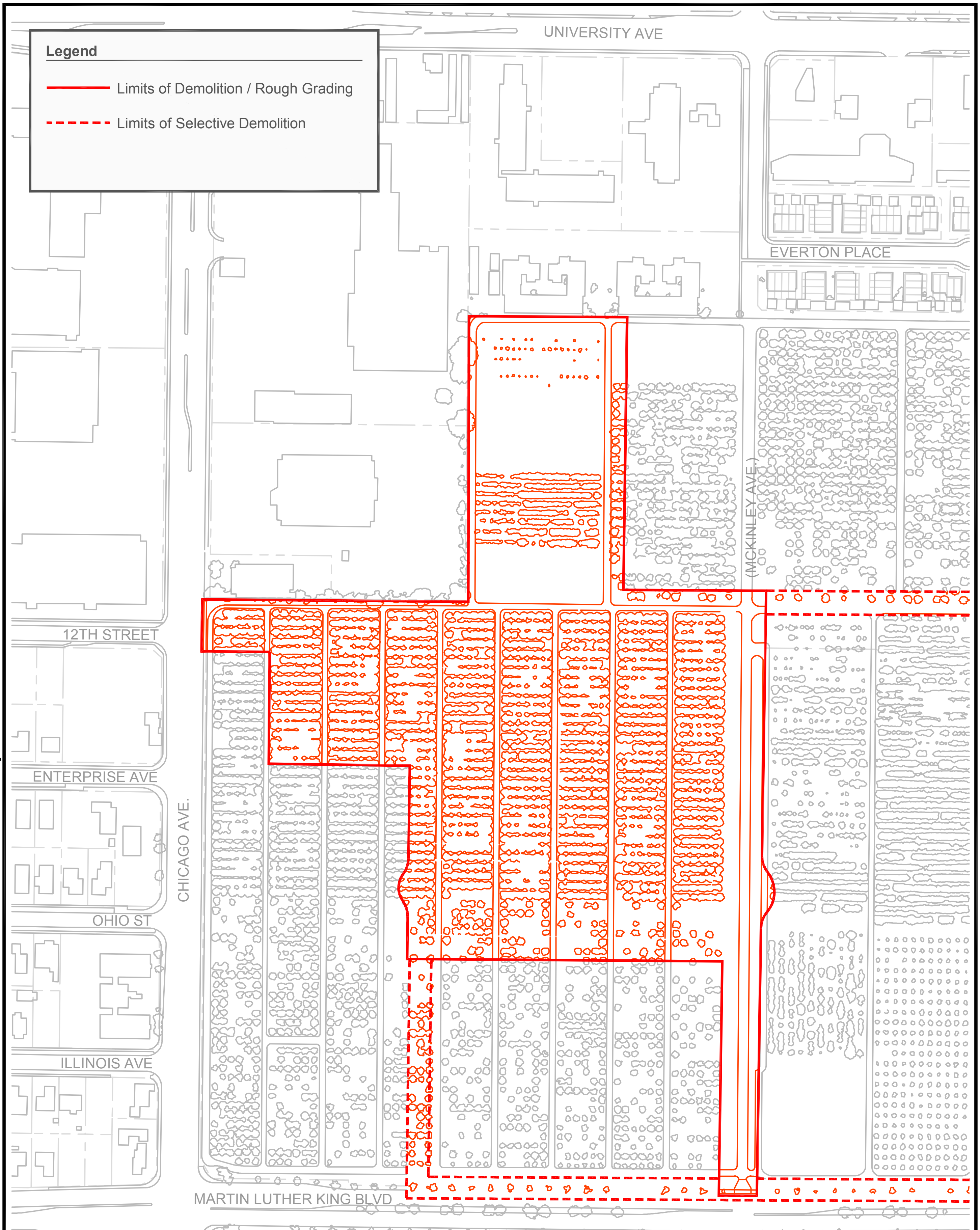
- Step 3 – Establish temporary site and construction access.

- Step 4 – Construct the support yard including central plant, electrical substation, loading dock, and other utilities within the support yard.

- Step 5a – In conjunction with the development of the SOM buildings, construct permanent roadways and streetscape improvements. Also construct interim fire department access as needed.

- Step 5b – Construct final landscape improvements including campus open space, storm drain swales, and detention basins.

These steps are illustrated in Figures 18-1 through 18-5b.



WINZLER & KELLY
WALKER·MACY
MILLER HULL ARCHITECTURE & PLANNING

North
0' 75' 150' 300'

Figure 18-1
Step 1 - Demolition / Rough Grading

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 18-1 -5b PH1 IMPLEMENT PLAN.dwg 06-23-09 04:20:04PM PScheetz

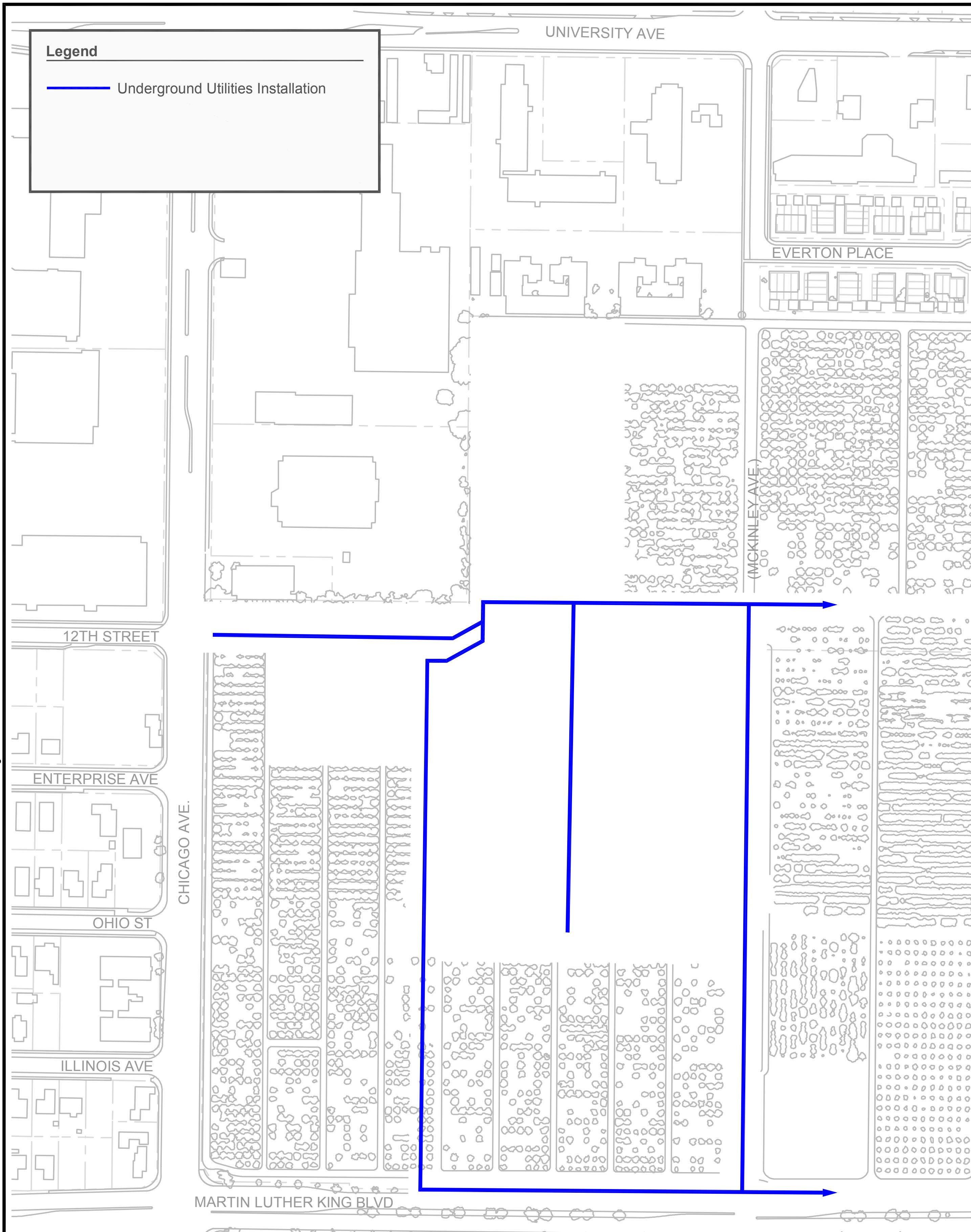


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Figure 18-2
Step 2 - Underground Utilities

UC Riverside School of Medicine **Infrastructure Development**

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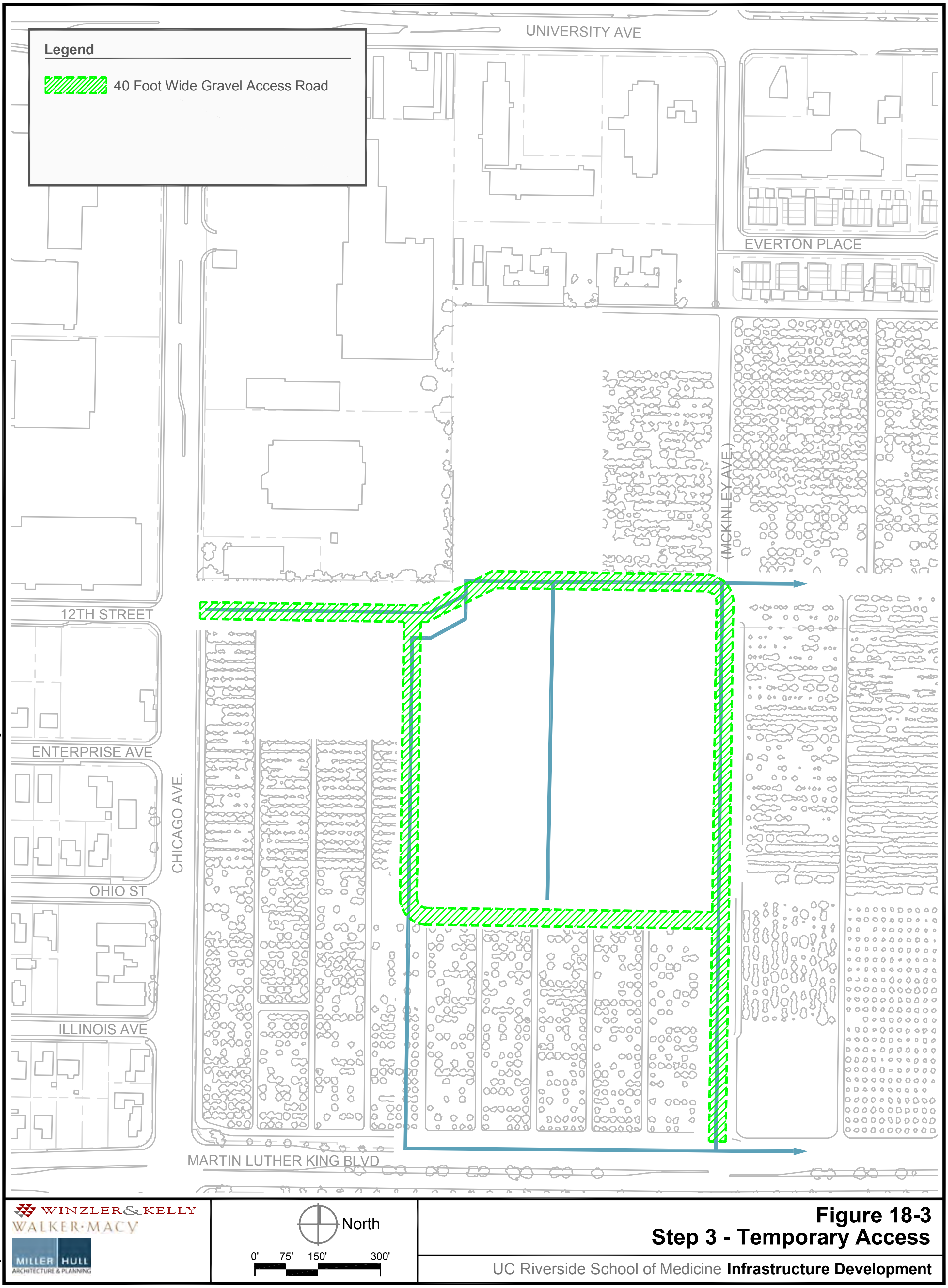

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 18-1 -5b PH1 IMPLEMENT PLAN.dwg 06-23-09 04:20:48PM PScheetz

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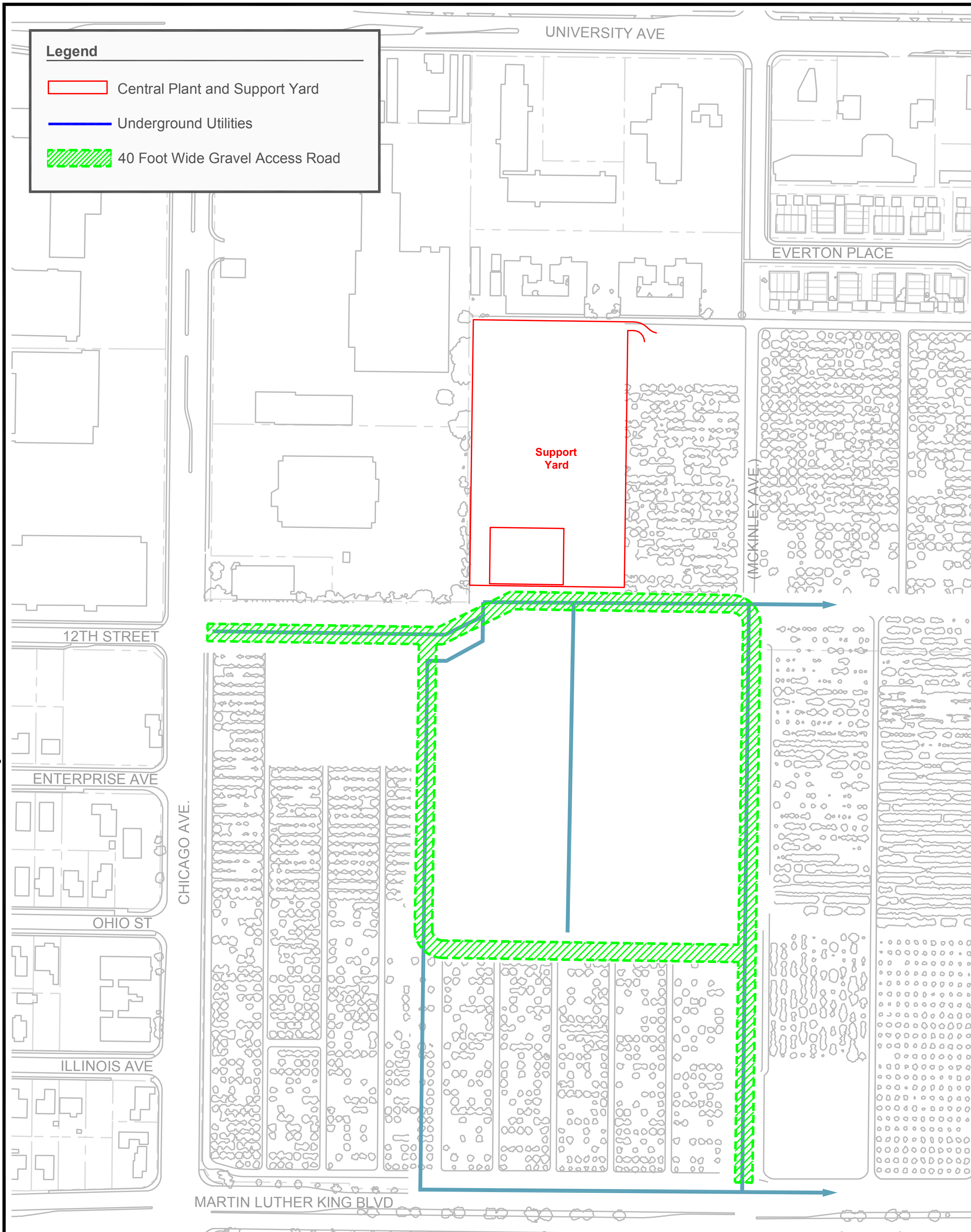
Figure 18-3
Step 3 - Temporary Access

UC Riverside School of Medicine **Infrastructure Development**

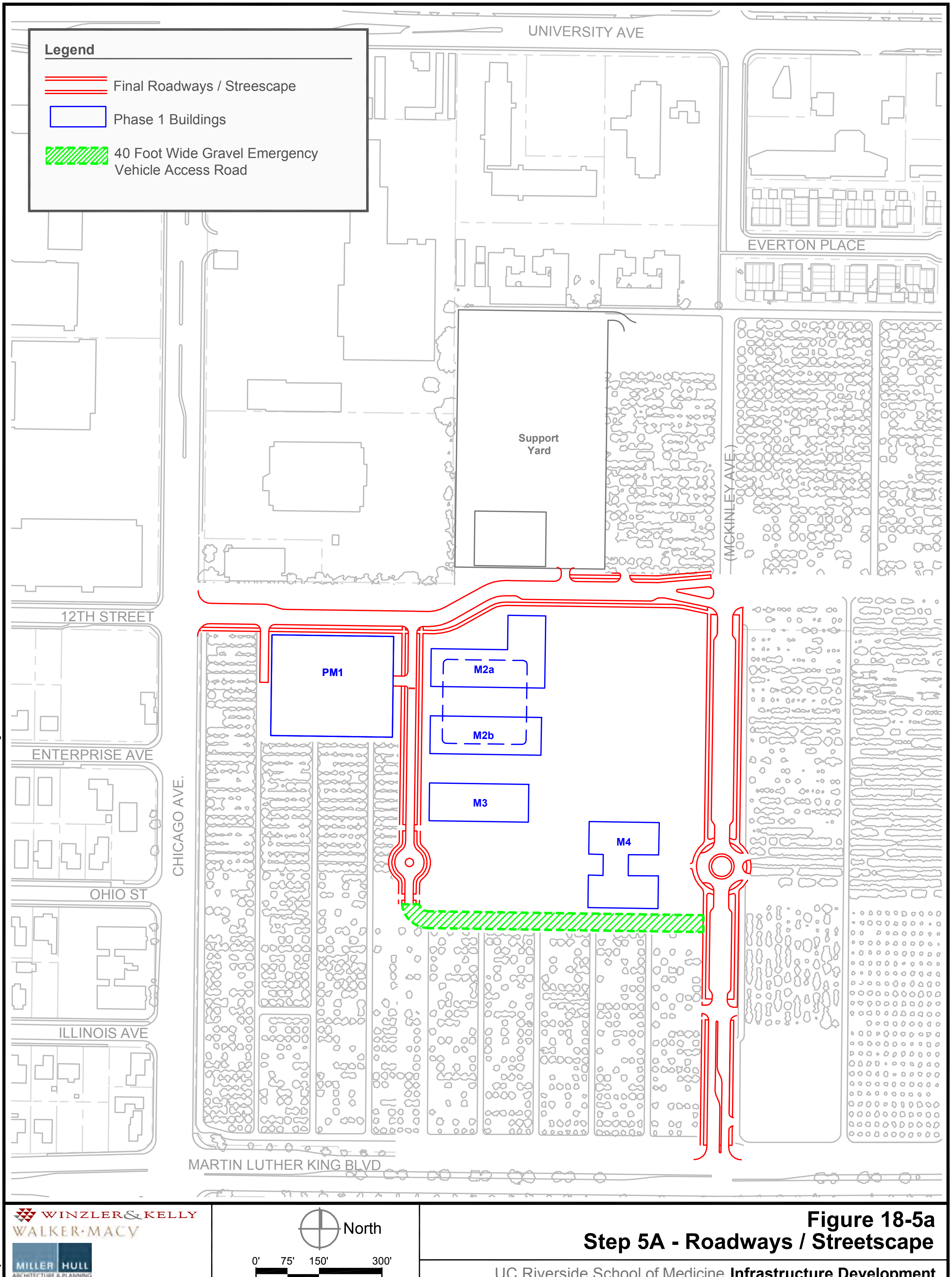


P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 18-1 -5b PH1 IMPLEMENT PLAN.dwg 06-23-09 04:21:09PM PScheetz

WINZLER & KELLY
WALKER·MACY
MILLER HULL ARCHITECTURE & PLANNING

Figure 18-4
Step 4 - Support Yard

UC Riverside School of Medicine **Infrastructure Development**

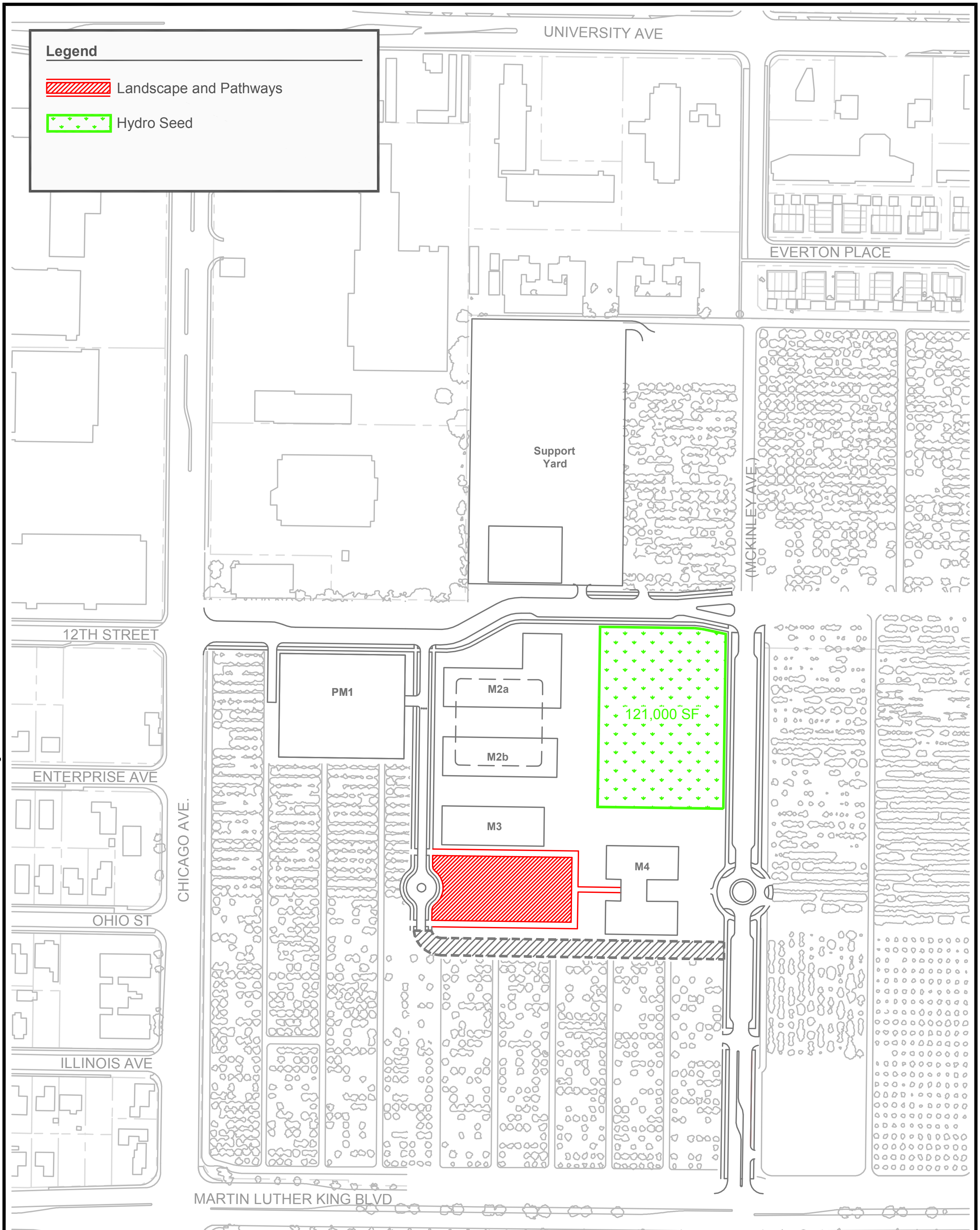


WINZLER & KELLY
WALKER·MACY
MILLER HULL ARCHITECTURE & PLANNING

Figure 18-5a
Step 5A - Roadways / Streetscape

UC Riverside School of Medicine **Infrastructure Development**

P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 18-1 -5b PH1 IMPLEMENT PLAN.dwg 06-23-09 04:21:35PM PScheetz



P:\Projects\11732 UC Riverside\1173209001 School of Medicine Infrastructure 1\CAD\1173209001 FIG 18-1 -5b PH1 IMPLEMENT PLAN.dwg 06-23-09 04:22:04PM PScheetz

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Figure 18-5b
Step 5B - Landscape

UC Riverside School of Medicine **Infrastructure Development**

Design and Construction Schedules

The design and construction schedule is anticipated to be completed under the following proposed schedule:

- Planning Studies, Investigations, and Models – 4 months
  Land Survey, Comprehensive Grading and Drainage Plan, Hydrogeology Investigations, Central Plant Model
- Schematic Design – 4 months
  Draft/Final Submittals
- Design Development – 4 months
  Draft/Final Submittals
- Construction Documents – 9 months
  50%, 75%, 95%, and Final Submittals
- Construction – 16-18 months
  Depending on start dates (i.e. wet season construction)

The construction period would be for a complete construction package (underground utilities, central plant, roadways, etc.) There may be a desire to stretch out the construction and/or installation of facilities/equipment to coincide with building construction (i.e. construct tunnels w/o piping, central plant building w/o boilers/chillers, etc.). Review periods, CEQA, and the 69kV electrical substation are not included in the durations. Since the work would include a structure for the Central Plant, it is anticipated that UCR architectural review (DRB) and state review (DSA) would be required. DSA approval could take several months.

Phased Approach

It is anticipated that the design and construction of the infrastructure to support the initial SOM development will be split into two construction phases. The first phase would include the underground infrastructure (including tunnels) that would be constructed within the streets and utility corridors between the building development zones. Central Plant modeling should be completed during this first phase to confirm the utility distribution piping and the utility tunnel size. Since the tunnels would be extended to the Support Yard area, the Central Plant and other Support Yard elements should be taken through a preliminary design phase to coordinate the tunnel alignments. Ideally, this would also include the hydrogeology investigations to assess the feasibility of the geothermal heat exchange system.

The Support Yard (including the Central Plant, Receiving Area, and other features) and SOM surface improvements (i.e., roads, landscape, and above-grade storm drain elements) would be completed in the second phase that would coincide with the planning, design, and construction of the SOM buildings.

Appendix 1

Meeting & Workshop Minutes

WINZLER & KELLY

School of Medicine Infrastructure Phase 1
Stakeholder Meeting Notes
January 27, 2009

Discussion Group	Item #	Discussion Items	Action	Responsible Party
Agriculture Operations	1	There are two pipeline systems within the existing Orchard Field. The systems provide irrigation water supply and site drainage.		
	2	There is an on-site irrigation water supply pump station along Cranford Avenue.	The University will provide the record drawings for the pump station.	**CPP**
	3	Site drainage from the fields is collected in 12" and 14" drainage pipelines and conveyed to a pump station at Chicago. The drainage water is pumped to a salvage reservoir for reuse.	The University will provide the record drawing for the pump station.	**CPP**
	4	The fields have experienced additional surface runoff from the construction of International Village to the east. The overland flow has increased erosion and sedimentation. During high flow storm events resulting in runoff with high sediment loading, the site drainage pump station is turned off and an overflow bypass diverts flows to the City's storm drain system on Chicago Avenue.		
	5	The irrigation drain line floods once every several years. The 12" and 14" irrigation drainage lines cannot convey the high storm flows resulting in localized flooding on Iowa Avenue.		
	6	During the School of Medicine (SoM) development, the western portion of the site will be maintained and a plan will be developed to relocate the irrigation water supply and runoff drainage to support the remaining portion of the site. Site drainage from the fields to the east of the SoM will need to be captured and pumped to Martin Luther King Jr. Blvd and Chicago Ave. The nearest overflow connection would be the County's pipeline in Cranford.	Initiate contact with the County Flood Control District	**W&K**

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	7	The research fields do not require a special buffer zone between the fields and the new SoM. Existing rows of trees would just be taken out of use for research to serve as a buffer.		
	8	The City is proposing to widen Chicago Avenue by 75'. The proposed widening will require removal of two rows of trees in the Orchard Field. Further reviewed showed that the actual amount of land needed varies from 6 to 15 feet.		
	9	Any available soil information would assist the team in assessing infiltration potential for future development.	The University will obtain the available soil data from the Research Staff.	**CPP**
Storm Drain	1	The SoM development will follow the campus' Stormwater Management Plan. However, if the University's storm drain system is connected to the County's storm drain system, then the University may need to follow the County's Stormwater Management guidelines.	Initiate contact with the County Flood Control District	**W&K**
	2	The County's 66-inch storm drain pipeline on Cranford Avenue does not collect runoff from the Orchard Field. The project team will discuss with the County on the possibility to allow runoff from the campus to drain to the 66-inch storm drain pipeline.	Initiate contact with the County Flood Control District	**W&K**
	3	As proposed in the WCIDS, stormwater runoff from the eastern side of the SoM will sheet flow to Cranford Avenue. However, under the existing condition, Cranford Avenue has a higher elevation than the SoM site. Winzler & Kelly will review the overland flow pattern, and will identify recommendations that would minimize the site re-grading. Winzler & Kelly will also evaluate the feasibility to drain the SoM surface runoff to Chicago Avenue.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	4	In general, the project site has a deep groundwater table.		
	5	The SoM site is adjacent to but outside of the FEMA 100-year floodplain.		
Domestic Water	1	The most direct domestic water system connection point to the new SoM would be the City's existing 20" water main on Cranford Ave.	Initiate contact with the City of Riverside	**W&K**
	2	The hydraulic capacity of the existing 20'' water main on Cranford Ave. will need to be obtained from the City	Initiate contact with the City of Riverside	**W&K**
	3	The system will minimize the number of connection points to the City's system. In the builtout condition, it is anticipated that the water supply for the West Campus will be connected to the East Campus, with one City system connection point as the backup water supply source.		
	4	Analysis of how new connections and phasing will affect the overall West Campus system will require access to the previous models.	The University will provide all available wet utility hydraulic models developed in the WCIDS to Winzler & Kelly.	**CPP**
Fire Marshall	1	The required fire flow demand for the SoM is 1,500 gpm.		
	2	New utility tunnels will be required to have fire sprinklers. This is a UCR requirement not a Fire Code Requirement.		
	3	Natural gas piping was mentioned to be planned in the tunnels but was not shown on the WCIDS tunnel figures. The Fire Marshall expressed concern about locating these lines in a tunnel. Sprinklers are required in any case.	Confirm whether routing natural gas in the tunnels is appropriate.	**W&K**
Sanitary Sewer	1	The University sanitary sewer system will connect to the City's collection system.		
	2	The hydraulic condition of the City's sanitary sewer collection system at the University connection point will need to be obtained from the City.	Initiate contact with the City of Riverside	**W&K**

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	3	The City has proposed adding a scalping plant to the sanitary sewer collection system.		
Electrical	1	A new underground 69 kV sub-transmission line extending from the east on the south side of Martin Luther King Jr. Blvd. was reported to be in the planning stages by the City of Riverside Public Utilities Dept.		
	2	The new 69 kV – 12.47 kV substation that will serve West Campus School of Medicine facilities will not be co-located with the existing City of Riverside substation located next to the north end of Parking Lot 30 adjacent to the I-215 freeway as stated in the 30 April 2008 West Campus Infrastructure Development Study. The preferred location for the new substation is within the area designated for the support yard		
	3	The first phase of the West Campus electrical distribution system design will define the space requirements for 12.47 kV switchgear to serve all facilities included in the ultimate build-out of the West Campus.		
	4	The configuration of the 12.47 kVdistribution system will be a primary selection system as recommended in the 30 April 2008 West Campus Infrastructure Development Study: Two 69 kV – 12.47 kV utility-owned transformers will feed two 12.47 kV switchgear busses through two 12.47 kV main breakers. The two main 12.47 kV busses will be connected with a tie circuit breaker.		
	5	All secondary unit substations will be fed through selector switches from both main 12.47 kV busses.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	6	Critical facilities, such as the vivarium, will be fed from a double-ended unit substation which will eliminate potential single point failures of a single transformer, secondary main breaker or secondary bus.		
	7	The utility support tunnels provided by this project shall have the spare capacity to handle utility services to serve a potential high end medical complex to be located south of the SoM site.		
	8	Individual emergency generators will be provided at laboratory facilities with critical power requirements.		
	9	Fuel storage will be sized to provide 16 hours of operation.		
	10	It was reported that UC Riverside's current utility rates are quite low; however, the current contract expires in 2010.	Check status of future rates	**CPP**
	11	The addition of cogeneration to the new heating/cooling plant should be considered.		
Steering Committee	1	The current plan for electrical power is to have the City of Riverside provide a new substation to supply power to the western half of the West Campus. A new substation would be located within the support yard.	Verify new electrical scheme with City.	**W&K**
	2	The committee concern about the size of the sub-station, as it may takes up too much space from the new support yard.		
	3	In order to minimize the cost, the central plant will be built in phases to match the phased development demands.		
	4	A Medical campus cannot afford utility shutdowns; therefore a looped utility system is desired as well as built-in redundancy for central utility systems.		

WINZLER & KELLY

School of Medicine Infrastructure Phase 1
Stakeholder Meeting Notes
January 27, 2009

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	5	Medical gases, deionized water, vacuum and compressed air supplies will be located within each facility near the points of use.		
	6	The committee would like to have a loop system to connect the SoM Central Plant (SoMCP) to the proposed West Campus Main Central Plant. The committee believes it is an important backup system for the campus. However, the project team commented that such a loop system could be cost prohibitive and it was removed from further consideration.		
	7	The new housing developments between Iowa and Cranford could be connected to the central plant, instead of having separate systems. Connection to the SoMCP would minimize the resources and enhance the campus sustainability. However, it may not be feasible due to the timing of the projects.		
	8	The committee commented that the project team will need to prepare a preliminary sizing of the SoMCP, so the project team can estimate the remaining area available for the support yard.		
	9	The new support yard will mainly consist of service type facilities that are needed to support the SoM. Physical Plant shops will be centralized on the East Campus. Custodial and Grounds, and possible some building maintenance shops will need a satellite location.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	10	The utility area will have many functions and space requirements in addition to the SoMCP. A preliminary space layout of the space for the SoMCP should include maximum build out of the SoM plus a "what if" for a possible "Extended Medical Campus" south of MLK.		
	11	The utility tunnel should be large enough for material transport. Utility tunnel options for material handling to key buildings to be identified by UCR such as the Vivarium will need to be wider for small cart type vehicles. Envelope and routing options will need to be investigated by Design Team (DT).	University to provide direction on whether first phase of SoM development will occur in northern or southern half of the site.	**CPP**
	12	The layout and sizing of tunnels to route utilities and to serve as material transport pathways will be dictated by which buildings are intended to be connected for material transport.	University to provide guidance on which buildings will need to be connected via tunnel for material transport	**CPP**
	13	Utility/ Material Handling Tunnels need to be rectangular not circular.		
	14	The committee would like to have a loop system for the electrical system and chilled water system for redundancy.		
	15	There is a proposed planning for the future medical center south of MLK Avenue. The utility planning should include consideration of the future medical center, such as space allocation for the future utility corridor expansion.		
	16	Utilize the term *high end medical complex* when referring to a possible hospital south of MLK (20 year plus planning horizon).		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	17	The medical center may require higher steam requirements. The University will verify the requirements. Steam loads required by a Medical Facility would be provided locally in the individual building and would not create the need for a steam boiler for the whole campus heating medium		
School of Medicine Representatives	1	The University presented the latest square footage planning data for each phase of the Medical Center development. The data is different than the information presented in the CAMPS.		
	2	The building layout as shown in the CAMPS is a planning concept. It should not be considered as the fixed elements for the purpose of this study.		
	3	Building M4, the education building, should be close to the street (with setback), in order to provide a sense of street boundary.		
	4	The three buildings in Phase 1 should be considered as a cluster of buildings in the study. The cluster will occupy the eastern side of the medical center site, and it would be either at the northern, central, or southern corners of the site (three possible locations).		
	5	The parking spaces can be developed after the buildings are constructed. The University can provide offsite parking spaces with shuttle services. However, over the last 5 years, the construction cost of the parking increased from $1000 per parking stall, to $16 millions for 600 parking spaces in a garage. Therefore, delay in parking spaces construction could increase the construction cost.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
TAPS	1	Surface lots have been planned on same sites as parking structures. Preference is not to build a parking lot that will later be converted to a parking garage. They would prefer structures to be built right away. Shuttling people from another lot to the School of Medicine while constructing a parking garage is not an option.		
	2	Structures are preferred, especially if it's a Third-party development		
	3	But we should set aside an area for parking from the beginning—and don't use academic footprints because it can be difficult to relocate parking for the development. Location of surface parking should consider phasing of buildings and parking structures to minimize disruption.		
	4	Surface lots should be built to a better standard than old UCR lots, which had 2" of asphalt over soil.		
	5	Shuttle buses from other surface lots are not an option unless the campus increases student fees to pay for the buses.		
	6	This project should begin to consider INTERIM pedestrian and bicycle access to the East Campus and the West Campus Academic core to the east of the School of Medicine. During the initial SoM development, the site will be isolated especially if Family Student Housing (and NW Mall) is not yet constructed There are currently no sidewalks on the north side of MLK and the campus would like them, especially as part of the proposed drainage swale	University to provide guidance on use of temporary asphalt paths to make the connection to the east?	**CPP**

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	7	Given the latest program information, the team should evaluate the parking requirements for the site.	University to provide guidance on modal split (i.e., number of parking spaces needed for the SoM, level of transit use foreseen for the first phase, etc.)	**TAPS**
Communications	1	There were concerns about the sequencing of Family Student Housing and the SoM. With the change in how the electrical system will be developed, it may not be feasible to construct the communication lines at this time.		
	2	Third party dark fiber to SoM is the preferred method for supplying communications		
	3	Other services may also be run through the dark fiber (i.e., fire alarm, security boxes, etc.)		
Police	1	Expressed a number of operational concerns related to providing police service to the area during construction (i.e., theft of building materials, vandalism, etc.) and at buildout (i.e., lack of adequate staff, remoteness of site relative to main body of campus, etc.)		
	2	At full buildout, the area would require 24-hr police service.		
	3	The vivarium will add another level of security		
	4	Radio communication at this part of the campus may be difficult. There may be a need to install booster systems.	Police department to provide info on systems.	**Police**
	5	Site lighting will need to be evaluated		
	6	Emergency vehicle access needs to be provided		
	7	The number and location of blue phones will need to be coordinated with TAPS		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	8	Currently no CCTV systems are in use		
	9	There may be WIFI access to the City's security cameras in the future		
	10	May need to consider placement of a police facility in support yard		
Central Plant	1	The contract for power with the City of Riverside ends in September of 2010. UCR and the City have a good relationship which would allow some preliminary discussions to begin to see if the favorable power rates and no demand costs are going to continue for the existing East Campus and new West Campus.		
	2	The Design Team is recommending that a Combined Heat and Power Plant (CHP) Cogeneration be evaluated for the West Campus in a future Study so that if it becomes mandated or desired that space has been accommodated in the Central Plant schemes and budgets confirmed along with reduction in Green House Gas emissions that can be tabulated. Although the CHP concept was not supported, the idea was not dismissed.		
	3	Hot water boilers are desired due to less maintenance, less heat loss in piping and distribution systems, and less operator attendance requirements.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	4	UCR has recently updated the emission control system with an SCR for NOx reduction on their steam boiler for the East Campus to meet the most stringent standards of 5 PPM. Low NOx burners and scenarios will be included in the new School of Medicine Central Plant (SoMCP). Different control equipment will be required due to lower stack temperatures available on hot water boilers.		
	5	UCR currently operates the East Campus Chilled Water system at a chilled water delta T of 22 degrees F which is very good. The high sustainability goal developed in the WCIDS of 30 degrees F is still the goal to establish the design criteria for the new SoMCP		
	6	It was stressed that UCR must enforce the design criteria on future building design teams so that highly efficient buildings with reduced loads per square foot are realized so that the central plant does not become undersized with no room to expand.		
	7	Pipe sizing criteria were recommended by the design team to be conservative with respect to maximum velocity to allow for future demand to be accommodated in the originally installed piping systems. The Project Team will evaluate the Min/Max system loads coupled with the pipe sizing criteria to see what it does to pipe size selection and additional incremental cost. Domestic hot water for high use medical buildings will be generated onsite at each building using heat exchangers and the distributed heating hot water system.		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	8	Special DI water systems, vacuum, and compressed gases will be locally supplied at buildings requiring them in lieu of a central system at the Central Plant		
	9	Not discussed but noted on the aerial photo of the East Campus Central Plant was a set of three large propane backup fuel tanks for the East Campus Central Plant. If required, the backup fuel supply would be located in the support yard adjacent to the SoMCP.	UCR is requested to confirm the requirement for backup fuel system at the new support yard.	**CPP**
	10	Evaporative cooling at each new building air handler was suggested by the Project Team as a cooling load reducing idea that could be further evaluated as a sustainable idea for future design teams completing the individual new campus buildings.		
Site Visit to East Campus Satellite Chiller Plant	1	Two 2000 ton Trane Centravac two stage chillers were installed in 2003. The chillers are not VFD. The primary loop is constant volume and the secondary loop is driven by variable speed pumps.		
	2	A 2.5 million gallon Thermal Energy Storage Tank is coupled with the chillers for demand trimming.		
	3	Chilled water leaving and stored temp is 38 F and return temp is 60 F from a delta T of 22 F		
	4	Piping in the plant is Victaulic and not desired by the plant operator. Currently some leaking at these joints was present. Welded piping leaves leaking problems only at flanges which are easier to fix		

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	5	The controls are semi manual for diverting the chilled water to or from the TES. A fully automated central plant optimization system does not exist. Normally during the peaking cooling season at 6 pm the system begins to charge the TES tank while the Main Plant maintains the loop temperature. Once the tank is charged around midnight the switch roles.		
	6	The cooling towers are National vertical counter flow open towers matched to the two large chillers. The towers have concrete wet wells and a vertical sump pump condenser water system.		
Students with Disabilities	1	They currently provide cart service to various buildings		
	2	Difficulty in sharing pathways with pedestrians		
	3	ADA parking needs to be provided at the buildings		
	4	Need to plan for drop off points		
	5	Potential need for space at support yard for carts		
Wrap Up	1	There is an overall desire to plan utilities to provide maximum flexibility for future site development		
	2	SoM buildings will require redundancy in the utility services. Research and other functions at these buildings cannot tolerate utility outages.		
	3	The parking and modal split needs to be evaluated	University will provide further detail on population numbers associated with building development	**CPP**

Discussion Group	Item #	Discussion Items	Action	Responsible Party
	4	The support yard area may need to consider the following uses: • Custodial shop space (plumbers and electricians) • Hazardous materials handling • Grounds office, stockpiles and storage • Receiving • Scalping station for wastewater (mini treatment plant that produces reclaimed water on campus) • Electrical Substation • Vehicle parking • Cart service base • Police and Fire		
	5	The three buildings in Phase 1 should be considered as a cluster of buildings in the study. The cluster will occupy the eastern side of the medical center site, and it would be either at the northern, central, or southern corners of the site (three possible locations).		

Acronyms/Abbreviations

SoM	School of Medicine
PMT	Project Management Team
CPP	Capital & Physical Planning
SoMCP	School of Medicine Central Plant
TAPS	Transportation and Parking Services
TES	Thermal Energy Storage
VFD	Variable Frequency Drive
WCIDS	West Campus Infrastructure Development Study
CAMPS	Campus Aggregate Master Planning Study

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Discussion Group/Lead	**Item #**	**Discussion Items**	**Action**	**Responsible Party**
SOM building program and adjacencies/ Walker Macy Circulation / Walker Macy	1.	City of Riverside has potential plans to convert MLK Blvd. to three lanes in each direction.	Study MLK Blvd to determine what happens to bike lanes and sidewalks.	**Walker Macy (WM)**
	2.	Discussed the use of the NW Mall extension for circulation.	Look at options for location and scale of NW Mall extension to Chicago. Determine if a wider ROW (78'?) is needed. Study implications of a potential need for a full intersection at Chicago.	**Walker Macy**
	3.	Review housing adjacent to Support Area, to east and to south. Issues to consider include better connections to the Support Yard, adding noise buffers, extending the NW Mall, adjacencies to the Vivarium and Research Buildings, whether the Vivarium can be co-located with a research building.	Investigate the logic of retaining housing facilities in the current location while considering service delivery requirement for research and vivarium.	**Walker Macy**
	4.	Layouts were presented showing first phase buildings and associated surface parking. Ambulatory Care Buildings have a much higher parking requirement. This results in more surface parking than can be accommodated on the eastern half of the site.	Review population projections by building type to determine actual phased parking demand. Create a matrix showing population growth by development phase.	**Walker Macy**
Electrical / Dick Lennig				
• Utility Electric Power Supply	1.	The new 69 kV – 12.47 kV substation at the support yard shall be sized to serve build-out of the SoM and the campus area west of Iowa. Other West Campus academic and housing facilities east of Iowa will be served by the existing University substation.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
• West Campus 12.47 kV Distribution System	1.	The first phase of the West Campus electrical distribution system design will define the space requirements for 12.47 kV switchgear to serve SoM facilities and facilities west of Iowa.		
• Standby Power Generation & Distribution System	1.	A central standby generating plant to serve critical laboratory loads and the vivarium, sited in the support yard, should be included in the infrastructure program.		
	2.	A standby (backup) electrical distribution system was not envisioned in the WCIDS.	Reevaluate appropriateness of centralized standby power.	**W&K**
Wet Utilities / Raymond Wong				
Storm Drain	1.	Based on the existing topography, the proposed swale at the northern side of MLK Blvd will not be able to collect stormwater runoff from Family Student Housing via sheet flow.		
	2.	The WCIDS indicated the total design flow from the area north of MLK Blvd is 397.1 cfs with the runoff being collected in the 75" RCP storm drain on MLK Blvd. Using the Manning's equation, the capacity of the 75" RCP storm drain pipe at 0.4% slope is around 300 cfs, under full pipe condition. It is less than the required capacity to convey the previously calculated design flow north of MLK Blvd.		
	3.	The WCIDS did not provide planning information for the SoM stormwater routing, nor did it discuss the downstream boundary condition.		

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Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	4.	Based on the existing topography, a potential drainage option is to provide swale along the NW Mall to intercept stormwater runoff, then discharge to Chicago Avenue.	The project team will need to coordinate with the City and County to establish the downstream boundary condition and determine the need for detention.	**W&K**
	5.	If there is a capacity restriction on the downstream system, the project site will need to provide stormwater detention to attenuate the peak runoff.	Help look for areas for detention for 100 year flow statement. Each project must take responsibility for dealing with stormwater flow.	**Walker Macy**
	6.	A potential option for stormwater management is to de-centralize the management system into building project site improvements. A stated sustainability goal identified in the WCIDS is to achieve LEED Silver certification on the new campus buildings. The University can further identify LEED SS6.1 and SS6.2 credit as mandatory for all building for stormwater management.	University to confirm whether LEED SS6.1 and SS6.2 credits can be made mandatory for new buildings.	**CPP**
Irrigation	1.	Due to the planned use of utility tunnels on the site, the existing irrigation drainage pipeline will need to be abandoned. The project team presented options to re-route the irrigation drainage. The options include temporarily relocating the existing Pump Station No.2 to Cranford Ave and extending the force main or providing a new gravity pipeline or siphon along the future NW Mall. The Steering Committee was concerned about the noise associated with a pump station. While an underground pump station could address this issue, a gravity or siphon option is preferred, if feasible.	W&K Evaluate rerouting options to determine if gravity flow is feasible. Campus to identify potential drain line connection points south of MLK.	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	For interim irrigation of the western half of the site, the project team suggested constructing bypass lines that are sized and located to serve the ultimate landscape irrigation system for the SoM		
	3.	Landscape irrigation demand assumptions in the WCIDS do not appear to reflect current practice. Irrigation demand was assumed to be 60% of the total site water demand and the irrigation demand number was calculated by projecting it from the potable water demand.	Determine irrigation need at campus, using current landscape irrigation methods and looking at a percentage reduction. Also review new psychology building landscape drip system, it's efficient, xeriscaping.	**Walker Macy**
Water	1.	The project team proposed providing a new water main along Cranford Ave and MLK Blvd. The new water main will have two connection points to the City's distribution system at Chicago Ave and Cranford Ave. The connection point locations and the new water main alignments conform to the buildout configuration as outlined in the WCIDS.	Discuss feasible connection points with the City and obtain the boundary condition data at the connection points. Another possible connection point would be at the intersection of University Ave and Cranford Ave.	**W&K**
	2.	The University provided the project team with the electronic files for the distribution model.	Verify the design flow data in the WCIDS model and update the design flow as needed. The project team will pay particular attention on the fire flow design criteria, since typically it is the most restricting condition to the water distribution system.	**W&K**

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Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Sewer	1.	The proposed sewer system will be similar to the concept outlined in WCIDS. The southern portion of the site will connect to the University sewer line on MLK Blvd. The northern portion of the site will connect to the City's sewer system at Cranford Ave and Everton Pl.	Discuss feasible connection points with the City and obtain the boundary condition data at the connection points.	**W&K**
	2.	The University provided the project team with the electronic files for the collection system model.	Confirm the size of the new sewer pipeline and the wastewater generation rate from the SoM development. The report will include a general comment on the accuracy of the wastewater projection and the adequacy of the proposed pipeline sizing in the WCIDS.	**W&K**
SOM Central Plant Discussion / Rich Fitterer				
• Review of Load Based on SF	1.	The goal for this first session was to see what the SoMCP footprint would look like taking into consideration worst case scenario within the boundaries of the SoM.		
	2.	The WCIDS identified loads for 20% and 45% of Title 24 energy load, which would minimize the Central Plant foot print.	Identify most appropriate energy load level.	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	3.	Using the revised (dated Feb 3 2009 from WM which updated initial development assumptions to 896,985gsf and making changes to Table 8-3 Medical Campus Full build out) CAMPS planned build out square footages escalated to a maximum story height of 5 stories and including the housing within the boundaries of the SoM, (using updated Table 8-3 from WCIDS for the medical Campus portion) the project size was increased from 1,966,000 gsf to 2,332,000 gsf (or an 18% contingency factor) See attached updated Table 8-3 used for load calculations		
	4.	An additional increase would occur if the type of facility mix changed. The Steering Committee will need to advise the Project Team of a more aggressive mix including more Medical Research Facilities which would increase the heating and cooling loads.	Define most aggressive facility mix for demand planning	**Steering Committee**
	5.	The Phase 1 build out is 592,000gsf which is being re-evaluated by the Project Team for location on the site. (Based on WM Feb 3 2009 summary)		
	6.	The conservative approach of using the 20% of T-24 load by building type is proposed for space allocation at the SoMCP.		
• Load Summary of Build-out options	1.	Build-out of the SoM precinct would be 2.33 million gsf and have a Peak Diversified cooling load of 5,189 tons not counting Thermal Energy Storage (TES) and 4,000 tons including Thermal Storage. The plant would be sized for 4,000 tons of cooling.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	Build-out of the SoM precinct would have a Diversified Heating Load of 44 MMBTU, which would be used to size the heating plant.		
	3.	The Project Team agrees with the Cooling Load but will look further on the Heating Load to see if the Medical facilities are accounted for with enough load due to hot water usage.	Reevaluate heating loads	**W&K**
	4.	Phase 1 Design Load for cooling would be based on 714,270 SF (including building height factor for those affected)for a 1,250 ton Peak Load reduced to 1,100 tons if TES were included. The type, sizing, and phasing of the TES would affect the final chiller size for phase 1 keeping in mind the full build out scenario.		
	5.	If the building use mix in CAMPS changed to more Medical Research buildings, the above sizing would be increased.		
• WCIDS Design Criteria	1.	The WCIDS included the following Design criteria for the SoMCP - CW - 30 degree delta T plant 25F piping - HW - 60 degree delta T plant 40F piping - TES water storage sized at 18,000 ton/hours - Energy efficient chiller modules - Walk through tunnels for distribution		

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Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	The East campus is currently operating at a delta T of 22F on the chilled water which is quite aggressive in its own right.	Review the 30 degree delta T for the chilled water system design since it may not really save energy, will drive up the cost of the load side air handler coil size, and since the Project Team is recommending making the piping mains sized on the conservative side the sizing benefit of a 30 degree delta T would not be actually realized.	**W&K / Interface**
	3.	The heating criteria of 20% of T-24 Heating Load of 16-19 BTU/SF will be reviewed since Medical Research may require a higher load density.	Review heating criteria	**W&K/ Interface**
	4.	Thermal storage was conceived as above grade 1 million gallon tanks 70ft high which is as high as the SoM buildings.	Review alternatives for placing tank above ground partially below ground. Etc.	**W&K/ Interface**
	5.	Energy efficient chillers in series were recommended in WCIDS and will be evaluated over the load cycle against currently available parallel chillers that could get the 30 degree delta T if it remains the criteria or 22F similar to the East Campus.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
• Criteria Challenges	1.	The 80% T-24 loads for CW and HW need to be further evaluated to validate the published load values especially for 100% OSA requirements and high Air change Rates in Medical and Research and Vivarium Facilities. If the loads are higher, the SoMCP sizing and footprint would be affected. The team is evaluating ASHRAE airchange criteria and performing calculations and comparing with Team experience for similar Facilities for next meeting to challenge both the Heating and Cooling Design criteria of the WCIDS		
	2.	The high delta T requirements will reduce pumping requirements but will require the load side coils to be larger for both CW and HW. If the flow requirements are reduced, the distribution system could be theoretically reduced in size. However, undersizing the distribution system could cost a lot in the future in energy cost or replacement if the delta T was not sustainable at each Building Load over the system. (Pumping Energy would increase if a lower delta T was achieved than planned.) System Load analysis and modeling during the design Phase will confirm the most sustainable alternative.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	3.	Cogeneration is an alternative not given much consideration in the WCIDS. This alternative is used on other CA campuses and would have a sustainable carbon footprint. It is recommended that the discussions with the City of Riverside be opened to see if this could be part of the sustainable Campus and perhaps fit into their long term plans. If considered, it should be looked at for the entire West Campus not just the SoM. (A comprehensive campuswide Cogen analysis was not included in the scope of work but we will take a broad brush look at it for the SoM Campus for space allowance in the Utility Yard and future evaluations.)		
• Additional criteria not considered in the WCIDS	1.	Ambulatory Facilities may be considered OSHPD level 3 facilities and would affect the design of the SoMCP and Distribution system		
	2.	The East Campus has a backup fuel system. The Steering Committee elected for a backup propane system to be included in the space planning for the SoMCP	W&K to confirm buffer around the tanks and how this changes if tanks are placed below ground.	**W&K**
	3.	Air regulations will require Best Available Control Technology (BACT) for NOX and CO for the Boiler systems. The likely scenario is a Selective Catalytic Reduction (SCR) control system on the exhaust stack of the selected boilers and fully metered combustion control systems.		
	4.	Emergency Generators at the SoMCP will need to be developed for the SoMCP and possibly the Medical Campus. Note: If central emergency generators are included then propane could be considered in lieu of diesel since it will be available for the boilers.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
• SoMCP Space requirements	1.	The maximum chiller plant space allocation is based on 750-1,500 ton chiller modules arranged in parallel configuration with a total capacity of 4,000 tons with a spare for the largest size chiller.		
	2.	The chiller room is about 6,000 sf with room for the primary loop, condenser loop and secondary loop pumps.		
	3.	A mating cooling tower yard would be parallel to the chiller lineup. Alternatively, the cooling towers could be on the roof which would provide plenty of Net Positive Suction Head (NPSH) for the pumping system and save a set of pumps and provide shading to the SoMCP.		
	4.	If the large size 1,500 ton chiller is used, the VFD would be mounted on the floor vs on the machine for a 750 ton machine. Chiller size optimization will be conducted in the design phase based on load scenario.		
	5.	A 1 million gallon TES tank, as discussed in the WCIDS, is included in the site plan. An alternative ice TES system will be evaluated for footprint and ability to build out incrementally with the chiller build out and still meet the desire to provide TES which will reduce electrical demand loads during peak cooling load periods.	Evaluate ice TES system	**W&K / Interface**
	6.	Alternative TES tank configuration can also be evaluated such as a half buried version as was mentioned in the meeting.	Evaluate alternatives as previously mentioned above.	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	7.	The Heating plant is based on fire tube hot water boilers with enough footprint to allow for two 20MMBTU plus an 10MMBTU boiler and a spare 20MMBTU or three 30MMBTU plus a 10MMBTU if the load gets larger after reviewing the load criteria again. The Boiler room is about 3,000sf.		
	8.	Fire tube boilers are selected at this point because of the turn down capability, efficiency, and cost at this size. Water tube would be considered at larger sizes over 40MMBTU in size. Either would require SCR at 5PPM NOx requirement unless burner technology gets improves before final design.		
	9.	A dual tank propane backup system that requires a distance of up to 100 ft from important buildings and property lines is proposed for the site. Sizing would be based on full build out and redundancy requirements.	Verify clearance requirements	**W&K**
	10	Consideration of underground installation was requested by UCR. Alternatively, protected tanks could be considered.		
	11	The electrical room is positioned to allow direct contact with both the boiler room and the chiller room for power distribution purposes. The transformer yard would be adjacent to the electrical room.		
	12	Emergency generators are not shown on the yard site plan but would be adjacent to the transformers.		
	13	SoMCP employee facilities occupy 1,200 sf and will need further definition.(A space plan has not been developed at this point. But will be by WM/MH	Review employee facility space requirements	**Walker Macy / Miller Hull**

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Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	14	Total building footprint is 18-20,000 sf with a 18% load contingency based on the maximum build out scenario. At this point it is one level. Mezzanine levels could be worked in if footprint needs to be optimized. It makes sense to put the cooling towers on the roof and utilize gravity for the condenser pumps suctions. Alternate Sustainable configurations would have different footprints.		
• Central Plant Utility Distribution	1.	Utility tunnel space planning needs to accommodate current projected piping sizes, space for future piping and communication cable/conduits, and space to get in and out of the rack system to intersecting pipeways to buildings.		
	2.	Utility tunnel cross section for planning purposes should be 8' wide by 10 ft deep, with lighting, ventilation, fire sprinklers (campus requirement) and drainage system.		
	3.	Alternate tunnel for material transport would need to be a minimum of 12'wide by 16' high as shown in the slide presented. An argument could be made to completely separate the utilities from the material handling to avoid interferences during maintenance, security of valve operators, damage due to collision. A side by side arrangement does not work well at tunnel side branches and utility intersections.	Check configuration of Stanford utility tunnels	**W&K**
	4.	The vivarium access is driving the need for the underground material transport tunnel. Alternatives for locating the vivarium for the shortest possibly tunnel length and having access from the site entry will be reviewed to push it north in the SoM.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	5.	Site Utility Loop piping has a design criteria in the WCIDS of 9 fps and 3.0 ft /100ft of pressure loss. An alternate criteria of 7 fps maximum velocity or 2.5ft/100ft which would result in a lower energy pumping cost due to a 64% lower pressure drop, provide 25% future capacity in the interim at a 30% increased cost of piping for the utility mains during the initial tunnel construction. It would avoid future pumping or replacement cost because the piping was not sized for unanticipated loads or changes in uses. If additional Loads are added to the system and pipe size is designed without extra capacity, pumping costs will increase forever at a higher rate than an oversized system installed initially.		
	6.	The location of the tunnel system will be developed around the east and west perimeter of the initial SoM buildout. The southern portion of the Loop would be north of the south parking structure so that the services could be distributed both directions from the tunnel and minimize tunnel length.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	7.	The loop piping would be upsized at the southern end so that, if needed, it could be fed from either direction in a maintenance situation. Hydraulic modeling in the design phase will be refined to the optimum size. It is recommended that a SoM Central plant and Hydraulic model be developed for the SoM Campus so that future changes in direction or uses can be evaluated with respect to impact on Central Plant equipment, Energy Use and resulting Greenhouse gas emissions and Loop pipe flows and size implications. This is normally done in the next design phase or once the plan is set.		
Central Plant Sustainable Elements	1.	Alternate Sustainable designs of the chilled water system and hot water generation will be reviewed and a cost effective low carbon footprint will be selected.		
	2.	Chillers will be highly efficient selections		
	3.	Non-ozone depleting refrigerant R134A will be selected for use		
	4.	VFDs will be selected on all equipment that it makes sense to do so including chillers, pumping systems and cooling towers		
	5.	Central Plant Optimization Programs (CPOP) will be utilized by the PLC based control systems		
	6.	Fully metered burner optimization systems and BACT to minimize emission from gas fired boilers will be utilized.		
	7.	Water saving scenarios will be utilized.		
	8.	The building design of the SoMCP will be designed within sustainability guidelines.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Sustainable Alternates for the SoMCP	1.	Geothermal condenser water cooling either through a open or closed lop system. At 2 tons per 400ft boring it would take 2500 borings for a 5000 ton cooling tower load		
	2.	Templifier heat pump system using a templifier to recover rejected heat from the condenser side of the chiller system for preheating boiler water in the primary loop. Compared to 100% direct firing of the boiler to meet the load the energy input is 65% more energy efficient and has a lower carbon footprint		
	3.	Irrigation/Domestic Cold Water Integration could provide a radiant cooling source or a heat rejection source for the chiller plant or a pre-heating source for domestic water if centralized		
	4.	Ice storage is modular in design and could be used initially 80% of the time for chilled water supply with 20% of the time requiring the chillers to provide recharging of the ice system if the full build out was implemented initially		
	5.	Co Generation could provide complete electrical needs for the entire West Campus and provide Chilled water through absorption chillers, Heating water and Domestic Heating water. Riverside low utility rates and long term commitments would affect the economics but it should be reviewed for the entire West Campus and if nothing else space provided in the planning process if it needs to be developed at a later time		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	6.	Solar Thermal panels at Building Load side would reduce the building loads while providing a renewable energy source and should be a design criteria element for future buildings		
	7.	Develop Building Design directives to mandate load reduction below T-24 goals and resulting impacts on the SoMCP		
Stormwater	1.	The University is open to pervious pavement options. However, the University is less inclined to green roof options. A potential issue would be the irrigation requirements during the dry weather period.		
	2.	The University is interested in having a highly visible stormwater management implementation that can showcase the University's effort in Low Impact Development.		
	3.	The proposed swale along the NW Mall at Chicago Avenue can potentially be placed along the northern side of the road.		
	4.	The campus is on loamy sand soil, which is effective for infiltration. The stormwater management should utilize infiltration as much as possible.		
	5.	The University does not currently operate any mechanical stormwater treatment units.		
	6.	The preference is for each building to provide its own stormwater management in order to reduce the carbon footprint per building and per project basis.		
	7.	The University commented that the University storm drain system could be connected to the drain line in Cranford. Ownership of the line will need to be verified.	Confirm location of City system	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Wrap up	1.	Campus and Project Goal to meet new mandates for green energy sources, carbon neutrality by 2020.		
	2.	Additional information is needed by the University to select sustainable options for implementation.	Project team to present pros/cons of various options discussed in the workshop.	**W&K / Interface**

Acronyms/Abbreviations

SoM	School of Medicine
PMT	Project Management Team
CPP	Capital & Physical Planning
SoMCP	School of Medicine Central Plant
TAPS	Transportation and Parking Services
TES	Thermal Energy Storage
VFD	Variable Frequency Drive
WCIDS	West Campus Infrastructure Development Study
CAMPS	Campus Aggregate Master Planning Study

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WINZLER & KELLY

School of Medicine Infrastructure Phase 1
Workshops #2-3 Meeting Notes
March 23, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Additional Analysis	1.	Based on the team's review of the WCIDS documents, it is apparent that the connectivity and phasing plans for some of the utility systems will need to be reevaluated in the future.		
	2.	Storm Drain: WCIDS planned for collection system components along NW Mall, SW Mall, and MLK Blvd. to connect to the existing County storm drain system in Cranford. The County is requesting coordination and calculations to verify ability of existing system to accept flows. Also, new City storm drain piping was not considered in Iowa Ave.	Coordinate with County to perform additional storm drain analysis for areas east of Cranford.	**W&K**
	3.	Sanitary Sewer: WCIDS planned for collection system components along NW Mall and SW Mall to Cranford Ave. with connections to an existing UCR sewer line in MLK Blvd. and an existing City sewer line at Everton Pl.	Evaluate feasibility of intercepting flows at Iowa.	**TBD**
	4.	Electrical: The City is in its environmental comment period for their 69kV Subtransmission Project. Additional routing analyses and negotiations need to occur to set a pathway through the West Campus acceptable to UCR and the City.	Prepare routing analysis for UCR use in negotiations.	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Sustainable Strategies	1.	Carbon neutrality by year 2050, Campus-Wide (versus each building being carbon-neutral)		
	2.	Although some options may not be selectable based on financial considerations, UCR may consider them anyway as a means of expressing the commitment to change the culture (e.g., have one turbine in an iconic spot. (See UCSD Peoples' Energy Park))		
	3.	Interface went through sustainable features that affect the SoMCP and discussed Pros and Cons of different systems. The following concepts were the chosen options for further review: geothermal, templifier heat pump technology, solar thermal at the SoMCP and SoMCP area, ice storage systems, solar PV (both campus and off-site solutions), wind technology (off site solutions).		
	4.	Upon completion of review of sustainable options for the SoMCP, Interface went through some options for building-side sustainable strategies focusing on load reduction. Interface noted that UCR should include these in the Master Plan but enforcement of strategies would have to be relied on either by a third party peer reviewer or through the University		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	5.	UCR expressed an interest greening the campus in a visible way to help demonstrate the sustainable achievements as well as incorporating the campus technologies into an educational tool. Interface will review this criteria and make suggestions. Some ideas were: • Building integrated wind technology. • PV on campus lighting systems. • Building integrated PV. • Solar thermal solutions		
	6.	UCR requested that Interface and the team consider the proposed use of an on-site blackwater treatment system. This would include the use of the residential facilities for water re-use. Interface and W&K to continue pursuing the strategy. The option is should only be consider if Riverside Public Utilities does not build a scalping station.		
	7.	UCR requested that Interface and W&K address carbon neutrality and both on site and off site strategies for achieving carbon neutrality.		
	8.	UCR wants further detail on total impact by each chosen sustainable measure (i.e. percentage of hot water delivered from the solar water heating system, percentage of boiler reduction from the templifiers, percentage of water reduction from geothermal, etc.).		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
SoM Building Program	1.	Walker Macy presented revised building layouts including a modified housing component.	• Evaluate mix of types for Graduate Medical Housing to ensure proper sizing of buildings (Single apts, quads, faculty apts) • Show more activity/open space between buildings on Grad Housing site, create more sense of place • Talk to UCSD about their new housing (1000 beds, 1:1 parking) • Look at option of arranging all housing along Cranford • Show utility tunnel in relationship with housing	**Walker Macy**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	Medical School Program and Layout • Research buildings should be planned at 4-stories for code reasons • Ambulatory and Education Buildings can be 5-6 stories • Show consistent street setbacks on plan • East Campus buildings have been smaller than their Master Plan footprints • Ambulatory Buildings will include clinics/imaging, Cancer Centers, Acute Care Centers. They'll be more 'square' buildings, as opposed to classroom buildings with a central corridor. Rooms will be bigger • Label the MOBs to the west as Ambulatory or Research. They'll be incubator space, not private clinics	• Examine splitting M6 into 2 phases. Build it as a package with the PM parking structure • Team should gather plans of ambulatory buildings to use as sizing examples	**Walker Macy**
Parking & Circulation	1.	Ambulatory uses can charge for parking, which may help pay for parking structure		
	2.	Parking for housing at UCSD is 1:1 (vs 0.5:1 on our plans).	Discuss with UCSD	**Walker Macy**
	3.	Parking structures could include a mix of uses. But Pharmacy will likely be inside Ambulatory building		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	4.	The police substation may be in the first parking garage (PM)		
	5.	Build North parking structure (PMOB) in Phase 1, closer to first cluster of buildings. Will likely require signalized intersection in Chicago.	Address parking requirements in parking structures, and incorporate cost of the structures in the cost plan as a separate system.	**Walker Macy / W&K / Saylor**
	6.	Need to have a route for bikes & pedestrians to Main Campus in Phase 1		
Irrigation	1.	Ag Ops water available (Gage Canal water) for domestic irrigation, but the Ag Ops piping system is 60+ years old and can't meet pressure demands. Ag Ops irrigation needs to be accommodated as family student housing develops.		
	2.	City wants to create a market for reclaimed water and will discuss with UCR in 2010. Use purple pipe system to allow for future reclaimed water use for irrigation.		
	3.	Decrease amount of turf so that it's just on mall and special gathering areas. Use low groundcover for the rest, non-central spaces		
	4.	UCR prefers a water-efficient landscape vs. "hot", xeriscape-type	Team to assess what campus will look like in early phase? (landscape-wise) Include benefits of the use of shade trees	**Walker Macy**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	5.	Suggest we develop a water budget, set targets. Determine how irrigation use relates to overall water use.	UCR to provide draft sustainability plan. Team to evaluate benchmark for UCR in reducing irrigation. Assess how their goals translate to SoM to "get your arms around it" for our plan.	**Walker Macy/ W&K**
	6.	Need to find a place for stormwater detention.	Determine porosity of soil/ability to infiltrate stormwater onsite. Examine individual detention at buildings vs. SOM site detention	**Walker Macy/ W&K**
	7.	Swale at MLK may not be needed to detain flow given topography and Cranford intercept	Verify	**W&K**
	8.	Concrete drainage swale along western edge of support area picks up flows from the north. Need to pick up water within support area.		
Support Yard	1.	Rich Whealan from Miller|Hull presented four schemes that had been generated by the team. Discussion centered around Scheme 4, and an evolving scheme 4A that was presented with a sketch overlay. This scheme moved the Boiler and Chiller buildings to the north to centralize a Corporation Yard on the southern half of the site. Location and adjacencies of Receiving, EH&S, Custodial, Skilled Craft, Grounds, Laydown Area, and covered parking were discussed.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	Receiving to be only a 1 bay loading dock. 2500 sf ample for EH&S HazMat storage and shipping at Support Yard		
	3.	UCR wants city power line underground (firm position). This would make substation smaller		
	4.	Substation will serve family housing too. Need to allow city staff to access the substation		
	5.	TES tanks 1.5 mil gallons each. Now need 2 tanks. TES tank 60' high – may be buried		
	6.	Include 50' buffer at north edge. Put 10' of heavy landscape along residential use boundary to north. The rest is landscape/storage/circulation.	Revise layout of buffer zone.	
	7.	Skilled craft need direct connections to parking/storage		
	8.	110' turnaround better than 100' for large trucks		
	9.	Mike Miller prefers steel-paneled Butler Building-modular, pull sheets off to move units in and out		
	10.	Propane setback is 50' from nearest structure.	Consider/research burying tanks	
Side Session - Telecommunications	1.	See attached notes from TEECOM		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party

Side Session – Meeting with City RE: Traffic	1.	**Meeting at City of Riverside**
		Kevin Marstall, Public Works Engineer
		Ken Pirie (Walker Macy)
		Mike Zilis (Walker Macy)
		Tuesday, March 24, 8am
		
		Iowa Ave.
		
		• Connect to storm and sewer in Iowa
		• City may be flexible in lane widths
		• Iowa improvements predicated on UCR inputs
		• City will provide Capital Improvement Plan (CIP) related to sizing of Iowa Avenue (and Chicago)
		
		MLK Jr. Blvd.
		
		• MLK is at its full width now
		  o Lanes/signal improvements would be driven by UCR
		  o No plans for bike lanes
		  o Sidewalk could be added- condition of SoM		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
		Chicago Ave. • Full intersection at NW Mall depends on UCR's traffic impact analysis (w/ DPP or before DPP) o Widening is being held up by ROW issues to the south of MLK o 1300' standard length between signals o We have +/- 900' from the existing signal at the shopping center o Improvements could be done and should be part of a detailed traffic study o Identify request for signal and lane width changes and talk to City		
Central Plant Design Loads	1.	WCIDS Cooling Loads vs W&K Load Requirements. Verify basis of comparison. At full SOM build out WCIDS plant size 2400T vs 7000T . W&K used conservative load criteria based on a comparison of ASHRAE, W&K sample building calculations, W&K and Interface Experience and PG&E "Cool Tools"study for Load criteria by use. Conservative assumptions used throughout W&K analysis including 23% SF contingency factor.		**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	2.	Thermal storage calculations for 3 million gallons of TES storage based on 20 degree Delta T, 6 hours of full peak capacity and central plant not reduced in size because peak demand period in Riverside lasts 10 hours. Full capacity is 42,000 ton hours		
	3.	Thermal Storage Tank design comparison for buried versus above grade versus Ice Storage will be compared for Phase 1 load build out	Provide comparison for decision	**W&K / Interface**
	4.	Penalty in energy cost for buried TES due to building height difference. Energy cost difference could be up to $100,000 per year at full build out and half of that for 50% burial	Confirm energy cost difference.	**W&K / Interface**
	5.	W&K Load requirements used same methodology to develop heating loads that differed from WCIDS. W&K loads used are 42btu/sf Peak vs 16 Btu/sf from WCIDS.		
	6.	Heating Load Peak to Average is a factor of 6 which indicates that boiler sizing should be in smaller modules to accommodate the large load swing at high efficiency. Peak capability is required to meet the demand but it only occurs less than 1 week per year.		
	7.	Phase 1 SOM Loads include the 23% contingency factor based on SF calculation which directly impacts equipment sizing for initial project.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	8.	Phase 1 Cooling Plant Peak Load is 2700 Tons Phase 1 TES Tank at 50% of build out is 1.5MM Gallons Phase 1 Heating Plant Load Peak is 48MMBTU UCR agreed to the conservative sizing concept.		
Central Plant Design Criteria	1.	Goal: SoM Campus goal to reduce Energy at the Load side by Design of Energy efficient buildings ultimately reducing the Load on the SoMCP		
	2.	Goal; Chilled Water Delta T of 30 DT cooling and 50DT Heating at the Load side and communicated to the future Designers as a Standard		
	3.	Chiller Plant Sized to operate between 20 and 30 DT cooling and Heating Plant sized to operate at 40-50DT heating.		
	4.	Loop Cooling Piping will be sized at 20DT and 7fps (+/-) Loop Heating Water will be sized at 7fps (+/-)		
	5.	TES Tank or ice sized at 20 DT cooling		
	6.	TES alternates for underground vs above ground vs ice will be developed	Cost comparison for each at Phase 1 Loads is required	**W&K/Interface and Saylor**
	7.	Design Standards should be developed for load side Design Teams		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	8.	Develop a review process for all new buildings to enforce the SoM Criteria affecting the SoMCP		
	9.	Cogeneration was recommended as a future study for the entire West Campus which would make more sense at the east side of the West Campus. The SoM will remove cogeneration from the space allocation in the Support Yard.		
Central Plant Equipment	1.	Chiller modules of 1500T selected for future 7000T plant. At 1500T, space is allocated for 7500T plus one 1500T chiller. Chiller selection will be capable of meeting design criteria from 20-30DT with variable speed chillers and variable primary and secondary loop pumps in the chiller plant		
	2.	A 24MMBTU Templifier for heat recovery of chiller condenser water will be used for preheating Heating Water and a Centralized Domestic Hot Water system		
	3.	Cooling towers are planned to be on the roof of the chiller plant to increase their efficiency and shorten the large piping runs. Variable speed fans and pumping systems would be included. Recycled water could be used for makeup water and water conservation		
	4.	Geothermal wells in a closed system is being investigated as an alternate to cooling towers	Cost analysis versus cooling towers needed for budget decision	**W&K/Interface**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	5.	Boiler Plant is recommended to be 800HP fire tube boilers modules with 400HP for low load times due to the following advantages: -Capability to match low loads due to high peak to average load ratio typical for the area (6:1) -More cost efficient -Smaller footprint	Confirm life span *Follow up* *-Life span confirmed to be 35-50 yr from manufacturers of both fire tube and water tube* Boiler downsizing due to templifier addition and solar thermal hot water generation will be reviewed for final recommendation	**W&K**
	6.	Boilers will have 30PPM burners and SCR to meet 5PPM NOx and 50PPM CO air discharge requirements		
Central Plant Layout	1.	Building Layout will be expandable from Phase 1 size to future footprint without impacting Support Yard planning		
	2.	Metal clad building is preferred by the UCR Facilities Department. Provides the ability to remove panels to support equipment replacement.		
	3.	Layout with central equipment access aisle was reviewed favorably by UCR		
	4.	Dual tunnels from SoMCP to SoM to provide redundant supply was reviewed favorably by UCR		
	5.	Cooling towers on the roof of the chiller plant is the basis for the recommended footprint		
	6.	Emergency Generator sizing and layout needs further consideration by the Design Team. Electrical backup will need to be provided for the Medical Research, Classroom, and Vivarium buildings.	Develop emergency generator sizing criteria and footprint adjacent to Chiller Plant	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	7.	If TES Water Tank is used 50% buried is the most probable option made from concrete.		
	8.	Available roof in Support Yard could be used for solar thermal heating for Central Hot Water System	Preliminary sizing required for inclusion	**W&K/Interface**
Backup fuel system	1.	Propane SNG Plant recommended due to facility size		
	2.	Confirmation by UCR of the UC System requirement was 14 days of storage based on average demand. This results in two 30,000 gal tanks for boiler backup only	Confirm final size after Emergency generator loads developed	**W&K**
	3.	Buried versus above ground cost differential and benefit analysis requested	Comparison of above ground to below ground	**W&K**
	4.	Distance to property line and important building remains 50ft up to 30,000gal size		
	5.	Confirmation of City requirements for above criteria is needed	W&K to contact Fire Marshal	**W&K**
OSHPD	1.	OSHPD 3 requirements for Ambulatory Facilities will be imposed on the individual facilities as they are built. SoMCP Planning Capacity will still include them as if they would be served by the SoMCP to allow capacity if the actual use changes in the future. Phase 1 load calculations would be unaffected by this scenario	OSHPD requirements for Riverside need to be confirmed	**W&K**
Utility/Transport Tunnel	1.	Loop concept from SoMCP to south of the first grouping of buildings was agreed to for Phase 1. Portion built will depend on final budget		
	2.	Transport Tunnel preferred to be in straight line from the Support Yard to the facilities served. Depth to be dependent on Vivarium depth.	Required Vivarium height including space for support utilities above will be provided	**Don Caskey**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	3.	Utility tunnel separate from the transport tunnel was recommended to avoid interferences and allow utility work to be independent of tunnel use for material transport; Also piping leaks would be kept separate from transport tunnel and provide the opportunity to enter lower floors of buildings served.		
	4.	Drainage of the utility tunnel will be to the north, due to the lay of the land sloping towards the Support Yard where a pump station could be located in a vault on each leg of the tunnel (post comment)	Include pump station in programming	**W&K**
	5.	Sanitary sewer lines are proposed to run down NW Mall.	Depth of tunnel and crossing utilities at the NW Mall needs to be confirmed	**W&K**
	6.	Gas lines are programmed to be located in the tunnel serving SoM Facilities code permitting		
	7.	Tunnels will have lights, ventilation, drainage and could have security cameras		
	8.	Branch line from tunnels will leave and change grade in a vault. Branch valves will be in the main tunnel. Branch Lines will be in surface covered utility trenches at grade for future access adjacent to sidewalks. Cost of building service trench downstream of the vault will be born by the individual buildings		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	9.	Presented options for ramped access to a below grade Receiving area, showing an example from Stanford University, though cautioned that the drivable ramp at Stanford was quite steep and still required approx. 250’ of ramp to bring vehicles to the tunnel level. After a brief discussion, it was determined that the Support Yard site did not have the space to provide ramped access to a lower level Receiving area, and that a service elevator would be used to provide access to the tunnel from an on-grade Receiving area.		
Utility Systems	1.	Storm Drain • Evaluate Draft Campus Sustainability Plan and establish low impact development goals for new buildings. • On-site detention will be required to attenuate peak flows to the County system. Options include the central landscaped area as well as above-ground and below-ground options along NW Mall.	The Team will provide detention alternatives for UCR approval.	**W&K / Walker Macy**
	2.	Sanitary Sewer • As noted previously, the previously planned routing of sanitary sewer flows from the entire West Campus to Cranford Ave. should be reevaluated. Adjustments were made to convey SoM flows to Chicago Ave.	Sanitary Sewer system layouts will be finalized once SoM building program elements have been finalized to coordinate alignments to avoid conflicting with the utility tunnel.	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	3.	Potable Water • Although the Fire Marshall indicated in a side discussion that a single point of connection to the City system would be all that was required, it was decided to provide a second connection for system redundancy and reliability. • The primary connection will be to the City system at Chicago Ave. & NW Mall. A standby secondary connection will be provided at Cranford Ave. and Everton Pl. (Metered and valved off for emergency use only)	UCR to check on whether there would be any significant City charges associated with this configuration.	**PMT**
	4.	Irrigation Water • Due to the potential surface parking requirements for the SoM, Ag Ops irrigation may not be needed. • A new irrigation line will need to be constructed from the existing Ag Ops reservoir to the SoM campus. The system should be constructed to allow for conversion to reclaimed water use in the future.		
	5.	Electrical • Electrical distribution will utilize the utility tunnel routing for SoM facilities and will be constructed in duct banks in Cranford Ave. to serve the future Family Student Housing.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	6.	Natural Gas • Connection point and routing changed to Chicago Ave at NW Mall to better serve the SoMCP and minimize larger service lines.		
	7.	Central Plant Utilities • Central Plant utilities will be routed through utility tunnels. Final layout will be dependent on confirmation of SoM building plan layout.		
Support Yard	1.	Rich Whealan presented the new Scheme 4A, based on the discussion from the previous day.		
	2.	Don was concerned about an internal corner labeled as ‘Skilled Craft’ with poor access to the yard area, though thought that the scheme was close in capturing the right mix of spaces.		
	3.	Jon clarified the need for covered parking spaces that are outlined in the program spreadsheet.		
	4.	<u>Perimeter setbacks and easements</u> • North – a 50’ setback is provided from the residential use to the north. This is not a required setback for UCR development, though it meets the City of Riverside setback requirements for an Industrial use adjacent to a Residential use. Locate a tree buffer in the northernmost 10’ along the existing 6’ high wall to provide screening at the property line.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
		• South – a 20' setback from the north edge of the sidewalk matches the standard setback within the West Campus development. • East – a 20' setback from the parking curb edge provides a stand setback for landscaping. • West – a 40' easement for the overhead power is provided along the west edge. This easement would also contain the underground utility tunnel.		
	5.	<u>General Organization</u> The location and arrangement of several program elements were discussed, with the following conclusions: • Electrical Substation – located in the NW corner of the site with easement access along the west edge of the site. • Propane yard – located along the NE corner of the site with access from the housing parking lot, through the 50' setback to a gate on the north of the propane yard. Propane delivery vehicles could continue south and exit through the Support Yard.		

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
		• A north-south drive lane travels through the site connecting the NW Mall, through the Corporation Yard and the Propane yard, to the housing parking area at the northeast corner of the site. Functions to the west side of the drive lane include; the Boiler and Chiller buildings, and Electrical Substation. Functions to the east of the drive lane include; Receiving, EH&S, and Custodial (following decision to locate the transport tunnel to the eastern side of the site). Locations of the Grounds, Skilled Craft, and covered vehicle storage will be considered in a revised scheme based on the findings from this workshop. • Boiler and Chiller functions are located toward the rear (north) of the Support Yard space aligned with the western edge, allowing for expansion to the east. Boiler and Chiller buildings are separated by an access way to facilitate replacement and service of the equipment. The Utility Tunnel loop will route through this access way. • Cooling Towers would be located on the rooftop above the Chiller building with screen walls. Total building height approx. 45'. Cooling Towers are not required if Geothermal heat rejection is pursued.		

WINZLER & KELLY

School of Medicine Infrastructure Phase 1
Workshops #2-3 Meeting Notes
March 24, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	6.	Utility and Transport Tunnel • A Utility Tunnel loop will be provided through the access way between the Boiler and Chiller buildings. • A portion of this loop will be constructed as a Transport Tunnel extending from the Phase I School of Medicine buildings to an elevator that connects the tunnel to the Receiving area.		
	7.	Thermal Storage vs. Ice Storage • Two TES tanks at 1.5M gallons each are required for full build out. Phase I build-out would require one 1.5M gallon tank. • Tank dimensions are approx. 65' dia. X 60' tall with half of the tank buried. Cost of burying the tanks may off-set some of the first costs associated with the Ice Storage system. • An Ice Storage system would use less footprint on the site, and could provide a more modular approach to growth and incremental costs at each phase of building development, though the first cost may be higher.		
	8.	Propane yard • Current capacity shown is 30,000 gals. – calculated to provide 1 day supply at peak demand. • Orlando Caalim pointed out they have a 90,000 cu. ft. capacity at the existing campus	Review and confirm required capacities for the School of Medicine	**W&K**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	9.	Co-Generation • Co-Generation was discussed, though it was concluded that space for a future Co-Generation plant would be provided at an East Support Yard adjacent to the freeway. No Co-Generation at the School of Medicine Support Yard.		
	10.	Emergency Power Generation • Space for a Generator yard needs to be provided in the Support Yard to provide emergency power generation for the Research programs at the School of Medicine.		
	11.	Overhead vs. underground power to the Substation. Impact to easement and size of Electrical Substation enclosure.		
	12.	During discussion of the utility tunnel, it was decided that the utility tunnel loop should pass through the access corridor between the Boiler and Chiller structures and that the preferred location for the transport tunnel would roughly align with the truck circulation path of the Support Yard. This suggested that several functions requiring access to the transport tunnel via an elevator, including; Receiving, EH&S, and Custodial functions, should move to the east edge of the Support Yard.		
	13.	UCR will review the Support Yard layout developed by Miller Hull and provide program and layout for the other Campus uses for the Support Yard space.	Provide a Support Yard plan that incorporates the organizational decisions.	**Miller|Hull**

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Cost Estimating	1.	Cost Model formats for use in the Detailed Project Program document were discussed.	Provide Saylor with sample templates	**PMT**
	2.	The cost plan will show costs for the utility tunnels for both phase 1A, and a separate cost for phase 1B (ambulatory care). If additional parking is needed for phase 1B, the cost of a second garage will need to be included.		
	3.	Costs for telecommunication and fire alarm system connections to the East Campus will be broken out as separate costs tied to other funding sources.	Provide Saylor with delineation of duct bank runs associated with each funding source.	**(W&K / TEECOM) PMT**

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
SOM Building Program / Walker Macy	1.	Discussed concepts for housing options at the northeast corner of the SoM site. The site can accommodate the housing, but the concepts for parking should be further developed (i.e., number of levels of podium parking). Parking could be accommodated in PM1.	• Keep housing as shown. • Include housing GSF and number of beds in the report.	**Walker Macy**
	2.	The steering committee expressed concern about the building layout in the southeast quadrant of the site. • Ambulatory care facilities would need drop off locations. • PM2 would not be a very inviting structure at the entry point to the campus. • The committee asked for parking assumptions to be double-checked.	• Flip M and M5 with PM2 on the plan to move parking away from the entrance. This allows for drop offs prior to vehicle parking. And sets back the large PM2 structure away from the entry area. • Verify ambulatory care parking allowance of 5 spaces per 1,000 gsf.	**Walker Macy**
	3.	Proposed buildings along MLK need to move south to establish the campus edge. Although the parking garage along MLK is within landscape buffer, this was not viewed as a concern.	Check setbacks.	**Walker Macy**
	4.	Peer review comments: • Consider eliminating construction of Cranford Ave. north of the roundabout and NW Mall east of the Support Yard entrance for the first phase. • Drop offs may break the continuity of trees/streetscape.	Add to cost reduction consideration list.	**W&K**

WINZLER & KELLY

School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Support Yard Program / Miller Hull	1.	• Propane storage should be moved below grade. • Peer reviewer suggested placing the propane storage tank in a vertical silo.	Modify plan to place the propane storage below grade.	**W&K / Miller Hull**
	2.	A question was brought up on the need for fire access along the site perimeter.	Confirm fire access along Support Yard perimeter road.	**Miller Hull**
	3.	Consider pushing back buildings from NW Mall to allow more wiggle room near entry.	More significant Support Yard configuration changes will be developed in response to cost reduction comments.	**Miller Hull**
	4.	See discussion on Central Plant for additional Support Yard discussions/modifications.		
Sustainability / Interface	1.	The cost for many of the sustainability items are significant. In order to piece together a viable project that includes these items, the team needs to identify elements that can be phased in a "pay as you go" approach.		
	2.	The open aquifer geothermal system consists of an extraction well that utilizes groundwater from the aquifer as a heat exchange medium for chiller condenser heat rejection. The water can be reinjected back into the aquifer or be used for irrigation/non-potable demands.		
	3.	The open aquifer geothermal system also has the flexibility of expansion over time. Additional wells can potentially be drilled to handle more load if the hydrogeological conditions are favorable.		

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	4.	Approximate payback period for the open aquifer geothermal system is 25 years. (45 years for the vertical bore geothermal system) See Slide 15 from the Sustainable Alternates presentation for more detail.		
Central Plant / W&K	1.	Peer review commented that demand loading was overly conservative. The team had developed bracketed loading which resulted in a low demand scenario similar to the WCIDS. The team discussed how the loading factors used in this analysis (high demand scenario) were based on a UCR desire for future flexibility.	Since the first phase buildings are unlikely to expand beyond the current planning numbers, the assumption used for future phases (i.e., potential additional story for each structure). The loading for the first phase has been reduced.	**W&K**
	2.	Confirmed 1.5MG TES tank size with peer reviewer. Consider relocation of TES tank closer to Chiller building and locate above grade. UCR decided to allow an above grade installation.	Reconfigure Support Yard.	**Miller Hull**
	3.	Agreed on a chiller configuration of three (3) 1,000 ton chillers and three (3) 1,200 ton cooling towers. • Consider moving cooling towers to ground level to reduce costs.	Modify plan. (NOTE: Cooling tower requirement may be modified due to geothermal option)	**W&K / Miller Hull**
	4.	Agreed to reduce boiler configuration to 2 - 400 HP units accounting for a full size templifier to provide 50% of the heating capacity and eliminate the need for 800 HP with SCR units. Space in the plant will allow placement of 800 HP units in the future if required as anticipated.	Modify plan.	**W&K**

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
	5.	Agreed on chilled water, heating hot water, and domestic hot water distribution pipe sizing. Pipe sizing of utility systems agreed to match conservative full build out loads at 7 fps design criteria velocity.		
General Utility Infrastructure/ W&K	1.	Plan should note that irrigation water system will also feed non-potable water demands at the buildings.	Modify plan.	**W&K**
	2.	Steering Committee questioned whether potable water demands for the Family Student Housing development could be met with the proposed connections for the Phase 1 SoM infrastructure.	Analysis of interim conditions in the West Campus was not in the scope of work. However, if the intent is for Family Student Housing to be separately metered and served by the City of Riverside, the developer will need to coordinate with the City to confirm the adequacy of the service.	**TBD**
	3.	Clarified the cost items for electrical: • Alternate A, connection to the existing University Substation, is below the line. • Alternate B, service from a substation at the Support Yard, is included in the base costs. • 69kV Substation costs are below the line.	Modify cost estimate.	**W&K / Saylor**
	4.	Peer review suggested a review of sewer pipe sizes at City connection points.	Verify	**W&K**
	5.	Hold costs for traffic signals in the base costs.	Verify.	**W&K / Saylor**

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Discussion Group/Lead	Item #	Discussion Items	Action	Responsible Party
Implementation	1.	Options for site preparation include 1) select demolition of existing site to accommodate utility infrastructure only (Development areas would be cleared by the building project); and 2) complete demolition of Phase 1 development area. The direction from the Steering Committee was to retain the assumption that complete demolition of Phase 1 site is included in Phase 1 Infrastructure costs.		
Cost Estimate	1.	The current cost estimate exceeds the planned budget for the project. This is primarily due to the increased level of service and flexibility for the utility systems. Direction was given to look at what basic infrastructure is necessary to serve the SoM.		
	2.	Reconfigure Support Yard to eliminate need for excess tunnel/piping. See other discussion items for details.	Modify estimate.	**W&K / Saylor**
	3.	The team should develop a list of non-essential level of service or sustainable elements that are in the project and their associated costs for the Steering Committee to evaluate and provide direction.	Develop general cost information on non-core items.	**W&K / Saylor**

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Acronyms/Abbreviations

SoM	School of Medicine
PMT	Project Management Team
CPP	Capital & Physical Planning
SoMCP	School of Medicine Central Plant
TAPS	Transportation and Parking Services
TES	Thermal Energy Storage
VFD	Variable Frequency Drive
WCIDS	West Campus Infrastructure Development Study
CAMPS	Campus Aggregate Master Planning Study
CUP	Central Utility Plant

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School of Medicine Infrastructure Phase 1
Workshops #4 Meeting Notes
May 15, 2009

Meeting Attendees		
Name	**Department/Utility System**	**Contact Info**
Jonathan Harvey	PMT	jon.harvey@ucr.edu (951) 827-6952
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Don Caskey	Steering Committee	
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Mike Miller	Steering Committee	
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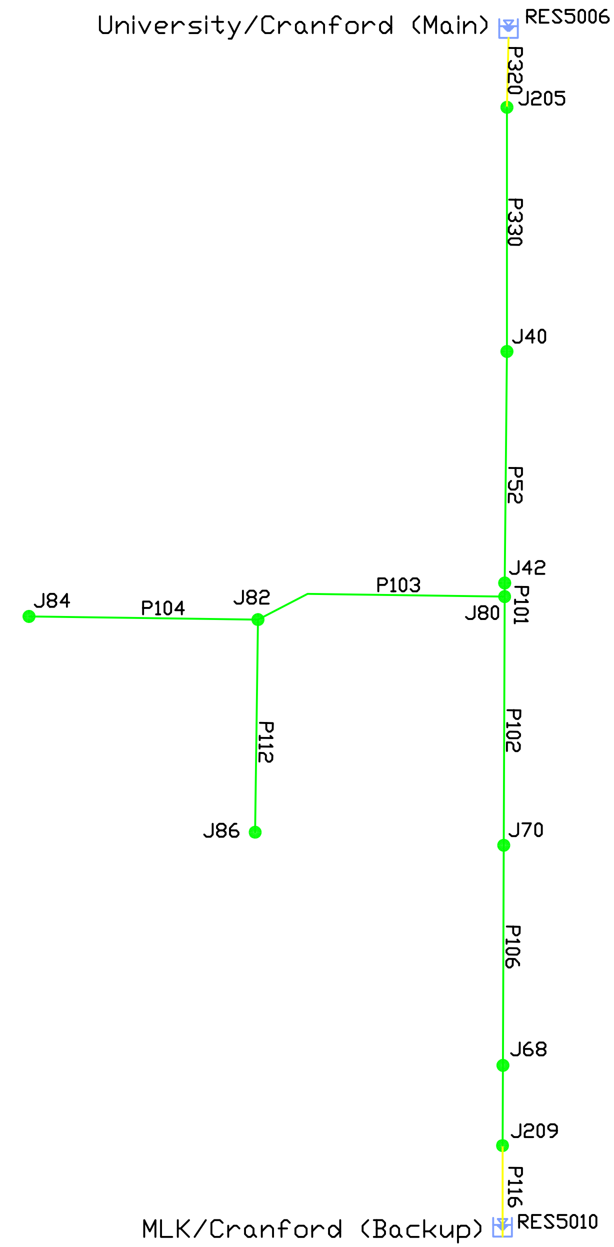
DOMESTIC WATER

University of California, Riverside
School of Medicine Development
Domestic Water System Analysis
Phase 1 Condition



SOM PHASE 1 CONDITION

NODE DATA (PEAK HOUR CONDITION)

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J205	0	976	1,238.11	113.57
J209	0	981	1,246.40	115
J40	0	982	1,218.56	102.5
J42	0	980	1,217.35	102.84
J68	0	981	1,216.90	102.22
J70	233	978	1,216.90	103.52
J80	348.2	980	1,216.97	102.68
J82	517.8	968.5	1,216.66	107.53
J84	0	963	1,216.66	109.91
J86	0	973	1,216.66	105.58

RESERVOIR DATA (PEAK HOUR CONDITION)

ID	Flow (gpm)	Head (ft)
RES5006	-1,099.00	1,248.58
RES5010	0.00	1,246.40

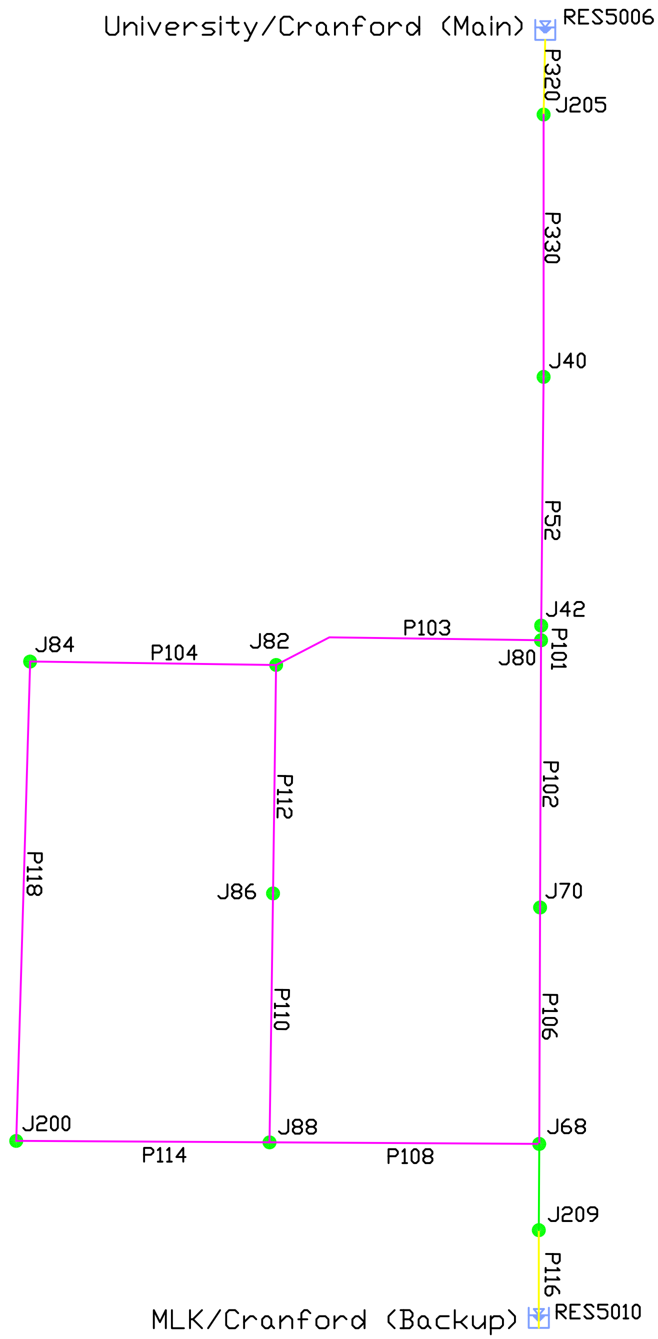
LINK DATA (PEAK HOUR CONDITION)

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)	Status	Flow Reversal Count
P101	J80	J42	36	14	130	-1,099.00	2.29	0.38	10.47	Open	0
P102	J70	J80	666	14	130	-233.00	0.49	0.07	0.1	Open	0
P103	J80	J82	677	14	130	517.80	1.08	0.31	0.46	Open	0
P104	J82	J84	613	14	130	0	0	0	0	Open	0
P106	J70	J68	589	14	130	0	0	0	0	Open	0
P112	J86	J82	563	14	130	0	0	0	0	Open	0
P116	RES5010	J209	202	8	120	0	0	0	0	Open	0
P320	RES5006	J205	415	8	120	1,099.00	7.01	10.47	25.23	Open	0
P330	J205	J40	653.84	8	120	1,099.00	7.01	19.55	29.91	Open	0
P52	J40	J42	620	14	130	1,099.00	2.29	1.21	1.95	Open	0

FIRE FLOW ANALYSIS OUTPUT (MAX DAY PLUS FIRE CONDITION)

ID	Static Demand (gpm)	Static Pressure (psi)	Static Head (ft)	Fire-Flow Demand (gpm)	Residual Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)
J40	0	111.94	1,240.35	1,500.00	73.84	2,643.95	20.07
J68	0	112.18	1,239.90	1,500.00	69.96	2,470.58	20.06
J70	116.5	113.48	1,239.90	1,500.00	72.17	2,648.98	20.06
J80	174.1	112.62	1,239.92	2,000.00	50.28	2,742.18	20.07
J82	258.9	117.57	1,239.84	1,500.00	76.07	2,854.23	20.07
J84	0	119.95	1,239.84	1,500.00	77.51	2,591.13	20.07
J86	0	115.62	1,239.84	1,500.00	73.24	2,523.39	20.06

University of California, Riverside
School of Medicine Development
Domestic Water System Analysis
Final Phase Condition



SOM FINAL PHASE CONDITION

NODE DATA (PEAK HOUR CONDITION)

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J200	441.87	972	1,107.78	58.83
J205	0	976	1,141.66	71.78
J209	0	981	1,246.40	115
J40	87.3	982	1,128.15	63.33
J42	74.8	980	1,115.68	58.79
J68	48.4	981	1,108.55	55.27
J70	591.21	978	1,109.31	56.9
J80	429.03	980	1,111.52	56.99
J82	542.92	968.5	1,108.26	60.56
J84	175.59	963	1,107.99	62.82
J86	1,004.54	973	1,107.72	58.37
J88	457.66	978	1,107.80	56.24

RESERVOIR DATA (PEAK HOUR CONDITION)

ID	Flow (gpm)	Head (ft)
RES5006	-3,853.32	1,248.58
RES5010	0.00	1,246.40

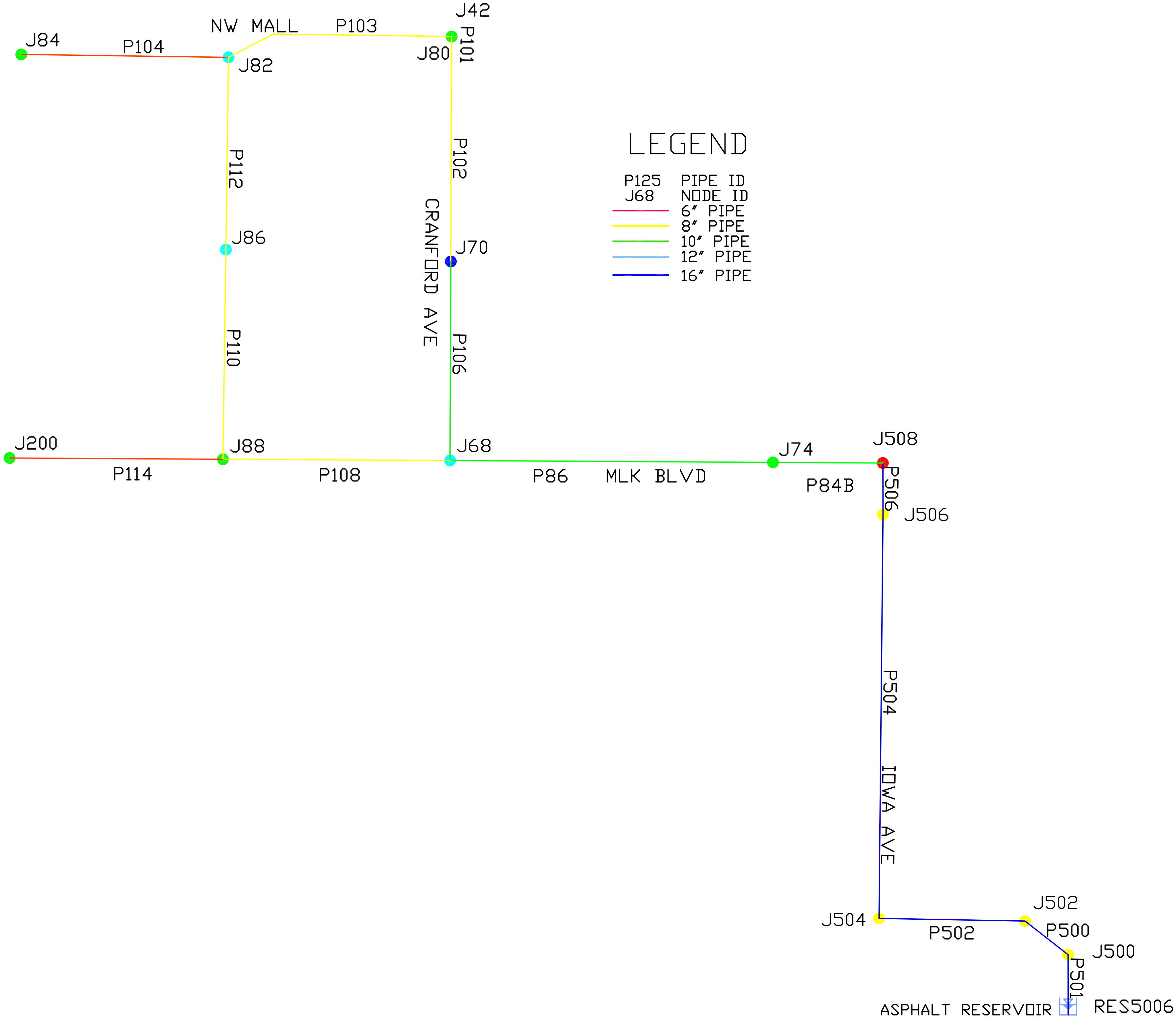
LINK DATA (PEAK HOUR CONDITION)

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)	Status	Flow Reversal Count
P101	J80	J42	36	14	130	-3,691.22	7.69	4.16	115.54	Open	0
P102	J70	J80	666	14	130	-1,468.99	3.06	2.21	3.31	Open	0
P103	J80	J82	677	14	130	1,793.20	3.74	3.26	4.81	Open	0
P104	J82	J84	613	14	130	502.81	1.05	0.27	0.45	Open	0
P106	J70	J68	589	14	130	877.78	1.83	0.76	1.29	Open	0
P108	J88	J68	672.26	14	130	-829.38	1.73	0.75	1.12	Open	0
P110	J88	J86	621	14	130	257.06	0.54	0.08	0.13	Open	0
P112	J86	J82	563	14	130	-747.48	1.56	0.54	0.97	Open	0
P114	J88	J200	631	14	130	114.65	0.24	0.02	0.03	Open	0
P116	RES5010	J209	202	8	120	0	0	0	0	Open	0
P118	J84	J200	1,195.40	14	130	327.22	0.68	0.21	0.18	Open	0
P320	RES5006	J205	415	8	120	3,853.32	24.59	106.92	257.63	Open	0
P330	J205	J40	653.84	14	130	3,853.32	8.03	13.52	20.67	Open	0
P52	J40	J42	620	14	130	3,766.02	7.85	12.47	20.11	Open	0

FIRE FLOW ANALYSIS OUTPUT (MAX DAY PLUS FIRE CONDITION)

ID	Static Demand (gpm)	Static Pressure (psi)	Static Head (ft)	Fire-Flow Demand (gpm)	Residual Pressure (psi)	Available Flow @Hydrant (gpm)	Available Flow Pressure (psi)
J200	220.9	103.09	1,209.91	1,500.00	69.85	3,227.58	20.09
J40	43.7	101.1	1,215.33	1,500.00	73.54	3,449.28	20.12
J68	24.2	99.28	1,210.12	1,500.00	66.5	2,965.89	20.09
J70	295.6	100.67	1,210.33	1,500.00	68.16	3,296.37	20.09
J80	214.5	100.06	1,210.92	2,000.00	54.65	3,269.76	20.09
J82	271.5	104.66	1,210.04	1,500.00	71.95	3,366.04	20.1
J84	87.8	107.01	1,209.97	1,500.00	73.87	3,202.23	20.1
J86	502.3	102.65	1,209.90	1,500.00	69.57	3,513.20	20.09
J88	228.8	100.49	1,209.92	1,500.00	67.59	3,196.06	20.09

IRRIGATION WATER


LEGEND
P125 PIPE ID
J68 NODE ID
6" PIPE
8" PIPE
10" PIPE
12" PIPE
16" PIPE
NW MALL
J84
P104
J82
P103
J42
J80
P101
P112
P102
CRANFORD AVE
J86
J70
P110
P106
J200
J88
J68
J74
J508
P114
P108
P86
MLK BLVD
P84B
P506
J506
P504
IOWA AVE
J504
J502
P502
P500
J500
P501
ASPHALT RESERVOIR
RES5006

SOM DEVELOPMENT (FULL SOM LANDSCAPE IRRIGATION DEMAND + FIELD 5 DEMAND)

NODE DATA (PEAK FLOW CONDITION)

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J200	36	972	1,230.75	112.12
J500	0	1,018.00	1,249.74	100.41
J502	0	1,020.00	1,249.51	99.45
J504	0	1,015.00	1,248.89	101.35
J506	0	1,000.00	1,247.18	107.1
J508	0	998	1,246.96	107.87
J68	90	985	1,234.80	108.24
J70	177	978	1,233.34	110.64
J74	83.4	994	1,243.58	108.14
J80	67	980	1,230.76	108.65
J82	82	968.5	1,228.83	112.8
J84	35	963	1,228.74	115.15
J86	719	973	1,228.05	110.51
J88	36	978	1,230.85	109.56

RESERVOIR DATA (PEAK FLOW CONDITION)

ID	Flow (gpm)	Head (ft)
RES5006	-1,325.40	1,250.00

LINK DATA (PEAK FLOW CONDITION)

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)	Status	Flow Reversal Count
P102	J70	J80	666	8	130	433.19	2.76	2.58	3.88	Open	0
P103	J80	J82	677	8	130	366.19	2.34	1.92	2.84	Open	0
P104	J82	J84	613	6	130	35.00	0.4	0.09	0.15	Open	0
P106	J70	J68	589	10	130	-610.19	2.49	1.45	2.47	Open	0
P108	J68	J88	672	8	130	541.81	3.46	3.95	5.87	Open	0
P110	J88	J86	621	8	130	469.81	3	2.8	4.51	Open	0
P112	J86	J82	563	8	130	-249.19	1.59	0.78	1.39	Open	0
P114	J88	J200	631	6	130	36.00	0.41	0.1	0.16	Open	0
P500	J500	J502	161.63	16	110	1,325.40	2.11	0.23	1.43	Open	0
P501	RES5006	J500	178.3	16	110	1,325.40	2.11	0.26	1.43	Open	0
P502	J502	J504	432.39	16	110	1,325.40	2.11	0.62	1.43	Open	0
P504	J504	J506	1,195.84	16	110	1,325.40	2.11	1.71	1.43	Open	0
P506	J506	J508	152.76	16	110	1,325.40	2.11	0.22	1.43	Open	0
P84B	J508	J74	325.34	10	130	1,325.40	5.41	3.38	10.38	Open	0
P86	J74	J68	955	10	130	1,242.00	5.07	8.79	9.2	Open	0

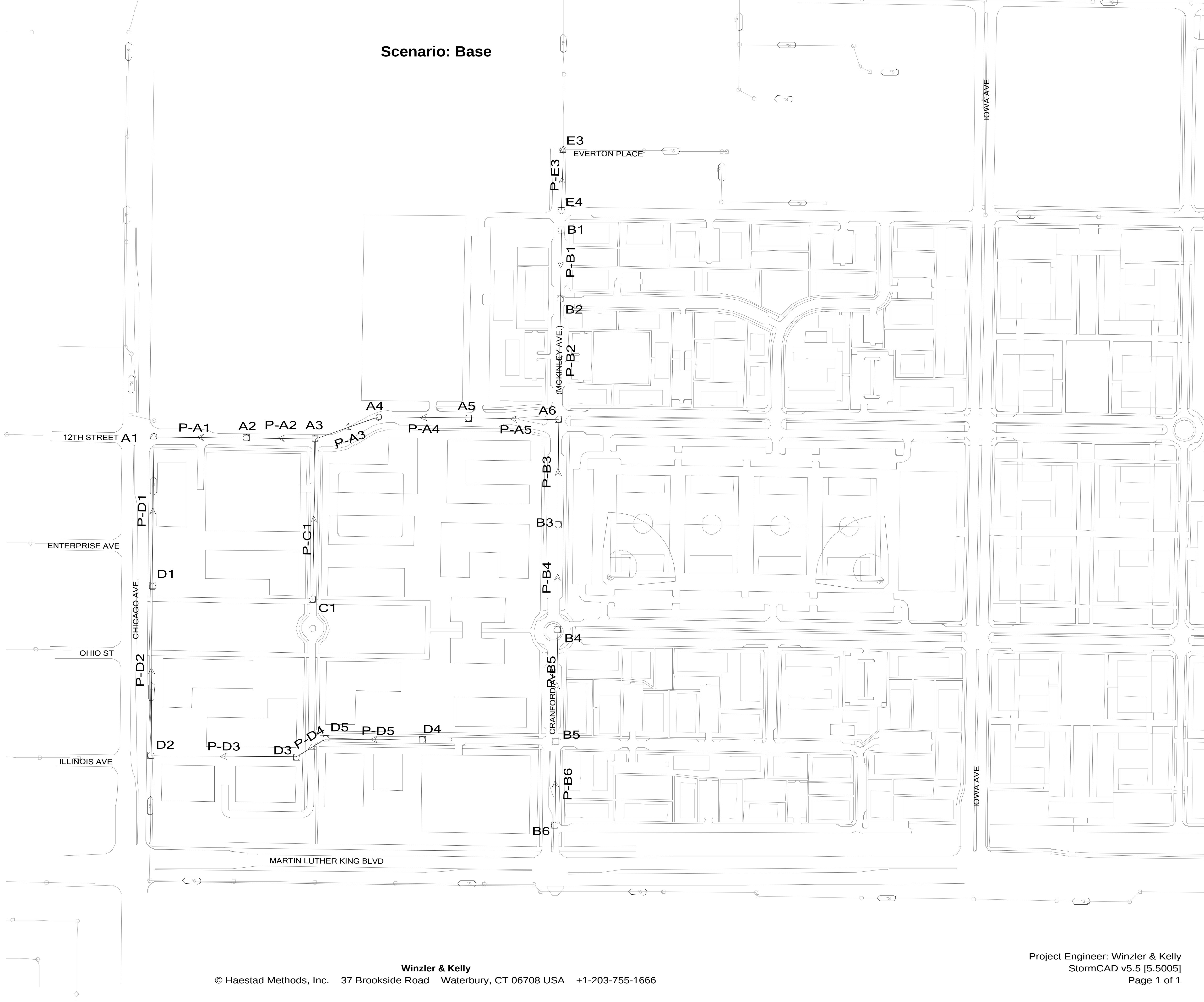
SANITARY SEWER

SEWER MODEL RESULTS

FULL BUILDOUT

PEAK DRY WEATHER FLOW

Scenario: Base



Title: UC Riverside School of Medicine
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Winzler & Kelly

Project Engineer: Winzler & Kelly
StormCAD v5.5 [5.5005]

Scenario: Base

Inlet Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Headloss Coefficient
A2	2+86	962.40	957.00	0.000	0.000	0.000	0.50
A3	4+98	964.40	958.50	0.000	0.000	0.000	0.50
A5	9+83	972.40	963.20	0.160	0.000	0.000	0.50
A6	12+61	976.75	966.50	0.890	0.000	0.000	0.50
B1	18+46	977.60	972.40	0.070	0.000	0.000	0.50
B2	16+32	977.70	969.50	0.310	0.000	0.000	0.50
B3	15+86	974.20	967.80	0.300	0.000	0.000	0.50
B4	19+11	974.40	969.10	1.160	0.000	0.000	0.50
B5	22+56	978.80	971.50	0.560	0.000	0.000	0.50
B6	25+15	982.00	975.70	0.150	0.000	0.000	0.50
C1	9+93	967.70	961.50	0.730	0.000	0.000	0.50
D1	4+59	962.40	957.35	0.490	0.000	0.000	0.50
D2	9+85	968.20	959.70	1.100	0.000	0.000	0.50
D3	14+35	971.90	964.40	0.630	0.000	0.000	0.50
D4	18+40	975.70	969.10	0.570	0.000	0.000	0.50
D5	15+42	972.20	965.50	0.000	0.000	0.000	0.50
E4	1+87	980.00	974.50	0.220	0.000	0.000	0.50

Scenario: Base

Junction Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
A4	7+05	968.00	960.10	4.00	0.50	961.35	961.19	961.03	960.87

Scenario: Base

Outlet Report

Label	Station (ft)	Ground Elevation (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Tailwater Condition	Tailwater Elevation (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)
E3	0+00	981.00	981.00	973.50	User-Specifie	974.00	974.00	974.00	974.00	974.00	0.220
A1	0+00	960.30	960.30	955.00	User-Specifie	955.50	955.50	955.50	955.50	955.50	7.120

Scenario: Base

Pipe Report

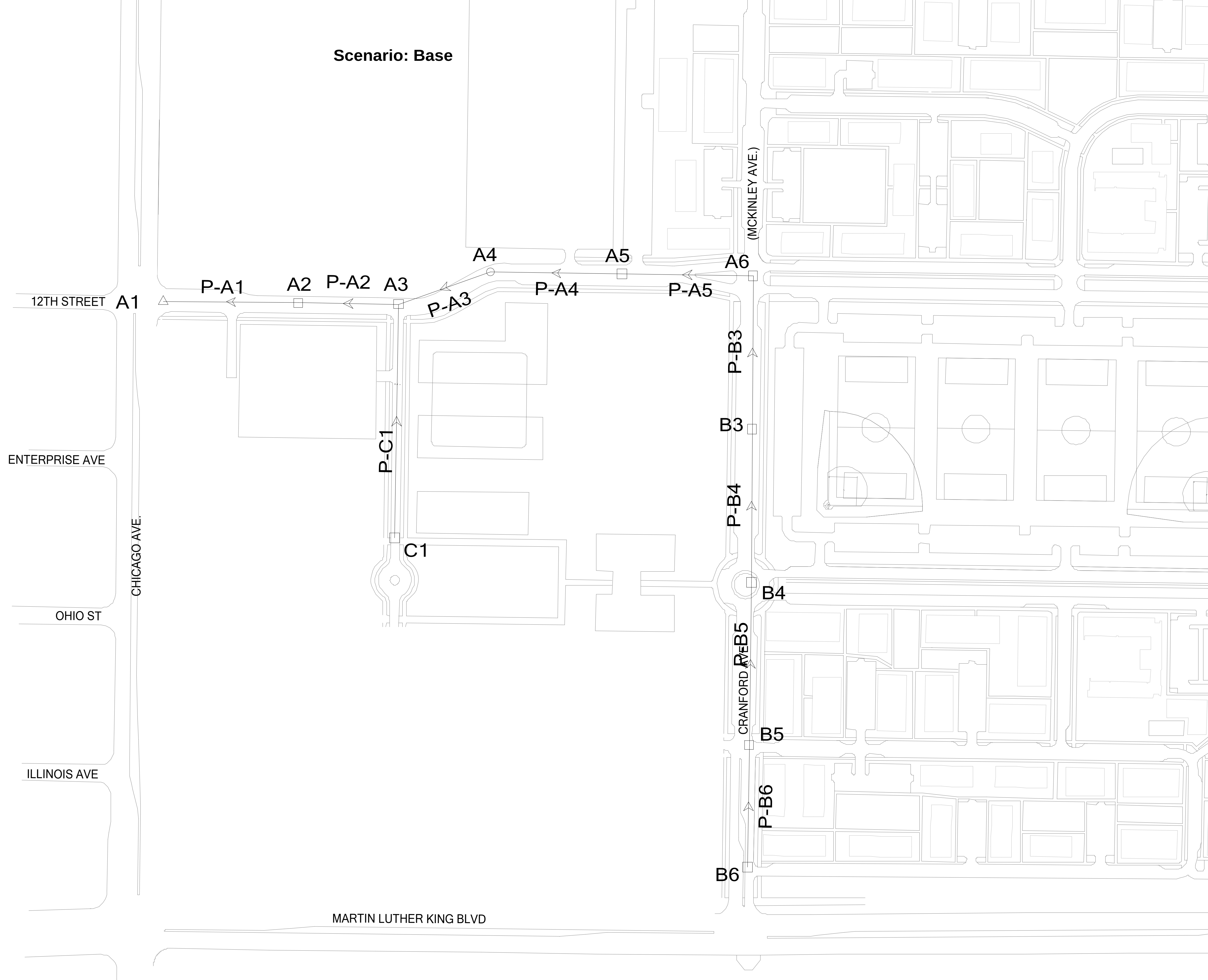
Label	Section Size	Length (ft)	Upstream Node	Downstream Node	Total Flow (cfs)	Full Capacity (cfs)	Constructed Slope (%)	Mannings n	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Avg End Depth / Rise (d/D) (%)	Average Velocity (ft/s)	Flow / Design Capacity (%)	Minimum Velocity (ft/s)	Maximum Velocity (ft/s)
P-A1	15 inch	286.00	A2	A1	4.330	5.402	0.70	0.013	957.00	955.00	962.40	960.30	4.15	4.05	957.85	955.84	67.6	4.89	80.2	2.00	10.00
P-A2	15 inch	212.00	A3	A2	4.330	5.433	0.71	0.013	958.50	957.00	964.40	962.40	4.65	4.15	959.34	958.03	75.1	4.92	79.7	2.00	10.00
P-A3	15 inch	207.00	A4	A3	3.600	5.679	0.77	0.013	960.10	958.50	968.00	964.40	6.65	4.65	960.87	959.53	71.9	4.90	63.4	2.00	10.00
P-A4	15 inch	278.00	A5	A4	3.600	6.821	1.12	0.013	963.20	960.10	972.40	968.00	7.95	6.65	963.97	961.03	67.8	5.63	52.8	2.00	10.00
P-A5	15 inch	278.00	A6	A5	3.440	7.038	1.19	0.013	966.50	963.20	976.75	972.40	9.00	7.95	967.25	964.13	67.0	5.70	48.9	2.00	10.00
P-B1	8 inch	214.00	B1	B2	0.070	1.407	1.36	0.013	972.40	969.50	977.60	977.70	4.53	7.53	972.52	969.78	30.1	2.10	5.0	2.00	10.00
P-B2	15 inch	371.00	B2	A6	0.380	5.809	0.81	0.013	969.50	966.50	977.70	976.75	6.95	9.00	969.74	967.40	45.8	2.67	6.5	2.00	10.00
P-B3	15 inch	325.00	B3	A6	2.170	4.085	0.40	0.013	967.80	966.50	974.20	976.75	5.15	9.00	968.45	967.40	62.1	3.38	53.1	2.00	10.00
P-B4	15 inch	325.00	B4	B3	1.870	4.085	0.40	0.013	969.10	967.80	974.40	974.20	4.05	5.15	969.69	968.54	53.2	3.26	45.8	2.00	10.00
P-B5	12 inch	345.00	B5	B4	0.710	2.971	0.70	0.013	971.50	969.10	978.80	974.40	6.30	4.30	971.85	969.78	51.4	3.11	23.9	2.00	10.00
P-B6	8 inch	259.00	B6	B5	0.150	1.539	1.62	0.013	975.70	971.50	982.00	978.80	5.63	6.63	975.88	971.92	44.5	2.80	9.7	2.00	10.00
P-C1	15 inch	495.00	C1	A3	0.730	5.029	0.61	0.013	961.50	958.50	967.70	964.40	4.95	4.65	961.83	959.53	54.6	2.92	14.5	2.00	10.00
P-D1	15 inch	459.00	D1	A1	2.790	4.622	0.51	0.013	957.35	955.00	962.40	960.30	3.80	4.05	958.05	955.67	54.8	3.94	60.4	2.00	10.00
P-D2	15 inch	526.00	D2	D1	2.300	4.318	0.45	0.013	959.70	957.35	968.20	962.40	7.25	3.80	960.35	958.17	58.8	3.57	53.3	2.00	10.00
P-D3	15 inch	450.00	D3	D2	1.200	6.601	1.04	0.013	964.40	959.70	971.90	968.20	6.25	7.25	964.83	960.45	47.2	4.09	18.2	2.00	10.00
P-D4	10 inch	107.00	D5	D3	0.570	2.221	1.03	0.013	965.50	964.40	972.20	971.90	5.87	6.67	965.83	964.91	50.5	3.41	25.7	2.00	10.00
P-D5	10 inch	298.00	D4	D5	0.570	2.408	1.21	0.013	969.10	965.50	975.70	972.20	5.77	5.87	969.43	965.89	43.4	3.61	23.7	2.00	10.00
P-E3	10 inch	187.00	E4	E3	0.220	1.602	0.53	0.013	974.50	973.50	980.00	981.00	4.67	6.67	974.71	974.00	42.5	2.06	13.7	2.00	10.00

SEWER MODEL RESULTS

PHASE 1 ONLY

PEAK DRY WEATHER FLOW

Scenario: Base



Scenario: Base

Inlet Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Headloss Coefficient
A2	2+86	962.40	957.00	0.000	0.000	0.000	0.50
A3	4+98	964.40	958.50	0.000	0.000	0.000	0.50
A5	9+83	972.40	963.20	0.163	0.000	0.000	0.50
A6	12+61	976.75	966.50	0.000	0.000	0.000	0.50
B3	15+86	974.20	967.80	0.000	0.000	0.000	0.50
B4	19+11	974.40	969.10	0.049	0.000	0.000	0.50
B5	22+56	978.80	971.50	0.209	0.000	0.000	0.50
B6	25+15	982.00	975.70	0.000	0.000	0.000	0.50
C1	9+93	967.70	961.50	0.735	0.000	0.000	0.50

Scenario: Base

Junction Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
A4	7+05	968.00	960.10	4.00	0.50	960.48	960.44	960.40	960.35

Scenario: Base

Outlet Report

Label	Station (ft)	Ground Elevation (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Tailwater Condition	Tailwater Elevation (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)
A1	0+00	960.30	960.30	955.00	User-Specifie	955.50	955.50	955.50	955.50	955.50	1.155

Scenario: Base

Pipe Report

Label	Section Size	Length (ft)	Upstream Node	Downstream Node	Total Flow (cfs)	Full Capacity (cfs)	Constructed Slope (%)	Mannings n	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Avg End Depth / Rise (d/D) (%)	Average Velocity (ft/s)	Flow / Design Capacity (%)	Minimum Velocity (ft/s)	Maximum Velocity (ft/s)
P-A1	15 inch	286.00	A2	A1	1.155	5.402	0.70	0.013	957.00	955.00	962.40	960.30	4.15	4.05	957.42	955.50	36.9	3.50	21.4	2.00	10.00
P-A2	15 inch	212.00	A3	A2	1.155	5.433	0.71	0.013	958.50	957.00	964.40	962.40	4.65	4.15	958.92	957.50	37.0	3.52	21.3	2.00	10.00
P-A3	15 inch	207.00	A4	A3	0.420	5.679	0.77	0.013	960.10	958.50	968.00	964.40	6.65	4.65	960.35	959.00	30.1	2.71	7.4	2.00	10.00
P-A4	15 inch	278.00	A5	A4	0.420	6.821	1.12	0.013	963.20	960.10	972.40	968.00	7.95	6.65	963.45	960.40	21.9	3.08	6.2	2.00	10.00
P-A5	15 inch	278.00	A6	A5	0.258	7.038	1.19	0.013	966.50	963.20	976.75	972.40	9.00	7.95	966.70	963.50	19.7	2.72	3.7	2.00	10.00
P-B3	15 inch	325.00	B3	A6	0.258	4.085	0.40	0.013	967.80	966.50	974.20	976.75	5.15	9.00	968.01	966.73	17.7	1.86	6.3	2.00	10.00
P-B4	15 inch	325.00	B4	B3	0.258	4.085	0.40	0.013	969.10	967.80	974.40	974.20	4.05	5.15	969.31	968.04	18.1	1.86	6.3	2.00	10.00
P-B5	12 inch	345.00	B5	B4	0.209	2.971	0.70	0.013	971.50	969.10	978.80	974.40	6.30	4.30	971.69	969.34	21.4	2.18	7.0	2.00	10.00
P-B6	8 inch	259.00	B6	B5	0.000	1.539	1.62	0.013	975.70	971.50	982.00	978.80	5.63	6.63	975.70	971.72	16.5	0.00	0.0	2.00	10.00
P-C1	15 inch	495.00	C1	A3	0.735	5.029	0.61	0.013	961.50	958.50	967.70	964.40	4.95	4.65	961.84	959.00	33.4	2.93	14.6	2.00	10.00

SEWER MODEL RESULTS

PHASE 1 ONLY

AVERAGE DRY WEATHER FLOW

Scenario: Base

Inlet Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Headloss Coefficient
A2	2+86	962.40	957.00	0.000	0.000	0.000	0.50
A3	4+98	964.40	958.50	0.000	0.000	0.000	0.50
A5	9+83	972.40	963.20	0.026	0.000	0.000	0.50
A6	12+61	976.75	966.50	0.000	0.000	0.000	0.50
B3	15+86	974.20	967.80	0.000	0.000	0.000	0.50
B4	19+11	974.40	969.10	0.006	0.000	0.000	0.50
B5	22+56	978.80	971.50	0.035	0.000	0.000	0.50
B6	25+15	982.00	975.70	0.000	0.000	0.000	0.50
C1	9+93	967.70	961.50	0.122	0.000	0.000	0.50

Scenario: Base

Junction Report

Label	Calculated Station (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
A4	N/A	968.00	960.10	4.00	0.50	N/A	N/A	N/A	N/A

Scenario: Base

Outlet Report

Label	Station (ft)	Ground Elevation (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Tailwater Condition	Tailwater Elevation (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)
A1	0+00	960.30	960.30	955.00	User-Specifie	955.50	955.50	955.50	955.50	955.50	0.189

Scenario: Base

Pipe Report

Label	Section Size	Length (ft)	Upstream Node	Downstream Node	Total Flow (cfs)	Full Capacity (cfs)	Constructed Slope (%)	Mannings n	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Avg End Depth / Rise (d/D) (%)	Average Velocity (ft/s)	Flow / Design Capacity (%)	Minimum Velocity (ft/s)	Maximum Velocity (ft/s)
P-A1	15 inch	286.00	A2	A1	0.189	5.402	0.70	0.013	957.00	955.00	962.40	960.30	4.15	4.05	957.17	955.50	26.7	2.06	3.5	2.00	10.00
P-A2	15 inch	212.00	A3	A2	0.189	5.433	0.71	0.013	958.50	957.00	964.40	962.40	4.65	4.15	958.67	957.20	14.6	2.07	3.5	2.00	10.00
P-A3	15 inch	207.00	A4	A3	0.067	5.679	0.77	0.013	960.10	958.50	968.00	964.40	6.65	4.65	960.20	958.70	11.8	1.56	1.2	2.00	10.00
P-A4	15 inch	278.00	A5	A4	0.067	6.821	1.12	0.013	963.20	960.10	972.40	968.00	7.95	6.65	963.30	960.22	8.6	1.78	1.0	2.00	10.00
P-A5	15 inch	278.00	A6	A5	0.041	7.038	1.19	0.013	966.50	963.20	976.75	972.40	9.00	7.95	966.58	963.32	7.7	1.56	0.6	2.00	10.00
P-B3	15 inch	325.00	B3	A6	0.041	4.085	0.40	0.013	967.80	966.50	974.20	976.75	5.15	9.00	967.89	966.59	7.2	1.07	1.0	2.00	10.00
P-B4	15 inch	325.00	B4	B3	0.041	4.085	0.40	0.013	969.10	967.80	974.40	974.20	4.05	5.15	969.19	967.90	7.4	1.07	1.0	2.00	10.00
P-B5	12 inch	345.00	B5	B4	0.035	2.971	0.70	0.013	971.50	969.10	978.80	974.40	6.30	4.30	971.58	969.20	8.7	1.28	1.2	2.00	10.00
P-B6	8 inch	259.00	B6	B5	0.000	1.539	1.62	0.013	975.70	971.50	982.00	978.80	5.63	6.63	975.70	971.59	6.7	0.00	0.0	2.00	10.00
P-C1	15 inch	495.00	C1	A3	0.122	5.029	0.61	0.013	961.50	958.50	967.70	964.40	4.95	4.65	961.63	958.70	13.2	1.72	2.4	2.00	10.00

STORM DRAIN

FINAL

PREPARED FOR: Jon Harvey, UCR Capital and Physical Planning

CC: Don Delgadillo, RCFCWCD
Everett Duckworth, RCFCWCD

PREPARED BY: Peter Young, Project Manager
Raymond Wong, Hydraulic Engineer

DATE: July 8, 2009

JOB #: **11732-09-001**

This technical memorandum summarizes the hydrology and hydraulic analysis for the proposed UC Riverside West Campus development area. The objective of this analysis is to evaluate the impact of the West Campus development on the existing Riverside County Flood Control and Water Conservation District (District) flood control system, including the pipeline capacity analysis, overland flow routing, and onsite storm water detention/retention in the proposed West Campus development.

The proposed UC Riverside West Campus development is bounded by I215/SR60 to the east, Everton Place and its western extension to the north, Chicago Avenue to the west, and Martin Luther King Jr. Boulevard (MLK) to the south. Within the vicinity of the West Campus development, the District maintains the following main storm drain pipeline systems:

- Line F is located along Cranford Avenue extension. This pipeline ranges from 66 inches to 72 inches in diameter. It flows south to MLK connecting to the District's Line E pipeline along MLK.

- Line E is located along MLK. It is a 75-inch diameter pipe and runs westerly down to the existing District stormwater retention basin at Kansas Avenue located on the south side of MLK.

- Line C is located at the intersection of Chicago Avenue and 12th St. This 30-inch diameter pipe runs along 11th St, and then along 12th St. The pipeline ultimately connects to the storm drain pipeline on Sedgwick Avenue to the west.

Figure 1 in Appendix A shows the stormwater tributary areas at the vicinity of the West Campus area, the location of the major District drainage facilities, as well as the nine Watershed

Connection Nodes (Node) for hydrology and hydraulic analysis. The tributary areas shown in Figure 1 were consolidated into the nine Watershed Connection Nodes, as shown in Table 1.

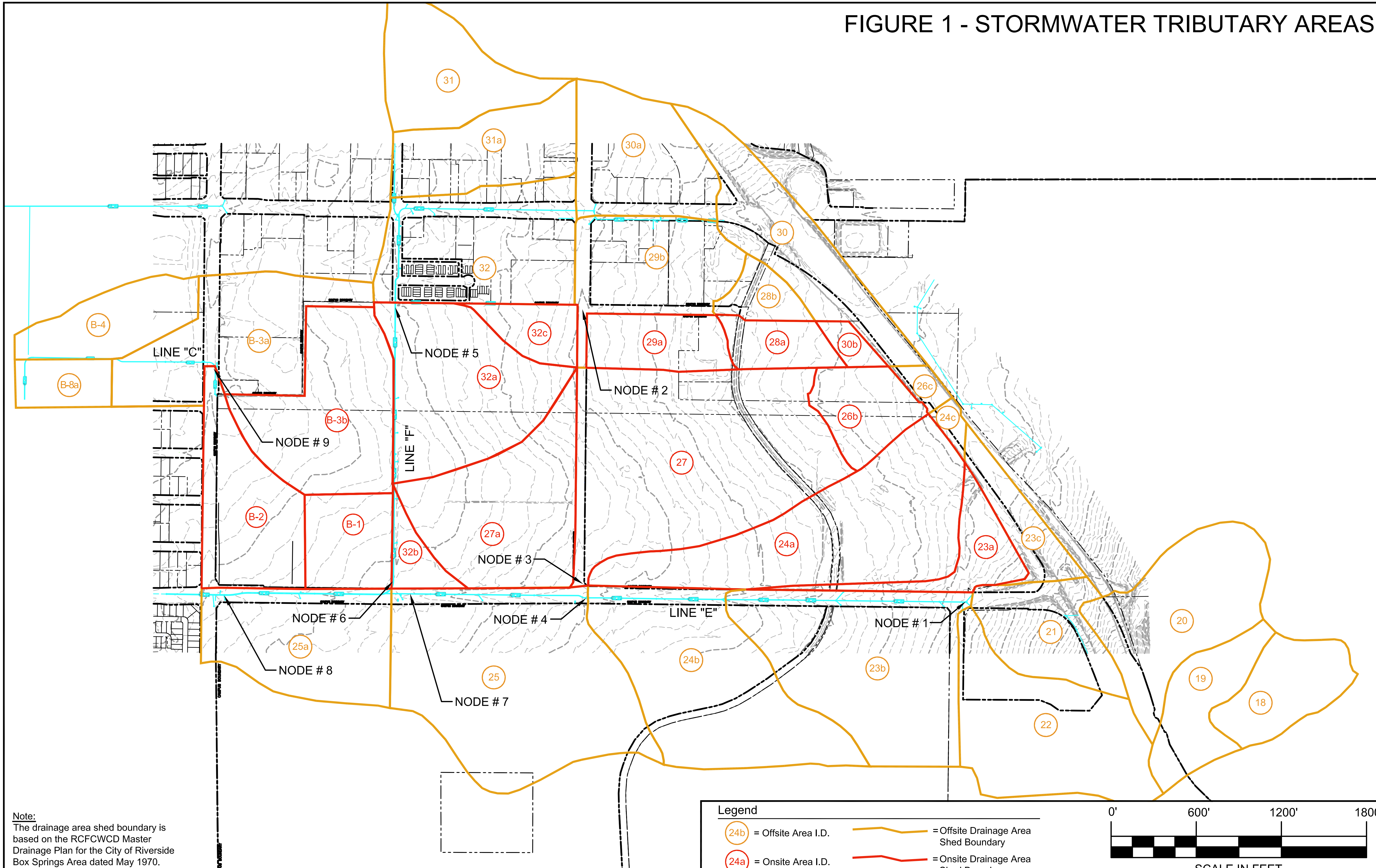
TABLE 1 – WATERSHED CONNECTION NODES TRIBUTARY AREAS

Watershed Connection Node	West Campus Onsite Tributary Areas					Offsite Tributary Areas				
1						18	19	20	21	22
2						30	28b	29b	30a	
3	30b	28a	29a	26b	27	26c				
4	24a	23a				23c	23b	24b	24c	
5						31	31a	32		
6	32c	32a	27a	32b						
7						25				
8						25a				
9	B1	B2	B3b			B3a				

The boundary definitions for the stormwater tributary areas are based on the District's *Master Drainage Plan for the City of Riverside Box Springs Area* (RCFCWCD, May 1970). Some of the tributary areas are further divided to partition the West Campus onsite and offsite drainage areas.

Currently, the West Campus area east of the Cranford Avenue extension drains to Lines E and F. The West Campus area west of Cranford Avenue drains to a concrete swale which connects to a 24-inch lateral pipe at Chicago Avenue and 12th Street, then the lateral pipe connects to Line C. The current land use at the West Campus area is mainly agricultural, serving as the University's research fields. The proposed development for the West Campus includes a series of new academic and research buildings, student housing, sport fields, support uses, and the new School of Medicine campus. In addition, as part of the surface improvements proposed by the City of Riverside on Iowa Avenue, a new storm drain pipeline will be constructed along Iowa Avenue, flowing south and connecting to Line E at MLK and Iowa Avenue. This new pipeline can potentially change the stormwater flow pattern as defined in the Master Drainage Plan. Flows from the northern portion of the tributary areas east of Iowa Avenue will be routed along the new pipeline on Iowa Avenue to Line E at MLK, instead of being routed to Line F along Cranford Avenue extension.

FIGURE 1 - STORMWATER TRIBUTARY AREAS



Note:
The drainage area shed boundary is based on the RCFCWCD Master Drainage Plan for the City of Riverside Box Springs Area dated May 1970.

HYDROLOGY ANALYSIS

In order to estimate the proposed stormwater runoff from the future West Campus development, a hydrology analysis was prepared. The hydrology analysis was based on the District's Master Drainage Plan, and then adjusted to reflect the proposed future development conditions.

As directed by the District, the land use information in the Master Drainage Plan, instead of the existing land use condition, is defined as the base case for this analysis. With this base case definition, the analysis can compare the impact of the currently proposed West Campus development concept to the storm drain system planning in the Master Drainage Plan.

This base case condition is different than the existing land use at the West Campus. Under the existing condition, most of the West Campus consists of agricultural research fields. However, in the base case condition as defined in the Master Drainage Plan, in addition to some agricultural land use, a large portion of the West Campus is designated as various urban land uses such as residential and commercial developments. Table 2 summarizes the land use and hydrology data for each tributary area under the base case condition. Note that all tributary areas are on the hydrologic soil group type C.

TABLE 2 – HYDROLOGY DATA SUMMARY FOR BASE CASE CONDITION

Tributary Area	Tributary Area per MDP	Location	Land Use	Area	District Connection	C Factor	Tc per MDP	I_{10}	Q_{10}	I_{100}	Q_{100}
-	-	-	-	acre	-	-	min	in/hr	cfs	in/hr	cfs
18	18	Offsite	Residential	8.90	Line E	0.825	10	1.84	13.5	2.63	19.3
19	19	Offsite	Residential	11.40	Line E	0.805	1	1.74	16.0	2.49	22.8
20	20	Offsite	Residential	24.10	Line E	0.77	2.8	1.54	28.6	2.20	40.8
21	21	Offsite	Residential	12.30	Line E	0.63	1.9	1.11	8.6	1.59	12.3
22	22	Offsite	Residential	26.10	Line E	0.57	6.7	0.96	14.3	1.37	20.4
23a	23	Onsite	Agricultural	7.36	Line E	0.44	4.7	0.9	2.9	1.29	4.2
23b	23	Offsite	Agricultural	34.47	Line E	0.44	4.7	0.9	13.6	1.29	19.5
23c	23	Offsite	Agricultural	6.77	Line E	0.44	4.7	0.9	2.7	1.29	3.8
24a	24	Onsite	Agricultural	34.53	Line E	0.43	1.4	0.88	13.1	1.26	18.7
24b	24	Offsite	Agricultural	33.64	Line E	0.43	1.4	0.88	12.7	1.26	18.2
24c	24	Offsite	Agricultural	1.33	Line E	0.43	1.4	0.88	0.5	1.26	0.7
25	25	Offsite	Commercial	43.50	Line E	0.41	1.9	0.84	15.0	1.20	21.4
26b	26	Onsite	Agricultural	8.23	Line F	0.78	13	1.59	10.2	2.27	14.6
26c	26	Offsite	Agricultural	1.62	Line F	0.78	13	1.59	2.0	2.27	2.9
27	27	Onsite	Agricultural	45.60	Line F	0.515	11	1.03	24.2	1.47	34.6
28a	28	Onsite	Residential	5.96	Line F	0.79	12	1.66	7.8	2.37	11.2
28b	28	Offsite	Residential	4.34	Line F	0.79	12	1.66	5.7	2.37	8.1
29a	29	Onsite	Commercial	8.93	Line F	0.78	7.7	1.26	8.8	1.80	12.5
29b	29	Offsite	Commercial	17.87	Line F	0.78	7.7	1.26	17.6	1.80	25.1
30	30	Offsite	Commercial	13.33	Line F	0.82	14	1.53	16.7	2.19	23.9
30b	30	Onsite	Commercial	1.37	Line F	0.82	14	1.53	1.7	2.19	2.4

TABLE 2 – HYDROLOGY DATA SUMMARY FOR BASE CASE CONDITION

Tributary Area	Tributary Area per MDP	Location	Land Use	Area	District Connection	C Factor	Tc per MDP	I_{10}	Q_{10}	I_{100}	Q_{100}
-	-	-	-	acre	-	-	min	in/hr	cfs	in/hr	cfs
31	31	Offsite	Commercial	12.90	Line F	0.825	13.5	1.56	16.6	2.23	23.7
32	32	Offsite	Commercial	23.30	Line F	0.75	5.2	1.12	19.6	1.60	28.0
25a	25a	Offsite	Residential	20.20	Line E	0.51	1.9	0.8	8.2	1.14	11.8
27a	27a	Onsite	Agricultural	26.80	Line F	0.75	2.1	1.09	21.9	1.56	31.3
30a	30a	Offsite	Commercial	11.50	Line F	0.795	3.9	1.34	12.3	1.91	17.5
31a	31a	Offsite	Commercial	21.20	Line F	0.78	6.1	1.27	21.0	1.81	30.0
32a	32a	Onsite	Residential	25.93	Line F	0.66	2.5	1.06	18.1	1.51	25.9
32c	32a	Onsite	Residential	5.47	Line F	0.66	2.5	1.06	3.8	1.51	5.5
32b	32b	Onsite	Residential	5.40	Line F	0.63	1.1	1.04	3.5	1.49	5.1
B1	B1	Onsite	Residential	9.20	Line C	0.762	14	1.53	10.7	2.19	15.3
B2	B2	Onsite	Residential	15.70	Line C	0.66	8.6	1.19	12.3	1.70	17.6
B3a	B3	Offsite	Commercial	23.91	Line C	0.75	2.9	1.11	19.9	1.59	28.4
B3b	B3	Onsite	Commercial	25.09	Line C	0.75	2.9	1.11	20.9	1.59	29.8

Data Source: *Master Drainage Plan for the City of Riverside Box Springs Area* (RCFCWCD, May 1970)

The hydrologic parameters, including the 10-year design flow, and the land use data in Table 2 are from the Hydrology Calculation Sheets (attached in Appendix D). The Hydrology Calculation Sheets is a package of backup hydrology calculation prepared in between 1968 and 1970 for the District's Master Drainage Plan. Since the Hydrology Calculation Sheets as well as the Master Drainage Plan do not have a design flow estimate for a 100-year storm, the 100-year design flow is estimated based on the hydrology parameters in the Hydrology Calculation Sheets and the Intensity- Duration-Frequency (IDF) curve in the District's Hydrology Manual.

In the Master Drainage Plan, the hydrology analysis was prepared using the Rational Method. The analysis showed the peak design flow under a 10-year design storm, but it did not contain flow hydrographs for stormwater routing and detention analysis. In addition, the current West Campus development concept is different than the base case condition set in the Master Drainage Plan. The current development concept includes developing all agriculture areas north of MLK within the West Campus that are shown in the Master Drainage Plan. It will potentially increase stormwater runoff so that onsite detention may be required. Therefore, in order to estimate the need for onsite detention, an additional hydrology analysis was conducted using the Synthetic Unit Hydrograph (SUH) method. A HEC-HMS model was developed for the tributary areas within the West Campus for SUH analysis. Stormwater runoff for the offsite tributary areas was estimated using the Rational Method based on the parameters in the Master Drainage Plan.

The analysis procedures and parameters of the SUH analysis are outlined in Section E of the District's hydrology manual. The following is a summary of the criteria used in the analysis.

- Valley S-Graph is used to develop the unit hydrograph.

- Per the District's direction, a one-hour design storm is used for the analysis.

- Precipitation for 2-year, 10-year, and 100-year one hour storms are 0.5 inch, 0.8 inch, and 1.2 inch respectively. Figure 2 shows the 10-year and 100-year rainfall distributions.

- A summary of development conditions for the West Campus onsite Watershed Connection Nodes are shown in Table 3. The table shows the difference in land use definition between the base case condition and the West Campus development condition, specifically on Watershed Connection Nodes 3, 4 and 6. The parameters in Table 3 establish the runoff loss rate in each onsite Watershed Connection Node for the SUH analysis.

Figure 2 - Rainfall Distribution

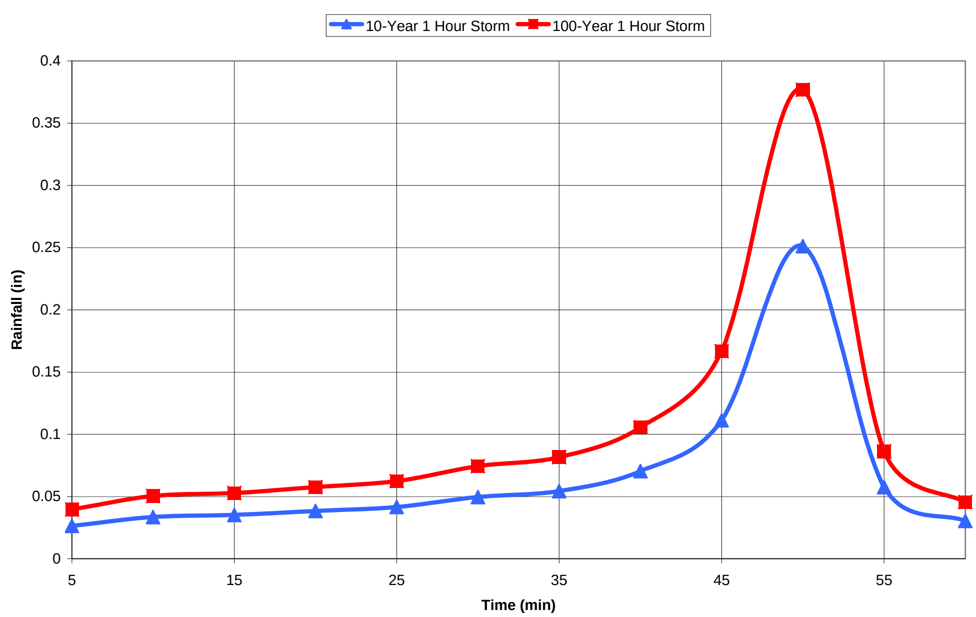


TABLE 3 - West Campus Onsite Watershed Connection Nodes Loss Rate Parameters Summary						
Base Case Condition per MDP						
Watershed Connection Node	**Developed Area %**	**Agricultural Area %**	**Runoff Index (RI)**	**Loss Rate for Pervious Areas (Fp, in/hr)**	**Impervious Area (Ai, %)**	**Adjusted Loss Rate (F, in/hr)**
3	23%	77%	75	0.3	0.17	0.25
4	0%	100%	77	0.28	0.00	0.28
6	58%	42%	72	0.34	0.29	0.25
9	100%	0%	69	0.37	0.70	0.14
Proposed Future West Campus Development Condition						
Area	**Developed Area %**	**Agricultural Area %**	**Runoff Index (RI)**	**Loss Rate for Pervious Areas (Fp, in/hr)**	**Impervious Area (Ai, %)**	**Adjusted Loss Rate (F, in/hr)**
3	100%	0%	69	0.37	0.53	0.19
4	100%	0%	69	0.37	0.53	0.19
6	100%	0%	69	0.37	0.53	0.19
9	100%	0%	69	0.37	0.53	0.19

Four analysis scenarios were developed in the HEC-HMS model to study the base case and future development conditions for both 10-year and 100-year storms. Per the District's direction, the SUH analysis in HEC-HMS was then calibrated with the Rational Method estimates based on the Master Drainage Plan. The calibration showed that, in general, the HEC-HMS model estimates a smaller peak flow than the Rational Method. While it is typical that the Rational Method usually has higher peak flow estimates than the SUH method, the flow estimate difference may also be due to the fact that the Rational Method in the Master Drainage Plan did not consider the effect of the Time of Concentration (Tc) attenuation. In the Master Drainage Plan, the calculation for downstream total runoff did not adjust the time of concentration for the upstream tributary areas for the travel time of the longest routing path (Sum of Tc). Therefore, the analysis may have overestimated downstream peak design flow for the tributary areas by using a shorter time of concentration.

To calibrate the model, the lag time and flow ratio parameters in the HEC-HMS model were adjusted for each Watershed Connection Node, such that the 10-year and 100-year peak design flow under the base case condition matched the Rational Method estimates based on the parameters from the Master Drainage Plan. The calibrated model then estimated the 10-year and 100-year design flow for the future West Campus development condition, as well as estimating the onsite detention requirements. The West Campus onsite flow was then combined with the offsite flow to provide the total design flow at each Watershed Connection Node. Table 4 summarizes the design flow under each scenario at each Watershed Connection Node. Note that the two West Campus Development conditions assumed the proposed new storm drain pipeline on Iowa Avenue to be connected to Line E, and there is no improvement assumed on Line E between Iowa Avenue and Cranford Avenue.

In Table 4, the flow data in each scenario breaks down into individual flow generated by each node. The node flow then further breaks down into onsite (within West Campus) and offsite (outside West Campus) flow. The total flow is the cumulative flow at each node including all upstream tributaries. The detention volume represents the stormwater storage volume needed for the West Campus development in order to match the proposed future flow to the base case condition as defined in the Master Drainage Plan. As highlighted by red in Table 4, even with detention, the total cumulative flow at Watershed Connection Nodes 6 and 7 are different than the base case condition. This is because of the proposed new storm drain pipeline along Iowa Avenue.

Note that this hydrology analysis was based on the District's Master Drainage Plan in terms of both the base case condition parameters and the calibration dataset. In order to validate the accuracy of the flow estimates, the hydrology analysis should be compared with available flow measurement and rainfall records in the vicinity of the site. In addition, for the HEC-HMS model calibration, the design flow estimates based on the SUH method yield much lower flow rates than the design flows documented in the Master Drainage Plan. The analysis in the Master Drainage Plan should be verified for its accuracy.

TABLE 4 – HYDROLOGY ANALYSIS DESIGN FLOW SUMMARY													
	Base Case Condition				West Campus Development Condition				West Campus Development Condition with Detention				
Watershed Connection Node	10-year Peak Flow				10-year Peak Flow				10-year Peak Flow				
	Node	On site	Off site	Total	Node	On site	Off site	Total	Node	On site	Off site	Total	Detention
	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	ac-ft
1	81	0	81	**81**	81	0	81	**81**	81	0	81	**81**	-
2	52	0	52	**52**	52	0	52	**52**	52	0	52	**52**	-
3	55	53	2	**107**	72	70	2	**125**	55	53	2	**107**	**0.58**
4	46	16	30	**126**	49	20	30	**130**	46	16	30	**126**	**0.31**
5	57	0	57	**57**	57	0	57	**57**	57	0	57	**57**	-
6	47	47	0	**212**	63	63	0	**120**	47	47	0	**105**	**0.47**
7	15	0	15	**141**	15	0	15	**270**	15	0	15	**248**	-
8	8	0	8	**361**	8	0	8	**398**	8	0	8	**361**	-
9	64	44	20	**64**	50	30	20	**50**	50	30	20	**50**	-
Watershed Connection Node	100-year Peak Flow				100-year Peak Flow				100-year Peak Flow				
	Node	On site	Off site	Total	Node	On site	Off site	Total	Node	On site	Off site	Total	Detention
	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	Cfs	ac-ft
1	116	0	116	**116**	116	0	116	**116**	116	0	116	**116**	-
2	75	0	75	**75**	75	0	75	**75**	75	0	75	**75**	-
3	78	75	3	**153**	102	100	3	**177**	78	75	3	**153**	**0.94**
4	65	23	42	**181**	77	35	42	**193**	65	23	42	**181**	**0.77**
5	82	0	82	**82**	82	0	82	**82**	82	0	82	**82**	-
6	68	68	0	**302**	91	91	0	**172**	68	68	0	**149**	**0.77**
7	21	0	21	**202**	21	0	21	**391**	21	0	21	**355**	-
8	12	0	12	**516**	12	0	12	**575**	12	0	12	**516**	-
9	91	63	28	**91**	80	52	28	**80**	80	52	28	**80**	-

HYDRAULIC ANALYSIS

Based on the design flow data from the hydrology analysis, a number of hydraulic analyses were prepared to test the adequacy of the existing District storm drain facilities for the base case and future conditions. Note that as discussed in previous sections, the base case condition is based upon the land use definition in the Master Drainage Plan (partial development), not the existing condition (agricultural research fields).

STORM DRAIN PIPELINE SYSTEM EVALUATION

The City of Riverside maintains a series of record drawings for the District's Line C, Line E and Line F pipelines. Within the record drawings the design capacity of each pipeline system is specified. Based on the design capacity data and the hydrology analysis results, the conveyance capacity of each pipe segment in the vicinity of the future West Campus was evaluated. Table 5 summarizes the findings. Note that the "Delta" column in Table 5 shows whether the pipelines have sufficient capacity, with negative values meaning the flow, in cfs, exceeds the pipeline capacity.

Findings

The analysis shows that under the base case condition as defined in the Master Drainage Plan, the pipeline system alone does not have sufficient capacity to convey the 10-year flow. The excess flow will become surface runoff routed along the street as overland flow.

Note that under the West Campus development condition with onsite detention, the flow on Line F is reduced, while the flow on Line E between Iowa Avenue and Cranford Avenue is increased (highlighted in red at Watershed Connection Nodes 6 and 7 in Table 5). This is due to the flow rerouting from Line F to Line E by the proposed storm drain pipeline on Iowa Avenue. The capacity analysis indicated that Line E between Iowa Avenue and Cranford Avenue does not have sufficient capacity (-235 cfs in Table 5) to handle the additional flow resulting from the new pipeline on Iowa Avenue.

TABLE 5 – DISTRICT PIPELINE CAPACITY SUMMARY

Watershed Connection Node	Location (pipeline, intersection)	Pipe Capacity	Reference	Base Case Condition		West Campus Development Condition		West Campus Development Condition with Detention	
				Design Flow					
				Total	Delta	Total	Delta	Total	Delta
		cfs		cfs	cfs	cfs	cfs	cfs	cfs
10-YEAR DESIGN PEAK FLOW									
1	Line E, Offsite	100	D319, Sht 17	81	19	81	19	81	19
2	(N) Iowa Pipe, Offsite	52	(N) Pipe Capacity for 10-Year Flow	52	-52*	52	0	52	0
3	(N) Iowa Pipe, MLK	107	(N) Pipe Capacity for 10-Year Flow	107	-107*	125	-18	107	0
4	Line E, Iowa	100	D319, Sht 15	126	-26	130	-30	126	-26
5	Line F, Offsite	131	D319, Sht 24	57	74	57	74	57	74
6	Line F, MLK	187	D319, Sht 18	212	-25	120	67	105	82
7	Line E, Cranford	120	D319, Sht 12	141	-21	270	-150	248	-128
8	Line E, Chicago	287	D319, Sht 9	361	-74	398	-111	361	-74
9	Line C, Chicago	25	D465, Sht 2 (Profile Lateral B)	64	-39	50	-25	50	-25
100-YEAR DESIGN PEAK FLOW									
1	Line E, Offsite	100	D319, Sht 17	116	-16	116	-16	116	-16
2	(N) Iowa Pipe, Offsite	52	(N) Pipe Capacity for 10-Year Flow	75	-75*	75	-23	75	-23
3	(N) Iowa Pipe, MLK	107	(N) Pipe Capacity for 10-Year Flow	153	-153*	177	-70	153	-46
4	Line E, Iowa	100	D319, Sht 15	181	-81	193	-93	181	-81
5	Line F, Offsite	131	D319, Sht 24	82	49	82	49	82	49
6	Line F, MLK	187	D319, Sht 18	302	-115	172	15	149	38
7	Line E, Cranford	120	D319, Sht 12	202	-82	391	-271	355	-235
8	Line E, Chicago	287	D319, Sht 9	516	-229	575	-288	516	-229
9	Line C, Chicago	25	D465, Sht 2 (Profile Lateral B)	91	-66	80	-55	80	-55

* The new pipeline on Iowa Avenue does not exist under base case condition, so the pipeline capacity is 0.

OVERLAND FLOW EVALUATION

Based on the District's Hydrology Manual, the flood control design criteria for the 10-year and 100-year storms are as follows.

- The 10-Year flood shall be contained within the Top of Curbs.
- The 100-Year flood shall be contained within street Right-of-Way limits.

In order to test whether the base case and the proposed development conditions would satisfy the flood control design criteria, an overland flow analysis was prepared to evaluate the street overland flow capacity to route the excess 10-year and 100-year flow that was above the pipeline capacity.

A HEC-RAS hydraulic analysis model was developed for the overland flow analysis. The model included the following street sections:

- MLK, between Iowa Avenue and Chicago Avenue
- Iowa Avenue, between Everton Place and MLK
  (City arterial, will be improved during future West Campus development.)
- Cranford Avenue, between Everton Place and MLK
  (Unpaved agricultural field road, the future Cranford Avenue "extension" within the campus boundaries will be a campus limited access street.)
- 12th Street, between Chicago Avenue and Ottawa Avenue

Since there is no field survey data for MLK and 12th Street, and Cranford Avenue and Iowa Avenue will be improved in the future, the street cross section geometry dataset is estimated based on the following data sources:

- City of Riverside topographic survey data to establish the cross section elevations and width.
- Record Drawing for 12th Street and MLK.
- District's Hydrology Manual to establish the street design criteria such as street cross slope.
- UC Riverside West Campus Infrastructure Development Study to establish the proposed street configuration for the future Iowa Avenue and Cranford Avenue.

Note that since the street cross section geometry is partly based on estimates, additional field survey or record drawing research may be warranted to confirm the cross section data for the overland flow analysis.

In the overland flow hydraulic model, each street section is modeled with two cross sections at the upstream and downstream ends. The streets are assumed to have uniform profile, with the slope defined by the centerline elevations at both ends. Normal depth is set for the downstream boundary conditions at MLK/Chicago Avenue, 12th Street/Ottawa Avenue, and Everton Place/Cranford Avenue. Note that the boundary condition at Everton Place/Cranford Avenue is for the overland flow on Cranford Avenue. Based on the existing grades as shown in the City of

Riverside topographic survey data, Cranford Avenue flows north towards Everton Place instead of south towards MLK.

Table 6 summarizes the flow input for each street section. Only street sections in the overland flow analysis, and their corresponding Watershed Connection Nodes that contribute stormwater runoff to the street sections, are listed in the table. The flow input is based on the excess stormwater flow above the pipeline system capacity as shown in Table 5, except for Iowa Avenue. On Iowa Avenue, the worst case flow scenario is modeled, by assuming all stormwater runoff flows along Iowa Avenue to MLK and the new pipeline does not exist or have no available capacity due to downstream backwater effect.

TABLE 6 - STREET OVERLAND FLOW INPUT SUMMARY

Street Section	Watershed Connection Node	HEC-RAS Stationing	Base Case Condition	West Campus Development Condition	West Campus Development Condition with Detention
10-Year Overland Flow (cfs)					
12th, Chicago/Ottawa	9	920	39	25	25
Cranford, Everton/MLK	6	2180	25	0	0
Iowa, Everton/MLK	3	11895	107	125	107
MLK, Iowa/Cranford	7	2268	21	150	128
MLK, Cranford/Chicago	8	1005	74	111	74
100-Year Overland Flow (cfs)					
12th, Chicago/Ottawa	9	920	66	55	55
Cranford, Everton/MLK	6	2180	115	0	0
Iowa, Everton/MLK	3	11895	153	177	153
MLK, Iowa/Cranford	7	2268	82	271	235
MLK, Cranford/Chicago	8	1005	229	288	229

Findings

The HEC-RAS overland flow analysis shows that the street sections do not satisfy the 10-year flood control design criteria under the base case condition on MLK between Cranford Avenue and Chicago Avenue. The model also shows slight capacity deficiency on 12th Street and Cranford Avenue. On Iowa Avenue, the model indicates capacity deficiency. However based on the existing grading, stormwater runoff on Iowa Avenue overflows toward Cranford Avenue at a local low point north of MLK. This overland flow release point help relieves the surface ponding on the street.

In the base case condition under the 100-year overland flow condition, 12th Street and Cranford Avenue satisfy the flood control design criteria, but MLK and Iowa Avenue have the water surface elevation above the ground surface elevation at the edges of the right-of-way limits.

In the West Campus development conditions, the capacity deficiency is increased due to the additional flow from the development. In addition, along the section of MLK between Iowa Avenue and Cranford Avenue, the capacity deficiency under the West Campus development condition is much higher than the base case condition. This is because the proposed new storm drain pipeline in Iowa Avenue intercepts stormwater runoff from east of Iowa Avenue that previously flowed to Line F and redirects it to Line E at MLK and Iowa Avenue. This additional flow overloads the existing Line E between Iowa Avenue and Cranford Avenue.

Table 7 shows the design flow summary of the overland flow analysis results.

TABLE 7 - STREET OVERLAND FLOW OUTPUT SUMMARY

Street Section	Watershed Connection Node	HEC-RAS Stationing	Overland Flow Capacity	Overland Flow Capacity Deficiency		
				Base Case Condition	West Campus Development Condition	West Campus Development Condition with Detention
10-Year Overland Flow (cfs)						
12th, Chicago/Ottawa	9	1170	37	2	0	0
Cranford, Everton/MLK	6	2180	20	5	0	0
Iowa, Everton/MLK	3	11895	8	99	117	99
MLK, Iowa/Cranford	7	2455	21	0	129	107
MLK, Cranford/Chicago	8	1146	24	50	87	50
100-Year Overland Flow (cfs)						
12th, Chicago/Ottawa	9	1170	89	0	0	0
Cranford, Everton/MLK	6	2180	125	0	0	0
Iowa, Everton/MLK	3	11895	16	137	161	137
MLK, Iowa/Cranford	7	2455	35	47	236	200
MLK, Cranford/Chicago	8	1146	43	186	245	186

Note that on Iowa Avenue (Watershed Connection Node 3), if the proposed new storm drain pipeline provides the 10-year design storm capacity as shown in Table 5, the overland flow deficiency for the West Campus Development condition would be 10 cfs and 54 cfs for 10-year design condition and 100-year design condition respectively.

ONSITE DETENTION EVALUATION

Based on the overland flow capacity deficiency data from the overland flow analysis, the following table summarizes the onsite peak flow attenuation requirements in order to detain the excess overland flow that exceed the street overland flow capacity. The requirement is based on future West Campus development conditions.

TABLE 8 - ONSITE DETENTION FOR WEST CAMPUS DEVELOPMENT CONDITION

Watershed Connection Node	Street Section	West Campus Development Condition Onsite Peak Flow	Excess Overland Flow needs Detention	Excess Overland Flow after detention
10-Year Flow (cfs)				
9	12th St	44	0	0
6	Cranford Avenue	47	0	0
3	Iowa Avenue	53	117	64
4	MLK	16	76	60
100-Year Flow (cfs)				
9	12th St	63	0	0
6	Cranford Avenue	68	0	0
3	Iowa Avenue	75	161	86
4	MLK	23	170	147

Findings

Table 8 shows that Watershed Connection Nodes 3 and 4 need to detain all onsite runoff, and even in this condition there are still excess overland flows that cannot be handled by the existing pipe, street and potential onsite detention. Additional onsite and offsite system improvements are needed to alleviate the capacity deficiency at Watershed Connection Nodes 3 and 4.

Table 9 summarizes the detention volume needed for each Watershed Connection Node. The table shows both the detention requirement to detain onsite runoff to minimize downstream capacity deficiency, and the detention requirement to simply match the post development runoff to the base case condition.

TABLE 9 - WEST CAMPUS DEVELOPMENT DETENTION VOLUME SUMMARY			
Watershed Connection Node	**Location**	**Detention to Minimize Downstream Capacity Deficiency**	**Detention to Match Base Case Condition**
10-Year Storm Detention Volume (ac-ft)			
9	Between Chicago and Cranford	0	0
6	Between Cranford and Iowa	0	0.47
3	East of Iowa (northern area)	3.5 (all onsite runoff)	0.58
4	East of Iowa (southern area)	1.9 (all onsite runoff)	0.31
100-Year Storm Detention Volume (ac-ft)			
9	Between Chicago and Cranford	0	0
6	Between Cranford and Iowa	0	0.77
3	East of Iowa (northern area)	4.9 (all onsite runoff)	0.94
4	East of Iowa (southern area)	2.7 (all onsite runoff)	0.77

RIVERSIDE COUNTY WATER QUALITY MANAGEMENT PLAN FOR URBAN RUNOFF

In addition to the flood control requirement summarized in this technical memorandum, the West Campus development is also required to compliant with the requirement set forth in the Riverside County Water Quality Management Plan for Urban Runoff (WQMP), dated July 24, 2006. The WQMP outlined both the stormwater quality and stormwater quantity requirements for new developments. While most stormwater quality requirements can be incorporated in various Low Impact Development (LID) design features throughout the West Campus, the stormwater quantity requirements may likely require a combination of LID design features as well as peak flow attenuation via onsite detention/retention.

In order to estimate the need of onsite detention/retention for the purpose of the stormwater quantity requirements, Item 1 in Methodology A under Section 4.4 of the WQMP is used as the design criteria, as follows:

- Releasing the post-development 2-year and 10-year, 24-hour volume at flow rates less than or equal to the pre-development 2-year and 10 year, 24-hour peak flow rates, respectively.

A SUH hydrology analysis is prepared for both the existing (note: it is the existing agricultural research fields land use, not the base case condition land use as defined in the Master Drainage Plan) and proposed West Campus development conditions under the 10-year, 24-hour storms. The analysis is to estimate the pre-development and post-development runoff volume difference. Assuming 40% of the stormwater quantity requirement will be handled by onsite LID design features, the following is a summary of the onsite stormwater quantity detention/retention requirements for each Watershed Connection Node under 10-year design storm.

- Watershed Connection Node 3 = 0.8 ac-ft
- Watershed Connection Node 4 = 0.4 ac-ft
- Watershed Connection Node 6 = 0.7 ac-ft
- Watershed Connection Node 9 = 0.5 ac-ft

Note that the stormwater quantity detention/retention volume requirement is not in addition to the flood control detention volume requirement. The total required stormwater volume is based on the higher of the two requirements between stormwater quantity and flood control.

CONCLUSION

This technical memorandum documented the hydrology and hydraulic analysis for the proposed UC Riverside West Campus development area. The following is a summary of the analysis findings for each main blocks of the development.

West Block, bounded by I215/SR60 to the east, and Iowa Avenue to the west

The block has two downstream connections. The northern part of the block drains to a proposed new storm drain pipeline on Iowa Avenue. The southern part of the block drains to the District's Line E pipeline on MLK. The tributary Watershed Connection Nodes for the block include Nodes 1 to 4 as shown in Figure 1. The hydrology analysis shows that the current West Campus Development concept generates higher stormwater runoff than the base case condition in the Master Drainage Plan. In order to match the projected future runoff to the base case condition (note: it is not the existing condition), the block needs to provide approximately 0.98 ac-ft of onsite stormwater storage under the 10-year storm design condition. However, since the WQMP stormwater quantity requirement is 1.2 ac-ft (Watershed Connection Nodes 3 and 4), the total onsite stormwater detention/retention volume is 1.2 ac-ft for the 10-year storm design condition. For the 100-year storm design condition, an additional 0.51 ac-ft of storage is needed for the block, to bring the total volume to approximately 1.71 ac-ft. The detention volume split for the northern and southern part of the block is approximately 67%/33% and 55%/45% for 10-year storm design condition and 100-year storm design condition respectively.

The hydraulic analysis shows that Line E does not have sufficient capacity for the 10-year storm event. In addition, since the proposed new storm drain pipeline on Iowa Avenue intercepts stormwater runoff from the east of Iowa Avenue, stormwater runoff drains to the new pipeline and connect to Line E on Iowa Avenue, instead of drains to Line F on Cranford Avenue. This configuration further overloads Line E between Iowa Avenue and Cranford Avenue, and the excess stormwater runoff becomes street overland flow. The overland flow analysis shows that Iowa Avenue does not have sufficient overland flow capacity. The analysis shows that even if the University detains all stormwater runoff east of Cranford Avenue, it still does not prevent surface flooding.

Therefore, with the new pipeline on Iowa Avenue, one or a combination of the following improvements is needed.

- Provide additional onsite stormwater detention east of Iowa Avenue (Note that this option needs to be combined with other improvement options, even if the West Campus detains all onsite runoff from the east of Iowa Avenue).

- Increase the capacity of the existing Line E between Iowa Avenue and Cranford Avenue. The additional capacity would be between 64 cfs and 117 cfs, depending on available additional onsite detention volume. This would be achieved by constructing a new pipeline parallel to the existing pipeline in MLK, or replacing the existing pipeline in MLK.

- Connect the proposed Iowa Avenue pipeline to Line F by constructing a new pipeline through the proposed Family Student Housing portion of the West Campus development.

Central Block, bounded by Iowa Avenue to the east, and Cranford Avenue to the west

The block drains to the District's Line F pipeline on Cranford Avenue, which connects to the District's Line E pipeline on MLK. The tributary Watershed Connection Nodes for the block include Nodes 5 and 6 as shown in Figure 1. The hydrology analysis shows that the current West Campus Development concept generates higher stormwater runoff than the base case condition in the Master Drainage Plan. In order to match the projected future runoff to the base case condition (note: it is not the existing condition), the block needs to provide approximately 0.47 ac-ft of onsite stormwater storage under the 10-year storm design condition. However, since the WQMP stormwater quantity requirement is 0.7 ac-ft (Watershed Connection Node 6), the total onsite stormwater detention/retention volume is 0.7 ac-ft for the 10-year storm design condition. For the 100-year storm design condition, an additional 0.07 ac-ft of storage is needed for the block, to bring the total volume to approximately 0.77 ac-ft.

In the proposed West Campus development condition, since the proposed new Iowa Avenue pipeline diverted flow from Line F to Line E, Line F will have sufficient capacity for the block. However, the analysis shows that the existing Line E between Cranford Avenue and Chicago Avenue and the overland flow on MLK does not have sufficient capacity for 10-year design condition. As shown in Table 8, even after all onsite stormwater runoff east of Iowa Avenue is detained onsite, MLK still has approximately 60 cfs and 147 cfs of excess overland flow under 10-year design condition and 100-year design condition respectively. Therefore, a combination of offsite detention, pipeline improvements, flow re-routing, and additional onsite detention within the Central Block is needed to alleviate potential flooding on MLK.

East Block, bounded by Cranford Avenue to the east, and Chicago Avenue to the west

The block drains to the District's Line C pipeline parallel to 12th Street. The tributary Watershed Connection Nodes for the block include Node 9 as shown in Figure 1. The hydrology analysis shows that the current West Campus Development concept generates lower stormwater runoff than the base case condition in the Master Drainage Plan. In addition, while the hydraulic analysis indicated that the pipeline does not have 10-year design capacity, the combination of pipeline and overland flow on 12th Street provide sufficient capacity to convey 10-year and 100-year design flows. However, since the WQMP stormwater quantity requirement is 0.5 ac-ft (Watershed Connection Node 9), the total onsite stormwater detention/retention volume is 0.5 ac-ft for the 10-year storm design condition. Additional detention volume is not required for the 100-year storm design condition.

RCFCWCD REVIEW

As noted in the Hydrology Analysis section, this analysis was based on the District's Master Drainage Plan in terms of both the base case condition parameters and the calibration dataset. In order to validate the accuracy of the flow estimates, the hydrology analysis should be compared with available flow measurement and rainfall records in the vicinity of the site. In addition, for the HEC-HMS model calibration, the design flow estimates based on the SUH method yield much lower flow rates than the design flows documented in the Master Drainage Plan. The analysis in the Master Drainage Plan should be verified for its accuracy.

A working draft version of this technical memorandum was forwarded to the District on June 23, 2009 for review and comments. The District indicated in the attached e-mail in Appendix C that the University is required to submit a plan check application and provide the plan check fee in order for the District to review the analysis. Since this analysis is part of the planning phase of the proposed West Campus Development, it is not applicable to file the plan check application to the District at this stage of the project. Additional coordination between the University and the District will be needed.

APPENDIX A

Hydrology Calculation Sheets
For
Master Drainage Plan for the
City of Riverside Box Springs Area (RCFCWCD, May 1970)

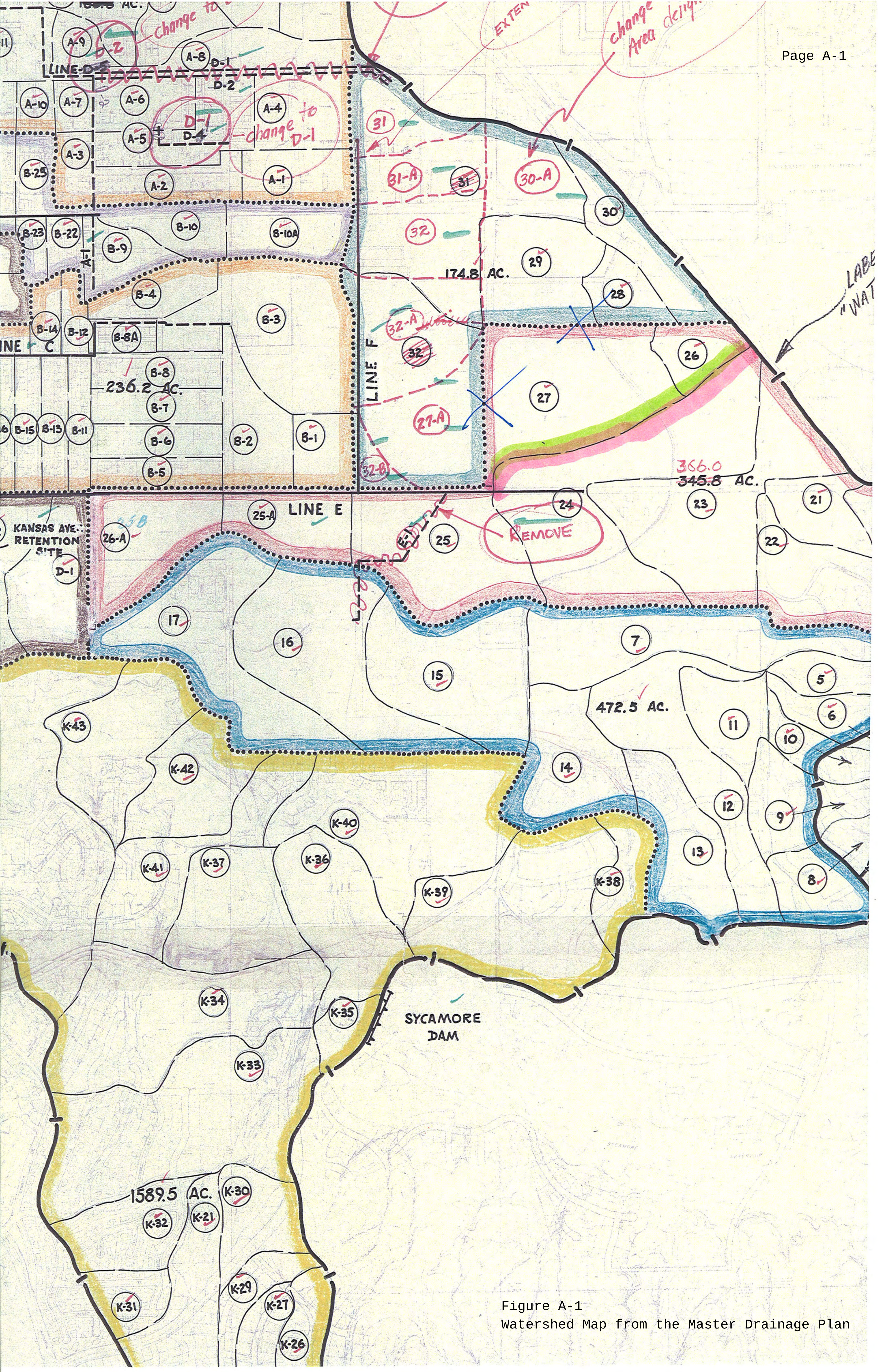


Figure A-1
Watershed Map from the Master Drainage Plan

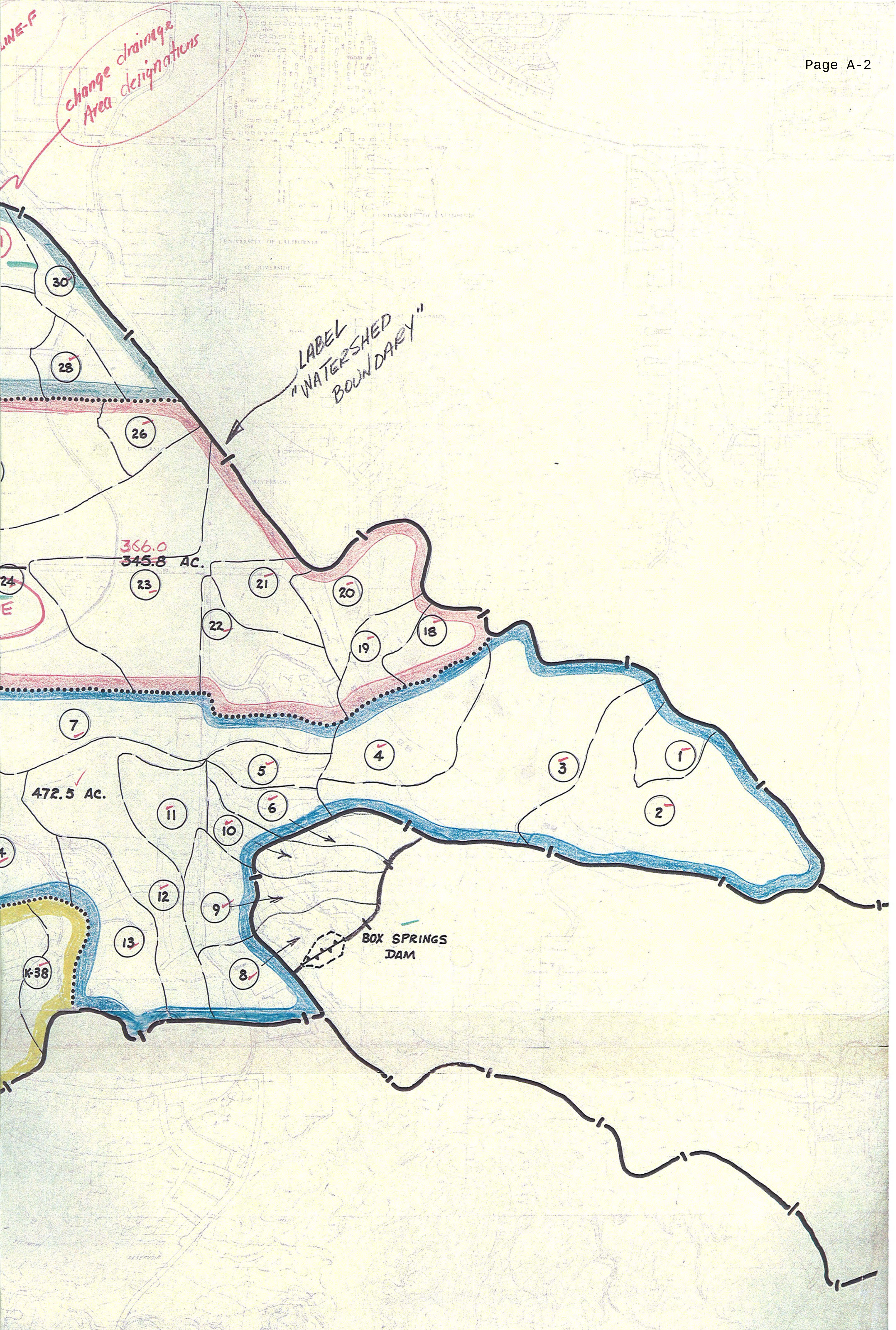


Figure A-1
Watershed Map from the Master Drainage Plan

New Calcs 11/4/69

HYDROLOGY CALCULATION SHEET

C.F.C. & W.C.D.

Sheet No. 1 of ___ Sheets

PROJECT LINE F Recalculations 11/4/69

Calculated by LBD 11/4/69 DATE

FREQUENCY 1/10

Checked by ______ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.020	Street	H=19	950	13.5		Initial Area Near
31	C-C	12.9	1.56	0.825	16.6							13.5	LINDEN & CRANFORD
						16.6	0.0160	36' street	604 3.4	1250	6.1		Flow down Side Street
31-A	C-C	21.2	1.27	0.780	21.0							19.6	And Assumed from Iowa to Cranford
						37.6							
							0.0143	Street	H=20	1400	14.0		Area in & around off Ramp on Hwy
30	C-C	14.7	1.53	0.82	18.5							14.0	60 @ 8th Street near UCR
						18.5	0.020	street	246 4.1	950	3.9		Area from Hwy 60 off Ramp
30-A	C-C	11.5	1.34	0.795	12.3							17.9	down 8th Street to Iowa Ave.
						30.8							
Combine with 28 & 29	From Sheet 2 Line E												
	$39.9 + \frac{1.26}{1.34}(\overset{16.9}{17.9}) =$		56.8 cfs									19.7	From Area 28 & 29 Page 2 on 5/3/68 Hydrology
						56.8	0.0184	48' street	248 4.8	1300	5.2		Area west from Iowa & 8th
32	C-C	23.3	1.12	0.750	19.5							24.9	to Cranford & 8th
						76.3							
Combine 32/30-A =	$76.3 + \frac{1.12}{1.34}(\overset{33.2}{37.9}) =$		109.5 cfs									24.9	From Area 32 Above
						109.5	0.00592	48" Ø PIPE RCP	540 9.0	1350	2.5		Pipe Flow down Cranford
32-A	SF-C	31.4	1.06	0.66	22.0							27.4	from 8th Street to Nat Low
						131.5							
							0.0160	street	H=14	880	13.0		Area to include portion of orchards
26	A-C	9.85	1.59	0.78	12.2							13.0	west of UCR
						12.2	0.0156	street	210 3.5	2300	11.0		Flow down street from orchard
27	A-C	22.8	1.14	0.76	19.8							24.0	road & city limit to Nat. Low
						32.0	0.0136	Assume 24" RCP	600 10.0	1250	2.1		Pipe Flow through orchard
27-A	A-C	26.8	1.09	0.75	22.0							26.1	from Iowa to Cranford
						54.0							
Combine 27-A/32-A =	$131.5 + \frac{1.06}{1.09}(\overset{52.5}{54.0}) =$		184.0 cfs									27.4	from Area 32-A
						184	0.010	54" Ø RCP	732 12.2	800	1.1		Flow down Cranford
32-B	SF-C	5.40	1.04	0.63	3.5							28.5	to Pennsylvania
						187.5							

N.G.

R.C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

Sheet No. 3 of 4 Sheet

PROJECT Box Springs LINE -F

FREQUENCY 1/10

Calculated by LBD DATE

Checked by 5/3/68 DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.0143	STREET	H= 20	1400	14.0	14.0	AREA IN [illegible] 60 AT 8th STREET [illegible]
30	C-C	14.7	1.53	0.82	18.5	18.5	0.0153	STREET	282 4.7	2880	10.2	24.2	[illegible] 8th ST. TO CRAWFORD AVENUE
31	C-C	71.0	1.14	0.755	61.2	79.7	0.00172	PIPE 51" ϕ ~~STREET~~	350 5.8	2320	6.7	30.9	SOUTH OF 8th STREET ON CRAWFORD AVE TO PENNSYLVANIA AVE.
32	SF-C	52.0	0.99	0.58	29.8	109.5							

O.K.

ADJUSTED Q / 28-29

$Q_{10} = 109.5 + \frac{.99}{1.26}\overset{31.4}{(39.9)}$

$Q_{10} = 140.9$ cfs @ T= 30.9 I= 0.99 O.K.

	[illegible]	20.2	0.81	0.50	8.2	262.8	0.0104	PIPE 60" ϕ	810 13.5	1560	2.0	45.5
ADD 28-32 to 18-27	[illegible]	27.4	0.77	0.48	10.7	270.8		PIPE	700 17.7			48.8

$Q_{10} = 122 + \frac{0.82}{0.83}(175.1) = 300$ cfs

Add directly AREA 26-A = 10.7

$Q_{10} = 310.7$ T= 46.3 I= 0.80

69" ϕ

VS 43.2 / 69" ϕ

ADJUSTED AT RETENTION SITE

$Q_{10} = 310.7 + \frac{0.85}{0.83}\overset{306}{(317.3)} = 616.7$ cfs

Total ACREAGE 1060 Ac. 46.3 87" RCP

R.C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

Sheet No. 1 of 4 Sheets

PROJECT Box Springs NAT. LOW NR. LINE E CANYON CREST

FREQUENCY 1/10

Calculated by LBD 5/2/68 DATE

Checked by ________ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.163	STREAM	H=150	920	10.0	10.0	DA-4 T.- AREA NORTH OF HWY 60-395
1	SF-C	11.3	1.84	0.825	17.2	17.2	0.119	STREAM	5.0	1600	5.3	15.3	DRAINAGE AREA NORTH OF HWY 60
2	SF-C	36.6	1.45	0.745	39.6	56.8	0.072	STREAM	10.0	3600	6.0	21.3	DRAINAGE AREA NORTH OF HWY 60-395
3	SF-C	50.0	1.22	0.63	38.4	95.2	0.082	STREAM	13.0	1800	2.3	23.6	DRAINAGE AREA NORTH OF HWY 60-395
4	SF-C	22.1	1.16	0.65	16.6	111.8	0.035	33" ϕ PIPE	1140 19.0	1040	0.9		DRAINAGE AREA SOUTH OF HWY 60-395
5	SF-C	4.70										24.5	TO CANYON CREST DRIVE
6	SF-C	13.55 8.85	1.13	0.64	9.8	121.7	0.028	STREAM	516 8.6	3320	6.4	30.9	AREA WEST OF CANYON CREST TO THE GAGE CANAL
7	SF-C	48.6	0.99	0.59	28.4	150.1	0.022	STREAM	480 8.0	1960	4.1	35.0	AREA WEST OF GAGE CANAL TO CRANFORD AVE.
15	SF-C	43.5	0.93	0.57	25.7	175.8	0.005	STREAM	240 4.0	1280	5.3	40.3	AREA CRANFORD AVE TO SOUTH ST WEST TO CHICAGO AVE.
16	SF-C	46.9	0.85	0.52	20.8	196.6	0.018	STREAM	480 8.0	1320	2.7	43.0	AREA FROM CHICAGO AVE WEST TO OTTAWA AVE.
17	SF-C	55.0	0.83	0.51	23.2	219.8							
							0.045	STREET	H=52	1160	11.0	11.0	DA-4 T.2 [illegible] INCLUDING INTERSECTION CANYON CREST - EL CERRITO DR.
8	SF-C	13.8	1.74	0.775	18.6	18.6	0.036	STREET	360 6.0	1200	3.3	14.3	FROM INTERSECTION CANYON CREST EL CERRITO NORTH TO NAT. LOW
9	SF-C	12.4	1.51	0.75	14.1	32.7	0.044	48" ϕ PIPE	180 3.0	640	3.5	17.8	AREA INCLUDING [illegible] TO THE EAST OF NAT. LOW AT CANYON CREST
10	SF-C	5.67	1.34	0.71	5.4	38.1	0.022	STREAM	180 3.0	1000	5.5	23.3	AREA INCLUDING NATURAL LOW WEST OF CANYON CREST
11	SF-C	14.0	1.17	0.65	10.6	48.7	0.022	STREAM	180 3.0	1000	5.5	28.8	AREA [illegible] AND AROUND EL CERRITO - MONTE VISTA NORTH TO NAT. LOW
12	SF-C	39.8	1.04	0.61	25.2	73.9	0.028	36" ϕ PIPE	750 12.5	1200	1.6	30.4	AREA [illegible] MONTE VISTA - [illegible] NORTH TO NAT. LOW
13	SF-C	26.5	1.00	0.585	15.5	89.4	0.026	STREET	[illegible] 5.5	2000	6.1	36.5	AREA [illegible] SOUTH [illegible] GAGE CANAL NORTH TO NAT. LOW
14	SF-C	32.8	0.91	0.55	16.4	105.8							

JUNCTION Adj. Q

97.5

$Q_{10} = 219.8 + \frac{0.83}{0.91}(105.8) = 317.3$ cfs

T= 43.0 I= 0.83

.C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

PROJECT Box Springs LINE E

FREQUENCY 1/10

Calculated by LBD 5/3/68 DATE

Checked by ______ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.130	STREAM	H=120	1000	10.0	DA-4 10.0	AREA NORTH OF HWY 60 & [illegible] DRIVE NORTH
18	SF-C	8.90	1.84	0.825	13.5	13.5	0.0545 0.088	STREAM	7.2	440	1.0	11.0	AREA SOUTH OF [illegible] ALONG HWY 60
19	SF-C	11.4	1.74	0.805	15.5	29.0	0.050	STREET	408 6.8	1160	2.8	13.8	AREA ADJACENT TO [illegible] TO INTERSECTION HWY 60 - PENNSYLVANIA AV
20	SF-C	24.1	1.54	0.770	28.6	57.6	0.040	STREET	420 7.0	800	1.9	25.7	AREA ALONG PENNSYLVANIA AVE TO INTERSECTION CANYON CREST
21	SF-C	12.3	1.11	0.63	8.5	66.1	0.0429	STREET	432 7.2	2800	6.7	32.4	AREA IN [illegible] TRACT THAT INCLUDE UNIV. DR. NORTH - ALONG CANYON CREST
22	SF-C	26.1	0.96	0.57	14.3	80.4	0.0182	STREET	372 6.2	1760	4.7	37.1	AREA ALONG PENN. AVE EASTWARD FROM INTERSECTION CANYON CREST
23	A-C	48.6	0.90	0.44	19.3	99.7	0.00795	PIPE 42"Φ ~~STREET~~	630 10.5	880	1.4	38.5	AREA EAST ALONG PENN. AVE TO INTERSECTION OF IOWA AVE.
24	A-C	69.5	0.88	0.43	25.2	124.9	0.0104	PIPE 45"Φ ~~STREET~~	690 11.5	2890	4.2	42.7	AREA EAST ALONG PENN AVE. TO CRANFORD AVENUE
25	A-C	62.1	0.83	0.40	20.6	145.5	0.0070	PIPE 51"Φ ~~STREET~~	630 10.5	2290	3.6	46.3	Refer to page 4
26-A	SF-C	27.4	0.80	0.49	10.7	156.2							
							0.0160	STREET	H=14	380	13.0		AREA TO INCLUDE [illegible] WEST OF UNIV. OF CAL [illegible]
26	A-C	9.85	1.59	0.78	12.2	12.2	0.0107	STREET	198 3.3	3000	15.2	13.0	AREA TO INCLUDE UNIV. OF CAL [illegible] TO IOWA AVE.
27	A-C	45.6	1.03	0.515	24.2	36.4						28.2	

ADD 26-27 to 25 $Q_{10} = 145.5 + \frac{0.83}{1.03}(34.4) = 175.1$ cfs.

$T = 42.7$ $I = 0.83$

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.0133	STREET	H=8	600	12.0	12.0	AREA EAST OF [illegible] ALONG CITY LIMITS TO GAGE CANAL
28	SF-C	10.3	1.66	0.79	13.5	13.5	0.0132	STREET	198 3.3	1520	7.7	19.7	ADJACENT AREA EASTWARD TO IOWA AVENUE.
29	C-C	26.8	1.26	0.78	26.4	39.9							

Refer to page 4

Sheet No. ___ of ___ Sheet

HYDROLOGY CALCULATION SHEET

F.C. & W.C.D.

PROJECT: LINE - E   New Sump Basin Site

Calculated by ____ 10/8/68 ____ DATE

Checked by ______________ DATE

FREQUENCY: 1/10

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	ΣQ CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	ΣT	REMARKS
												40.4	
						287	0.005	63" ϕ	828 13.8	1560	1.9	42.3	Area from Cranford Av EASTERLY TO CHICAGO AVE
25-A	SF-C	20.2	0.84	0.515	8.8	296	0.007	60" ϕ	930 15.5	2585	2.8	45.1	From Chicago Ave Easterly Along Pennsylvania Ave to Sump
26-A	SF-C	28.1	0.81	0.500	11.4	307							
						Refer to Page 1							
												43.0	
						320	0.0125	4x3.5 OPEN channel	594 9.9	1200	2.0	45.0	Flow through low from Ottawa AVE to PARK Site
D-1	SF-C	24.2	0.81	0.500	9.8	330	0.0225	stream	360 6.0	400	1.1	46.1	Flow through Natural low through Park to KANSAS
D-2	SF-C	26.4	0.80	0.500	11.0	341	0.0097	stream	278 3.8	720	3.2	49.3	Flow of Area in [illegible] around the Sump BASIN
D-3	SF-C	31.9	0.77	0.485	11.9	353							

New Sump Basin Site the above Areas has to be added with the Box Springs Low).

$Q_T = 353 + \frac{0.77}{0.81}(307) = 645\text{ cfs} @ T = 49.3$ (292)

HYDROLOGY CALCULATION SHEET

.F.C. & W.C.D.

Sheet No. 2 of __ Sheets

PROJECT Line-E [illegible] 11/[illegible]

Calculated by [illegible] DATE

Checked by ______ DATE

FREQUENCY 1/10

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
From Hydrology - page 2 5/3/60												38.5	
						100.0	0.0024	42" RCP	10.8	950	1.5	40.0	[illegible] To Iowa Ave.
24	C-C	33.1	0.86	0.690	19.7	120	0.0104	41" RCP	12.8	2980	3.7	43.5	Flow down [illegible] from Iowa to [illegible]
25	C-C	62.1	0.82	0.680	34.6	154.6							
Con[illegible] 25/26-A	154.6 + $\frac{0.82}{1.04}$ ($\frac{148}{[illegible]}$) = 302.6 cfs												
												43.5	[illegible]
						302.6	0.005	72" RCP	11.2	1560	2.3	46.0	Flow down [illegible] Ave. [illegible] to Chicago Ave.
25-A	SF-C	20.2	0.80	0.510	8.3	310.9	0.007	69" RCP	12.2	2585	5.5	49.5	
26-A	SF-C	23.1	0.77	0.470	10.1	321							

[illegible]

11/[illegible]

C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

Check for peaks

Sheet No. 4 of 4 Sheets

PROJECT LINE - E

FREQUENCY 1/10

Calculated by ____________ DATE ____

Checked by ____________ DATE ____

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	ΣQ CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	ΣT	REMARKS
18-24 / 26-27													
Adjusted Q_{10} =	$125 + \frac{0.85}{1.03}(36.4) =$	156 cfs									38.5	38.5	
						156	0.0098	PIPE 51" Ø	672 11.2	1320	1.9	40.4	
25	A-C	43.5	0.84	0.41	11.2	167.2							
ADJUSTED													
18-27 / 28-32	$167.2 + \frac{0.84}{0.99}(\cancel{140.9}) = \cancel{333.2}$ 287												
	T = 40.4	I = 0.99											
						~~333.2~~ 287	0.0104	PIPE 66" Ø	780 13.0	1560	2.0	40.4	COMBINED AREAS 18-27 / 28-32 [illegible] FROM [illegible] AVE
												42.4	EASTERLY TO CHICAGO AVE
25-A	SE-C	20.2	0.83	0.51	8.6	~~341.8~~ 296	0.007	PIPE 69" Ø	810 13.5	2280	2.8	43.2	FROM CHICAGO AVE [illegible] ALONG PENN. AVE & So. [illegible]
26-A	SE-C	27.4	0.83	0.51	11.6	~~353.4~~ 308							

$Q_T = 353.4 + \left(\frac{0.83}{0.83}\right)(317.3) =$

$Q_{10} =$ 670.7 cfs   T = 43.2 min   PIPE = 69 [illegible]

C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

Sheet No. 6 of ___ Sheets

PROJECT Box Springs Alt. #1 LINE-C

FREQUENCY 1/10

Calculated by LBD 5/10/68 DATE

Checked by ________ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	Σ Q CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	Σ T	REMARKS
							0.0135	STREAM	H=12'	880'	14.0	14.0	T_c AREA ABOVE & TO THE WEST OF PENN. & CRANFORD
B-1	SF-C	9.20	1.53	0.762	10.7	10.7	0.00625 0.0098	64' STREET	186 3.1	1600	8.6	22.6	AREA ADJACENT & INCLUDING C[illegible] AVE. NORTH OF PENN. AVE TO CATCH BASIN
B-2	SF-C	15.7	1.19	0.66	12.3	23.0	0.0066	24" PIPE	420 7.0	1200	2.9	25.5	AREA ALONG CHICAGO AVE TO A POINT ALONG DRAIN TO 11th ST.
B-3	C-C ~~SF-C~~	49.0	1.11	0.75	40.6	63.6	0.0042	39" PIPE	468 7.8	240	0.5	26.0	PIPE FLOW FROM 11th & OTTAWA TO 12th & OTTAWA
B-8A	SF-C	4.96	1.09	0.62	3.5	67.1							
							0.0112	36' STREET	H=18	1000	T_c=13.0	13.0	AREA AROUND ILLINOIS AVE & OTTAWA AVE.
B-5	SF-C	8.55	1.59	0.775	10.6	10.6	0.0120	36' STREET	3.2	1400	7.3	20.3	INTERSECTION OHIO & OTTAWA
B-6	SF-C	10.4	1.25	0.68	8.8	19.4	0.0106	36' STREET	3.7	1600	7.2	27.5	INTERSECTION ENTERPRISE & OTTAWA
B-7	SF-C	10.5	1.06	0.615	6.8	26.2	0.0109	36' STREET	3.6	1840	8.5	36.0	INTERSECTION 11th & OTTAWA
B-8	SF-C	15.4	0.91	0.55	7.7	33.9							
ADJUST Q_{10} =	$33.9 + \frac{0.91}{1.09}\left(\overset{56}{67.1}\right) = 89.9$												
												36.0	TIME TAKEN FROM ABOVE FLOW TO 12th & OTTAWA
B-11	SF-C	11.8	0.90	0.54	5.7	89.9	0.0111	39"φ PIPE	660 11.0	360	0.5	36.5	COMBINED BOTH AREAS
B-12	SF-C	5.09	0.90	0.54	2.5	8.2	0.0111	39"φ PIPE	660 11.0	360	0.5	36.5	TO DWIGHT & 12th STREET
B-13	SF-C	8.46	0.90	0.54	4.1	98.1	0.0125	39"φ PIPE	720 12.0	240	0.3	36.8	COMBINED BOTH AREAS
B-14	SF-C	5.34	0.90	0.54	2.6	6.7	0.0125	39" PIPE	720 12.0	240	0.3	36.8	TO DOUGLASS & 12th STREET
B-15	SF-C	7.90	0.90	0.54	3.8	104.8	0.010	42" PIPE	672 11.2	200	0.3	37.1	ANGELO & 12th ST.
B-16	SF-C	7.90	0.90	0.54	3.8	108.6	0.020	42" PIPE	672 11.2	200	0.3	37.4	MICHEAL & 12th ST.
B-17	SF-C	4.63	0.89	0.54	2.2	112.4	0.0141	39" PIPE	840 14.0	200	0.2	37.6	KANSAS & 12th ST.
B-18	SF-C	11.1	0.88	0.52	5.1	114.6	0.0141	42" PIPE	720 12.0	640	0.9	38.5	EUCALYPTUS & 12th ST.
						119.7							

Sheet No. 7 of ___ Sheets

C.F.C. & W.C.D. HYDROLOGY CALCULATION SHEET

PROJECT: Box Springs Alternate #1 LINE-C

Calculated by LBD 5/10/68 DATE

FREQUENCY 1/10

Checked by ________ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr.	C	ΔQ CFS	ΣQ CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	ΣT	REMARKS
												38.5	EUCALYPTUS & 12th
						119.7	0.0084	45"Ø PIPE	660 11.0	240	0.4	38.9	EUCALYPTUS & 11th
B-19	SF-C	5.04	0.87	0.52	2.3								
						122.0	0.0075	48"Ø PIPE	600 10.0	400	0.7	39.6	EUCALYPTUS & 10th
B-20	SF-C	13.4	0.86	0.52	6.0								
						128.0	0.0033	48"Ø PIPE	630 10.5	600	0.9	40.5	EUCALYPTUS & 8th
B-21	SF-C	15.1	0.85	0.52	6.7								
						134.7							
Refer to page 14													
							0.0065	36' STREET	H=12	1200	Tc=15.0	15.0	STREET FLOW TO 10th & OTTAWA
B-4	SF-C	12.4	1.47	0.75	13.7								
						13.7	0.0063	24" PIPE	246 4.1	640	2.6	17.6	PIPE FLOW TO 8th & OTTAWA
B-9	C-C	11.9	1.35	0.80	12.8								
						26.5							
							0.0120	64' STREET	H=12	1000	Tc: 15.0	15.0	8th STREET NEAR INTERSECTION OF CRANFORD AVE.
B-10A	C-C	11.9	1.47	0.81	14.2								
						14.2	0.0143	64' STREET	3.6	1400	6.5	21.5	INTERSECTION 8th & OTTAWA
B-10	C-C	14.1	1.22	0.77	13.3								
						27.5							
ADD B-4, B-9 to B-10, B-10A Q=		54.0 cfs											
												21.5	FROM 8th & OTTAWA TO 8th & DWIGHT
						54.0	0.0097	33"Ø PIPE	546 9.1	310	0.6	22.1	8th & DWIGHT TO 8th & DOUGLASS
* B-22	C-C	3.57	1.23	0.77	3.4								
						57.4	0.0091	33"Ø PIPE	576 9.6	220	0.4	22.5	8th & DOUGLASS TO 8th & EUCALYPTUS
* B-23 (refer to page 15)	C-C	2.87	1.19	0.765	2.6								
						60.0	0.0114	33"Ø PIPE	606 10.1	1400	2.3	24.8	8th & EUCALYPTUS
* B-24	C-C	5.45 (1.18, 4.27)	1.12	0.750	4.6								
						64.6							
* ADJUST AT 8th & EUCALYPTUS = Q_{10} =		$134.7 + \frac{0.85}{1.12}(64.6)$ (49.0) =			183.7 cfs								
												40.5	
						183.7	0.0116	51"Ø PIPE	992 13.2	600	0.8	41.3	FLOW FROM 8th & EUCALYTUS TO 7th & EUCALYPTUS
B-28 (Page 15)	C-C	4.43	0.85	0.685	2.6								
						186.3							

Sheet No. 8 of ___ Sheets

C.F.C. & W.C.D.

HYDROLOGY CALCULATION SHEET

PROJECT Box Springs

FREQUENCY 1/10

Calculated by LBD 5/10/68 DATE

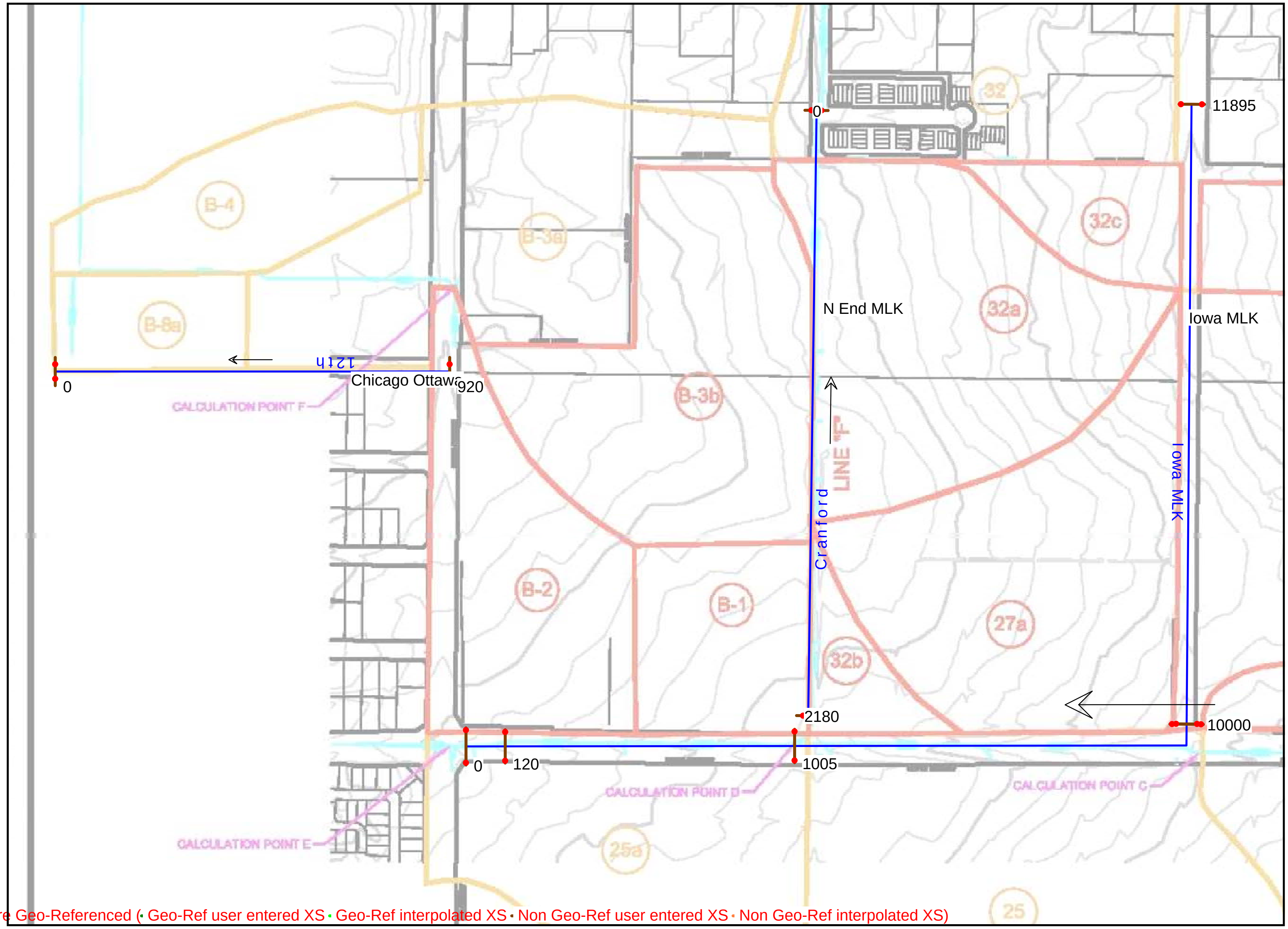
Checked by ______ DATE

DRAINAGE AREA	Soil & Development	A Acres	I In/hr	C	ΔQ CFS	ΣQ CFS	SLOPE	SECTION	V FPS	L FT.	T MIN.	ΣT	REMARKS
							0.00520	STREET	H=1.6	290	11.0 Tc	11.0	Tc FROM DWIGHT TO DOUGLASS ON 7th STREET
B-25 page 15	C-C	7.35	1.74	0.85	10.9	10.9	0.0138	36' STREET	204 3.4	9 650	3.2	14.2	FROM DOUGLASS & 7th TO KANSAS & 7th
B-26	C-C	10.2	1.52	0.82	12.7	23.6	0.0075	24" PIPE	438 7.3	3 400	0.9	15.1	7th & KANSAS TO 7th & EUCALYPTUS
B-27	C-C	7.6	1.46	0.81	9.0	32.6							
ADJUST. FLOWS @ 7th & EUCALYPTUS													
	$Q_{10} = 186.3 + \frac{0.85}{1.46}(\overset{19.0}{32.6}) =$			205.3 cfs		I=0.85	T=41.3					41.3	
						205.3	0.0141	51"Ø PIPE	786 13.1	19 1350	1.7	43.0	MAIN TRUNK FLOW FROM EUCALYPTUS & 7th to PARK & 7th
B-29 Page 15	SF-C	15.8	0.83	0.52	6.8	211.6							
Recalc													
refer to page 14							0.0167	36' STREET	H=10	10 600	Tc 11.5	11.5	EUCALYPTUS & 9th ST TO SEDGWICK & 9th ST
B-30	C-C	8.0	1.70	0.84	11.4	11.4	0.0128	36' STREET	198 3.3	16 1250	6.3	17.8	SEDGWICK & 9th ST TO PARK AVE & 9th ST
B-31	C-C	10.8	1.34	0.79	11.4	22.8	0.0024	PIPE 30"Ø	270 4.5	2 850	3.2	21.0	PIPE FLOW UP PARK AVE TO 9th & PARK AVE
B-32	C-C	12.8	1.23	0.77	12.1	34.9							
ADD TO B-29	$Q_{10} = 211.6 +$	34.9 =	246.5	t=43.0	I=0.83							43.0	
						246.5	0.0155	54"Ø PIPE	1080 16.0	14 900	0.8	43.8	TRUNK LINE FLOW DOWN 7th ST TO COMMERCE
B-33 Page 15	C-C	8.65	0.82	0.68	9.6	256.1							
ADJUSTED FLOW @ 7th & COMMERCE		$256 + \frac{0.82}{0.90}(\overset{171}{188}) =$			427 cfs	I=0.82	t=43.8					43.8	
						427	0.0141	69"Ø PIPE	1020 17	12 850	0.8	44.6	TRUNK FLOW TO 7th & FREEWAY
B-34 Refer to page 16	C-C	4.95	0.81	0.67	2.7	429.7							

APPENDIX B

HEC-RAS Overland Flow Model Output

Figure B-1 HEC-RAS Model Layout



None of the XS's are Geo-Referenced (Geo-Ref user entered XS · Geo-Ref interpolated XS · Non Geo-Ref user entered XS · Non Geo-Ref interpolated XS)

APPENDIX B.1

HEC-RAS Overland Flow Model Output

10-Year and 100-Year Overland Flow Analysis

Table B-1 10-Yr and 100-Yr Analysis Output

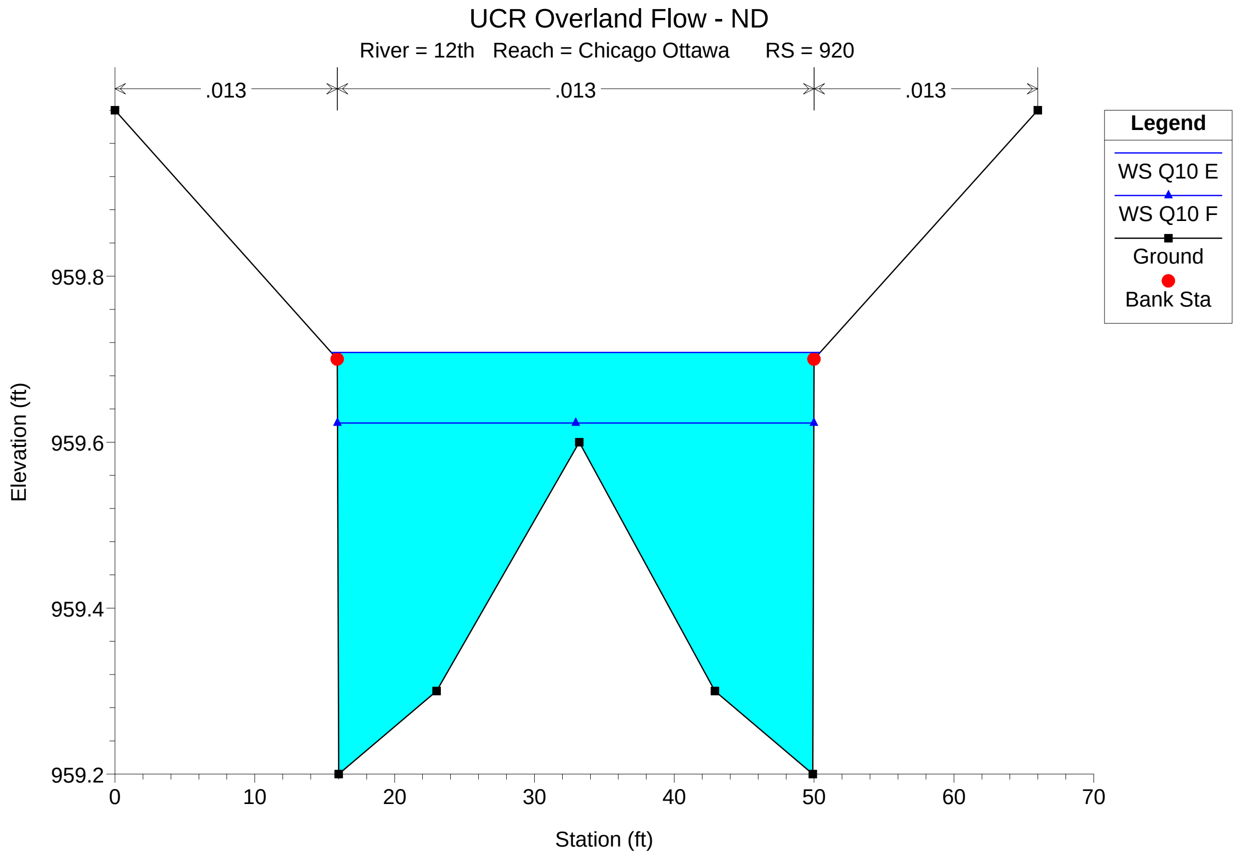
HEC-RAS Plan: UCR Overland

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Iowa MLK	Iowa MLK	11895	Q10 E	106.90	1000.00	1001.05	1000.94	1001.17	0.001451	2.89	37.69	70.00	0.69
Iowa MLK	Iowa MLK	11895	Q10 F	124.50	1000.00	1001.11	1000.97	1001.25	0.001381	3.02	41.99	70.02	0.68
Iowa MLK	Iowa MLK	11895	Q10 F Det	106.90	1000.00	1001.05	1000.94	1001.17	0.001451	2.89	37.69	70.00	0.69
Iowa MLK	Iowa MLK	11895	Q100 E	152.80	1000.00	1001.18	1001.03	1001.35	0.001412	3.30	47.25	70.05	0.70
Iowa MLK	Iowa MLK	11895	Q100 F	177.10	1000.00	1001.09	1001.09	1001.39	0.003145	4.46	40.50	70.01	1.02
Iowa MLK	Iowa MLK	11895	Q100 F Det	152.80	1000.00	1001.03	1001.03	1001.30	0.003258	4.26	36.63	69.99	1.02
Iowa MLK	Iowa MLK	10000	Q10 E	106.90	996.20	997.14	997.14	997.34	0.003007	3.62	30.20	69.96	0.95
Iowa MLK	Iowa MLK	10000	Q10 F	124.50	996.20	997.17	997.17	997.40	0.003235	3.93	32.41	69.97	1.00
Iowa MLK	Iowa MLK	10000	Q10 F Det	106.90	996.20	997.14	997.14	997.34	0.003007	3.62	30.20	69.96	0.95
Iowa MLK	Iowa MLK	10000	Q100 E	152.80	996.20	997.24	997.24	997.50	0.003149	4.21	37.01	69.99	1.01
Iowa MLK	Iowa MLK	10000	Q100 F	177.10	996.20	997.53		997.68	0.001122	3.07	57.88	78.00	0.63
Iowa MLK	Iowa MLK	10000	Q100 F Det	152.80	996.20	997.45		997.58	0.001050	3.01	51.72	70.08	0.61
Iowa MLK	Iowa MLK	2268	Q10 E	21.50	996.14	996.62	996.62	996.73	0.004308	2.74	7.84	34.70	1.02
Iowa MLK	Iowa MLK	2268	Q10 F	149.70	996.14	997.10	997.10	997.33	0.003255	3.90	39.09	85.78	1.00
Iowa MLK	Iowa MLK	2268	Q10 F Det	128.40	996.14	997.05	997.05	997.26	0.003327	3.79	34.68	81.73	1.01
Iowa MLK	Iowa MLK	2268	Q100 E	82.10	996.14	996.92	996.92	997.10	0.003359	3.43	24.88	71.92	0.98
Iowa MLK	Iowa MLK	2268	Q100 F	271.30	996.14	997.32	997.32	997.66	0.003003	4.74	58.05	88.07	1.02
Iowa MLK	Iowa MLK	2268	Q100 F Det	234.90	996.14	997.26	997.26	997.57	0.003070	4.51	52.83	88.05	1.02
Iowa MLK	Iowa MLK	1005	Q10 E	74.20	983.50	984.26	984.26	984.42	0.003238	3.31	23.34	69.90	0.96
Iowa MLK	Iowa MLK	1005	Q10 F	110.90	983.50	984.37	984.37	984.57	0.003343	3.68	31.04	77.82	1.00
Iowa MLK	Iowa MLK	1005	Q10 F Det	74.20	983.50	984.26	984.26	984.42	0.003238	3.31	23.34	69.90	0.96
Iowa MLK	Iowa MLK	1005	Q100 E	229.10	983.50	984.61	984.61	984.91	0.003130	4.49	51.74	88.04	1.02
Iowa MLK	Iowa MLK	1005	Q100 F	288.40	983.50	984.71	984.71	985.06	0.002972	4.84	60.44	88.08	1.02
Iowa MLK	Iowa MLK	1005	Q100 F Det	229.00	983.50	984.61	984.61	984.91	0.003133	4.49	51.71	88.04	1.03
Iowa MLK	Iowa MLK	120	Q10 E	74.20	974.90	975.66	975.66	975.82	0.003236	3.31	23.35	69.90	0.96
Iowa MLK	Iowa MLK	120	Q10 F	110.90	974.90	975.77	975.77	975.97	0.003332	3.67	31.07	77.86	1.00
Iowa MLK	Iowa MLK	120	Q10 F Det	74.20	974.90	975.66	975.66	975.82	0.003236	3.31	23.35	69.90	0.96
Iowa MLK	Iowa MLK	120	Q100 E	229.10	974.90	976.01	976.01	976.31	0.003130	4.49	51.74	88.04	1.02
Iowa MLK	Iowa MLK	120	Q100 F	288.40	974.90	976.11	976.11	976.46	0.002982	4.84	60.38	88.08	1.02
Iowa MLK	Iowa MLK	120	Q100 F Det	229.00	974.90	976.01	976.01	976.31	0.003135	4.49	51.70	88.04	1.03
Iowa MLK	Iowa MLK	0	Q10 E	74.20	973.36	974.23	974.23	974.42	0.003615	3.48	21.61	61.75	1.01
Iowa MLK	Iowa MLK	0	Q10 F	110.90	973.36	974.36	974.36	974.57	0.003289	3.69	30.56	76.94	0.99
Iowa MLK	Iowa MLK	0	Q10 F Det	74.20	973.36	974.23	974.23	974.42	0.003615	3.48	21.61	61.75	1.01
Iowa MLK	Iowa MLK	0	Q100 E	229.10	973.36	974.63	974.63	974.91	0.003021	4.23	54.28	97.81	1.00
Iowa MLK	Iowa MLK	0	Q100 F	288.40	973.36	974.73	974.73	975.05	0.002977	4.45	64.66	105.66	1.01
Iowa MLK	Iowa MLK	0	Q100 F Det	229.00	973.36	974.63	974.63	974.91	0.003018	4.23	54.28	97.81	1.00
Cranford	N End MLK	2180	Q10 E	24.50	982.60	983.14	983.04	983.20	0.001360	2.01	12.25	39.72	0.61

Table B-1 10-Yr and 100-Yr Analysis Output

HEC-RAS Plan: UCR Overland (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Cranford	N End MLK	2180	Q10 F	0.10	982.60	982.67	982.65	982.67	0.001351	0.45	0.22	6.37	0.42
Cranford	N End MLK	2180	Q10 F Det	0.10	982.60	982.67	982.65	982.67	0.001351	0.45	0.22	6.37	0.42
Cranford	N End MLK	2180	Q100 E	115.20	982.60	983.57		983.74	0.001350	3.49	38.82	81.60	0.70
Cranford	N End MLK	2180	Q100 F	0.10	982.60	982.67	982.65	982.67	0.001351	0.45	0.22	6.37	0.42
Cranford	N End MLK	2180	Q100 F Det	0.10	982.60	982.67	982.65	982.67	0.001351	0.45	0.22	6.37	0.42
Cranford	N End MLK	0	Q10 E	24.50	979.60	980.13	980.04	980.20	0.001400	2.03	12.14	39.45	0.62
Cranford	N End MLK	0	Q10 F	0.10	979.60	979.67	979.65	979.67	0.001402	0.45	0.22	6.32	0.43
Cranford	N End MLK	0	Q10 F Det	0.10	979.60	979.67	979.65	979.67	0.001402	0.45	0.22	6.32	0.43
Cranford	N End MLK	0	Q100 E	115.20	979.60	980.57	980.49	980.74	0.001400	3.53	38.27	80.95	0.71
Cranford	N End MLK	0	Q100 F	0.10	979.60	979.67	979.65	979.67	0.001402	0.45	0.22	6.32	0.43
Cranford	N End MLK	0	Q100 F Det	0.10	979.60	979.67	979.65	979.67	0.001402	0.45	0.22	6.32	0.43
12th	Chicago Ottawa	920	Q10 E	38.80	959.20	959.71	959.71	959.88	0.003725	3.35	11.60	34.95	1.01
12th	Chicago Ottawa	920	Q10 F	25.30	959.20	959.62	959.62	959.75	0.004102	2.91	8.70	34.07	1.01
12th	Chicago Ottawa	920	Q10 F Det	25.30	959.20	959.62	959.62	959.75	0.004102	2.91	8.70	34.07	1.01
12th	Chicago Ottawa	920	Q100 E	66.20	959.20	959.88	959.88	960.08	0.002624	3.68	19.13	53.14	0.91
12th	Chicago Ottawa	920	Q100 F	55.40	959.20	959.82	959.82	960.01	0.002959	3.58	15.99	46.43	0.94
12th	Chicago Ottawa	920	Q100 F Det	55.40	959.20	959.82	959.82	960.01	0.002959	3.58	15.99	46.43	0.94
12th	Chicago Ottawa	0	Q10 E	38.80	947.00	947.51	947.51	947.68	0.003721	3.34	11.61	34.96	1.01
12th	Chicago Ottawa	0	Q10 F	25.30	947.00	947.42	947.42	947.55	0.004142	2.92	8.68	34.07	1.02
12th	Chicago Ottawa	0	Q10 F Det	25.30	947.00	947.42	947.42	947.55	0.004142	2.92	8.68	34.07	1.02
12th	Chicago Ottawa	0	Q100 E	66.20	947.00	947.68	947.68	947.88	0.002620	3.68	19.15	53.16	0.91
12th	Chicago Ottawa	0	Q100 F	55.40	947.00	947.62	947.62	947.81	0.002952	3.58	16.01	46.46	0.94
12th	Chicago Ottawa	0	Q100 F Det	55.40	947.00	947.62	947.62	947.81	0.002952	3.58	16.01	46.46	0.94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.013
.013
.013
Legend
WS Q10 E
WS Q10 F
Ground
Bank Sta
Elevation (ft)
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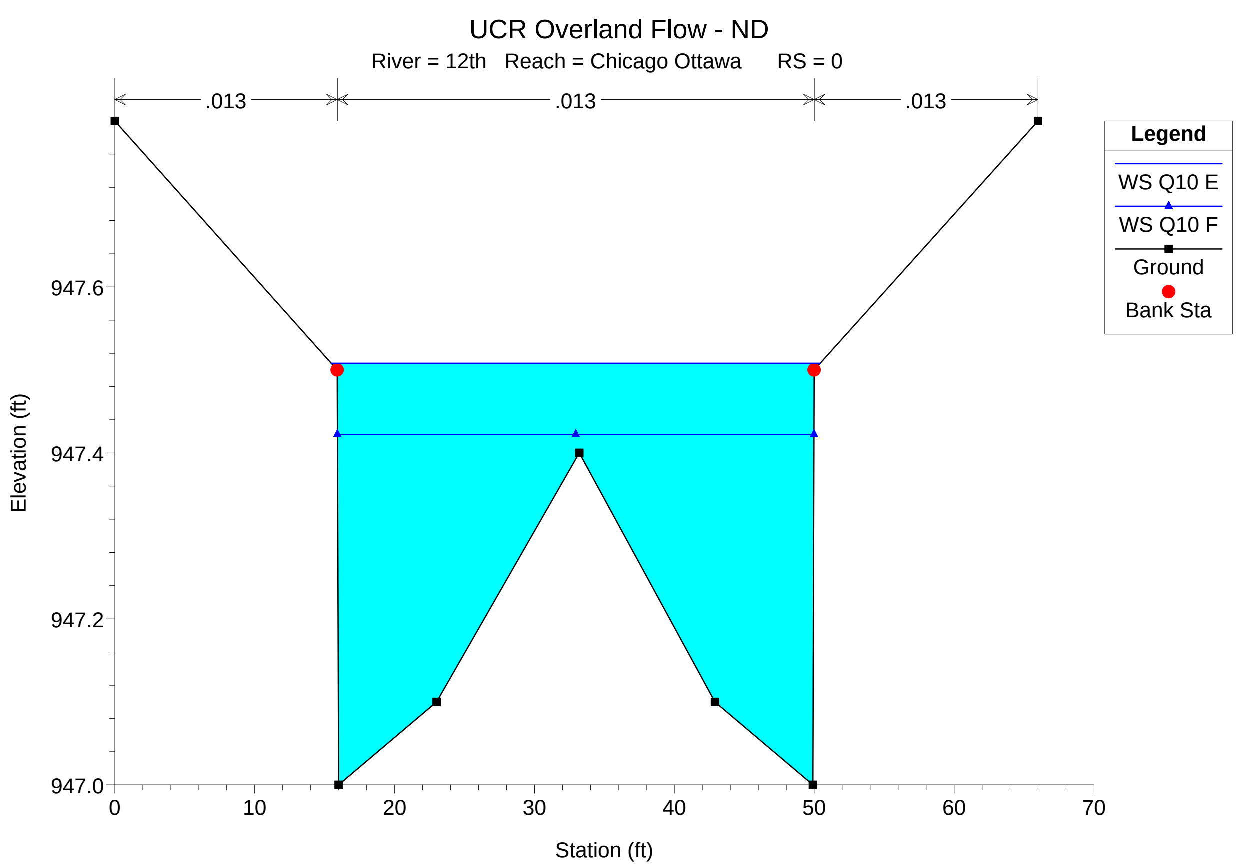
959.6
959.4
959.2
0
10
20
30
40
50
60
70
Station (ft)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.013
.013
Legend
WS Q10 E
WS Q10 F
Ground
Bank Sta
Elevation (ft)
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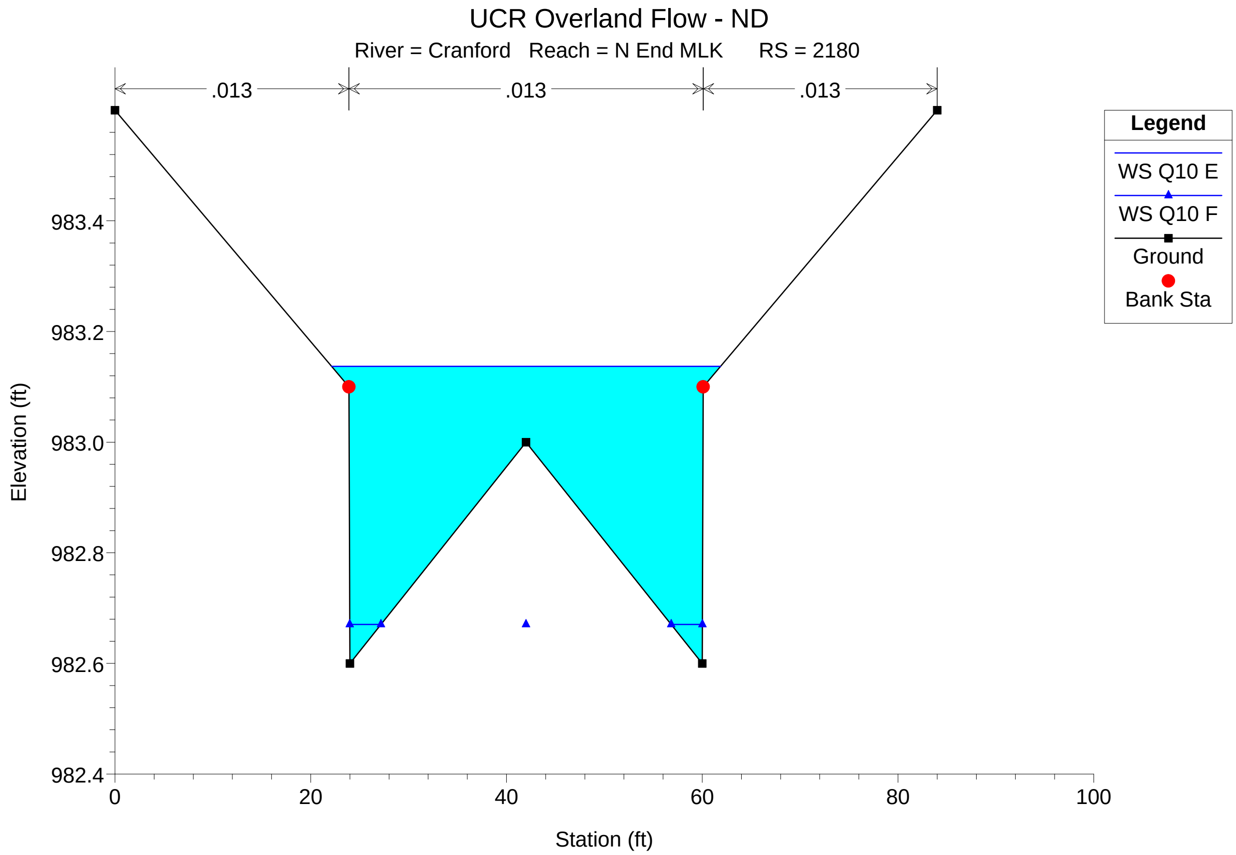
947.4
947.2
947.0
0
10
20
30
40
50
60
70
Station (ft)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.013
.013
.013
Legend
WS Q10 E
WS Q10 F
Ground
Bank Sta
Elevation (ft)
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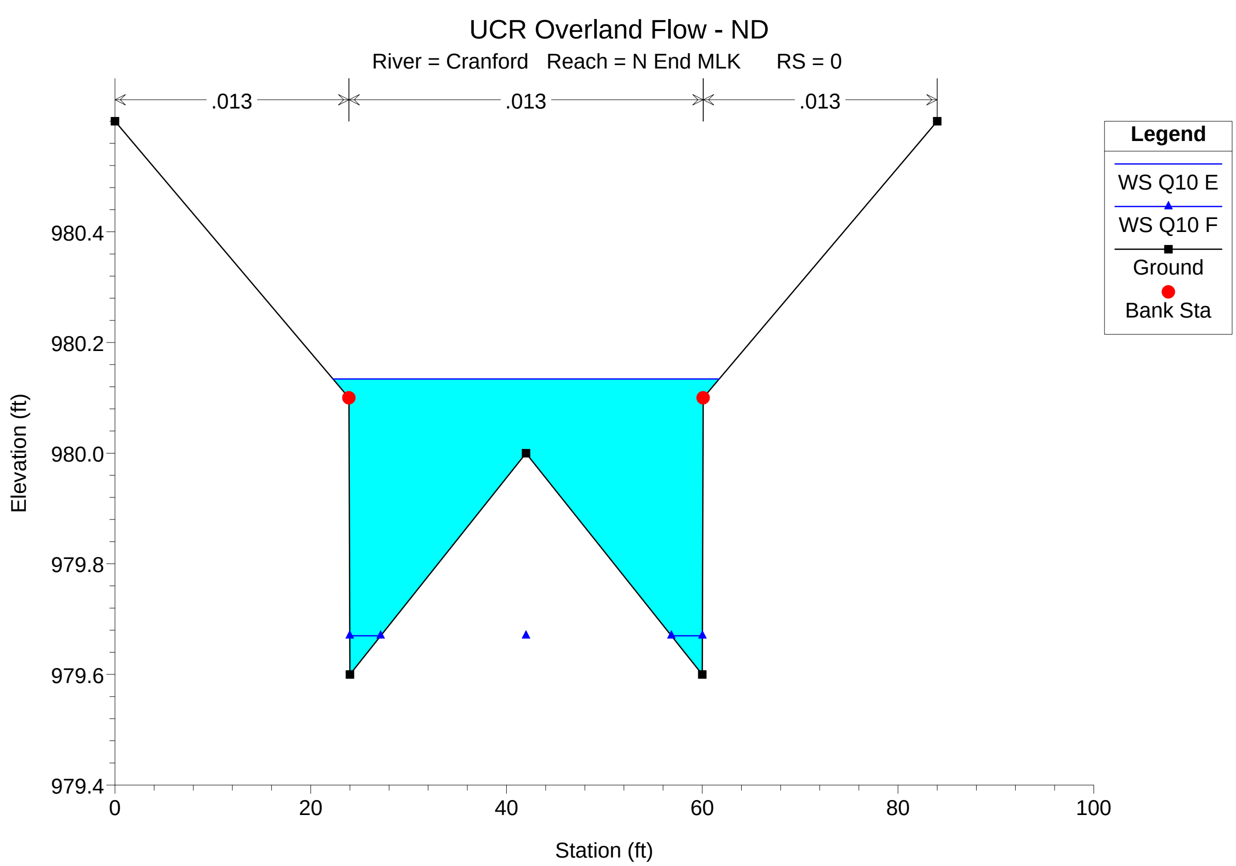
983.2
983.0
982.8
982.6
982.4
0
20
40
60
80
100
Station (ft)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.013
.013
Legend
WS Q10 E
WS Q10 F
Ground
Bank Sta
Elevation (ft)
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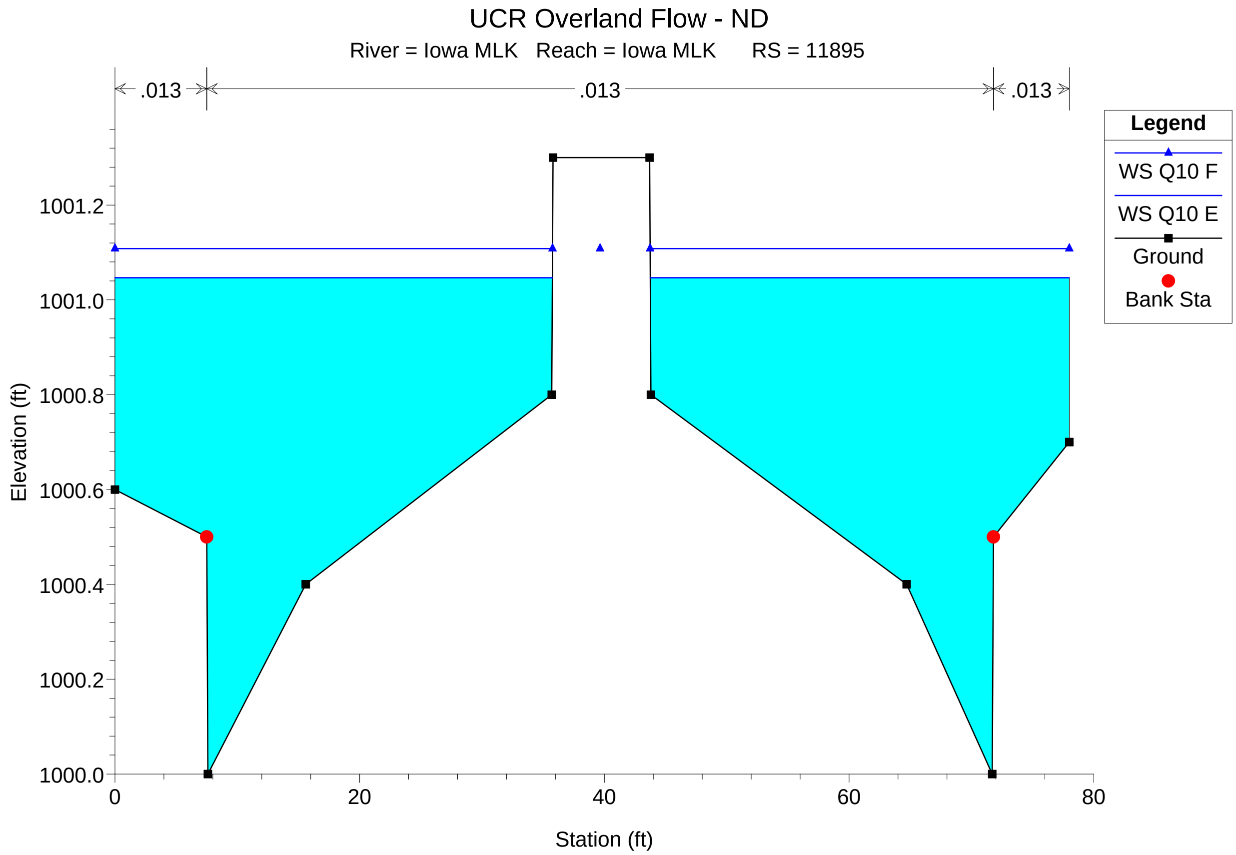
980.2
980.0
979.8
979.6
979.4
0
20
40
60
80
100
Station (ft)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.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
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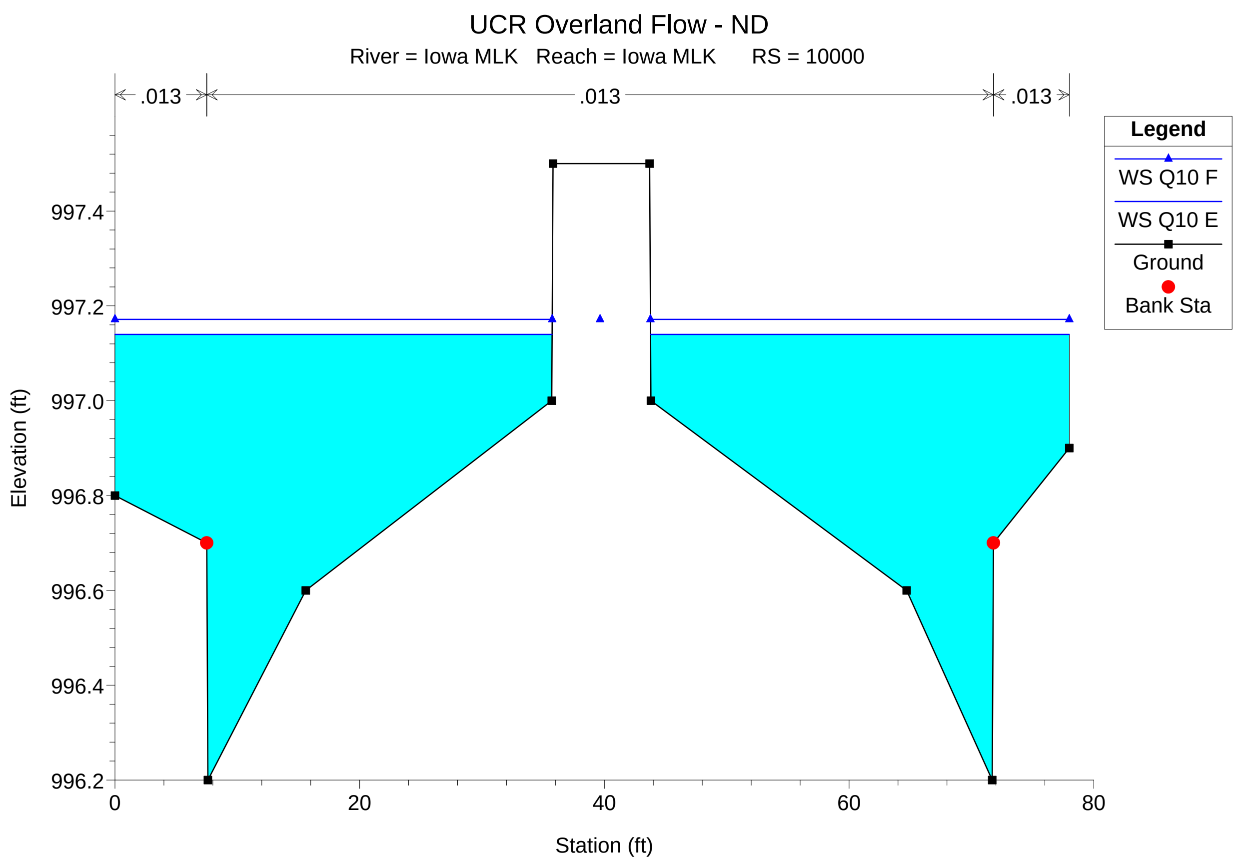
1001.0
1000.8
1000.6
1000.4
1000.2
1000.0
0
20
40
60
80
Station (ft)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.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
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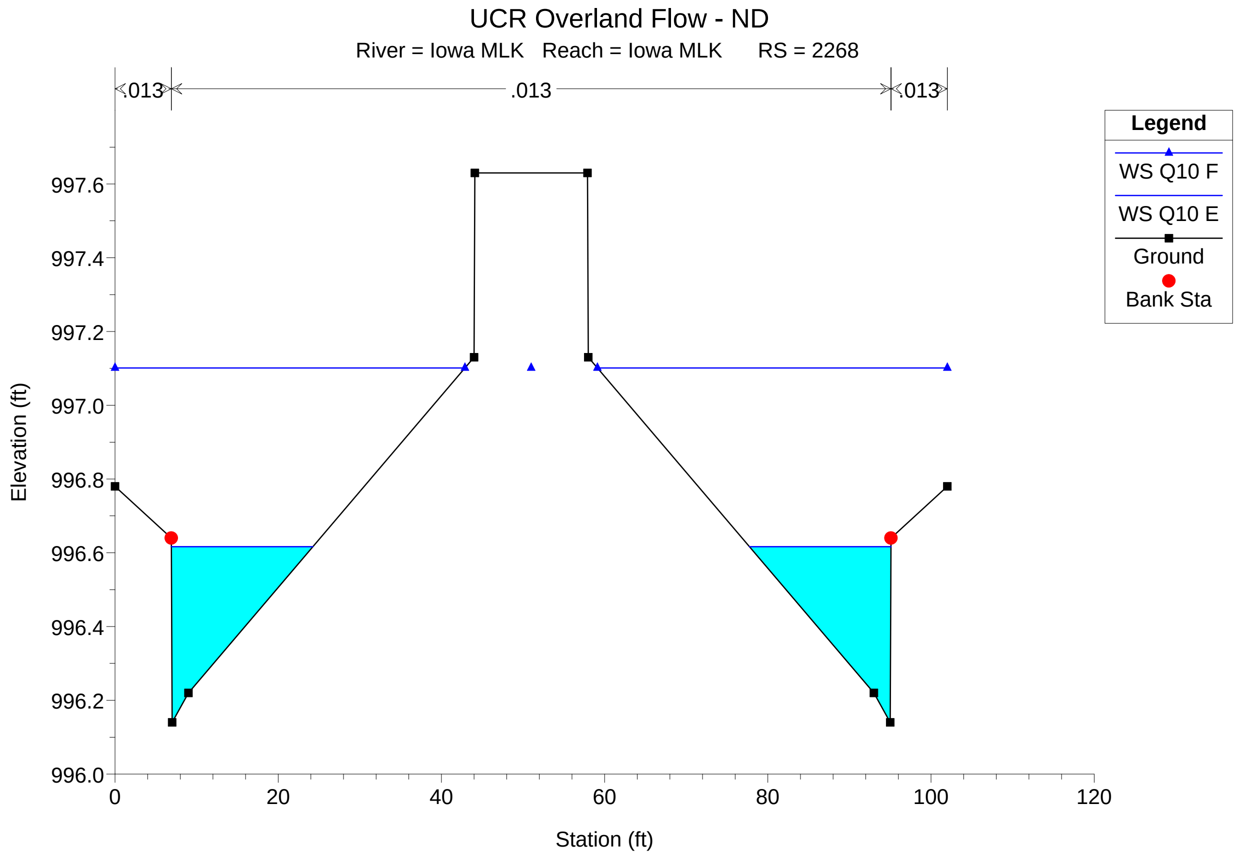
997.2
997.0
996.8
996.6
996.4
996.2
0
20
40
60
80
Station (ft)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.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
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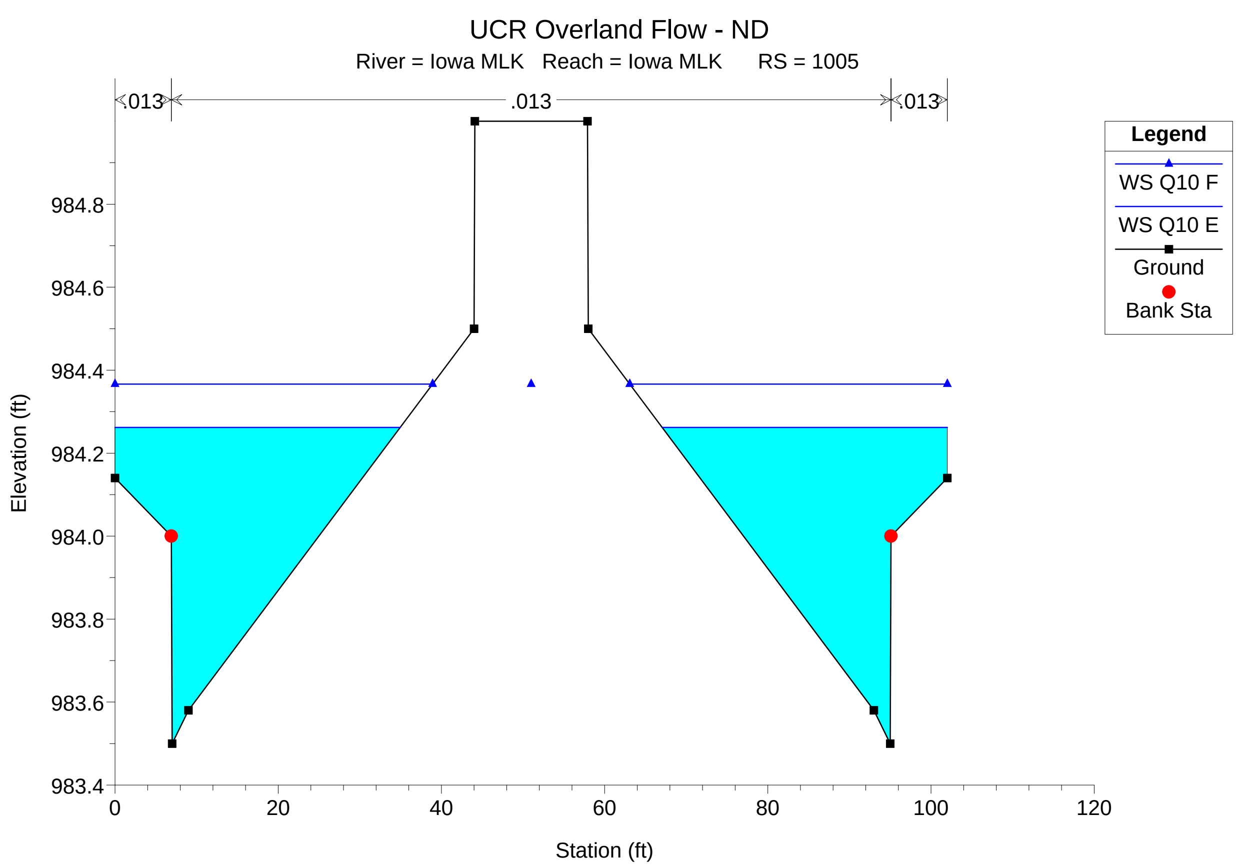
997.4
997.2
997.0
996.8
996.6
996.4
996.2
996.0
0
20
40
60
80
100
120
Station (ft)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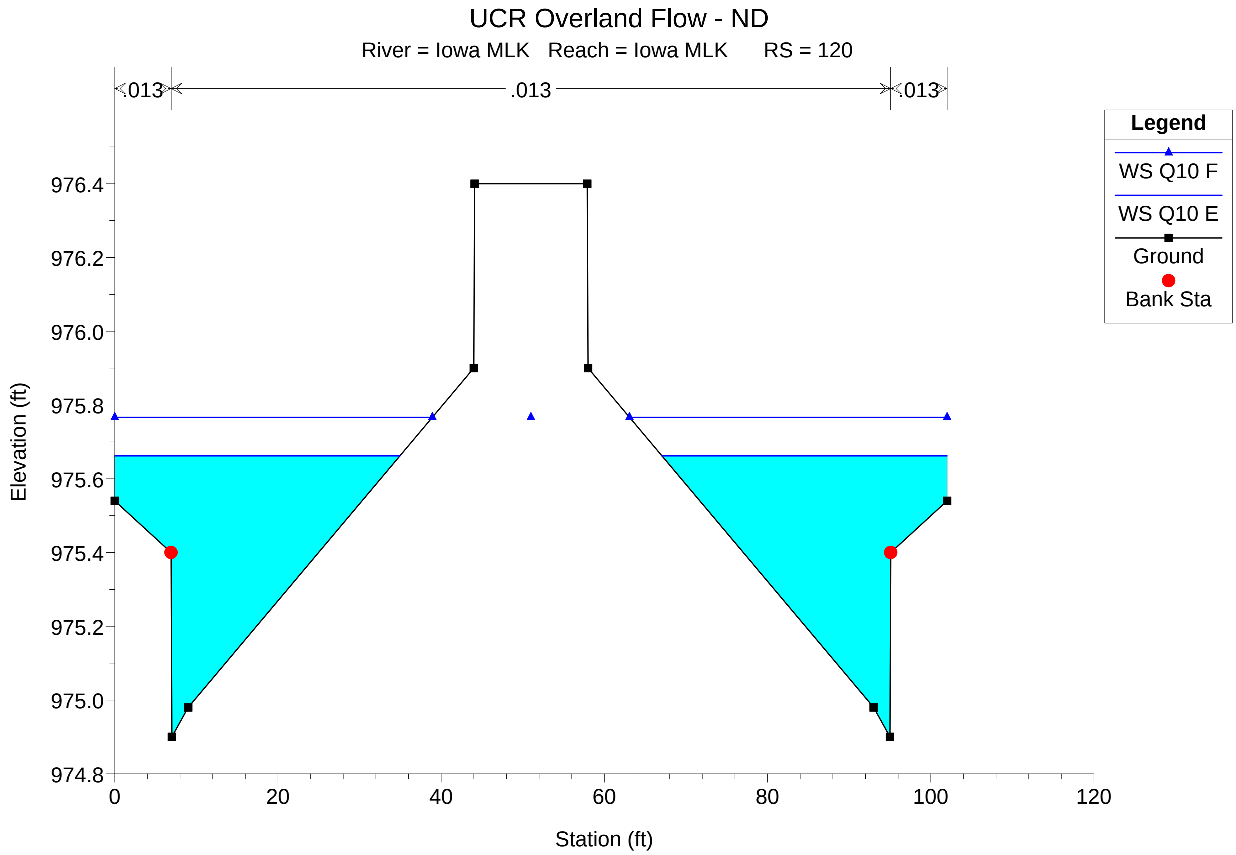
River = Iowa MLK Reach = Iowa MLK RS = 1005
.013
.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
984.8
984.6
984.4
984.2
984.0
983.8
983.6
983.4
0
20
40
60
80
100
120
Station (ft)


UCR Overland Flow - ND
River = Iowa MLK   Reach = Iowa MLK   RS = 120
.013
.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
976.4
976.2
976.0
975.8
975.6
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975.0
974.8
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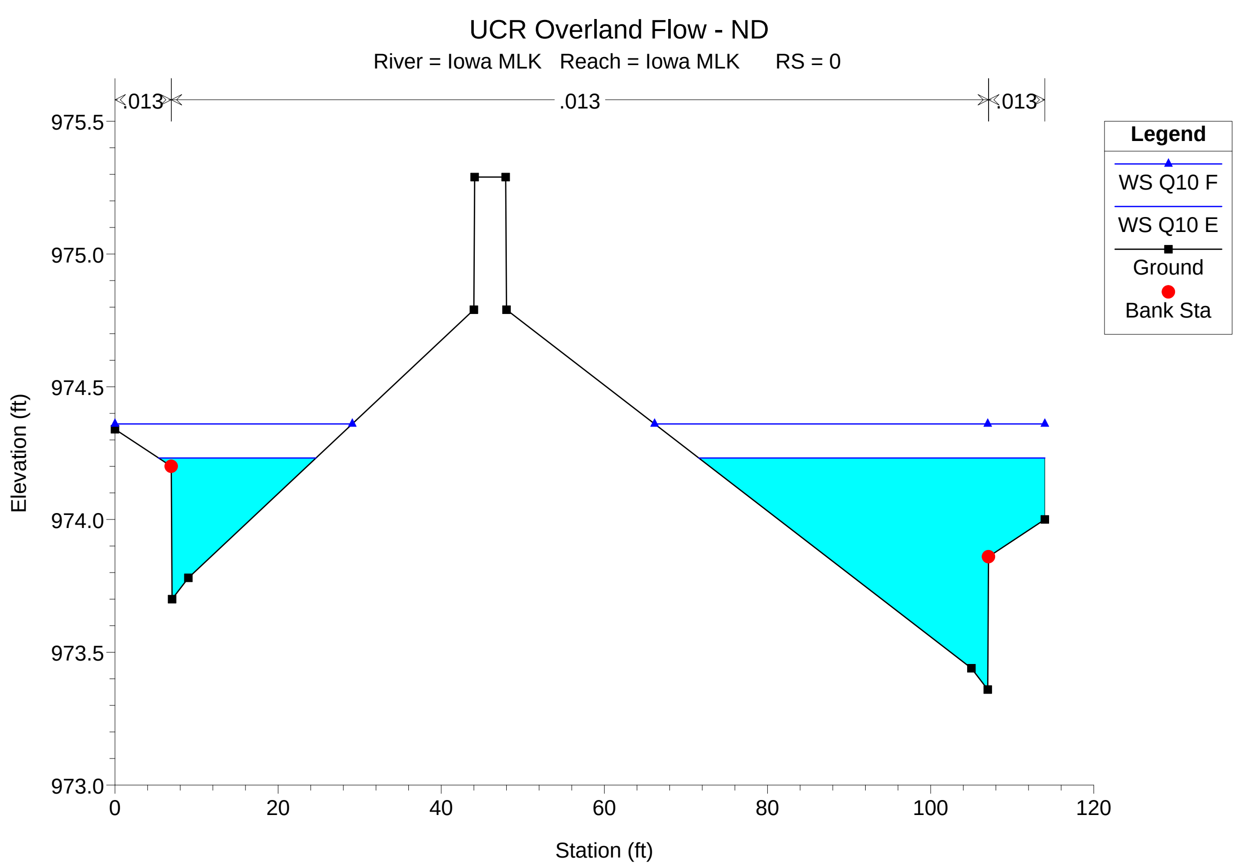
20
40
60
80
100
120
Station (ft)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River = Iowa MLK   Reach = Iowa MLK   RS = 0
.013
.013
.013
Legend
WS Q10 F
WS Q10 E
Ground
Bank Sta
Elevation (ft)
975.5
975.0
974.5
974.0
973.5
973.0
0
20
40
60
80
100
120
Station (ft)

APPENDIX B.2

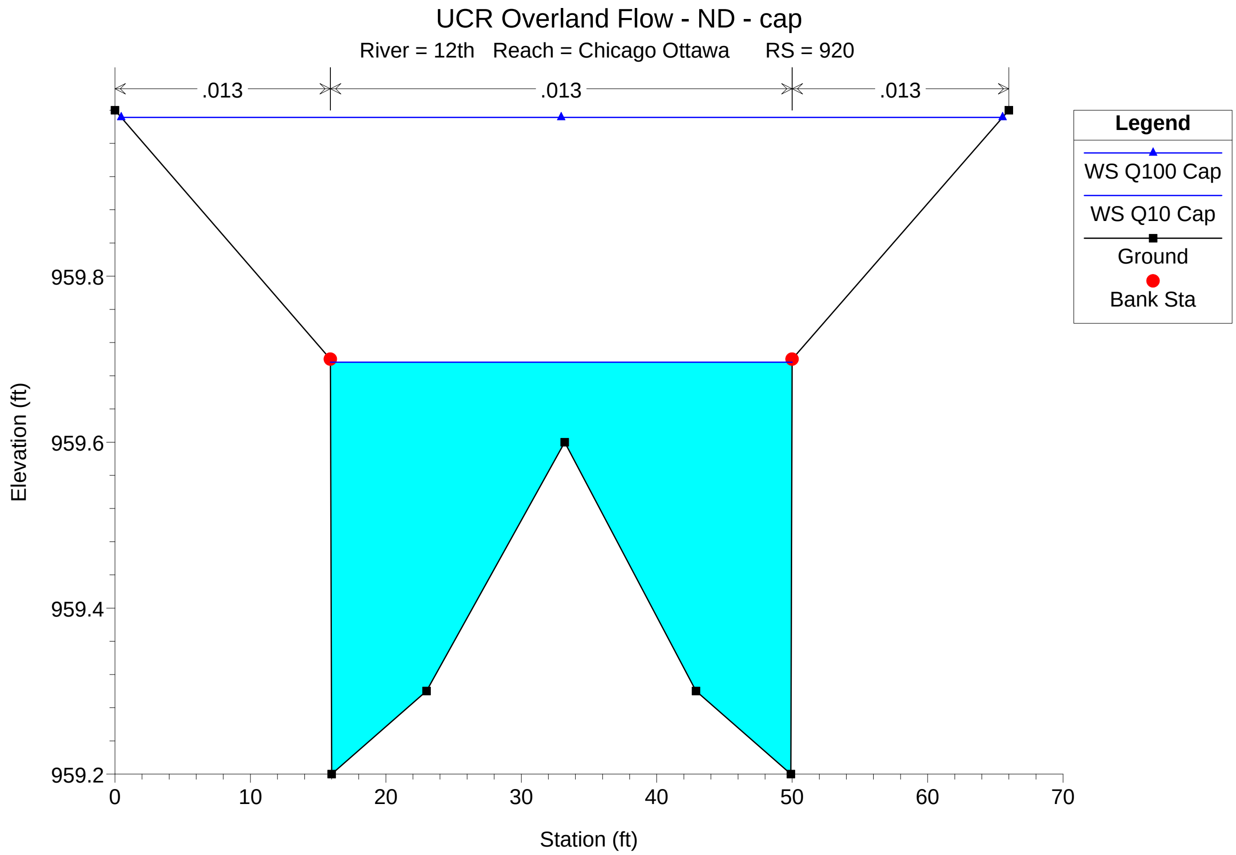
HEC-RAS Overland Flow Model Output

Overland Flow Capacity Analysis

Table B-2 Overland Flow Capacity Analysis Output

HEC-RAS Plan: UCR Overland

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Iowa MLK	Iowa MLK	11895	Q10 Cap	8.00	1000.00	1000.48	1000.41	1000.53	0.002123	1.74	4.61	23.55	0.69
Iowa MLK	Iowa MLK	11895	Q100 Cap	16.00	1000.00	1000.60		1000.66	0.002048	1.90	8.76	46.61	0.70
Iowa MLK	Iowa MLK	10000	Q10 Cap	8.00	996.20	996.69		996.73	0.001882	1.64	4.86	24.64	0.65
Iowa MLK	Iowa MLK	10000	Q100 Cap	16.00	996.20	996.81		996.86	0.001971	1.87	8.90	47.02	0.69
Iowa MLK	Iowa MLK	2268	Q10 Cap	21.00	996.14	996.61	996.61	996.73	0.004289	2.72	7.72	34.42	1.01
Iowa MLK	Iowa MLK	2268	Q100 Cap	35.00	996.14	996.72	996.72	996.85	0.003692	2.92	12.21	50.74	0.98
Iowa MLK	Iowa MLK	1005	Q10 Cap	24.00	983.50	984.00	984.00	984.12	0.004169	2.79	8.60	36.16	1.01
Iowa MLK	Iowa MLK	1005	Q100 Cap	43.00	983.50	984.14	984.14	984.27	0.003264	2.93	15.24	60.21	0.93
Iowa MLK	Iowa MLK	120	Q10 Cap	24.00	974.90	975.40	975.40	975.52	0.004167	2.79	8.60	36.16	1.01
Iowa MLK	Iowa MLK	120	Q100 Cap	43.00	974.90	975.54	975.54	975.67	0.003264	2.93	15.24	60.21	0.93
Iowa MLK	Iowa MLK	0	Q10 Cap	24.00	973.36	973.98	973.98	974.10	0.003792	2.77	8.88	39.77	0.97
Iowa MLK	Iowa MLK	0	Q100 Cap	43.00	973.36	974.10	974.10	974.24	0.003716	3.11	14.19	49.83	1.00
Cranford	N End MLK	2180	Q10 Cap	20.00	982.60	983.10	983.01	983.15	0.001362	1.85	10.79	36.20	0.60
Cranford	N End MLK	2180	Q100 Cap	125.00	982.60	983.60	983.52	983.78	0.001355	3.58	41.30	84.00	0.70
Cranford	N End MLK	0	Q10 Cap	20.00	979.60	980.10	980.01	980.15	0.001401	1.87	10.70	36.20	0.61
Cranford	N End MLK	0	Q100 Cap	125.00	979.60	980.60	980.52	980.78	0.001400	3.63	40.81	83.89	0.72
12th	Chicago Ottawa	920	Q10 Cap	37.00	959.20	959.70	959.70	959.87	0.003807	3.30	11.20	34.10	1.02
12th	Chicago Ottawa	920	Q100 Cap	89.00	959.20	959.99	959.99	960.21	0.002222	3.87	25.77	65.08	0.86
12th	Chicago Ottawa	0	Q10 Cap	37.00	947.00	947.50	947.50	947.67	0.003798	3.30	11.21	34.10	1.01
12th	Chicago Ottawa	0	Q100 Cap	89.00	947.00	947.79	947.79	948.01	0.002222	3.87	25.78	65.08	0.86


UCR Overland Flow - ND - cap
River = 12th Reach = Chicago Ottawa RS = 920
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
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959.6
959.4
959.2
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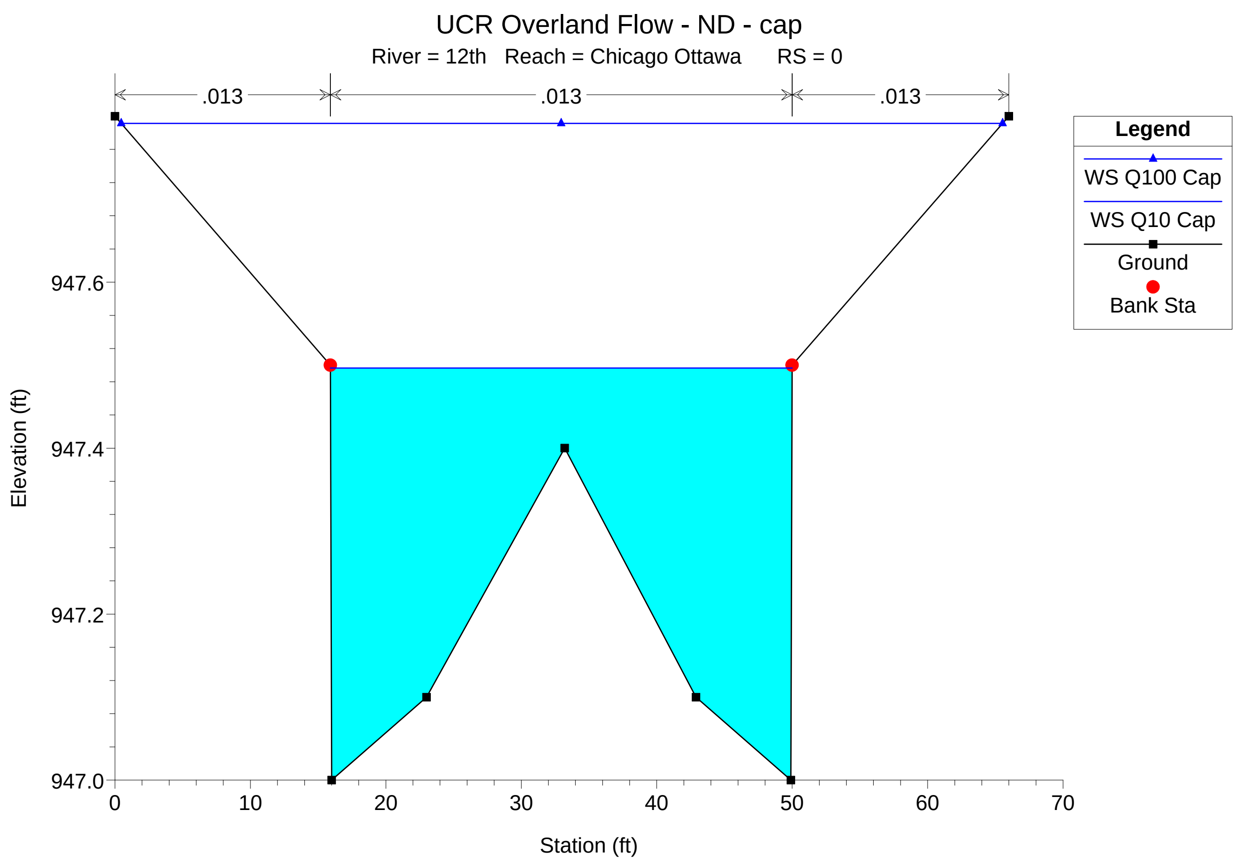
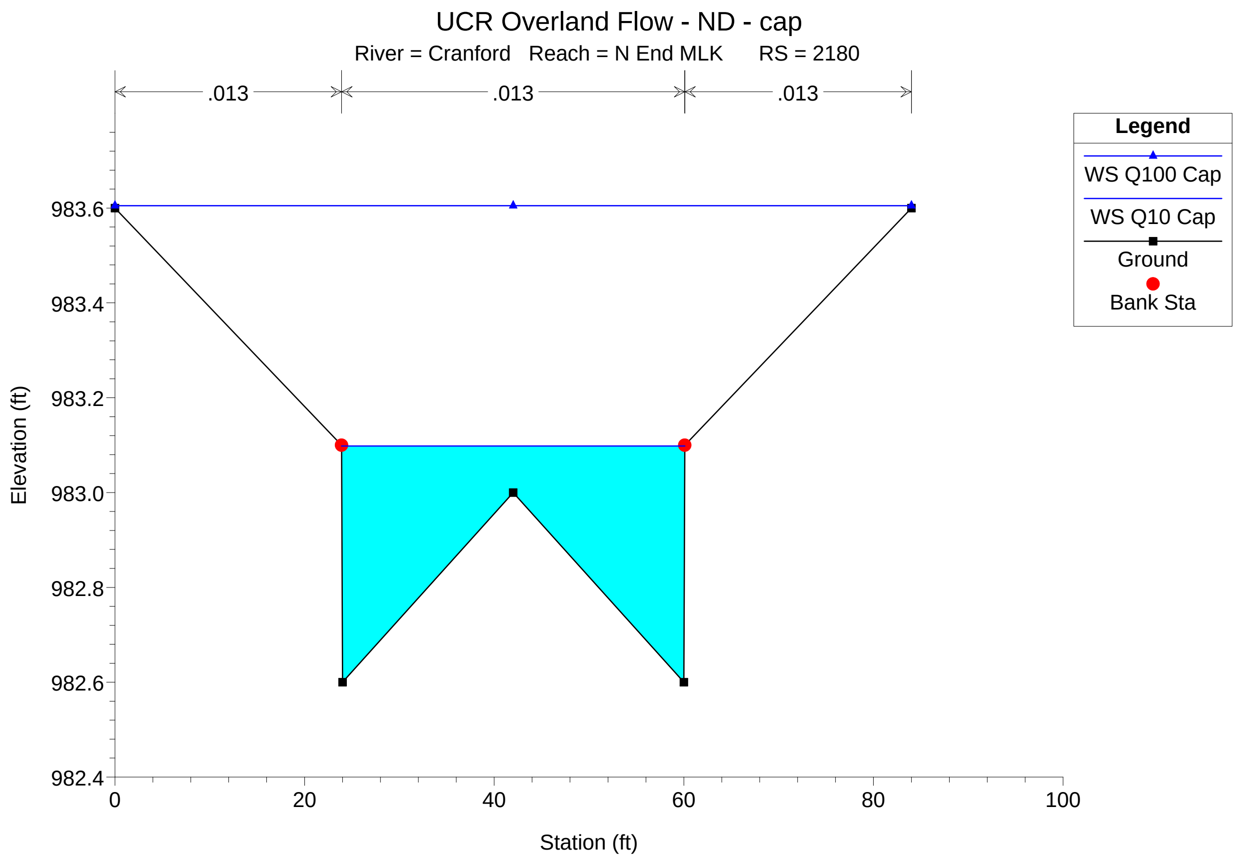
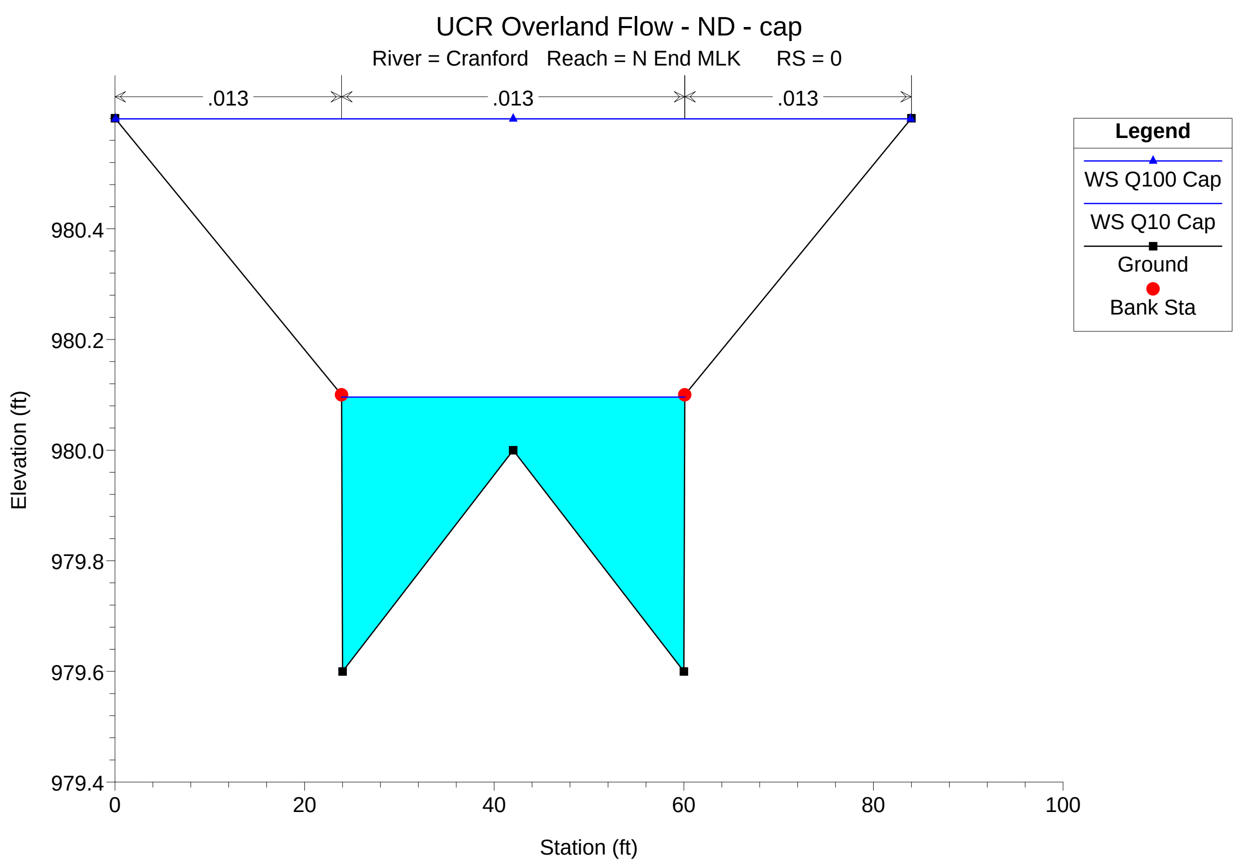
50
60
70
Station (ft)


UCR Overland Flow - ND - cap
River = 12th Reach = Chicago Ottawa RS = 0
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
947.6
947.4
947.2
947.0
0
10
20
30
40
50
60
70
Station (ft)


UCR Overland Flow - ND - cap
River = Cranford Reach = N End MLK RS = 2180
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
983.6
983.4
983.2
983.0
982.8
982.6
982.4
0
20
40
60
80
100
Station (ft)


UCR Overland Flow - ND - cap
River = Cranford Reach = N End MLK RS = 0
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
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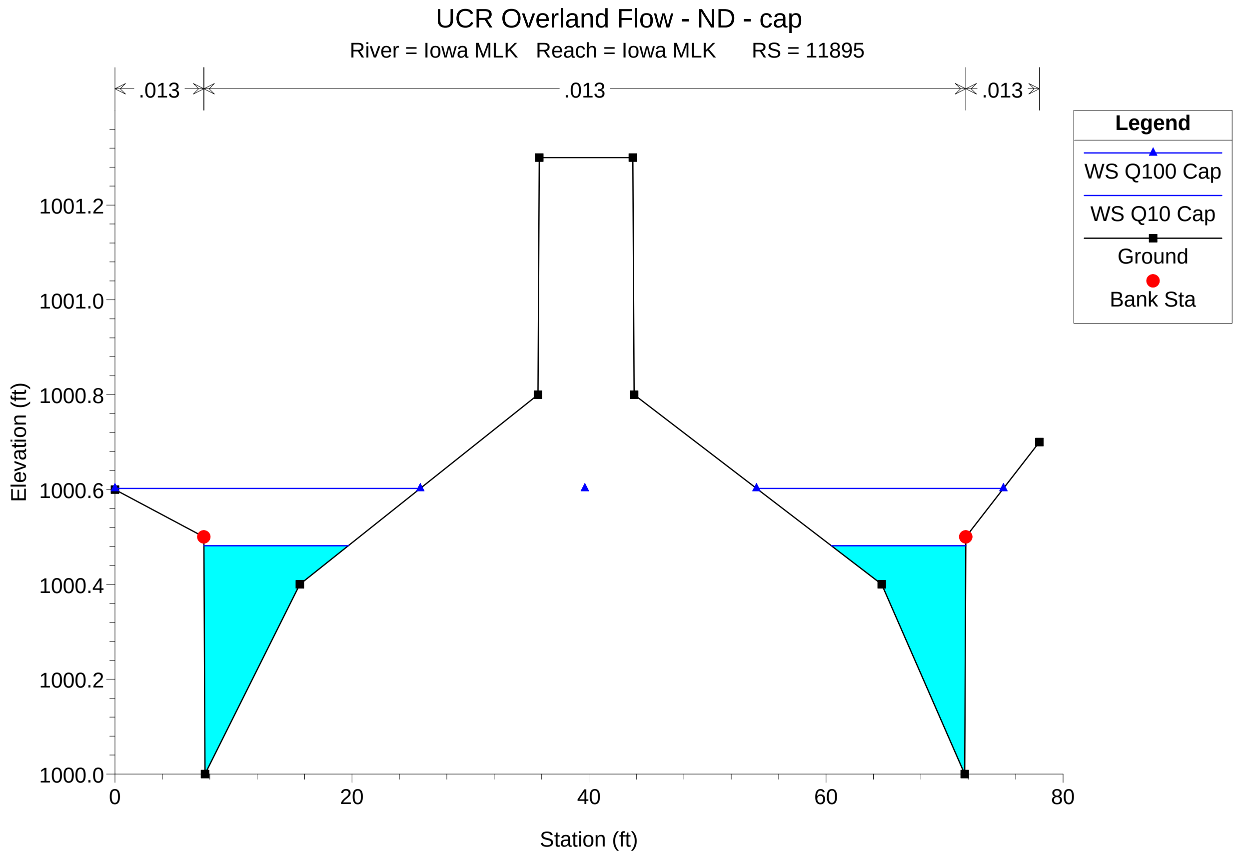
980.2
980.0
979.8
979.6
979.4
0
20
40
60
80
100
Station (ft)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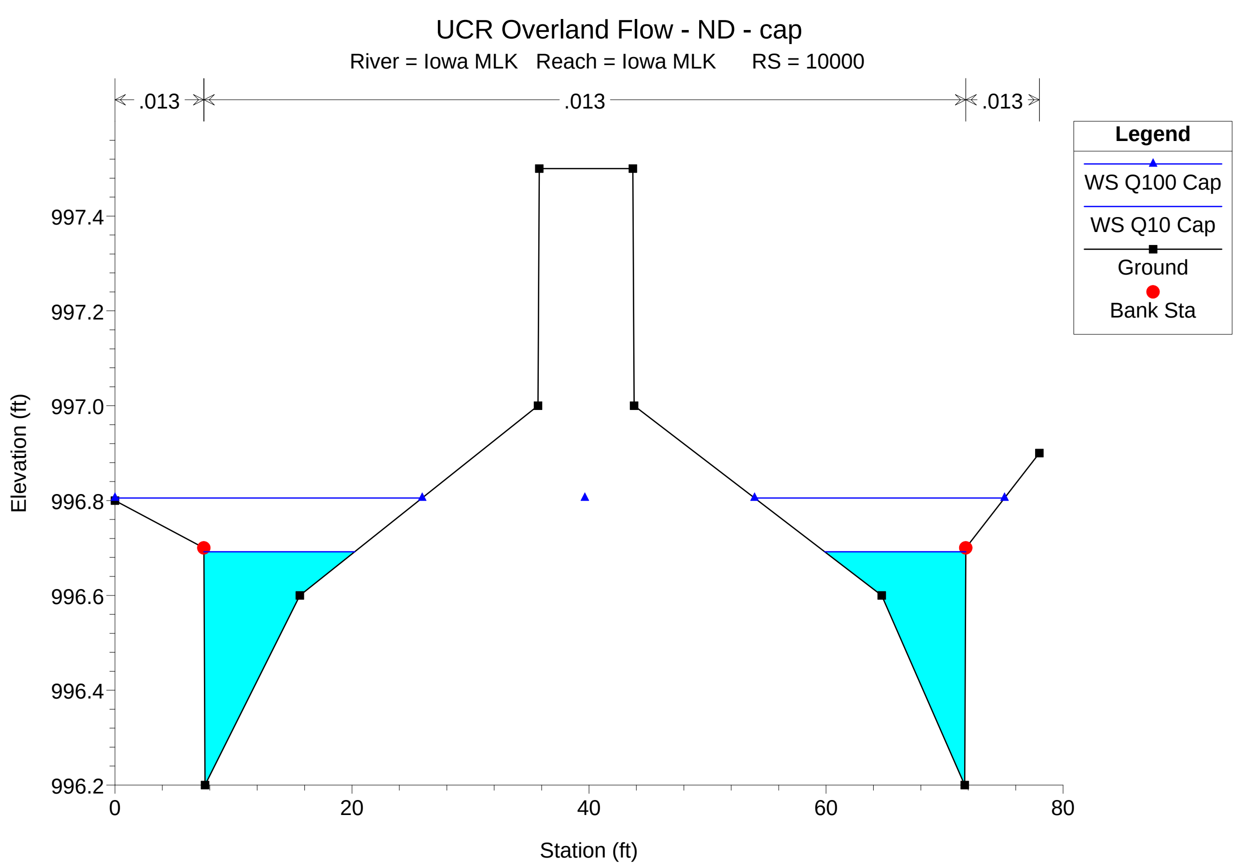
River = Iowa MLK Reach = Iowa MLK RS = 11895
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
1001.2
1001.0
1000.8
1000.6
1000.4
1000.2
1000.0
0
20
40
60
80
Station (ft)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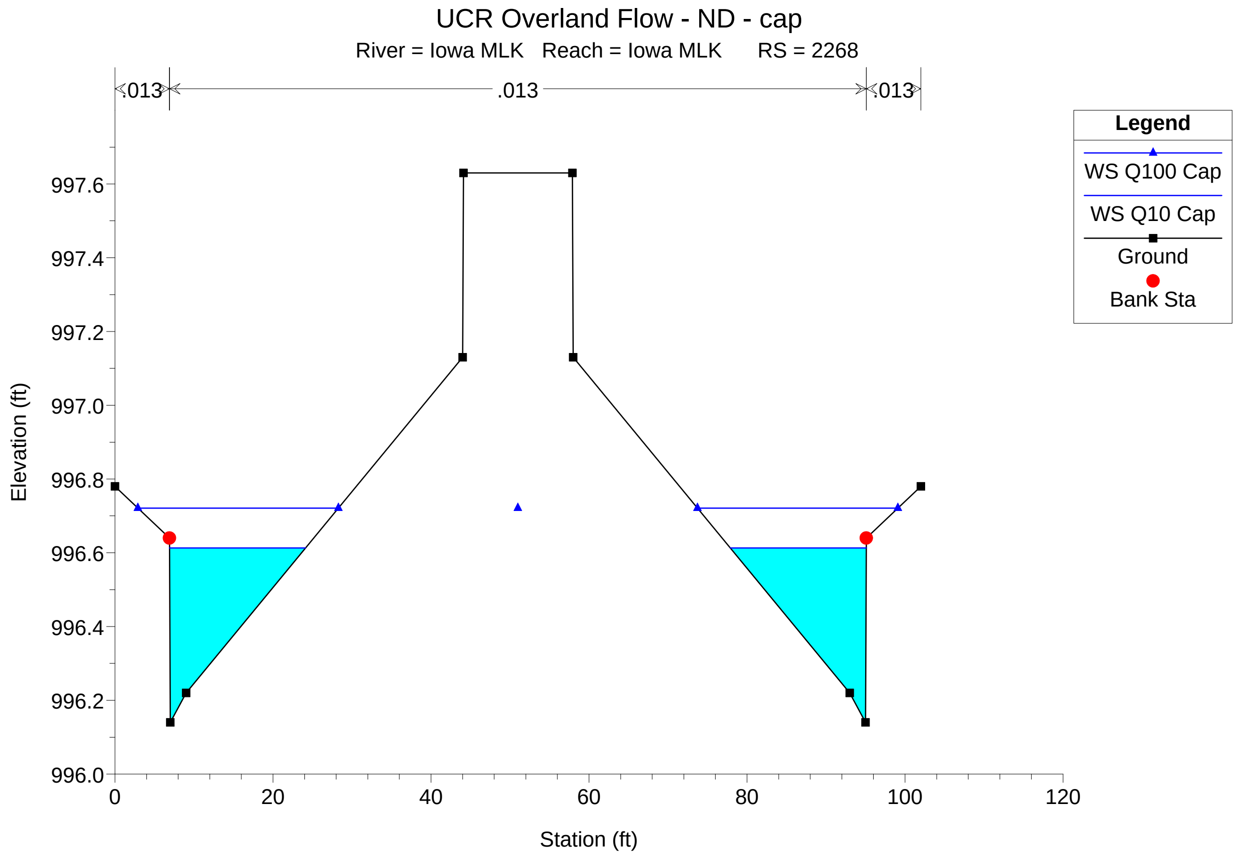
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
997.4
997.2
997.0
996.8
996.6
996.4
996.2
0
20
40
60
80
Station (ft)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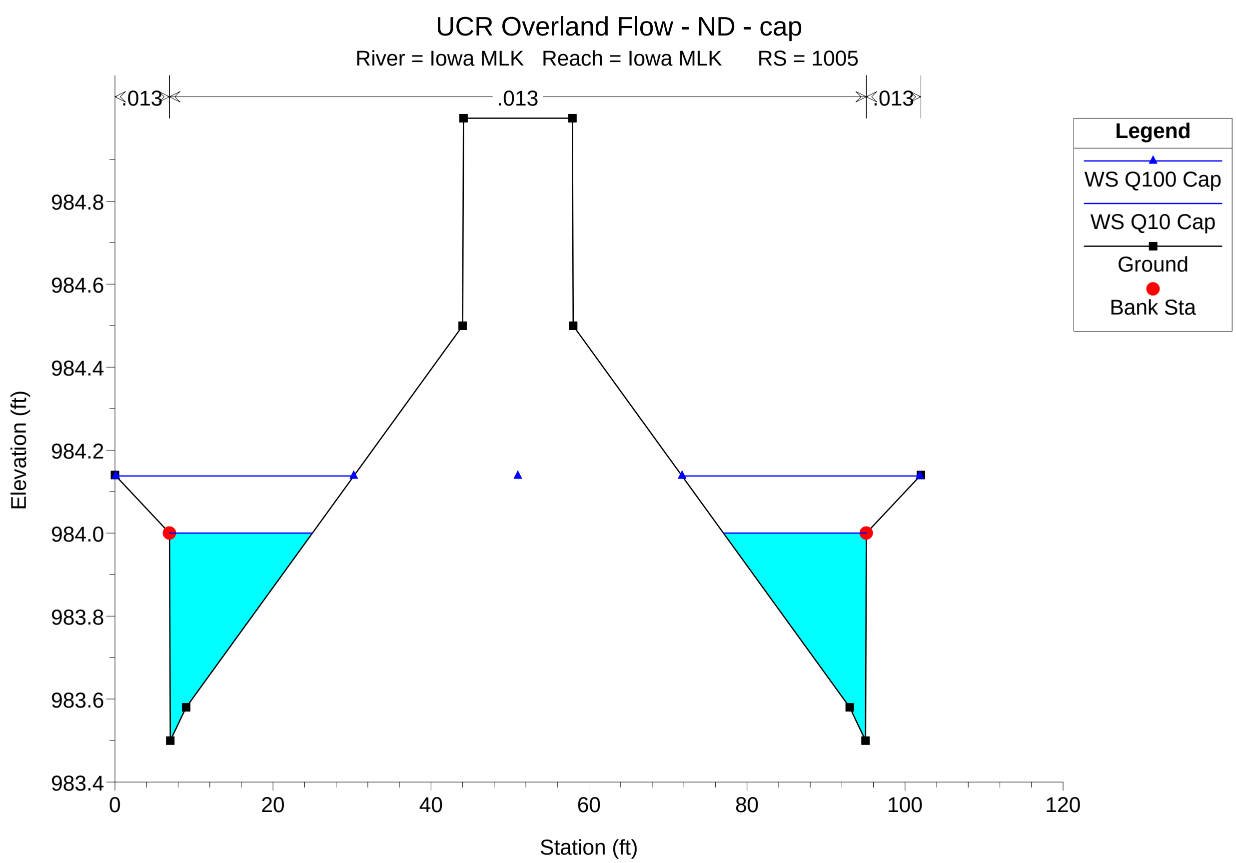
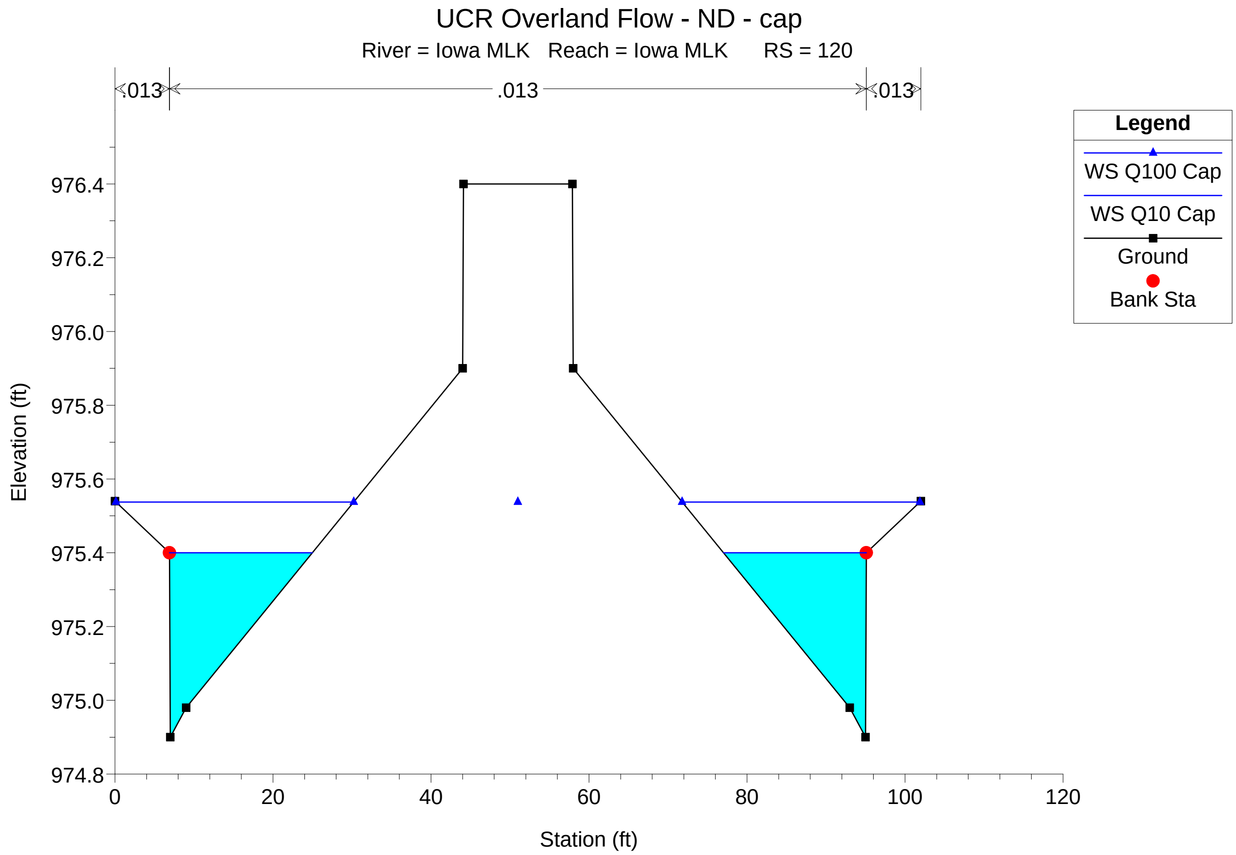
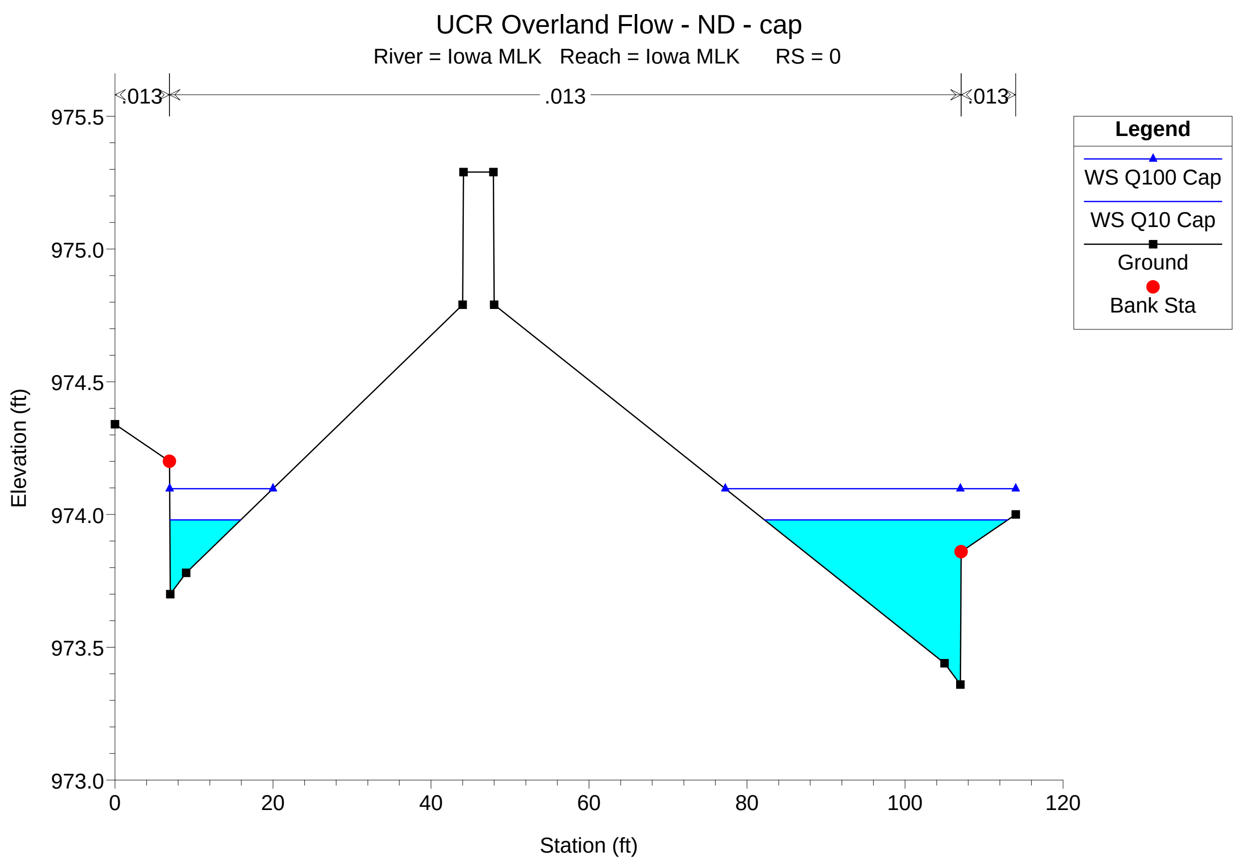
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
997.6
997.4
997.2
997.0
996.8
996.6
996.4
996.2
996.0
0
20
40
60
80
100
120
Station (ft)


UCR Overland Flow - ND - cap
River = Iowa MLK Reach = Iowa MLK RS = 1005
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
984.8
984.6
984.4
984.2
984.0
983.8
983.6
983.4
0
20
40
60
80
100
120
Station (ft)


UCR Overland Flow - ND - cap
River = Iowa MLK Reach = Iowa MLK RS = 120
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
976.4
976.2
976.0
975.8
975.6
975.4
975.2
975.0
974.8
0
20
40
60
80
100
120
Station (ft)


UCR Overland Flow - ND - cap
River = Iowa MLK Reach = Iowa MLK RS = 0
.013
.013
.013
Legend
WS Q100 Cap
WS Q10 Cap
Ground
Bank Sta
Elevation (ft)
975.5
975.0
974.5
974.0
973.5
973.0
0
20
40
60
80
100
120
Station (ft)

APPENDIX C

Communication Records with Riverside County Flood Control and Water Conservation District

Anthony La Marca

From: Duckworth, Everett [EDuckworth@rcflood.org]
Sent: Wednesday, June 24, 2009 9:26 AM
To: Raymond Wong; Delgadillo, Don
Cc: jon.harvey@ucr.edu; Peter Young; Anthony La Marca
Subject: RE: UC Riverside West Campus Development SD Analysis TM

Attachments: Plan_Check_Deposit_Based_Fee_Worksheet.pdf

Plan_Check_Deposit_Based_Fee_W...

Raymond,

Thank you for allowing us to participate in this project. Please fill out the attached application with the applicable fees, to be sent in with two copies of applicable documents associated with your project.

The District does not normally recommend conditions for land divisions or other land use cases within the City of Riverside. District comments/recommendations for such cases are normally limited to items of specific interest to the District including District Master Drainage Plan (MDP) facilities, other regional flood control and drainage facilities which could be considered a logical component or extension of a master drainage plan system, and District Area Drainage Plan fees.

Note that a letter from the controlling Agency, is recommended, specifying the District's participation of the project and request for maintenance and ownership of the proposed drainage facilities.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, June 23, 2009 2:28 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: jon.harvey@ucr.edu; Peter Young; Anthony La Marca
Subject: UC Riverside West Campus Development SD Analysis TM

Hello Everett and Don,

The attached PDF file contains the working draft TM for the UC Riverside West Campus Development storm drain analysis. The analysis is based on our previous discussions to evaluate the impact of the West Campus development to the storm drain system. We are looking forward to the District's review and comments.

We would like to have a conference call with the District to discuss the analysis findings, as well as to answer any initial questions the District may have. Due to project schedule constraints, we would appreciate if we can schedule a call this week to discuss the analysis.
Alternatively, if the District prefers, we maybe able to have a meeting at the District's office. Please let us know your preference.

Please let us know if you have any questions. Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC

Hydraulic Engineer
Winzler & Kelly
1735 North First Street, Suite 301
San Jose, CA, 95112
P 408.451.9615
F 408.451.9665
C 650.867.3304
raymondwong@w-and-k.com

Peter Young

From: Raymond Wong
Sent: Thursday, April 30, 2009 2:35 PM
To: Duckworth, Everett
Cc: jon.harvey@ucr.edu; Delgadillo, Don; Peter Young; Anthony La Marca
Subject: RE: Conference Call Notes

Thank you Everett. Yes, we have the same understanding on the design criteria and analysis method.

We will develop an 1 hour duration SUH and adjust the n value in the Lag time calculation to match the SUH peak flow to the MDP flow.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Thursday, April 30, 2009 11:34 AM
To: Raymond Wong
Cc: jon.harvey@ucr.edu; Delgadillo, Don
Subject: FW: Conference Call Notes

Yes,

I believe that we have the same understanding. I will clarify a little so that future plan checker's will have the same understanding:

1. (a) Use the hydrology Manual but vary the "n" value so that the SUH results are similar to the rational tabling, since you will use this value to compare to flow rates also generated by rational tabling.(b) If you use the "CivilD" software, the 1 hour SUH distribution is included already. Other softwares will need to have the attached 1-hour distribution added, since the 1 hour is not in our manual, yet.

2. Yes, the only SUH that needs to be provided is for the onsite flows in your use in determining volume and sizing of onsite basins.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Wednesday, April 29, 2009 3:07 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young; jon.harvey@ucr.edu
Subject: RE: Conference Call Notes

Hello Everett,

Thank you for the comments. We have two questions regarding the comments and would appreciate your input.

1 - Regarding the comment on Step 1 in the Summary of the Analysis Methodology, does the County require the Synthetic Unit Hydrograph method to follow:
(a) The County Hydrology Manual, or
(b) Create a hydrograph that the peak 10-year flow matches the peak flow from the MDP?

Note that if we use (a) the peak flow will likely lower than the peak flow estimated in the MDP (b).

2 - We would like to clarify that we estimate the design flow (10- and 100- year storms) in Synthetic Unit Hydrograph method only for the West Campus area in the

proposed future conditions. For the existing base case condition within West Campus area, and offsite area for both existing and future conditions, we will use Rational Methods. Is it acceptable to the County?

We are looking forward to your input, so we can complete the storm drain analysis for the School of Medicine development in West Campus. Thank you for your assistance.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Wednesday, April 29, 2009 9:27 AM
To: Raymond Wong; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Here are our comments--I have most of them in red for your use.

Thanks,

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 28, 2009 10:40 AM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Thank you Everett, we are looking forward to the comments.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Tuesday, April 28, 2009 7:10 AM
To: Raymond Wong; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

I should have our comments to you by the end of today. Don and I are in a seminar, yesterday and today.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Wednesday, April 22, 2009 2:21 PM
To: Delgadillo, Don; Duckworth, Everett
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Thank you for the update Don. We are looking forward to your feedback.

Thanks,
Raymond

-----Original Message-----

From: Delgadillo, Don [mailto:DDELGADI@rcflood.org]
Sent: Wednesday, April 22, 2009 10:53 AM
To: Raymond Wong; Duckworth, Everett
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Raymond,

We are preparing a reply to your notes. It may be sent this afternoon.

Regards,

Don Delgadillo, P.E.
Engineering Project Manager
RCFC&WCD
951.955.4683

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 21, 2009 5:27 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: Conference Call Notes

Hello Everett and Don,

Thank you again for your time on Friday to discuss about the District's storm drain design criteria. The attached contains the conference call notes and a summary of our analysis procedures. We would appreciate if you can please review and comment on the summary, and to confirm the analysis procedures. Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC
Hydraulic Engineer
Winzler & Kelly
1735 North First Street, Suite 301
San Jose, CA, 95112
P 408.451.9615
F 408.451.9665
raymondwong@w-and-k.com

University of California Riverside– School of Medicine

CONFERENCE CALL NOTE

For

RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT STORM DRAIN DESIGN CRITERIA

Call Date: April 17, 2009
Call Time: 1:30pm to 2:40pm

Call Attendees:
Everett Duckworth (Riverside County Flood Control & Water Conservation District)
Don Delgadillo (Riverside County Flood Control & Water Conservation District)
Peter Young (Winzler & Kelly)
Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)

Purpose: **To clarify the design method and requirements for storm drain.**

W&K's Understanding:

- The 1973 Master Drainage Plan and the County pipeline system design are based on a 10-year storm design criteria. The Master Drainage Plan indicated that the balance of flow above the 10-year design flow will become street overland flow.
- Current County design standards **for flood protection criteria states that the 10-year flood shall be contained within the top of curbs, and the 100-year flood shall be contained within street Right of Way limits. Initiate a storm drain when either condition is exceeded. Special conditions or other authorities may require stricter controls; ie: for reasons of traffic (one dry lane) or pedestrian safety, lower maximum depths of flow in streets may be required.** The City should be consulted regarding these stricter controls. However, the County did not prepare a 100-year storm analysis **and Line E was designed for the 10-year flood ONLY**.
- The County wants to ensure the 10-year flow will not overwhelm the **Line E** pipeline system. All **10-year** flow in excess of the pipeline system design capacity must be **detained onsite**.
- The County assumes the detention basin at Kansas is at capacity in a 10-year event**, but does not know MLK street capacity.**
- The County believes that MLK has capacity to convey the slight increase in runoff from the future West Campus development to MLK. The County **is** not aware of any flooding issues nor flooding records at MLK.
- The County would like to maintain at least one lane in each direction open for traffic on MLK during a 100-year storm. The open lane should have no ponding water, but the City of Riverside should be consulted.
- When the District's Master Drainage Plan was prepared in 1973, the University didn't have a campus plan in the proposed West Campus area. The development

type is listed in the Master Drainage Plan. “SF” means single family housing, etc. However, the runoff coefficients used in the hydrology analysis are around 0.7, which is typically for some level of development such as low density commercial or medium density residential developments.

W&K Comments:
In addition to MLK, we think the overland flow from the proposed School of Medicine development on the western end of the West Campus will route to 12th and Chicago. In addition, as part of the proposed West Campus development, the City will expand Iowa Avenue, and will install a new storm drain pipeline along Iowa Avenue. The new storm drain pipeline will connect to Line E at Iowa and MLK. We will verify the capacity of the existing storm drain pipeline along MLK between Iowa and Cranford, because the proposed Iowa pipeline redirects flow from the east of Iowa to MLK, which the flow currently route to Line F along Cranford.

SUMMARY OF THE ANALYSIS METHODOLOGY:

10-Year Storm:

1. Estimate the 10-year runoff from the proposed West Campus development. In order to estimate potential onsite detention volume, the analysis will be based on the Synthetic Unit Hydrograph Method as defined in Section E of the District’s Hydrology Manual. Note that the 1973 County Master Drainage Plan used Rational Method for hydrology analysis. Rational Method can only estimate the peak flow rate, not detention storage volume. **However, based on the MDP Rational Method peak flows, Winzler & Kelly can generate a Synthetic Unit Hydrograph that duplicates Rational Method peak flows.**
2. Compare the estimated 10-year peak runoff with the hydrology analysis results from the Master Drainage Plan **peak flow and the generated synthetic unit hydrolgraph.**
   .
3. If the estimated 10-year runoff **is** larger than the estimate from the Master Drainage Plan, provide a pipe inlet restriction to the County pipeline system, and/or provide on-site detention to detain the excess peak flow from a 10-year storm.
4. Check the City and County record drawings to obtain the design flow for Lines C (on 12th between Chicago and Ottawa), E (on MLK between Iowa and Chicago), and F (on Cranford between Everton and MLK). If the pipeline capacity is not shown in the record drawings, we will prepare a normal depth calculation using Manning’s equation to estimate the pipeline full capacity. The District has back up hydraulics for District pipes in this area.
5. Verify the aforementioned pipeline design flow is higher than a combination of:
   - Any tributary runoff outside of West Campus as per the Master Drainage Plan, plus,
   - The estimated 10-year runoff from the proposed West Campus development that would discharge to the pipeline system.
6. Check the hydraulic capacity of Line E along MLK, between Cranford and Iowa, for the future condition with a new storm drain pipeline along Iowa. Size on-site

detention if needed to ensure the 10-year flow in the pipeline does not exceed the pipe design capacity.

100-Year Storm:

7. Estimate the base case 100-year peak flow. The base case is based on the District's Master Drainage Plan. Rational Method will be used, with the runoff coefficient from the Master Drainage Plan. The 100-year flow estimate will include both West Campus and upstream tributaries. **However, based on the MDP Rational Method peak flows, Winzler & Kelly can generate a Synthetic Unit Hydrograph that duplicates Rational Method peak flows.**.
8. Similar to 10-year storm analysis (Step 1), estimate the 100-year runoff from the proposed West Campus development using the Synthetic Unit Hydrograph Method as defined in Section E of the District's Hydrology Manual. Peak flow from the upstream tributary will be based on the **[SUH]** calculation in Step 7.
9. Subtract the pipeline capacities from the 100 year peak flows and route the flow through the 10 year flow attenuation basin as estimated in Step 3,. The result becomes the "100-year minus 10-year" flow for street overland flow.
10. Prepare simple street overland flow analysis on MLK (between Chicago and Iowa), 12th (between Chicago and Ottawa), Cranford (between Everton and MLK), and Iowa (between Everton and MLK) using HEC-RAS modeling software. The street cross sections will be obtained from the City and County record drawings, and the concept plan for the proposed Iowa Avenue widening. For the purpose of the hydraulic analysis, the beginning water surface elevation for the downstream boundary conditions will be set at the top of curb. For each street section, a hydraulic analysis will be prepared for the base case condition and the proposed West Campus builtout condition.
11. If the hydraulic analysis shows that the proposed West Campus development will significantly increase the street flooding, we will provide on-site 100-year detention to reduce the peak street overland flow.
12. It should be noted that these comments are based on plans and data submitted, which may be lacking required information, are incorrect/incomplete or otherwise deficient in places. Additional comments can be expected from the District after plans have been resubmitted and further review has taken place.

Peter Young

From: Duckworth, Everett [EDuckworth@rcflood.org]
Sent: Thursday, April 16, 2009 11:22 AM
To: Raymond Wong
Cc: Delgadillo, Don; Anthony La Marca; Peter Young
Subject: RE: UCR expansion Box Springs

Raymond, to answer your questions:

No,

We have not verified a 100-year conveyance of the pipe and the street.

The District is not planning any future facilities due to deficiencies at this time. Your study showing the 100 year flows within the pipe and the street may show deficiencies in the pipe and/or street conveyance.
If this is the case, we will require that your storm drain be restricted to only allow enough flow that can be adequately conveyed by the District pipe(s). The remaining flows that may be in excess of the street capacity will continue to operate in the same condition as it does today.

This 100 year study and criteria is important to ensure that the downstream facilities are not negatively affected. Due to other regional 100 year facilities, the District does not recognize increased runoff of 100 year flows, associated with development. Therefore, 100 year detention basins are not appropriate here. However, the use of low impact development and water quality basins are encouraged.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 14, 2009 12:19 PM
To: Duckworth, Everett
Cc: Delgadillo, Don; Anthony La Marca; Peter Young
Subject: RE: UCR expansion Box Springs

Hello Everett,

Thank you for the clarification.

Since the 100-year criteria is adopted after the old MDP, did the District verify if the system (pipe plus street overland flow) can at least provide 100-year protection under the existing condition?

If the District does not allow UCR to provide detention basin for a 100-year event, and if the 100-year event from the future development does overload the District's system (pipe plus street overland flow), then possible options may include improve the District's drainage system, or the District provides 100-year detention basins?

Regardless, it is our intention to provide the development with various Low Impact Development features, so we can provide an environmental sustainable campus and along the way minimize additional runoff impact from the development site.

Thank you Everett for your assistance.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]

Sent: Tuesday, April 14, 2009 11:36 AM
To: Raymond Wong
Cc: Delgadillo, Don
Subject: FW: UCR expansion Box Springs

Raymond,

In regards to your questions:

1. District has new 100-year criteria since the old MDP was adopted.
2. District does not allow private entities, or schools, to maintain 100-year route-down basins. We are not talking increased runoff criteria here as the County of Riverside only mitigates the 2, 5 and 10 year frequencies.
3. The criteria that was discussed previously is still required for the proposed improvements.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Friday, April 10, 2009 6:58 PM
To: Delgadillo, Don
Cc: Duckworth, Everett; Anthony La Marca
Subject: RE: UCR expansion Box Springs

Hello Don,

We have a question regarding the storm drain analysis for the UCR West Campus Development, and would appreciate your input.

Given the original hydrology analysis in the County's MDP considered the ultimate condition, the increased runoff due to the West Campus development should be already accounted for in the original hydrology analysis.

If the currently proposed future West Campus development concept generates higher runoff than the ultimate condition in the original hydrology analysis, we propose to provide on-site detention to detain any increased runoff from the existing condition (Orchard Fields), so the proposed builtout runoff leaving West Campus will be less than the ultimate condition in the original hydrology analysis. Since there is no flow increase, the County storm drain flow and street overland flow in the future will be about the same as the existing condition.

In this case, can we satisfy the County storm drain design criteria?

Since we need additional clarifications on the County's expectation on the storm drain analysis, we would like to setup a conference call so we can further discuss. We would like to better understand the County design criteria and how we can apply the criteria to this project, so our analysis can ensure the West Campus development will not adversely impact the County storm drain system.

Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC
Hydraulic Engineer
Winzler & Kelly
1735 North First Street, Suite 301
San Jose, CA, 95112
P 408.451.9615
F 408.451.9665
C 650.867.3304
raymondwong@w-and-k.com

MEETING MINUTES FOR THE CONFERENCE CALL WITH THE
RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
For
University of California – School of Medicine

Call Date: February 17, 2009
Call Time: 1:30pm to 2:00pm

- Winzler & Kelly to verify the existing system using the GIS system that is available on The Counties' website.
  - Using the GIS, W&K will determine the names of the as-builts that are available from the county.
  - W&K to contact the county Reduction Department to coordinate the transfer of as-built info in PDF format.
- The county has two storm drain master plans that are available on the web.
  - The Box Springs master plan is the one that will apply to UCR.
  - This master plan was prepared in 1970 and the zoning assumptions need to be verified.
- The GIS has the watershed boundaries used in the master plan. The boundary line does not cross Iowa Ave., whereas the WCIDS shows the proposed drainage continuing past Iowa Ave. to the west. Although the existing county SD pipes were sized for build out conditions, the existing pipe capacity needs to be verified. This is especially true if the proposed plan modifies the watershed boundaries from what is shown in the Box Springs master plan.
- Mr. Duckworth seemed to think that the rational method would be adequate for this project if the tributary area is small and detention is not needed, but he recommended we reference the County Hydrology Manual and get further guidance for other methods.
- The county requires that the 100yr storm event is contained within the public road R/W.
- W&K needs to verify that the ultimate downstream condition is controlled.
- The WCIDS figures show an 18'' county line in Chicago Ave. The county has no record of this line being there. This is likely a city owned and maintained line and was mislabeled in the WCIDS.
- The county will require that a Water Quality Management Plan be prepared on behalf of UCR to ensure that the stormwater entering their system meets the minimum standards.

Action Items:
- W&K to get all pertinent as-built info from the county
- W&K to obtain the backup hydrology calculations from the County
- Discuss the 18'' storm drain line in Chicago Ave with the City

Call Attendees:
Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)
Everett Duckworth (Riverside County Flood Control & Water Conservation District)

OPINION OF PROBABLE COST PHASE 1

U.C. RIVERSIDE COST STUDY

RIVERSIDE , CA

LSA JOB NUMBER:
09-029 R4

June 24, 2009

PREPARED FOR
WINZLER & KELLY
BY LELAND SAYLOR ASSOCIATES

595 Market Street, Suite 400 | San Francisco | California | 94105
415-291-3200 | 415-291-3201 (f) | www.lelandsaylor.com

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	BID DATE:	**UNKNOWN**
DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

1.0 PROJECT SYNOPSIS

1.1 TYPE OF STUDY:

OPINION OF PROBABLE COST PHASE 1

1.2 PROJECT DESCRIPTION:

Construction Type:	III, FIRE RATED
Foundation Type:	CONTINUOUS SPREAD FOOTING, GRADE BEAMS WHERE REQUIRED EQUIPMENT PADS INCLUDED.
Exterior Wall Type:	CENTRIA PANEL SYSTEM . INSULATED
Roof Type:	SLOPED COOL ROOF MEMBRANE
Stories Below Grade:	NONE
Stories Above Grade:	ONE
Sitework:	SITE WORK IS MOSTLY TUNNEL LOOP TO THE MEDICAL BUILDING LOCATIONS AND A SEPARATE SERVICE TUNNEL
Plumbing System:	STANDARD BUILDING PLUMBING SUPPLEMENTED BY THE REQUIREMENTS CHILLER AND BOILER SYSTEMS FOR THE CENTRAL PLANT .
Mechanical System:	STANDARD BUILDING HVAC SUPPLEMENTED BY THE REQUIREMENTS OF CHILLER AND BOILER SYSTEMS FOR THE CENTRAL PLANT
Fire Protection System:	STANDARD BUILDING FIRE PROTECTION SYSTEM AS WELL AS TUNNELS
Electrical Service:	STANDARD LIGHTING, DEVICES, SPECIAL SYSTEMS FOR THE STRUCTURES. NEW H.V. SYSTEM EQUIPMENT FOR CHILLERS, ADDITIONAL POWER FOR THE CENTRAL PLANT EQUIPMENT.

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	BID DATE:	**UNKNOWN**
DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

1.3 GENERAL NOTES REGARDING PROJECT:

THE STUDY INVOLVES THE CREATION OF A NEW CENTRAL PLANT AND SUPPORTING TUNNEL SYSTEM TO PROVIDE UTILITIES TO A NEW MEDICAL COMPLEX. ALL MAJOR BUILDING SYSTEMS WILL BE SUPPLIED TO THE MEDICAL COMPLEX THROUGH THE TUNNEL SYSTEM. THERE IS AN ADDITIONAL SERVICE TUNNEL THAT CONNECTS A RECEIVING AREA IN THE CENTRAL PLANT AREA TO THE VIVERIUM. TELEPHONE AND FIRE ALARM SYSTEMS ARE EXTENDED FROM THE EXISTING CAMPUS SERVICES .

2.0 DEFINITIONS

2.1 ESTIMATE OF COST:

An Estimate of Cost is prepared from a survey of the quantities of work - items prepared from written or drawn information provided at the design-development, working drawing or bid-documents stage of the design. Historical costs, information provided by contractors and suppliers, plus judgmental evaluation by the Estimator are used as appropriate as the basis for pricing. Allowances as appropriate will be included for items of work which are not indicated on the design documents provided that the Estimator is made aware of them, or which, in the judgment of the Estimator, are required for completion of the work. We cannot, however, be responsible for items or work of an unusual nature of which we have not been informed.

PROJECT: **U.C. RIVERSIDE COST STUDY** JOB NUMBER: **09-029 R4**
LOCATION: **RIVERSIDE , CA** PREPARED BY: **MK**
CLIENT: **WINZLER & KELLY** BID DATE: **UNKNOWN**
DESCRIPTION: **NEW INFRASTRUCTURE FOR MEDICAL EXPANSION** ESTIMATE DATE: **06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

3.0 BIDS & CONTRACTS

3.1 MARKET CONDITIONS:

In the current market conditions for construction, our experience shows the following results on competitive bids, as a differential from Leland Saylor Associates final estimates:

Number of Bids		Percentage Differential
1	....	+25 to 100%
2 - 3	....	+10 to 25%
4 - 5	....	0 to +10%
6 - 7	....	0 to -10%
8 or more	....	-10 to -20%

Accordingly, it is extremely important to ensure that a minimum of 4 to 5 valid bids are received. Since LSA has no control over the bid process, there is no guarantee that proposals, bids or construction cost will not vary from our opinions or our estimates. Please see Competitive Bidding Statement in the estimate detail section for more information.

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	BID DATE:	**UNKNOWN**
DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

4.0 ESTIMATE DOCUMENTS

4.1 This Estimate has been compiled from the following documents and information supplied:

DRAWINGS:

Architectural	Mechanical	Landscaping
SEVERAL SKETCHES	*None*	*None*
Structural	**Plumbing**	**Accessibility Standards**
None	*None*	*None*
Civil	**Electrical**	**Other**
None	*None*	*None*

SPECIFICATIONS / PROJECT MANUAL:

THERE WERE SUPPORTING DOCUMENTATION THAT PROVIDE A SCOPE FOR THE PROJECT AND SEVERAL PHONE CALLS AND E-MAILS WITH THE SUPPORTING DESIGN TEAM.

COSTS PROVIDED BY OTHERS:

COST FOR ELECTRICAL SUBSTATION WORK , PROPANE TANK WORK AND SEVERAL ALLOWANCES

4.2 The user is cautioned that significant changes in the scope of the project, or alterations to the project documents after completion of the opinion of probable cost phase 1 can cause major cost changes. In these circumstances, Leland Saylor Associates should be notified and an appropriate adjustment made to the opinion of probable cost phase 1.

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
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DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

5.0 GROSS SQUARE FEET

BUILDING	GSF
CENTRAL PLANT - OPERATIONS	
CHILLER BUILDING	8,240
BOILER BUILDING	6,660
ELECTRICAL ROOM	1,200
CORRIDOR SPACE	1,790
CENTRAL PLANT OPERATIONS	17,890
CENTRAL PLANT - ADMINISTRATION	3,140
RECEIVING	1,500
COVERED OUTDOOR SPACE	1,500
TOTAL Gross Floor Area	24,030

6.0 WAGE RATES

6.1 This Estimate is based on market wage-rates and conditions currently applicable in RIVERSIDE , CA .

7.0 PRORATE ADDITIONS TO THE ESTIMATE

7.1 **GENERAL CONDITIONS:** **10.00%**

An allowance based on 10.00% of the construction costs subtotal has been included for Contractor's General Conditions.

Leland Saylor Associates
A Certified DVBE

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	BID DATE:	**UNKNOWN**
DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

7.2A DESIGN CONTINGENCY: **10.00%**

An allowance based on 10.00% of the construction costs subtotal has been included for Design/Estimating Contingency.

NOTE: This allowance is intended to provide a Design Contingency sum only, for use during the design process. It is not intended to provide for a Construction Contingency sum.

7.2B ESTIMATING CONTINGENCY: **5.00%**

An allowance based on 5.00% of the construction costs subtotal has been included for Estimating Contingency.

NOTE: This allowance is based on the opinion of the drawings' completeness at this stage of the design.

7.3 ESCALATION: **0.00%**

An allowance of 0.00% has been included in this estimate for construction material & labor cost escalation up to the anticipated mid-point of construction, based on the following assumptions:

Construction start date:	
Construction period:	
Mid-point of construction:	
Annual escalation rate:	**0.00%**
Allowance for escalation:	**0.00%**

No allowance has been made for Code Escalation or Technological Escalation.

Leland Saylor Associates
A Certified DVBE

PROJECT:	**U.C. RIVERSIDE COST STUDY**	JOB NUMBER:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	BID DATE:	**UNKNOWN**
DESCRIPTION:	**NEW INFRASTRUCTURE FOR MEDICAL EXPANSION**	ESTIMATE DATE:	**06/24/2009**

PREFACE AND NOTES TO THE ESTIMATE

7.4 BONDS: **0.00%**

An allowance of 0.00% of the construction cost subtotal is included to provide for the cost of Payment and Performance Bonds, if required.

7.5 CONTRACTOR'S FEE: **5.00%**

An allowance based on 5.00% of the construction cost subtotal is included for Contractor's office Overhead and Profit. Office overhead of the contractor is always included with the

All field overhead of the contractor is included in the General Conditions section of the estimate.

8.0 SPECIAL NOTES PERTAINING TO THIS ESTIMATE

8.1 SPECIFIC INCLUSIONS:

The following items are specifically included in this estimate:

NOTHING OUT OF SCOPE EXCEPT FOR 69kV YARD WHICH IS LISTED AS AN ALTERNATE .

8.2 SPECIFIC EXCLUSIONS:

The following items are specifically excluded from this estimate:

HAZMAT- NONE ANTICIPATED
SOIL REMEDIATION- NO REPORTS OF THIS REQUIREMENT

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-039 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	ROLLED UP SUMMARY FOR ENTIRE PROJECT.	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
1.0	CENTRAL PLANT AND SERVICE YARD				30,219,175
2.0	SITE UTILITIES			-	12,780,579
3.0	ROADWAYS AND LANDSCAPING			-	5,602,354
4.0	LOADING DOCK AND SERVICE TUNNEL			-	2,665,924
	BASE OPINION OF COST - ABOVE THE LINE			-	51,268,033
	FENCING ALTERNATE			-	457,343
	ELECTRICAL SERVICE FOR ALTERNATE A				3,636,360
	RPU 69kV SUBSTATION				4,469,488
	GARAGE ALTERNATE			-	26,744,758
	COMMUNICATIONS / FA ALTERNATE				1,261,397
	TOTAL BELOW THE LINE COSTS				36,569,346
	TOTAL COSTS				87,837,379

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
1.0	FOUNDATION			11.80	**283,672**
2.0	VERTICAL STRUCTURE			16.68	**400,858**
3.0	FLOORS AND ROOF STRUCTURES			37.14	**892,470**
4.0	EXTERIOR CLADDING			83.25	**2,000,386**
5.0	ROOFING WATERPROOFING AND SKYLIGHTS			1.24	**29,745**
	SHELL (1-5)			**150.11**	**3,607,131**
6.0	INTERIOR PARTITIONS, DOORS AND GLAZING			6.95	**166,952**
7.0	FLOORS, WALLS, CEILING FINISHES			2.26	**54,318**
	INTERIORS (6-7)			**9.21**	**221,270**
8.0	MISC EQUIPMENT AND SPECIALTIES			0.54	**13,055**
9.0	VERTICAL TRANSPORTATION			-	**NONE**
	EQUIPMENT AND VERTICAL TRANSPORTATION (8-9)			**0.54**	**13,055**
10.0	PLUMBING			4.45	**107,000**
11.0	HVAC			577.02	**13,865,791**
12.0	ELECTRICAL LIGHTING, POWER, COMMUNICATIONS			27.01	**649,053**
13.0	FIRE PROTECTION SYSTEMS			3.97	**95,515**
	MECHANICAL AND ELECTRICAL (10-13)			**612.46**	**14,717,359**
	TOTAL BUILDING CONSTRUCTION (1-13)			**772.32**	**18,558,815**
14.0	SITE PREPARATION AND DEMOLITION			2.04	**48,960**
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING			33.29	**799,954**
16.0	UTILITIES ON SITE			113.64	**2,730,861**
	TOTAL SITE (14-16)			**148.97**	**3,579,775**
	TOTAL SITE & BUILDING			**921.29**	**22,138,590**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	PRORATES				
	General Conditions	10.00%			**2,213,859**
	Design Contingency	10.00%			**2,213,859**
	Estimating Contingency	5.00%			**1,106,929**
	Escalation -Present costs in today's dollars	0.00%			**-**
	SUBTOTAL			**1,151.61**	**27,673,237**
	Overhead and Profit	5.00%			**1,383,662**
	TOTAL CONSTRUCTION COSTS			**1,209.19**	**29,056,899**
	CM at Risk	4.00%			**1,162,276**
	TOTAL SITE & BUILDING (1-16)			**1,257.56**	**30,219,175**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

The prices in this Estimate are based on Competitive Bidding. Competitive Bidding is receiving responsive bids from at least five (5) or more General Contractors and three (3) or more responsive bids from Major Subcontractors or Trades. Major Subcontractors are Structural Steel, Plaster / EIFS Contractors, Mechanical, Plumbing and Electrical Subcontractors.

Without Competitive Bidding, Contractor bids can and have ranged from 25%-to 100% over the prices in this Estimate, depending on the size of the job.

We urge you to notify your client of the existing bidding climate, and work with them to ensure that the project is adequately publicized so that they can get the minimum number of bids for competitive bidding. Please contact LSA if you need ideas about how to publicize your project.

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
0.0	GENERAL CONDITIONS (SEE PRORATES ABOVE)				
	SUBTOTAL 0.0				NONE
1.0	FOUNDATION				
	ASSUMES NO PILES , PIERS OR CAISSONS				
	FOUNDATIONS				
	BOILER BUILDING FOUNDATION	354	LF	55.00	19,470
	CHILLER BUILDING FOUNDATION	390	LF	55.00	21,450
	ELECTRICAL ROOM	120	LF	55.00	6,600
	CENTRAL PLANT ADMISTRATION	240	LF	55.00	13,200
	SLABS ON GRADE- CONCRETE				
	BOILER BUILDING SLAB ON GRADE - 6"	6,660	SF	8.00	53,280
	EQUIPMENT SLABS FOR ABOVE = 24"	1,500	SF	20.00	30,000
	CHILLER BUILDING SLAB ON GRADE - 6"	8,204	SF	8.00	65,632
	EQUIPMENT SLABS FOR ABOVE = 24"	1,250	SF	20.00	25,000
	ELECTRICAL ROOM SLAB ON GRADE - 6"	1,200	SF	8.00	9,600
	CORRIDOR SPACE	1,790	SF	8.00	14,320
	CENTRAL PLANT ADMINISTRATION 6"	3,140	SF	8.00	25,120
	SUBTOTAL 1.0				283,672

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
2.0	**VERTICAL STRUCTURE**				
	BOILER BUILD VERT STRUCT. - 29FT= 9#/ SF	59,940	#	1.85	**110,889**
	CHILLER BUILD VERT STRUCT. - 16FT= 12#/ SF	98,880	#	1.85	**182,928**
	ELECTRICAL ROOM -16 FT =12# /SF	14,400	#	1.85	**26,640**
	CORRIDOR SPACE 16 FT =12# /SF	21,480	#	1.85	**39,738**
	CENTRAL PLANT ADMIN VERT STRUCT. - 16FT=7#/SF	21,980	#	1.85	**40,663**
	SUBTOTAL 2.0				**400,858**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
3.0	**FLOORS AND ROOF STRUCTURES**				
	NO MEZZANINE FIGURED IN THIS SCHEME				
	HORIZONTAL OR ROOF STRUCTURE				
	BOILER BUILD ROOF STRUCT. - 8#/ SF	52,800	#	1.85	**97,680**
	BOILER BUILD SOLAR PANEL SUPPORT STRUCT. - = 2#/ SF ADDER	13,200	#	1.85	**24,420**
	CHILLER BUILD ROOF STRUCT. - 8#/ SF	65,920	#	1.85	**121,952**
	ELECTRICAL ROOM =7#/SF	8,400	#	1.85	**15,540**
	CORRIDOR SPACE =7# /SF	12,530	SF	8.00	**100,240**
	CENTRAL PLANT ADMIN ROOF STRUCT. -=7#/SF	21,980	#	1.85	**40,663**
	METAL DECK				
	BOILER BUILD. METAL DECK	6,660	SF	4.50	**29,970**
	CHILLER BUILD. METAL DECK	8,240	SF	4.50	**37,080**
	CORRIDOR SPACE METAL DECK	1,790	SF	4.50	**8,055**
	CENTRAL PLANT ADMIN - METAL DECK	3,140	SF	4.50	**14,130**
	INSULATION				
	BOILER BUILD RIGID INSULATION	6,660	SF	6.00	**39,960**
	CHILLER BUILD RIGID INSULATION	8,240	SF	6.00	**49,440**
	ELECTRICAL ROOM	1,200	SF	6.00	**7,200**
	CENTRAL PLANT ADMIN - RIGID INSULATION	3,140	SF	6.00	**18,840**
	WHITE ELASTOMERIC ROOF - COOL ROOF				
	BOILER BUILD ROOF	6,660	SF	12.00	**79,920**
	CHILLER BUILD ROOF	8,240	SF	12.00	**98,880**
	ELECTRICAL ROOM	1,200	SF	12.00	**14,400**
	CENTRAL PLANT ADMIN- ROOF	3,140	SF	12.00	**37,680**
	ROOF PENETRATIONS	21,700	SF	1.10	**23,870**
	ROOF GUTTERS AND DOWNSPOUTS	21,700	SF	1.50	**32,550**
	SUBTOTAL 3.0				**892,470**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
4.0	**EXTERIOR CLADDING**				
	ALL EXTERIOR WALL MATERIALS- CENTRIA W/				
	METAL SUPPORT FRAME - $49.00 +12.00				
	BOILER BUILDING -	12,390	SF	61.00	**755,790**
	CHILLER BUILDING	11,310	SF	61.00	**689,910**
	ELECTRICAL ROOM	1,920	SF	30.00	**57,600**
	CENTRAL PLANT ADMIN CMU VENEER WITH METAL STUDS	3,840	SF	30.00	**115,200**
	FENESTRATION				
	BOILER BUILDING -	2,478	SF	55.00	**136,290**
	CHILLER BUILDING	2,262	SF	55.00	**124,410**
	ELECTRICAL ROOM	384	SF	55.00	**21,120**
	CENTRAL PLANT ADMINISTRATION	768	SF	55.00	**42,240**
	DOORS, FRAMES, HARDWARE -COMPLETE				
	BOILER BUILDING -				
	ROLL UP DOORS	1	EA	7,500.00	**7,500**
	MAN- DOORS	4	EA	2,500.00	**10,000**
	CHILLER BUILDING				
	ROLL UP DOORS	1	EA	7,500.00	**7,500**
	MAN- DOORS	4	EA	2,500.00	**10,000**
	OFFICE , CONTROL RM, TELDATA , STORAGE AREA				
	MAN- DOORS	8	EA	2,500.00	**20,000**
	BUILDING THERMAL INSULATION- ADDITIONAL INSULATION TO MEET R-19 REQUIREMENT				
	CENTRAL PLANT ADMINISTRATION	3,140	SF	0.90	**2,826**
	SUBTOTAL 4.0				**2,000,386**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
5.0	**ROOFING WATERPROOFING AND SKYLIGHTS**				
	BOILER BUILDING -	6,660	LF	1.50	**9,990**
	CHILLER BUILDING	8,240	LF	1.50	**12,360**
	CORRIDOR SPACE METAL DECK	1,790	SF	1.50	**2,685**
	CENTRAL PLANT ADMINISTRATION	3,140	LF	1.50	**4,710**
	SUBTOTAL 5.0				**29,745**
6.0	**INTERIOR PARTITIONS, DOORS AND GLAZING**				
	ALL INTERNAL WALL MATERIALS				
	BOILER BUILDING -	1,920	SF	15.00	**28,800**
	CHILLER BUILDING	1,920	SF	15.00	**28,800**
	CENTRAL PLANT ADMINISTRATION	4,396	SF	15.00	**65,940**
	SOUND ISOLATION				
	BOILER BUILDING -	1,920	SF	0.90	**1,728**
	CHILLER BUILDING	1,920	SF	0.90	**1,728**
	CENTRAL PLANT ADMINISTRATION	4,396	SF	0.90	**3,956**
	DOORS (INTERIOR)				
	BOILER BUILDING -	4	EA	2,250.00	**9,000**
	CHILLER BUILDING	4	EA	2,250.00	**9,000**
	CENTRAL PLANT ADMINISTRATION	8	EA	2,250.00	**18,000**
	SUBTOTAL 6.0				**166,952**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
7.0	**FLOORS, WALLS, CEILING FINISHES**				
	FLOORS COVERINGS				
	BOILER BUILDING - SEALED CONCRETE	6,660	SF	0.75	**4,995**
	CHILLER BUILDING - SEALED CONCRETE	8,240	SF	0.75	**6,180**
	CORRIDOR SPACE - SEALED CONCRETE	1,790	SF	0.75	**1,343**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	5.50	**17,270**
	CEILING SUSP. SYSTEMS				
	BOILER BUILDING - LIMITED AREA	800	SF	6.50	**5,200**
	CHILLER BUILDING - LIMITED AREA	800	SF	6.50	**5,200**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	4.50	**14,130**
	SUBTOTAL 7.0				**54,318**
8.0	**MISC EQUIPMENT AND SPECIALTIES**				
	BOILER BUILDING -	6,660	SF	0.50	**3,330**
	CHILLER BUILDING	8,240	SF	0.50	**4,120**
	CORRIDOR SPACE	1,790	SF	0.50	**895**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	1.50	**4,710**
	SUBTOTAL 8.0				**13,055**
9.0	**VERTICAL TRANSPORTATION**				
	SUBTOTAL 9.0				**NONE**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
10.0	**PLUMBING**				
	EQUIPMENT				
	BUILDING PLUMBING				
	BOILER BUILDING -	6,660	SF	5.00	**33,300**
	CHILLER BUILDING	8,240	SF	5.00	**41,200**
	CORRIDOR SPACE	1,790	SF	5.00	**8,950**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	7.50	**23,550**
	SUBTOTAL 10.0				**107,000**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
11.0	**HVAC**				
	CHILLER PLANT				
	WATER CHILLER 1000 TON - w/ VFD's	3	EA	350,000.00	**1,050,000**
	TEMPLIFIER	1	EA	410,000.00	**410,000**
	INSTRUMENTATION FOR ABOVE UNITS	4	EA	200,000.00	**800,000**
	INSTALLATION OF Chiller EQUIPMENT	4	EA	200,000.00	**800,000**
	GEOTHERMAL WELL SYSTEM-	2,000	TON	2,000.00	**4,000,000**
	H.V.ELECTRICAL CONNECTIONS FOR CHILLERS AND TEMPLIFIER	4	EA	200,000.00	**800,000**
	PIPING ASSOCIATED WITH Chiller EQUIPMENT	4	EA	250,000.00	**1,000,000**
	PUMPS ASSOCIATED WITH Chiller EQUIPMENT	4	LOTS	150,000.00	**600,000**
	CHWS/R- 24" INSULATED DIA. HEADERS	400	LF	470.00	**188,000**
	24" VALVES IN SUPPORT AREA	4	EA	26,000.00	**104,000**
	BOILER PLANT				
	BOILERS- 400 HP FIRETUBE 9ppm BURNER	2	EA	280,000.00	**560,000**
	INSTALLATION OF BOILER EQUIPMENT	2	EA	33,600.00	**67,200**
	ELECTRICAL FOR BOILERS	2	EA	33,600.00	**67,200**
	PUMPS ASSOCIATED BOILERS	4	EA	15,000.00	**60,000**
	CONTROLS FOR BOILER	2	EA	42,000.00	**84,000**
	PIPING ASSOCIATED WITH BOILER EQUIPMENT	2	EA	44,800.00	**89,600**
	12 " HEADERS INSULATED	400	LF	187.00	**74,800**
	12" VALVES HEADER	4	EA	6,800.00	**27,200**

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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	DOMESTIC WATER				
	SOLAR WATER HEATING SYSTEM FOR DHW				
	SOLAR PANEL SYSTEM ON BOILER BLDG ROOF	7,500	SF	90.00	**675,000**
	7500 GAL STORAGE TANK W/ ACCESSORIES INCLUDES ,CIRCULATING PUMPS INTERNAL HEAT EXCHANGER				
	SOLAR PANEL STEEL SUPPORT SYSTEM FOR PANELS	7,500	SF	15.00	**112,500**
	DHW PUMPS	3	EA	2,000.00	**6,000**
	DHW HEX SOLAR - INCLUDED IN SOLAR PACKAGE				
	TEMPLIFIER HEX	1	LS	100,000.00	**100,000**
	6" HEADER INSULATED	200	LF	51.00	**10,200**
	4" VALVES IN SUPPORT AREA	2	EA	1,200.00	**2,400**
	TES TANK STORAGE - ABOVE GROUND				
	CONCRETE TANK -65FT DIA-60 FT HIGH	1,500,000	GAL	1.10	**1,650,000**
	TES PIPING FROM TES TANK TO SUPPORT AREA-BELOW GROUND				
	24" TES PIPING S/R INSULATED	150	LF	470.00	**70,500**
	24 " CONTROL VALVES TO TES FROM SUPPORT	4	EA	35,000.00	**140,000**
	24 X24X24 TEE WITH 24" VALVE AND BLIND FLANGE AT TAP POINT	1	EA	30,000.00	**30,000**
	MISC OTHER VALVING AND PRESSURE CONTROLS	1	LS	15,000.00	**15,000**
	EXCAVATION - LAYBACK CUT - NO SHORING	444	CY	11.50	**5,111**
	BACKFILL	267	CY	15.00	**4,000**
	BUILDING HVAC				
	BOILER BUILDING -	6,660	SF	12.00	**79,920**
	CHILLER BUILDING	8,240	SF	12.00	**98,880**
	CORRIDOR SPACE -	1,790	SF	12.00	**21,480**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	20.00	**62,800**
	SUBTOTAL 11.0				**13,865,791**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
12.0	**ELECTRICAL LIGHTING, POWER, COMMUNICATIONS**				
	BOILER BUILDING -	6,660	SF	15.00	**99,900**
	CHILLER BUILDING	8,240	SF	15.00	**123,600**
	CORRIDOR SPACE	1,790	SF	15.00	**26,850**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	25.00	**78,500**
	ADDED ELECTRICAL EQUIPMENT				
	480 V NORMAL POWER SWITCH BOARD	1	EA	75,000.00	**75,000**
	480 V STANDBY POWER SWITCH BOARD	1	EA	50,000.00	**50,000**
	480 MCC	1	EA	12,500.00	**12,500**
	SWITCHGEAR CONTROL BATTERIES	1	LS	7,500.00	**7,500**
	EMS SYSTEM FOR SUPPORT AREA THESE ITEMS ARE A TURNKEY QUOTE FROM VENDOR TO BE ASSIGN TO THE G.C.				
	EMS SYSTEM FOR CENTRAL PLANT	50	EA	370.00	**18,500**
	EMS SYSTEM FOR SUPPORT AREA	100	EA	370.00	**37,000**
	EMS FRONT END FOR SUPPORT AREA	1	LS	23,000.00	**23,000**
	EMS BACK BONE ALLOWANCE	1	LS	60,000.00	**60,000**
	MARK UP AND CONTINGENCY	1	LS	36,703.00	**36,703**
	SUBTOTAL 12.0				**649,053**
13.00	**FIRE PROTECTION SYSTEMS**				
	BOILER BUILDING -	6,660	SF	4.50	**29,970**
	CHILLER BUILDING	8,240	SF	4.50	**37,080**
	CORRIDOR SPACE -	1,790	SF	4.50	**8,055**
	CENTRAL PLANT ADMINISTRATION	3,140	SF	6.50	**20,410**
	SUBTOTAL 13.00				**95,515**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
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CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	**SITE PREPARATION AND DEMOLITION**				
	SERVICE SITE				
	CLEARING & GRUBBING	244,800	SF	0.10	**24,480**
	EROSION CONTROL	244,800	SF	0.050	**12,240**
	DEMOLITION				
	MISC DEMO	244,800	SF	0.050	**12,240**
	SUBTOTAL 14.0				**48,960**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
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OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**SITE PAVING ,STRUCTURES AND LANDSCAPING**				
	SUPPORT AREA CONCRETE PAVING				
	FINISH GRADING	139,005	SF	0.25	**34,751**
	CONCRETE PAVING @ SUPPORT YARD	27,245	SF	12.50	**340,563**
	CRUSHED GRAVEL AT SUPPORT YARD ,IN EASEMENTS AND SETBACKS	109,260	SF	1.50	**163,890**
	PARKING PAD FOR TRUCKS, DELIVERIES, PROPANE REFUELING	6,450	SF	12.50	**80,625**
	MISC WALKS AT SUPPORT AREA	2,500	SF	5.00	**12,500**
	LANDSCAPE @SUPPORT AREA	1	LS	7,500.00	**7,500**
	FLAG POLES	3	EA	2,500.00	**7,500**
	FENCING				
	8 FT CHAIN LINE LINK PERIMETER FENCING AT SUPPORT YARD.	1,850	LF	35.00	**64,750**
	8FT WALL AT PROPANE TANK AREA	160	LF	62.50	**10,000**
	SLIDING GATE AT PROPANE AREA	1	EA	12,500.00	**12,500**
	PERIMETER WALL AT EAST CORNER	70	LF	62.50	**4,375**
	SLIDING GATE AT SECONDARY ENTRANCE	1	EA	12,500.00	**12,500**
	LARGE DOUBLE GATE - MANUAL- 25 FT	2	EA	9,500.00	**19,000**
	LARGE DOUBLE GATE -REMOTE OPERATION- 25 FT AT PRIMARY ENTRANCE	1	EA	14,500.00	**14,500**
	MONUMENTS & SIGNS- SUPPORT YARD	2	EA	7,500.00	**15,000**
	SUBTOTAL 15.0				**799,954**

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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	CENTRAL PLANT	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	**UTILITIES ON SITE**				
	PROPANE TANK FOR BOILERS				
	PROPANE TANKS - 30,000 GALLON	1	EA	70,000.00	**70,000**
	UNDERGROUND UTILITIES	1	EA	6,500.00	**6,500**
	ADD SADDLES	1	EA	6,000.00	**6,000**
	FREIGHT	1	EA	12,500.00	**12,500**
	LABOR TO INSTALL	1	EA	7,500.00	**7,500**
	CONNECTION POINTS FOR PROPANE AT TANKS	1	EA	1,500.00	**1,500**
	CATHODIC PROTECTION SYSTEM	1	LS	7,500.00	**7,500**
	LEAK DETECTION AND MONITOR SYSTEM	1	LS	10,000.00	**10,000**
	EXCAVATION FOR TANK	260	CY	11.50	**2,990**
	BACK FILL	198	CY	14.50	**2,871**
	STAND BY POWER SYSTEM				
	STAND-BY ELECTRICAL				
	Diesel Generator, 1750 kW, 12.47 kV, 3-Phase, 4-Wire Price is approximately equal to Natural Gas Generator of same size.	3	EA	500,000.00	**1,500,000**
	12.47 kV Metal-Clad Generator Switchgear, NEMA 1 Nema 3R Walk In Enclosure	1	EA	100,000.00	**100,000**
	12.47 kV Generator & Feeder Circuit Breaker, Vacuum Drawout, 600 A	7	EA	35,000.00	**245,000**
	2.5 MVA Pad-Mounted Transformer, 12.47 kV - 480 V	1	EA	125,000.00	**125,000**
	5 MVA Pad-Mounted Transformer, 12.47 kV - 4.16 kV	1	EA	225,000.00	**225,000**
	Concrete-Encased Duct Bank, 5" PVC, 2 x 3, Incl. Excavation & Backfill (2) SOM, (2) Central Plant, (2) spare	500	LF	75.00	**37,500**
	4/0 Bare Copper Counterpoise, Installed in Concrete-Encasement	500	LF	12.00	**6,000**
	15 kV Shielded Power Cable, Copper Conductor, TR-XLPE 133% Insulation Level, 500 kcmil (2) SOM, (2) Central Plant	6,000	LF	25.00	**150,000**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	CENTRAL PLANT	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	UNDERGROUND FUEL TANKS - FOR 3-1750 kw GENERATORS	2	EA	54,500.00	**109,000**
	FUEL LINE FROM TANKS	600	LF	45.00	**27,000**
	UNDERGROUND UTILITIES	3	EA	6,500.00	**19,500**
	LEAK DETECTOR SYSTEM EACH TANK	2	EA	7,500.00	**15,000**
	FREIGHT	2	EA	12,500.00	**25,000**
	LABOR TO INSTALL -1,000 GAL TNKS	2	EA	7,500.00	**15,000**
	CONNECTION POINTS FOR DIESEL AT GENERATORS	3	EA	1,500.00	**4,500**
	SUBTOTAL 16.0				**2,730,861**
	ALTERNATE FOR NATURAL GAS SYSTEM				
	BASE ESTIMATE				
	UNDERGROUND FUEL TANKS - FOR 3-2000kw GENERATORS EACH GENERATOR BURNS 150 GALLONS PER HOUR = 72 HRS X150= 10800GALL0NS OR 2- 10,000 GAL TANKS	1	LS	215,000.00	**215,000**
	ALTERNATE				
	NATURAL GAS- NATURAL GAS LINES FOR PHASE 1				
	TIE INTO THE NATURAL GAS SYSTEM IN BOILER AREA.	(1)	LS	1,500.00	**(1,500)**
	NATURAL GAS FEEDER- 6"	(600)	LF	50.00	**(30,000)**
	6" VALVES IN SUPPORT AREA	(3)	EA	750.00	**(2,250)**
	6" VALVES AT GENERATOR AREA	(3)	EA	750.00	**(2,250)**
	CONNECTION POINTS FOR NATURAL GAS AT GENERATORS	(3)	EA	1,500.00	**(4,500)**
	SAVINGS USING NATURAL GAS GENERATORS				**174,500**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	SITE UTILITIES	GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	SITE PREPARATION AND DEMOLITION				NONE
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING			82.13	1,973,569
16.0	UTILITIES ON SITE			307.51	7,389,493
	TOTAL SITE (14-16)			389.64	9,363,061
	TOTAL SITE & BUILDING			389.64	9,363,061
	PRORATES				
	General Conditions	10.00%			936,306
	Design Contingency	10.00%			936,306
	Estimating Contingency	5.00%			468,153
	Escalation -Present costs in today's dollars	0.00%			-
	SUBTOTAL			487.05	11,703,827
	Overhead and Profit	5.00%			585,191
	TOTAL CONSTRUCTION COSTS			511.40	12,289,018
	CM at Risk	4.00%			491,561
	TOTAL SITE & BUILDING (1-16)			531.86	12,780,579

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
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DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	SITE UTILITIES	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

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PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES SITE UTILITIES	ESTIMATE DATE:	06/24/2009
		GSF:	24,030

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**SITE PAVING ,STRUCTURES AND LANDSCAPING**				
	STRUCTURES -				
	UTILITY TUNNEL SITE UTILITIES-12 X12 X 760 LF	760	LF	2,174.09	**1,652,308**
	CALCULATIONS ARE FOR 100 LF TO DETERMINE EACH LF	(1)	LF	217,409.00	**(217,409)**
	EXCAVATION	800	CY	12.63	**10,104**
	SHORING	2,500	SF	4.44	**11,100**
	BARRICADE AND PROTECTION	200	LF	25.00	**5,000**
	REMOVE EXCESS SOIL	1,200	TON	20.67	**24,804**
	TRENCH CLEANING	1,400	SF	1.44	**2,016**
	CONCRETE FOOTING	56	CY	366.79	**20,540**
	FORMING 2 SIDES	2,500	SF	9.24	**23,100**
	REBAR ALLOW #6 @10"OC EW @EA FACE	20,000	LBS	1.32	**26,400**
	CONCRETE 3000 PSI	72	CY	243.56	**17,536**
	CONCRETE SLAB ALLOW 10"THICK FORMING AND SHORING SUPPORT	1,200	SF	14.83	**17,796**
	REBAR ALLOW #6 @ 8"OC EW EA FACE	12,000	LBS	1.39	**16,680**
	CONCRETE 3000 PSI	37	CY	265.43	**9,821**
	BENTONITE WATERPROOFING WALLS AND SLAB	3,700	SF	4.17	**15,429**
	ENGINEERED BACKFILL	267	CY	63.98	**17,083**
	TOTAL -$217409 FOR 100 FT = 2174.09/ LF				
	TRANSITION MANHOLE 10X8X8	5	EA	25,000.00	**125,000**
	PUMPSTATIONS	5	EA	7,500.00	**37,500**
	VENTILATION	8,360	SF	7.50	**62,700**
	LIGHTS AND RECEPTACLES	8,360	SF	3.00	**25,080**
	SPRINKLERS AND DETECTION	8,360	SF	5.50	**45,980**
	LADDERS IN THE TUNNEL MANHOLES	5	EA	5,000.00	**25,000**
	SUBTOTAL 15.0				**1,973,569**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	SITE UTILITIES	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	**UTILITIES ON SITE**				
	THE FOLLOWING MECHANICAL UTILITIES ARE INSTALLED IN UTILITY TUNNELS				
	PIPE SUPPORTS IN TUNNEL (@6' SPACING)	127	EA	1,500.00	**190,000**
	CHILLED WATER SYSTEM FROM SUPPORT AREA				
	CHWS/R -16" DIA INSULATED	1,520	LF	260.00	**395,200**
	16" VALVES CONTROL IN TUNNEL	10	EA	22,000.00	**220,000**
	16" X16"X8" TEE W/ 8"VALVE, 10 FT OF 8"PIPE AND BLIND FLANGE AT TAP POINT	14	EA	7,000.00	**98,000**
	HEATING HOT WATER FROM SUPPORT AREA				
	12" HHW S/R INSULATED	1,520	LF	187.00	**284,240**
	12" CONTROL VALVES IN THE TUNNEL	10	EA	6,800.00	**68,000**
	12"X12"X8 TEE WITH 8" VALVE , 10 FT OF 8" PIPE AND BLIND FLANGE AT TAP POINT.	14	EA	6,500.00	**91,000**
	DOMESTIC HOT WATER FROM SUPPORT AREA				
	4" DW PIPE -INSULATED	1,520	LF	44.00	**66,880**
	4" VALVES CONTROL IN TUNNEL	10	EA	1,200.00	**12,000**
	4"X4"X4" TEE WITH 4" VALVE , 10 FT OF 4" PIPE AND BLIND FLANGE AT TAP POINT	14	EA	2,500.00	**35,000**
	NATURAL GAS IN TUNNEL FROM SUPPORT AREA				
	NATURAL GAS FEEDER- 6"	760	LF	50.00	**38,000**
	6" VALVES IN SUPPORT AREA	2	EA	750.00	**1,500**
	6" VALVES CONTROL IN TUNNEL	5	EA	750.00	**3,750**
	6"X6"X4" TEE WITH 4" VALVE , 10 FT OF 4" PIPE AND BLIND FLANGE AT TAP POINT	7	EA	2,500.00	**17,500**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	SITE UTILITIES	GSF:	**24,030**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	ALTERNATE B				
	HV CONDUIT AND WIRE IN TUNNEL				
	PIPE SUPPORTS IN TUNNEL (ELECTRICAL)	127	EA	500.00	**63,333**
	6-5" COND. 4-NORMAL POWER, 2 STANDBY (2) PHASE 1, (2) FULL BUILDOUT, (2) STANDBY (NO SPARE)	760	LF	120.00	**91,200**
	3-500KCMILS W/GROUND PER CIRCUIT (2) NORMAL PHASE 1 SOM, (2) STANDBY	13,680	LF	25.00	**342,000**
	8-5" COND. 6-NORMAL POWER, 2 STANDBY (2) PHASE 1, (2) FAMILY STUDENT HOUSING, (2) FULL BUILDOUT, (2) STANDBY (NO SPARE)	210	LF	160.00	**33,600**
	3-500KCMILS W/GROUND PER CIRCUIT (2) NORMAL PHASE 1 SOM, (2) STANDBY	5,040	LF	25.00	**126,000**
	HV CONDUIT AND WIRE IN DUCT BANK				
	Concrete-Encased Duct Bank (from substation to central plant/tunnel) 5" PVC, 4 x 4, Incl. Excavation & Backfill (2) PHASE 1 SOM, (4) CENTRAL PLANT, (2) FAMILY STUDENT HOUSING, (6) FULL BUILDOUT SOM, (2) SPARE	500	LF	251.00	**125,500**
	3-500KCMILS W/GROUND PER CIRCUIT (2) PHASE 1 SOM, (4) CENTRAL PLANT	9,000	LF	25.00	**225,000**
	4/0 Bare Copper Counterpoise, Installed in Concrete-Encasement	500	LF	12.00	**6,000**
	RPU SUBSTATION CONNECTION	1	EA	25,000.00	**25,000**
	2-5" COND. 2-NORMAL POWER, 0 STANDBY TO FAMILY STUDENT HOUSING	1,120	LF	40.00	**44,800**
	WIRE PULLED WHEN ABOVE UNIT IS BUILT				
	MANHOLE, PRECAST, TRAFFIC-RATED COVER, 4' X 6'-6" X 7'	6	EA	7,500.00	**45,000**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
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OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	SWITCH YARD - 12 Kv EQUIPMENT				
	THIS EQUIPMENT TIES INTO THE 69kV SUBSTATION WHICH IS AN ALTERNATE OR THE POWER RUN FROM THE CAMPUS SUBSTATION				
	Outdoor Walk-In 12.47 kV Metal-Clad Switchgear Enclosure, Normal Power Supply, Single Aisle, 75' L x 15'W x 9'-6"H	1	EA	75,000.00	**75,000**
	12.47 kV Main Breakers & Tie Breaker, Vacuum Drawout, 2000 A	3	EA	75,000.00	**225,000**
	12.47 kV Feeder Circuit Breaker, Vacuum Drawout, 600 A	12	EA	50,000.00	**600,000**
	Utility Metering Section	2	EA	5,000.00	**10,000**
	CENTRAL PLANT ELECTRICAL EQUIPMENT				
	2.5 MVA Pad-Mounted Transformer, 12.47 kV - 480 V	2	EA	125,000.00	**250,000**
	5 MVA Pad-Mounted Transformer, 12.47 kV - 4.16 kV	2	EA	225,000.00	**450,000**
	Central Plant 4.16 kV Main Switchgear, 1200 A Bus Nema 3R Walk In Enclosure	1	EA	75,000.00	**75,000**
	4.16 Main and Tie Circuit Breaker, 1200 A, Vacuum Drawout	3	EA	35,000.00	**105,000**
	MISC SPECIAL SYSTEMS				
	TEL/DATA SYSTEM				
	TEL/DATA TO BE RUN IN TUNNEL				
	TEL/DATA LADDER CABLE TRAYS- 2/TUNNEL	1,520	LF	35.00	**53,200**
	TELEPHONE/ DATA CONDUIT ONLY FOR PHASE 1 - NOT IN TUNNELS				
	PUBLIC RIGHT -OF-WAY CONNECTION TO SERVICE PROVIDER	2	EA	2,500.00	**5,000**
	4-4" CONDUITS W/ EXCAVATION AND SLURRY BACKFILL	800	LF	60.00	**48,000**
	6-4" CONDUITS W/ EXCAVATION AND SLURRY BACKFILL	2,000	LF	65.00	**130,000**
	COMMUNICATIONS MANHOLE	9	EA	7,500.00	**67,500**

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OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	DOMESTIC WATER FOR PHASE 1				
	CITY CONNECTION TO (E) 8" LINE WITH METERS AND DOUBLE DETECTOR CHECK VALVES	1	EA	25,000.00	**25,000**
	CITY CONNECTION TO (E) 20" LINE WITH METERS AND DOUBLE DETECTOR CHECK VALVES	1	EA	50,000.00	**50,000**
	DUCTILE IRON PIPE 10" IN TUNNEL	760	LF	60.00	**45,600**
	PVC- C-905 14", INCL. EXCAVATION AND BACKFILL	2,030	LF	95.00	**192,850**
	14" ISOLATION VALVE	10	EA	5,800.00	**58,000**
	14" ISOLATION VALVE WITH BLIND FLANGE	2	EA	6,300.00	**12,600**
	FIRE HYDRANTS	6	EA	2,500.00	**15,000**
	STORM SEWER FOR PHASE 1				
	CONNECTION TO 30"COUNTY STORM DRAIN	1	EA	7,500.00	**7,500**
	PERIMETER SWALE S	44,000	SF	2.00	**88,000**
	8" PERFORATED PIPE	2,200	LF	10.00	**22,000**
	IMPERMEABLE GEO-TEX FABRIC	2,200	SF	3.50	**7,700**
	18" STORM DRAIN PIPING TO DETENTION BASINS	1,500	LF	107.00	**160,500**
	18" RCP PIPE	1,000	LF	73.00	**73,000**
	Pre-cast concrete culvert (3'x6'x20' long)	6	EA	6,000.00	**36,000**
	DETENTION BASINS #1	30,000	SF	10.50	**315,000**
	DETENTION BASINS #2	19,000	SF	10.50	**199,500**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	SANITARY SEWER SYSTEM FOR PHASE 1				
	VCP PIPE 8",	250	LF	36.00	**9,000**
	EXCAVATION - LAYBACK CUT - NO SHORING	278	CY	11.50	**3,194**
	BACKFILL	250	CY	15.00	**3,750**
	VCP PIPE 12",	325	LF	79.00	**25,675**
	EXCAVATION - LAYBACK CUT - NO SHORING	361	CY	11.50	**4,153**
	BACKFILL	325	CY	15.00	**4,875**
	VCP PIPE 15",	2,400	LF	78.00	**187,200**
	EXCAVATION - LAYBACK CUT - NO SHORING	2,667	CY	11.50	**30,667**
	BACKFILL	2,400	CY	15.00	**36,000**
	MANHOLES	11	EA	7,500.00	**82,500**
	EXCAVATION	102	CY	11.50	**1,171**
	SHORING	220	SF	25.00	**5,500**
	BACKFILL	16	CY	15.00	**244**
	NATURAL GAS				
	6" GAS LINE EXCAVATION, BACKFILL INCLUDED IN UNIT PRICE.	900	LF	65.00	58,500
	IRRIGATION WATER				
	TIE INTO ASPHALT RESERVOIR LINE.	1	EA	2,500.00	2,500
	PLASTIC PURPLE PIPE- 16"	2,200	LF	95.00	209,000
	PLASTIC PURPLE PIPE- 10"	4,250	LF	70.00	297,500
	PLASTIC PURPLE PIPE- 8"	1,900	LF	60.00	114,000
	EXISTING FEEDER LINE TIE INS TO 10" PIPE	10	EA	250.00	2,500
	TEMP SALVAGE PUMP STATION - 2-7.5 SUB	1	EA	20,000.00	20,000
	NEW BOOSTER PUMP STATION - 3 EA 50 HP PUMPS W/ VFD'S	1	EA	75,000.00	75,000
	12" RCP PIPE	1,050	LF	44.00	46,200
	18' RCP PIPE	870	LF	73.00	63,510
	ISOLATION VALVES	10	EA	3,500.00	35,000
	ISOLATION VALVES WITH BLIND FLANGES	4	EA	3,750.00	15,000
	TEMPORARY DRAIN SWALE FOR FIELD 5	3,200	SF	2.00	6,400
	SUBTOTAL 16.0				**7,389,493**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
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DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	ROADWAYS AND LANDSCAPING	GSF:	**776,890**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	SITE PREPARATION AND DEMOLITION			**0.20**	**155,378**
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING			**4.39**	**3,408,911**
16.0	UTILITIES ON SITE			**0.70**	**540,000**
	TOTAL SITE (14-16)			**5.28**	**4,104,289**
	TOTAL SITE & BUILDING			**5.28**	**4,104,289**
	PRORATES				
	General Conditions	10.00%			**410,429**
	Design Contingency	10.00%			**410,429**
	Estimating Contingency	5.00%			**205,214**
	Escalation -Present costs in today's dollars	0.00%			**-**
	SUBTOTAL			**6.60**	**5,130,361**
	Overhead and Profit	5.00%			**256,518**
	TOTAL CONSTRUCTION COSTS			**6.93**	**5,386,879**
	CM at Risk	4.00%			**215,475**
	TOTAL SITE & BUILDING (1-16)			**7.21**	**5,602,354**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
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OPINION OF PROBABLE COST PHASE 1

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	ROADWAYS AND LANDSCAPING	GSF:	**776,890**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	**SITE PREPARATION AND DEMOLITION**				
	SERVICE SITE				
	CLEARING & GRUBBING	776,890	SF	0.10	**77,689**
	EROSION CONTROL	776,890	SF	0.050	**38,845**
	DEMOLITION				
	MISC DEMO	776,890	SF	0.050	**38,845**
	SUBTOTAL 14.0				**155,378**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
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DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	ROADWAYS AND LANDSCAPING	GSF:	**776,890**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**SITE PAVING ,STRUCTURES AND LANDSCAPING**				
	ASPHALT STREET PAVING				
	STREET PAVING FROM CHICAGO AVE TO CRANFORD DR. NW MALL ROAD				
	FINISH GRADING	168,080	SF	0.25	**42,020**
	ASPHALT PAVING @ N.W.MALL	70,720	SF	5.50	**388,960**
	WALKS @ N.W.MALL	21,760	SF	5.00	**108,800**
	CURBS AND GUTTERS	2,720	LF	25.00	**68,000**
	LANDSCAPE @ N.W.MALL	75,600	SF	5.00	**378,000**
	TREES	70	EA	1,000.00	**70,000**
	IRRIGATION @ N.W.MALL	75,600	SF	1.90	**143,640**
	STREET PAVING ON CRANFORD DR FROM MLK .				
	FINISH GRADING	167,400	SF	0.25	**41,850**
	ASPHALT PAVING @ CRANFORD AVENUE	70,200	SF	5.50	**386,100**
	WALKS @ CRANFORD AVE	21,600	SF	5.00	**108,000**
	CURBS AND GUTTERS	2,700	LF	25.00	**67,500**
	LANDSCAPE @ CRAWFORD AVE.	75,600	SF	5.00	**378,000**
	TREES	70	EA	1,000.00	**70,000**
	IRRIGATION @ CRAWFORD AVE.	75,600	SF	1.90	**143,640**
	ROUNDABOUT ON CRANFORD - M4	1	EA	75,000.00	**75,000**

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OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	LIMITED ACCESS STREET RUNNING SOUTH FROM N.W. MALL WEST OF M2 AND M3				
	FINISH GRADING	32,850	SF	0.25	**8,213**
	ASPHALT PAVING @ LIMITED ACCESS STREET	10,800	SF	5.50	**59,400**
	WALKS @ LIMITED ACCESS STREET	7,200	SF	5.00	**36,000**
	CURBS AND GUTTERS	900	LF	25.00	**22,500**
	LANDSCAPE AND SWALE @ LIMITED ACCESS STREET	14,850	SF	5.00	**74,250**
	TREES	30	EA	550.00	**16,500**
	IRRIGATION @ LIMITED ACCESS STREET	14,850	SF	1.90	**28,215**
	ADDITIONAL LANDSCAPING SCOPE NOT DEFINED BUT REQUIRED				
	LANDSCAPE OUTSIDE DEVELOPED PARCELS	112,736	SF	3.50	**394,576**
	LANDSCAPE AND GENERAL AREA LIGHTING	112,736	SF	0.50	**56,368**
	CONCRETE PATHS BETWEEN FACILITIES	1,600	LF	40.00	**64,000**
	TREES	238	EA	550.00	**130,900**
	SITE FURNISHINGS - ALLOWANCE	1	LS	15,000.00	**15,000**
	SPECIALTY PAVING	500	SF	25.00	**12,500**
	HYDROSEEDING	161,380	SF	0.13	**20,979**
	SUBTOTAL 15.0				**3,408,911**
16.0	**UTILITIES ON SITE**				
	TRAFFIC SIGNALS				
	TRAFFIC SIGNALS AT CHICAGO/NW MALL - TWO LANES EACH DIRECTION WITH TURN LANES	1	EA	235,000.00	**235,000**
	TRAFFIC SIGNALS AT CRANFORD & MLK DR - THREE LANES IN EACH DIRECTION WITH TURN LANES	1	EA	305,000.00	**305,000**
	SUBTOTAL 16.0				**540,000**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
1.0	FOUNDATION			24.80	**37,200**
2.0	VERTICAL STRUCTURE			18.50	**27,750**
3.0	FLOORS AND ROOF STRUCTURES			49.60	**74,400**
4.0	EXTERIOR CLADDING			107.28	**160,918**
5.0	ROOFING WATERPROOFING AND SKYLIGHTS			3.00	**4,500**
	SHELL (1-5)			**203.18**	**304,768**
6.0	INTERIOR PARTITIONS, DOORS AND GLAZING			13.95	**20,925**
7.0	FLOORS, WALLS, CEILING FINISHES			7.25	**10,875**
	INTERIORS (6-7)			**21.20**	**31,800**
8.0	MISC EQUIPMENT AND SPECIALTIES			0.75	**1,125**
9.0	VERTICAL TRANSPORTATION			-	**NONE**
	EQUIPMENT AND VERTICAL TRANSPORTATION (8-9)			**0.75**	**1,125**
10.0	PLUMBING			5.00	**7,500**
11.0	HVAC			12.00	**18,000**
12.0	ELECTRICAL LIGHTING, POWER, COMMUNICATIONS			12.00	**18,000**
13.0	FIRE PROTECTION SYSTEMS			4.50	**6,750**
	MECHANICAL AND ELECTRICAL (10-13)			**33.50**	**50,250**
	TOTAL BUILDING CONSTRUCTION (1-13)			**258.63**	**387,943**
14.0	SITE PREPARATION AND DEMOLITION				**2,438**
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING				**1,562,678**
16.0	UTILITIES ON SITE				**NONE**
	TOTAL SITE (14-16)			**1,043.41**	**1,565,115**
	TOTAL SITE & BUILDING			**1,302.04**	**1,953,058**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	PRORATES				
	General Conditions	10.00%			195,306
	Design Contingency	10.00%			195,306
	Estimating Contingency	5.00%			97,653
	Escalation -Present costs in today's dollars	0.00%			-
	SUBTOTAL			1,627.55	2,441,323
	Overhead and Profit	5.00%			122,066
	TOTAL CONSTRUCTION COSTS			1,708.93	2,563,389
	CM at Risk	4.00%			102,536
	TOTAL SITE & BUILDING (1-16)			1,777.28	2,665,924

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

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PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
0.0	**GENERAL CONDITIONS (SEE PRORATES ABOVE)**				
	SUBTOTAL 0.0				**NONE**
1.0	**FOUNDATION**				
	ASSUMES NO PILES , PIERS OR CAISSONS				
	FOUNDATIONS AND SLAB ON GRADE				
	RECEIVING AREA	120	LF	55.00	**6,600**
	COVERED OUTDOOR SPACE	120	LF	55.00	**6,600**
	RECEIVING AREA -6"	1,500	SF	8.00	**12,000**
	COVERED OUTDOOR SPACE 6"	1,500	SF	8.00	**12,000**
	SUBTOTAL 1.0				**37,200**
2.0	**VERTICAL STRUCTURE**				
	RECEIVING AREA --16FT=7#/SF	10,500	#	1.85	**19,425**
	COVERED OUTDOOR SPACE --16FT=3#/SF	4,500	#	1.85	**8,325**
	SUBTOTAL 2.0				**27,750**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
3.0	**FLOORS AND ROOF STRUCTURES**				
	NO MEZZANINE FIGURED IN THIS SCHEME				
	HORIZONTAL OR ROOF STRUCTURE				
	RECEIVING AREA -ROOF STRUCTURE =7#/SF	10,500	#	1.85	**19,425**
	COVERED OUTDOOR SPACE ROOF STRUCTURE =3#/SF	4,500	#	1.85	**8,325**
	METAL DECK				
	RECEIVING AREA -ROOF STRUCTURE	1,500	SF	4.50	**6,750**
	COVERED OUTDOOR SPACE ROOF STRUCTURE	1,500	SF	4.50	**6,750**
	INSULATION				
	RECEIVING AREA -ROOF STRUCTURE	1,500	SF	6.00	**9,000**
	WHITE ELASTOMERIC ROOF - COOL ROOF				
	RECEIVING AREA -ROOF STRUCTURE	1,500	SF	12.00	**18,000**
	ROOF PENETRATIONS	1,500	SF	1.10	**1,650**
	ROOF GUTTERS AND DOWNSPOUTS	3,000	SF	1.50	**4,500**
	SUBTOTAL 3.0				**74,400**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
4.0	**EXTERIOR CLADDING**				
	ALL EXTERIOR WALL MATERIALS- CENTRIA W/				
	METAL SUPPORT FRAME - $49.00 +12.00				
	RECEIVING AREA	1,760	SF	61.00	**107,360**
	FENESTRATION				
	RECEIVING AREA	528	SF	61.00	**32,208**
	DOORS, FRAMES, HARDWARE -COMPLETE				
	LOADING DOCK , STORAGE AND ELEVATOR AREA				
	ROLL UP DOORS	2	EA	7,500.00	**15,000**
	MAN- DOORS	2	EA	2,500.00	**5,000**
	BUILDING THERMAL INSULATION				
	RECEIVING AREA	1,500	SF	0.90	**1,350**
	SUBTOTAL 4.0				**160,918**
5.0	**ROOFING WATERPROOFING AND SKYLIGHTS**				
	RECEIVING AREA	1,500	SF	1.50	**2,250**
	COVERED OUTDOOR SPACE	1,500	SF	1.50	**2,250**
	SUBTOTAL 5.0				**4,500**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
6.0	**INTERIOR PARTITIONS, DOORS AND GLAZING**				
	ALL INTERNAL WALL MATERIALS				
	RECEIVING AREA	750	SF	15.00	**11,250**
	SOUND ISOLATION				
	RECEIVING AREA	750	LF	0.90	**675**
	DOORS (INTERIOR)				
	RECEIVING AREA	4	EA	2,250.00	**9,000**
	SUBTOTAL 6.0				**20,925**
7.0	**FLOORS, WALLS, CEILING FINISHES**				
	FLOORS COVERINGS				
	RECEIVING AREA	1,500	SF	0.75	**1,125**
	CEILING SUSP. SYSTEMS				
	RECEIVING AREA	1,500	SF	6.50	**9,750**
	SUBTOTAL 7.0				**10,875**
8.0	**MISC EQUIPMENT AND SPECIALTIES**				
	RECEIVING AREA	1,500	SF	0.75	**1,125**
	SUBTOTAL 8.0				**1,125**
9.0	**VERTICAL TRANSPORTATION**				
	SUBTOTAL 9.0				**NONE**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	1,500
		COVERED OUTDOOR SPACE	1,500
		TUNNEL LF:	640

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
10.0	**PLUMBING**				
	RECEIVING AREA	1,500	SF	5.00	**7,500**
	SUBTOTAL 10.0				**7,500**
11.0	**HVAC**				
	RECEIVING AREA	1,500	SF	12.00	**18,000**
	SUBTOTAL 11.0				**18,000**
12.0	**ELECTRICAL LIGHTING, POWER, COMMUNICATIONS**				
	RECEIVING AREA	1,500	SF	12.00	**18,000**
	COVERED OUTDOOR SPACE ROOF STRUCTURE				
	SUBTOTAL 12.0				**18,000**
13.00	**FIRE PROTECTION SYSTEMS**				
	RECEIVING AREA	1,500	SF	4.50	**6,750**
	SUBTOTAL 13.00				**6,750**
14.0	**SITE PREPARATION AND DEMOLITION**				
	SERVICE SITE				
	CLEARING & GRUBBING	3,750	SF	0.25	**938**
	MASS EXCAVATION & FILL NONE				
	EROSION CONTROL	3,750	SF	0.150	**563**
	DEMOLITION				
	MISC DEMO	3,750	SF	0.250	**938**
	SUBTOTAL 14.0				**2,438**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	LOADING DOCK AND SERVICE TUNNEL	RECEIVING BLDG GSF:	**1,500**
		COVERED OUTDOOR SPACE	**1,500**
		TUNNEL LF:	**640**

OPINION OF PROBABLE COST PHASE 1

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**SITE PAVING ,STRUCTURES AND LANDSCAPING**				
	SERVICE TUNNEL STRUCTURE -				
	UTILITY TUNNEL SITE UTILITIES-12 X12 X 640 LF	640	LF	2,174.09	**1,391,418**
	CALCULATIONS ARE FOR 100 LF TO DETERMINE EACH LF	(1)	LF	217,409.00	**(217,409)**
	EXCAVATION	800	CY	12.63	**10,104**
	SHORING	2,500	SF	4.44	**11,100**
	BARRICADE AND PROTECTION	200	LF	25.00	**5,000**
	REMOVE EXCESS SOIL	1,200	TON	20.67	**24,804**
	TRENCH CLEANING	1,400	SF	1.44	**2,016**
	CONCRETE FOOTING	56	CY	366.79	**20,540**
	FORMING 2 SIDES	2,500	SF	9.24	**23,100**
	REBAR ALLOW #6 @10"OC EW @EA FACE	20,000	LBS	1.32	**26,400**
	CONCRETE 3000 PSI	72	CY	243.56	**17,536**
	CONCRETE SLAB ALLOW 10"THICK FORMING AND SHORING SUPPORT	1,200	SF	14.83	**17,796**
	REBAR ALLOW #6 @ 8"OC EW EA FACE	12,000	LBS	1.39	**16,680**
	CONCRETE 3000 PSI	37	CY	265.43	**9,821**
	BENTONITE WATERPROOFING WALLS AND SLAB	3,700	SF	4.17	**15,429**
	ENGINEERED BACKFILL	267	CY	63.98	**17,083**
	TOTAL -$217409 FOR 100 FT = 2174.09/ LF				
	PUMPSTATIONS INTERIOR	5	EA	7,500.00	**37,500**
	VENTILATION	7,040	SF	7.50	**52,800**
	LIGHTS AND RECEPTACLES	7,040	SF	5.00	**35,200**
	SPRINKLERS AND DETECTION	7,040	SF	6.50	**45,760**
	SUBTOTAL 15.0				**1,562,678**
16.0	**UTILITIES ON SITE**				
	SUBTOTAL 16.0				**NONE**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES FENCING ALTERNATE	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	SITE PREPARATION AND DEMOLITION				NONE
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING (ALTERNATE)				335,050
16.0	UTILITIES ON SITE				NONE
	TOTAL SITE ALTERNATES (14-16)				335,050
	TOTAL SITE & BUILDING				335,050
	PRORATES (INCLUDED)				
	General Conditions	10.00%			33,505
	Design Contingency	10.00%			33,505
	Estimating Contingency	5.00%			16,753
	Escalation -Present costs in today's dollars	0.00%			-
	SUBTOTAL				418,813
	Overhead and Profit	5.00%			20,941
	TOTAL CONSTRUCTION COSTS				439,753
	CM at Risk	4.00%			17,590
	TOTAL PROJECT COSTS				457,343

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES FENCING ALTERNATE	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

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PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES FENCING ALTERNATE	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**ALTERNATE FOR FENCING**				
	8 FT CMU BLOCK PERIMETER FENCING AT SUPPORT YARD.	14,480	SF	22.50	**325,800**
	FOUNDATION FOR CMU BLOCK FENCE	1,850	LF	40.00	**74,000**
	8 FT CHAIN LINE LINK PERIMETER FENCING AT SUPPORT YARD INCLUDES FOUNDATION	(1,850)	LF	35.00	**(64,750)**
	SUBTOTAL 15				**335,050**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	ELECTRICAL SERVICE FOR ALTERNATE A		

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	UTILITIES ON SITE				**2,664,000**
	TOTAL SITE ALTERNATES (14-16)				**2,664,000**
	TOTAL SITE & BUILDING				**2,664,000**
	PRORATES (INCLUDED)				
	General Conditions	10.00%			**266,400**
	Design Contingency	10.00%			**266,400**
	Estimating Contingency	5.00%			**133,200**
	Escalation -Present costs in today's dollars	0.00%			**-**
	SUBTOTAL				**3,330,000**
	Overhead and Profit	5.00%			**166,500**
	TOTAL CONSTRUCTION COSTS				**3,496,500**
	CM at Risk	4.00%			**139,860**
	TOTAL PROJECT COSTS				**3,636,360**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES ELECTRICAL SERVICE FOR ALTERNATE A	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

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PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES ELECTRICAL SERVICE FOR ALTERNATE A	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	**UTILITIES ON SITE**				
	ALTERNATE A				
	HV CONDUIT AND WIRE IN TUNNEL				
	PIPE SUPPORTS IN TUNNEL ELECTRICAL AND TELEPHONE	162	EA	500.00	**80,833**
	6-5" COND. 4-NORMAL POWER, 2 STANDBY (2) PHASE 1, (2) FULL BUILDOUT, (2) STANDBY (NO SPARE)	760	LF	120.00	**91,200**
	3-500KCMILS W/GROUND PER CIRCUIT (2) NORMAL PHASE 1 SOM, (2) STANDBY	9,120	LF	25.00	**228,000**
	12-5" COND. 10-NORMAL POWER, 2 STANDBY	210	LF	160.00	**33,600**
	3-500KCMILS W/GROUND PER CIRCUIT (4) CENTRAL PLANT, (2) PHASE 1 SOM, (2) STANDBY	5,040	LF	25.00	**126,000**
	HV CONDUIT AND WIRE IN DUCT BANK				
	RPU SUBSTATION CONNECTION	1	EA	25,000.00	**25,000**
	Concrete-Encased Duct Bank (from University substation to Cranford/NW Mall) 5" PVC, 4 x 4, Incl. Excavation & Backfill (2) PHASE 1 SOM, (4) CENTRAL PLANT, (2) FAMILY STUDENT HOUSING, (6) FULL BUILDOUT SOM, (2) SPARE	3,500	LF	251.00	**878,500**
	3-500KCMILS W/GROUND PER CIRCUIT (2) PHASE 1 SOM, (4) CENTRAL PLANT	63,000	LF	25.00	**1,575,000**
	4/0 Bare Copper Counterpoise, Installed in Concrete-Encasement	3,500	LF	12.00	**42,000**
	14-5" COND. 14-NORMAL POWER (4) Central Plant, (2) SOM Phase 1, (6) SOM Full Buildout, (2) SPARE	500	LF	221.00	**110,500**
	3-500KCMILS W/GROUND PER CIRCUIT (2) PHASE 1 SOM, (4) CENTRAL PLANT	9,000	LF	25.00	**225,000**
	4/0 Bare Copper Counterpoise, Installed in Concrete-Encasement	500	LF	12.00	**6,000**
	2-5" COND. 2-NORMAL POWER, 0 STANDBY TO FAMILY STUDENT HOUSING	620	LF	40.00	**24,800**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES ELECTRICAL SERVICE FOR ALTERNATE A	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	MANHOLE, PRECAST, TRAFFIC-RATED COVER, 4' X 6'-6" X 7'	10	EA	7,500.00	**75,000**
	15 KV SWITCH FOR MANHOLE	7	EA	35,000.00	**245,000**
	ELECTRICAL MANHOLE @ TUNNEL 10X10X 12	1	EA	25,000.00	**25,000**
	ELIMINATE ALTERNATE B FROM BASE COSTS	1	LS	(1,127,433.33)	**(1,127,433)**
	SUBTOTAL				**2,664,000**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES** **69kV SUBSTATION AT SUPPORT YARD**	ESTIMATE DATE:	**06/24/2009**

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	UTILITIES ON SITE				**3,274,350**
	TOTAL SITE ALTERNATES (14-16)				**3,274,350**
	TOTAL SITE & BUILDING				**3,274,350**
	PRORATES (INCLUDED)				
	General Conditions	10.00%			**327,435**
	Design Contingency	10.00%			**327,435**
	Estimating Contingency	5.00%			**163,718**
	Escalation -Present costs in today's dollars	0.00%			**-**
	SUBTOTAL				**4,092,938**
	Overhead and Profit	5.00%			**204,647**
	TOTAL CONSTRUCTION COSTS				**4,297,584**
	CM at Risk	4.00%			**171,903**
	TOTAL PROJECT COSTS				**4,469,488**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES 69kV SUBSTATION AT SUPPORT YARD	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

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PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	69kV SUBSTATION AT SUPPORT YARD		

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	**UTILITIES ON SITE**				
	POWER PLAN FOR ALTERNATE B				
	ELECTRICAL SWITCH YARD 69Kv Sub				
	69kV RISER POLES AT SUBSTATION	2	EA	65,000.00	**130,000**
	69 Kv-12.47 Kv TRANSFORMER 20/27/33 MVA	2	EA	850,000.00	**1,700,000**
	69Kv SF-6 CIRCUIT BREAKER - 1200 AMP	5	EA	65,000.00	**325,000**
	ISOLATION AND BY PASS AIR SWITCH	15	EA	3,000.00	**45,000**
	NEUTRAL GROUNDING RESISTER	2	EA	15,000.00	**30,000**
	SUBSTATION STRUCTURES - 69 KV BUSSING AND JUMPERS	1	LS	150,000.00	**150,000**
	REINFORCED CONCRETE PADS FOR TRANSFORMERS , CB'S AND RESISTORS	9	EA	7,500.00	**67,500**
	GROUNDING FOR EQUIPMENT ABOVE	9	EA	2,500.00	**22,500**
	3 SETS OF 3-500 KCMILS 15 KV SHIELDED	450	LF	20.00	**9,000**
	4/0 GROUND WIRE	150	LF	12.00	**1,800**
	3-5" PVC CONCRETE ENCASED DUCTS	50	LF	75.00	**3,750**
	SUBSTATION GROUNDING SYSTEM	1	LS	25,000.00	**25,000**
	CONTROL AND COMMUNICATIONS SYSTEM	1	LS	150,000.00	**150,000**
	CHAIN LINK FENCE - 7 FT HIGH	600	LF	30.00	**18,000**
	SHIPPING SUBSTATION FROM FACTORY TO RIVERSIDE	2	EA	35,000.00	**70,000**
	ACCEPTANCE TESTING	1	LS	50,000.00	**50,000**
	UNDERGROUND 69kV DUCT BANK				
	Concrete-Encased Duct Bank (from Chicago Avenue to 69kV Substation) 5" PVC, 3 x 3, Incl. Excavation & Backfill	1,400	LF	125.00	**175,000**
	3-500KCMILS W/GROUND PER CIRCUIT	8,400	LF	25.00	**210,000**
	4/0 Bare Copper Counterpoise, Installed in Concrete-Encasement	1,400	LF	12.00	**16,800**
	MANHOLE, PRECAST, TRAFFIC-RATED COVER, 4' X 6'-6" X 7'	6	EA	12,500.00	**75,000**
	SUBTOTAL				**3,274,350**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
1.0	FOUNDATION			2.37	**1,154,502**
2.0	VERTICAL STRUCTURE			9.34	**4,551,147**
3.0	FLOORS AND ROOF STRUCTURES			11.01	**5,364,800**
4.0	EXTERIOR CLADDING			0.55	**265,860**
5.0	ROOFING WATERPROOFING AND SKYLIGHTS			-	**NONE**
	SHELL (1-5)			**23.27**	**11,336,310**
6.0	INTERIOR PARTITIONS, DOORS AND GLAZING			0.12	**59,500**
7.0	FLOORS, WALLS, CEILING FINISHES			3.97	**1,935,980**
	INTERIORS (6-7)			**4.10**	**1,995,480**
8.0	FUNCTION EQUIPMENT AND SPECIALTIES			0.25	**120,000**
9.0	VERTICAL TRANSPORTATION			1.86	**908,000**
	EQUIPMENT AND VERTICAL TRANSPORTATION (8-9)			**2.11**	**1,028,000**
10.0	PLUMBING			0.53	**257,600**
11.0	HVAC			0.75	**365,400**
12.0	ELECTRICAL LIGHTING, POWER, COMMUNICATIONS			4.55	**2,216,760**
13.0	FIRE PROTECTION SYSTEMS			4.00	**1,948,800**
	MECHANICAL AND ELECTRICAL (10-13)			**9.83**	**4,788,560**
	TOTAL BUILDING CONSTRUCTION (1-13)			**39.30**	**19,148,350**
14.0	SITE PREPARATION AND DEMOLITION			0.49	**240,000**
15.0	SITE PAVING ,STRUCTURES AND LANDSCAPING			0.17	**83,080**
16.0	UTILITIES ON SITE				**121,800**
	TOTAL SITE (14-16)			**0.91**	**444,880**
	TOTAL SITE & BUILDING			**40.22**	**19,593,230**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	GARAGE ALTERNATE	GSF:	487,200

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
	PRORATES				
	General Conditions	10.00%			1,959,323
	Design Contingency	10.00%			1,959,323
	Estimating Contingency	5.00%			979,661
	Escalation -Present costs in today's dollars	0.00%			-
	SUBTOTAL			50.27	24,491,537
	Overhead and Profit	5.00%			1,224,577
	TOTAL CONSTRUCTION COSTS			52.78	25,716,114
	CM at Risk	4.00%			1,028,645
	TOTAL PROJECT COSTS			54.89	26,744,758

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	GARAGE ALTERNATE	GSF:	487,200

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

The prices in this Estimate are based on Competitive Bidding. Competitive Bidding is receiving responsive bids from at least five (5) or more General Contractors and three (3) or more responsive bids from Major Subcontractors or Trades. Major Subcontractors are Structural Steel, Plaster / EIFS Contractors, Mechanical, Plumbing and Electrical Subcontractors.

Without Competitive Bidding, Contractor bids can and have ranged from 25%-to 100% over the prices in this Estimate, depending on the size of the job.

We urge you to notify your client of the existing bidding climate, and work with them to ensure that the project is adequately publicized so that they can get the minimum number of bids for competitive bidding. Please contact LSA if you need ideas about how to publicize your project.

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
0.0	**GENERAL CONDITIONS (SEE PRORATES ABOVE)**				
	SUBTOTAL 0.0				**NONE**
1.0	**FOUNDATION**				
	SPREAD FOOTING	1,000	CY	550.00	**550,000**
	OTHER FOUNDATION ITEMS	1	LS	50,000.00	**50,000**
	EXCAVATE FOR BUILDING	7,733	CY	6.00	**46,400**
	BACKFILL	5,742	CY	3.00	**17,226**
	EXCAVATE FOR FOUNDATIONS	613	CY	6.00	**3,676**
	SLAB ON GRADE, 5"	69,600	SF	7.00	**487,200**
	SUBTOTAL 1.0				**1,154,502**
2.0	**VERTICAL STRUCTURE**				
	COLUMNS	456	CY	750.00	**342,222**
	CONCRETE EXT. WALLS	36,190	SF	65.00	**2,352,350**
	INT. CONCRETE SHEARWALLS	18,095	SF	65.00	**1,176,175**
	ELEVATOR SHAFT WALLS	6,720	SF	65.00	**436,800**
	MISC STEEL STRUCTURE ITEMS	487,200	SF	0.50	**243,600**
	SUBTOTAL 2.0				**4,551,147**
3.0	**FLOORS AND ROOF STRUCTURES**				
	ELEVATED CONCRETE SLABS, 5"	417,600	SF	12.00	**5,011,200**
	MISC IRON	487,200	SF	0.25	**121,800**
	MISC ROUGH CARPENTRY	1	LS	30,000.00	**30,000**
	MISC FINISH CARPENTRY	1	LS	30,000.00	**30,000**
	MISC ROUGH HARDWARE	1	LS	50,000.00	**50,000**
	WATERPROOFING	487,200	SF	0.25	**121,800**
	SHEET METAL ENCLOSURES				**-**
	INSULATION				**-**
	ROOF PENETRATIONS				**-**
					-
	SUBTOTAL 3.0				**5,364,800**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
4.0	**EXTERIOR CLADDING**				
					-
	PLASTER FOR EXT WALLS	36,190	SF	6.00	**217,140**
	SKINS				-
	COATINGS				-
	CAULKING & SEALANTS	487,200	SF	0.10	**48,720**
	DOORS				-
	INTERIOR SURFACE OF EXTERIOR WALLS				-
	PAINT				-
	THERMAL INSULATION				-
	SOUND INSULATION				-
	BASE				-
					-
	SUBTOTAL 4.0				**265,860**
5.0	**ROOFING WATERPROOFING AND SKYLIGHTS**				
					-
	PITCH POCKETS & PARAPET WATERPROOFING				-
	ROOF & OVERFLOW DRAINS				-
	ALL ITEMS NOT CAPABLE OF CATEGORIZATION				-
	MISC. IRON				-
	SHEET METAL				-
	ROUGH HARDWARE				-
	CAULKING				-
	WATERPROOFING ABOVE GRADE				-
	MISC. PAINTING NOT ON INT./EXT. SURFACE OF STRUCTURE				-
					-
	SUBTOTAL 5.0				**NONE**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
6.0	**INTERIOR PARTITIONS, DOORS AND GLAZING**				
					-
	NEW 3070 FIRE RATED DOORS	14	EA	450.00	**6,300**
	OTHER MECH & ELEC DOORS	1	LS	7,000.00	**7,000**
	FRAMES	14	EA	550.00	**7,700**
	HARDWARE FOR DOORS, AVE	20	EA	550.00	**11,000**
	MISC GYP WALLS	2,500	SF	11.00	**27,500**
	PLASTER				-
	EMULSIONS				-
	DOORS (INTERIOR)				-
	BASES				-
	BORROWED LIGHTS - GLAZING				-
	SOUND ISOLATION				-
	FIRE STOPS				-
	INSULATION				-
					-
	SUBTOTAL 6.0				**59,500**
7.0	**FLOORS, WALLS, CEILING FINISHES**				
					-
	PAINT ALL WALLS & CEILINGS	955,490	SF	2.00	**1,910,980**
	MISC BUILDING SPECIALTIES	1	LS	5,000.00	**5,000**
	SIGNAGE	1	LS	20,000.00	**20,000**
	INTEGRATED SYSTEMS				-
	ACOUSTICAL TILE				-
	GYPSUM WALLBOARD				-
	PLASTER				-
	SOUND ISOLATION (OTHER THAN CONCRETE FILL)				-
	HARD SURFACES FOR WALLS AND FLOORS				-
	TILE TERRAZZO-MARBLE				-
	VINYL WALL COVERINGS				-
	LAMINATED PLASTICS				-
	DECORATIVE WOOD				-
	DECORATIVE PAPER				-
	PADDED WALLS				-
					-
	SUBTOTAL 7.0				**1,935,980**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES GARAGE ALTERNATE	ESTIMATE DATE:	06/24/2009
		GSF:	487,200

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
8.0	**FUNCTION EQUIPMENT AND SPECIALTIES**				
	PARKING EQUIPMENT	1	LS	120,000.00	**120,000**
	DRAPES				-
	OTHER ITEMS APPENDED TO WALLS, FLOORS, OR CEILINGS				-
	BUILT-IN FURNITURE				-
	BENCHES & THEATRE SEATING				-
					-
	CHALK AND TACK BOARD				-
	TOILET PARTITIONS				-
	TOILET ACCESSORIES				-
	FOLDING AND DEMOUNTABLE PARTITIONS				-
	SEATING				-
	FIRE EXTINGUISHERS				
	MAIL SPECIALTIES				-
	OTHER GENERAL BUILDING SPECIALTIES				-
					-
	SUBTOTAL 8.0				**120,000**
9.0	**VERTICAL TRANSPORTATION**				
	ELEVATOR, 7 STOP	2	EA	335,000.00	**670,000**
	NEW CONCRETE STAIRWAYS	14	EA	17,000.00	**238,000**
	DUMB-WAITERS				-
	ESCALATORS				-
	MOVING WALKWAYS				-
	BELTS				-
	BAGGAGE HANDLING SYSTEMS				-
	PNEUMATIC TUBE SYSTEMS				-
	CHUTES				-
	STAIRS				-
					-
	SUBTOTAL 9.0				**908,000**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
10.0	**PLUMBING**				
					-
	EQUIPMENT				-
	DRAINAGE ITEMS	487,200	SF	0.50	**243,600**
	BOILERS				-
	STORAGE TANKS				-
	WATER HEATERS				-
	PUMPS, CIRCULATING, SUMP &EJECTION				-
					-
	FIXTURES ALLOWANCE	4	EA	1,000.00	**4,000**
	PLUMBING ROUGH-INS	4	EA	2,500.00	**10,000**
	PIPING				-
	VALVES & SPECIALTIES				-
	INSULATION				-
	PLUMBING ACCESSORIES				-
	TESTING, PERMITS & STERILIZATION				-
	SEWER, GAS, FIREWATER DOMESTIC WATER MORE THAN 5 FEET FROM BLDG. ARE TO BE INCLUDED WITH SITE UTILITIES				-
					-
					-
	SUBTOTAL 10.0				**257,600**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	GARAGE ALTERNATE	GSF:	487,200

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
11.0	**HVAC**				
	ALLOWANCE FOR HVAC, ETC.	487,200		0.75	**365,400**
	EQUIPMENT				-
	BOILERS				-
	CHILLERS				-
	HVAC UNITS				-
	SPLIT SYSTEMS				-
	TANKS				-
	HEAT EXCHANGERS				-
	AIR HANDLING SYSTEMS				-
	TERMINAL DISTRIBUTION ITEMS				-
	CONTROLS & POINTS				-
	THERMOSTATS				-
	VALVES				-
	AIR DAMPERS, FIRE DAMPERS				-
	ACTUATORS				-
	DUCT WORK				-
	GRILLS & REGISTERS				-
	INSULATION				-
	PIPING & INSULATION				-
	VALVES				-
	SPECIALTIES				-
	PERMITS, TESTING				-
	STERILIZATION				-
					-
	SUBTOTAL 11.0				**365,400**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
12.0	**ELECTRICAL LIGHTING, POWER, COMMUNICATIONS**				
					-
	LIGHTING	487,200	SF	3.00	**1,461,600**
	EMERGENCY BALLASTS FOR LIGHTING	487,200	SF	0.35	**170,520**
	OTHER POWER DEVICES AND SWITCHING	487,200	SF	0.65	**316,680**
	PANEL BOARDS				-
	MOTOR CONTROL CENTERS				-
	TRANSFORMERS				-
	FEEDERS				-
	EMERGENCY GENERATORS & FUEL SUPPLY				-
	AUTOMATIC TRANSFER EQUIPMENT				-
	UPS SYSTEMS				-
	FIXTURES, EXTERIOR & INTERIOR				-
	CONDUIT &RACEWAY, FIXTURES				-
	DEVICES, MISCELLANEOUS				-
	CONDUIT & RACEWAY SYSTEMS, DEVICES				-
	FEES				-
	PERMITS				-
	TESTING				-
					-
	ELECTRICAL SITE UTILITIES MORE THAN 5 FEET FROM BUILDING ARE TO BE INCLUDED UNDER SITE UTILITIES				-
					-
	INTRUSION SYSTEMS				-
	SECURITY CAMERA SYSTEM	487,200	SF	0.30	**146,160**
	CLOSED CIRCUIT T.V.				-
	CATV				-
	CARDKEY ACCESS SYSTEMS				-
	DATA NETWORKS				-
	PHONE & INTERCOM				-
	PARKING CONTROL ELECTRIC SIGNS	487,200	SF	0.25	**121,800**
					-
					-
	SUBTOTAL 12.0				**2,216,760**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
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CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES	ESTIMATE DATE:	06/24/2009
	GARAGE ALTERNATE	GSF:	487,200

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
13.00	**FIRE PROTECTION SYSTEMS**				
					-
	FIRE PROTECTION- WET SYSTEM	487,200	SF	4.00	**1,948,800**
	ALARM AND VALVE TREE(S)				-
	FP PIPING				-
	FP HEADS				-
	FP SPECIALTIES & PERMITS				-
	WET STAND PIPES				-
	DRY STAND PIPES				-
	SPRINKLERS				-
	MANIFOLDS				-
	FIRE HOSE CABINETS				-
	FIRE EXTINGUISHERS				-
	GASEOUS SYSTEMS				-
	PERMITS AND TESTING				-
					-
	SUBTOTAL 13.00				**1,948,800**

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
14.0	**SITE PREPARATION AND DEMOLITION**				
					-
	SERVICE SITE				-
	CLEARING & GRUBBING	600,000	SF	0.25	**150,000**
	MASS EXCAVATION & FILL				-
	EROSION CONTROL	600,000	SF	0.10	**60,000**
	STORM DRAINS				-
	FIRE ROADS				-
					-
	DEMOLITION	600,000	SF	0.05	**30,000**
	BUILDINGS				
					-
	STRUCTURE				-
	PAVING				
	UTILITIES				
	SUBTOTAL 14.0				**240,000**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES**	ESTIMATE DATE:	**06/24/2009**
	GARAGE ALTERNATE	GSF:	**487,200**

OPINION OF PROBABLE COST - STAND ALONE GARAGE

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
15.0	**SITE PAVING ,STRUCTURES AND LANDSCAPING**				**-**
	SITE PAVING ,STRUCTURES AND LANDSCAPING IRRIGATION	487,200	SF	0.15	**73,080**
	BENCHES				**-**
	PLAYGROUND EQUIPMENT				**-**
	MONUMENTS & SIGNS	2	EA	5,000.00	**10,000**
	SUBTOTAL 15.0				**83,080**
16.0	**UTILITIES ON SITE**				**-**
					-
	SW. GEAR				**-**
	SITE UTILITIES FOR GARAGE	487,200	SF	0.25	**121,800**
	VAULTS				**-**
	LUMINARIES & LANDSCAPE LIGHTING				**-**
	MISCELLANEOUS ENCLOSURES				**-**
					-
					-
	SUBTOTAL 16.0				**121,800**

PROJECT:	**U.C. RIVERSIDE COST STUDY**	LSA JOB NO:	**09-029 R4**
LOCATION:	**RIVERSIDE , CA**	PREPARED BY:	**MK**
CLIENT:	**WINZLER & KELLY**	CHECKED BY:	**YM**
DESCRIPTION:	**DETAILED SUMMARY WITH PRORATES COMMUNICATIONS AND FIRE ALARM ALTERNATE**	ESTIMATE DATE:	**06/24/2009**

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	UTILITIES ON SITE				**924,100**
	TOTAL SITE ALTERNATES (14-16)				**924,100**
	TOTAL SITE & BUILDING				**924,100**
	PRORATES (INCLUDED)				
	General Conditions	10.00%			**92,410**
	Design Contingency	10.00%			**92,410**
	Estimating Contingency	5.00%			**46,205**
	Escalation -Present costs in today's dollars	0.00%			**-**
	SUBTOTAL				**1,155,125**
	Overhead and Profit	5.00%			**57,756**
	TOTAL CONSTRUCTION COSTS				**1,212,881**
	CM at Risk	4.00%			**48,515**
	TOTAL PROJECT COSTS				**1,261,397**

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES COMMUNICATIONS AND FIRE ALARM ALTERNATE	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL

Competitive Bidding

The prices in this Estimate are based on Competitive Bidding. Competitive Bidding is receiving responsive bids from at least five (5) or more General Contractors and three (3) or more responsive bids from Major Subcontractors or Trades. Major Subcontractors are Structural Steel, Plaster / EIFS Contractors, Mechanical, Plumbing and Electrical Subcontractors.

Without Competitive Bidding, Contractor bids can and have ranged from 25%-to 100% over the prices in this Estimate, depending on the size of the job.

We urge you to notify your client of the existing bidding climate, and work with them to ensure that the project is adequately publicized so that they can get the minimum number of bids for competitive bidding. Please contact LSA if you need ideas about how to publicize your project.

PROJECT:	U.C. RIVERSIDE COST STUDY	LSA JOB NO:	09-029 R4
LOCATION:	RIVERSIDE , CA	PREPARED BY:	MK
CLIENT:	WINZLER & KELLY	CHECKED BY:	YM
DESCRIPTION:	DETAILED SUMMARY WITH PRORATES COMMUNICATIONS AND FIRE ALARM ALTERNATE	ESTIMATE DATE:	06/24/2009

OPINION OF PROBABLE COST - ALTERNATES

ITEM #	DESCRIPTION	QUANTITY	UNIT	COST	TOTAL
16.0	**UTILITIES**				
	OFF-SITE TELECOM REQUIREMENTS				
	ALLOCATE TO FAMILY STUDENT HOUSING				
	8 - 4" CONDUITS RUN OFF SITE (6) Communication, (1) Fire Alarm, (1) BMS/PCMS	1,260	LF	75.00	**94,500**
	EXCAVATION	1,260	LF	9.00	**11,340**
	SLURRY BACKFILL	1,260	LF	5.00	**6,300**
	MANHOLE, PRECAST, TRAFFIC-RATED COVER, 4' X 6'-6" X 7'	5	EA	7,500.00	**37,500**
	48 strand fiber optic cable (1) Fire Alarm, (1) BMS/PCMS	2,520	LF	55.00	**138,600**
	ALLOCATE TO SOM				
	8 - 4" CONDUITS RUN OFF SITE (6) Communication, (1) Fire Alarm, (1) BMS/PCMS	640	LF	75.00	**48,000**
	EXCAVATION	640	LF	9.00	**5,760**
	SLURRY BACKFILL	640	LF	5.00	**3,200**
	MANHOLE, PRECAST, TRAFFIC-RATED COVER, 4' X 6'-6" X 7'	3	EA	7,500.00	**22,500**
	48 strand fiber optic cable (1) Fire Alarm, (1) BMS/PCMS	1,280	LF	55.00	**70,400**
	ALLOCATE TO C&C				
	48 strand fiber optic cable (1) Fire Alarm, (1) BMS/PCMS in existing conduit to Telecom Building	5,200	LF	55.00	**286,000**
	FIRE ALARM SYSTEM - SITE WORK				
	SOM - 1 FIREMESH NETWORK	1	LS	200,000.00	**200,000**
	SUBTOTAL				**924,100**

Date	Item	Subject
2/3/09	UCR email w/attachments	SOM information: proposed program; enrollment projections; and initial development assumptions
2/12/09	UCR email	Utility rate information
2/17/09	Conference call notes	Riverside County Flood Control & Water Conservation District (Flood Control District) - Storm drain discussion
2/18/09	Conference call notes	City of Riverside - Potable water discussion
2/19/09	Conference call notes	City of Riverside - Storm drain discussion
3/4/09	Conference call notes	UCR Agricultural Operations
3/5/09	Email notes	UCR Agricultural Operations
3/9/09	Meeting notes	Joint City of Riverside and UC Riverside Planning Meeting – West Campus Development/School of Medicine Infrastructure 1
3/13/09	UCR email	SOM parking assumption
3/19/09	Table	Initial SOM Support Yard program requirements
3/25/09	RPU email	Recycled water information
3/30/09	UCR Letter to Riverside Public Utilities (RPU)	Comments on the Initial Study/Proposed Mitigated Negative Declaration, Subtransmission Project, February 2009
4/9/09	Meeting notes	UCR meeting with RPU to discuss 69kV Subtransmission Project
4/15/09	RPU email	Potable water information
4/16/09	Flood Control District email	Storm drain analysis criteria
4/17/09 (Revised 5/22/09)	Meeting notes	Joint City of Riverside and UC Riverside Planning Meeting – West Campus Development/School of Medicine Infrastructure 1
4/17/09	Conference call notes	Riverside County Flood Control & Water Conservation District - Storm drain analysis criteria
4/28/09	RPU email	Potable water
4/30/09	Flood Control District email	Storm drain analysis criteria
5/5/09	UCR Administrative Draft Report Comments	Comments from EH&S
5/12/09	UCR Letter to RPU	Subtransmission Project proposed alternate route for RPU consideration
5/13/09	UCR Letter to City of Riverside – Mayor and Members of the City Council	May 19, 2009 Public Hearing – Construction of 69 kV Subtransmission Project
6/5/09	Final Draft Report Comments	Comments from RPU RE: Water
6/5/09	Meeting notes	UCR & RPU - 69 kV Subtransmission Project
6/10/09	Meeting notes	UCR Agricultural Operations & RPU - 69 kV Subtransmission Project
6/19/09	RPU email	Potable water boundary condition information
6/23/09	W&K email	Summary of telephone discussion with Rob Van Zanten (RPU) RE: Proposed Sanitary Sewer connections to RPU system
6/24/09	Flood Control District email	Storm Drain analysis report review

Peter Young

From: Jon Harvey [jon.harvey@ucr.edu]
Sent: Tuesday, February 03, 2009 4:17 PM
To: Peter Young
Cc: Kieron Brunelle
Subject: School of Medicine Program Information
Attachments: SOM proposal PART III-Chapters 1-2 Rev.pdf; SOM Initial Development Assumptions.pdf

Peter

Preliminary School of Medicine program assumptions are attached per last week's meeting. The information further defines the propose program and spaces, and furnishes population figures.

If you have any questions, please feel free to give me a call.

Thanks

Jon

Jon Harvey
Capital & Physical Planning
951-827-6952

PART III. THE SCHOOL

The UCR School of Medicine will achieve its mission through the education of new physicians and the creation of new knowledge by researchers. These fundamental objectives are central to addressing critical healthcare needs of the region, state, and nation. This part of the medical school proposal discusses the people who comprise the school – medical students, faculty, Ph.D. students, and interns and residents – as well as the programs that support their activities. In outlining the major programmatic elements of the medical school, key operational considerations and financial assumptions will be highlighted with respect to the school's commitment to diversity and affirmative action, delivery of the four-year curriculum, postgraduate training programs, the research enterprise, and the clinical functions.

At maturity, the UCR School of Medicine will enroll a total of 400 medical students, 160 graduate students, and 160 postgraduate students (residents and interns). The delivery of medical education programs supporting these students and the research and clinical enterprises will be carried out by 138 full-time equivalent (FTE) faculty, with actual faculty headcount being significantly higher than the FTE. The planned enrollment targets provide the basis to launch the medical school into a significant venture.

CHAPTER I. STUDENT ENROLLMENT

The first class of medical students will matriculate in academic year 2012 with a class size of 50, ramping up to 100 students per class by 2017-18, for a total medical student body of 400 students. To support the research enterprise and to help meet state and national needs for technically trained scientists and engineers, the medical school will incrementally increase graduate student (Ph.D.) enrollment to 160 by 2021-22. Core postgraduate medical education programs (internships and residencies) will grow to 160 by 2017-18. UCR's infrastructure, support services, faculty, and staff will gradually increase in conjunction with enrollment projections. Enrollment projections are illustrated in Figure 8.

Medical Student Enrollment

Medical student enrollment will build upon the existing UCR/UCLA Program, which currently enrolls 48 students in the first two years of medical school. This number will rise to 52 in 2008-09 and 56 in 2009-10 with the addition of eight enrollees in UC's PRogram In Medical Education (PRIME). PRIME is a university-wide program that supports medical students who have demonstrated a commitment to practicing in underserved areas. Upon opening in 2012-13, the school will have 50 new first-year enrollees and 28 second-year students from the UCR/UCLA Program, for a total medical student enrollment of 78. Medical student enrollment will expand rapidly, to 100 students per class by 2017-18.

From a recruitment standpoint, these ambitious projections are attainable given the large, unmet demand for medical education in California (see Part II, Chapter II) and the current success of the UCR/UCLA Program in attracting prospective medical students to UCR. (See Part III, Chapter III). Additional expansion of medical student enrollment may be considered during the latter portion of the growth phase to broaden UCR's impact on the medical education needs of the region and the state; however, further growth would require an assessment of additional infrastructure and resource needs.

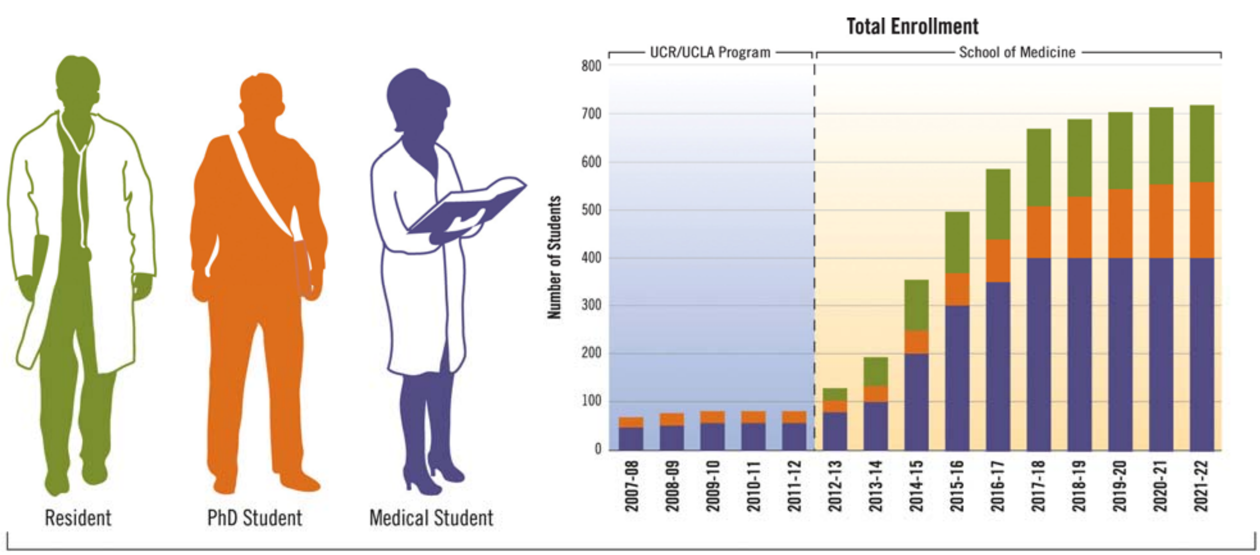
Ph.D. Student Enrollment

The medical school will build on the recently revised graduate program in biomedical sciences. Expansion of academic graduate student enrollment will commence upon approval of the medical school, growing from its current level of approximately 20 to 25 students when the medical school opens and reaching 160 in 2021-22. Graduate students will receive their Ph.D.s in the strategic medical research areas identified in the planning process. (See Part III, Chapter VI). Ph.D. student growth in the medical school also contributes to UCR's aggressive goal to expand campus wide graduate student enrollment four-fold by 2021.

Intern and Resident Enrollment

Graduate medical education programs will be launched in summer 2012 with 26 postgraduate medical students, growing to 160 by 2017-18. These programs will offer the required training to achieve board certification and medical licensure and will provide additional health care services in the region. The operating structure necessary for development, accreditation, and implementation of the programs will start in 2008-09, with a program director specific to each clinical program assigned two years prior to the admission of the first residents. Ultimately, UCR plans to expand postgraduate training into other more specialized training programs and to double or triple the size of this program.

Figure 1. Student Enrollment Projections



CHAPTER II. FACULTY

Faculty ranks in the medical school will be built upon the existing 14 faculty FTE in the UCR/UCLA Program. These faculty already provide the first two years of medical school instruction and direct active research programs in the biomedical sciences. Upon build-out, 138 faculty FTE will be required to deliver the four-year curriculum, expand the biomedical research base, support the clinical education enterprise, and establish and manage the postgraduate programs. This total is based on long-established and state-supported student-faculty ratios of 3.5:1 for M.D. students, 18.7:1 for Ph.D. students, 10:1 for interns and residents.

The distribution of faculty ranks at maturity is expected to mirror that of the overall UC medical school averages of 50 percent full professor, 20 percent associate professor, and 30 percent assistant professor. It is important to note that the headcount faculty will be much higher than the calculated 138 faculty FTE since the faculty ranks will include a number of clinical faculty and community physicians with part-time positions or responsibilities in the School of Medicine. Table 2 outlines the faculty growth trajectory in relation to enrollment.

Faculty Recruitment

Faculty resources and support services will be needed to meet the unique instructional and clinical training requirements of the medical school. The strategy for building the faculty ranks includes the early recruitment of four senior research leader faculty; these professor-level faculty will be expected to rapidly advance the medical school's research vision. By 2020-21 an additional 50 basic science/clinical research scientist faculty are projected to support the basic science and clinical teaching aspects of the four-year medical school. The existing faculty, senior research leader faculty, and basic science/clinical research faculty together will total 68 faculty FTE focused on both education and health sciences research initiatives. In addition to these FTE, it is anticipated there will be 70 FTE in clinical education faculty and community faculty who support the clinical education requirements for medical students and postgraduate students. Detailed definitions of these faculty types can be found in Appendix C.

Table 1. UCR School of Medicine Student Enrollment and Faculty Projections

	'07-'08	'08-'09	'09-'10	'10-'11	'11-'12	'12-'13	'13-'14	'14-'15	'15-'16	'16-'17	'17-'18	'18-'19	'19-'20	'20-'21	'21-'22
Enrollment															
Medical Students															
1st Year	24	28	28	28	28	50	50	100	100	100	100	100	100	100	100
2nd Year	24	24	28	28	28	28	50	50	100	100	100	100	100	100	100
3rd Year								50	50	100	100	100	100	100	100
4th Year									50	50	100	100	100	100	100
Total Medical Students	**48**	**52**	**56**	**56**	**56**	**78**	**100**	**200**	**300**	**350**	**400**	**400**	**400**	**400**	**400**
Graduate Academic (PhD)	**20**	**25**	**25**	**25**	**25**	**25**	**33**	**49**	**70**	**90**	**110**	**130**	**145**	**155**	**160**
Intern and Residents						**26**	**60**	**107**	**128**	**147**	**160**	**160**	**160**	**160**	**160**
Faculty FTE Funding Calculations															
Metrics															
Medical Student Metric	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
PhD Student Metric (funding in '12-'13)						18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
Intern and Resident Metric (funding in '12-'13)						10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
State Funded Faculty FTEs (other than residents) [1]	14.0	15.0	16.0	16.0	16.0	23.0	30.0	59.0	89.0	104.0	120.0	121.0	122.0	122.0	122.0
State Funded Faculty FTEs (residents)	-	-	-	-	-	3.0	6.0	11.0	13.0	15.0	16.0	16.0	16.0	16.0	16.0
Total SOM State Funded Faculty FTEs	**14.0**	**15.0**	**16.0**	**16.0**	**16.0**	**26.0**	**36.0**	**70.0**	**102.0**	**119.0**	**136.0**	**137.0**	**138.0**	**138.0**	**138.0**
Faculty FTE Resources (refer to descriptions)															
Existing Faculty	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Research Leader Faculty				-	1.0	1.0	2.0	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0
Other Basic Science/Clinical Research Faculty	-	-	2.0	2.0	6.0	8.0	12.0	14.0	31.0	34.0	46.0	48.0	49.0	50.0	50.0
Clinical Education Faculty			1.0	3.0	6.0	13.0	18.0	32.0	35.0	40.0	43.0	43.0	43.0	43.0	43.0
Community Clinical Physicians (1st/2nd Year) [2]						4.0	5.0	5.5	6.3	5.5	4.7	4.0	3.2	2.4	2.0
Community Clinical Physicians (Clerkships)								10.5	12.7	22.5	24.3	24.0	24.8	24.6	25.0
Total FTEs	**14.0**	**14.0**	**17.0**	**19.0**	**27.0**	**40.0**	**51.0**	**78.0**	**102.0**	**119.0**	**136.0**	**137.0**	**138.0**	**138.0**	**138.0**
Excess (Deficit) of SOM Faculty FTEs	**-**	**1.0**	**(1.0)**	**(3.0)**	**(11.0)**	**(14.0)**	**(15.0)**	**(8.0)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

[1] Faculty FTE funding calculations assume funding for the medical student enrollment increase due to the PRIME Program (24 to 28 students per year) beginning in '08-'09, but do not assume funding for incremental growth in PhD students between '07-'08 and '11-'12. Funding for Ph.D. students will not be assumed as the medical school is currently not approved. Beginning in '12-'13 it is assumed the medical school will have approval and faculty funding for Ph.D. students will be allowed at the 18.7:1 metric.

[2] Community Based Faculty for 1st and 2nd year are reported beginning in initial year of school. Funding for community faculty currently used for clinical education of 1st and 2nd year students is provided by support from UCLA and UCR. Current funding sources for these faculty will be discontinued upon inception of UCR medical school.

SOM Initial Development Assumptions (continued)

1. **Ambulatory Care Facility - Phase I**

Assumptions:

- Construction start date: 3rd quarter of 2013
- 50-60 Primary Care and Select Specialty Physicians
- General Practice Clinics, Outpatient Surgery, Imaging, Pharmacy, Lab
- 1000 ASF per Physician
- Compliance with OSHPD 3 requirements

TOTAL NSF	65,000 ASF	
TOTAL GSF	100,000 GSF	(65% efficiency)

2. **Medical Research Laboratories - Phase I**

Assumptions:

- Construction start date: 1st quarter of 2013 Program assumptions in two-structures
- 50-65 FTE Principal Investigators
- 1,200 ASF -1,500 ASF Primary Research Lab/ Investigator
- Program Models: Stanford CCSR; Hauptman Woodward Institute Biomedical Research
- Institute

Research Lab Space	82,500 ASF	
Lab Support Space	41,250 ASF	(At 50% of Lab)
Lab Core Space (vivarium separated)	20,625 ASF	(At 25% of Lab)
TOTAL ASFL	144,375 ASF	(72% of Total ASF)
Office / Meeting Space	35,000 ASF	
Conference Center	10,000 ASF	
Other Assignable (Loading, Foodservice, etc.)	10,000 ASF	
TOTAL Other ASF	55,000 ASF	(28% of Total NSF)
TOTAL NSF	195,375 ASF	
TOTAL GSF	306,731 GSF	

3. **Medical Education Building**

Assumptions:

- Construction start date: 3rd quarter of 2011
- 100 Students/Class
- Program Models: Texas Tech University HSC, El Paso; UCLA Geffen SOM
- Lecture Halls / Classrooms / Small Group Rooms 16,000 ASF
- Gross Anatomy Suite 7,500 ASF
- Basic Sciences Teaching Laboratories 5,000 ASF
- Student "Colleges" / Student Services 10,500 ASF
- Library (Printed and Electronic Collections) 15,000 ASF
- Clinical Skills Center 5,500 ASF
- Simulation Center 3,500 ASF
- Administration 17,500 ASF
- Building Support 3,000 ASF

TOTAL NSF	83,500 ASF	
TOTAL GSF	144,000 GSF	(58 % efficiency)

4. **Vivarium Facility**

Assumptions:

- Construction start date: 1st quarter of 2012
- 55 FTE Principal Investigators
- Average of 500 Rodents/ Primary Research Investigator (27,500 Total)
- Single Corridor System

- Procedure Room/Holding Room Ratio: 1:2
- 140-Cage Ventilated Racks
- Program Models: UG Davis West Enterprise Campus Mouse Facility; MD Anderson South Campus Vivarium Facility

Vivarium Holding Core (incl. Quarantine)	8,000 ASF	
Vivarium Core Facilities	4,000 ASF	
Vivarium Imaging ,	2,500 ASF	
Vivarium Surgery and Laboratory	2,500 ASF	
Vivarium Corridors	3,060 ASF	
TOTAL ASFL	20,060 ASF	(18% of Vivarium)
Office / Admin/ Entry	2,000 ASF	
TOTAL Other ASF	2,000 ASF	
TOTAL NSF	22,060 ASF	
TOTAL GSF	40,100 GSF	(55 % efficiency)

SOM Long-Term Development Assumptions

5. **Medical Research Laboratory- Phase II**

Assumptions:

- 2018 - 2020 Completion Date
- 25-30 FTE Principal Investigators
- 1,200 ASF -1,500 ASF Primary Research Lab/ Investigator
- Program Models: Stanford CCSR; Hauptman Woodward Institute Biomedical Research
- Institute

Research Lab Space	41,250 ASF	
Lab Support Space	20,625 ASF	(At 50% of Lab)
Lab Core Space (vivarium separated)	10,312 ASF	(At 25% of Lab)
TOTAL ASFL	72,187 ASF	(72% of Total ASF)
Office / Meeting Space	17,500 ASF	
Conference Center	5,000 ASF	
Other Assignable (Loading, Foodserv, etc.)	5,000 ASF	
TOTAL Other ASF	27,000 ASF	(28% of Total ASF)
TOTAL NSF	99,687 ASF	
TOTAL GSF	153,364 GSF	(65 % efficiency)

6. **Ambulatory Care Facility - Phase II**

Assumptions:

- Completion Date beyond 2013
- 30 Primary Care and Select Specialty Physicians
- General Practice Clinics
- 1000 ASF per Physician
- Compliance with OSHPD 3 requirements

TOTAL NSF	32,500 ASF	
TOTAL GSF	50,000 GSF	(65 % efficiency)

SOM Long Term Development Assumptions (continued)

7. **Ambulatory Care Facility - Phase III**

Assumptions:

- Completion Date beyond 2013
- 50-60 Primary Care and Select Specialty Physicians
- General Practice Clinics, Outpatient Surgery, Imaging, Lab
- 1000 ASF per Physician
- Compliance with OSHPD 3 requirements

TOTAL NSF	65,000 ASF	
TOTAL GSF	100,000 GSF	(65 % efficiency)

8. **Ambulatory Care Facility Parking Garages - Phases II and III**

Assumptions:

- Three Parking Garage Structures adjacent to ACFs
- Completion Dates beyond 2013
- 345 SF per parking space
- 1250 total Parking Spaces for Ambulatory Care

TOTAL GSF	431,250 GSF

Peter Young

From: Jon Harvey [jon.harvey@ucr.edu]
Sent: Thursday, February 12, 2009 2:06 PM
To: Peter Young
Subject: FW: SoM I-1 Utility Rates Updated from WCIDS

Peter,

Utility rate information is included below for your information and use.

Jon

From: Deborah Pecora [mailto:deborah.pecora@ucr.edu] **On Behalf Of** Mike Miller
Sent: Thursday, February 12, 2009 2:01 PM
To: jon.harvey@ucr.edu
Subject: RE: WCIDS - Utility Rates

Jon:
Per Miller, updates are in red below.

Debby Pecora
Administrative Assistant to Mike Miller
Assistant Vice Chancellor, Facilities
University of California Riverside
Phone: (951) 827-3340
Fax: (951) 827-3651
Email: deborah.pecora@ucr.edu

From: Jon Harvey [mailto:jon.harvey@ucr.edu]
Sent: Thursday, January 22, 2009 4:53 PM
To: Mike Miller
Subject: FW: WCIDS - Utility Rates

Mike,

This is the previous email per conversation.

Jon

From: Mike Miller [mailto:mike.miller@ucr.edu]
Sent: Friday, January 11, 2008 8:55 AM
To: jon.harvey@ucr.edu
Cc: George MacMullin; Kieron Brunelle; George Palmer
Subject: RE: WCIDS - Utility Rates

Jon:
This looks pretty close, but we should probably review annually.
Thanks.
Mike

From: Jon Harvey [mailto:jon.harvey@ucr.edu]
Sent: Thursday, January 10, 2008 1:32 PM
To: george.palmer@ucr.edu; Mike Miller
Cc: George MacMullin; Kieron Brunelle
Subject: WCIDS - Utility Rates

Mike, George,

We appreciate your taking the time to discuss the complex issues associated with the purchase and delivery of utility commodities. A summary of the major points is included below along with the utility rate information that will be used for planning purposes.

Further discussions on the West Campus water pressure will be included in the upcoming WCIDS Work Session, and can hopefully be resolved at that time. A follow-up meeting will be scheduled after the Work Session if further discussions are needed.

Please let me know if you have any comments to the information. We would like to send the rates information to the WCIDS consultant team tomorrow.

Thanks

Jon

----

1. Campus domestic water is essentially supplied by the City.
2. The City is planning to build a new water reservoir south of MLK to replace an existing reservoir. This could be the second West Campus water supply source.
3. Gage canal water is used for domestic water. The water is filtered, treated, and blended prior to placement into the city water supply.
4. West Campus domestic water should be a closed loop system that can be supplied from two points: east campus and the city. The potential West Campus water pressure problem requires further review. Physical Plant will examine the potential problem.
5. Campus has a 20 year agreement with the Gage Canal company which will be up for renewal in six to seven years. Water from the Gage Canal can be used for landscape irrigation.
6. Campus usage / typical loads
    a. Water – 840,000 ccf per year
    b. Electric base load is under 6.0 megawatts
    c. Natural Gas is roughly 3.0 million therms per year
7. Utility Rates for WCIDS planning purposes.
    a. Water
        i. $1.17 / CCF domestic water **1.20 / CCF**
        ii. $500 to $600 / acre foot irrigation
        iii. Cost for water will increase 10 percent per year for the next few years. Campus is currently in the second year of the five year program, and anticipates the rates will continue to increase well into the future.
    b. Electric
        i. Flat rate - $0.0625 / kwh **$0.065 / kwh (Sept 2009 @ $0.070 / kwh and Sept 2010 @ $0.078 / kwh)**
        ii. Current agreement has the rate increasing to $0.0725 over the next three years.
    c. Natural Gas
        i. $0.65 / therm
    d. Planning can assume that these rates will be effective over the next five years.

MEETING MINUTES FOR THE CONFERENCE CALL WITH THE
RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

For

University of California – School of Medicine

Call Date: February 17, 2009
Call Time: 1:30pm to 2:00pm

- Winzler & Kelly to verify the existing system using the GIS system that is available on The Counties' website.
    - Using the GIS, W&K will determine the names of the as-builts that are available from the county.
    - W&K to contact the county Reduction Department to coordinate the transfer of as-built info in PDF format.
- The county has two storm drain master plans that are available on the web.
    - The Box Springs master plan is the one that will apply to UCR.
    - This master plan was prepared in 1970 and the zoning assumptions need to be verified.
- The GIS has the watershed boundaries used in the master plan. The boundary line does not cross Iowa Ave., whereas the WCIDS shows the proposed drainage continuing past Iowa Ave. to the west. Although the existing county SD pipes were sized for build out conditions, the existing pipe capacity needs to be verified. This is especially true if the proposed plan modifies the watershed boundaries from what is shown in the Box Springs master plan.
- Mr. Duckworth seemed to think that the rational method would be adequate for this project if the tributary area is small and detention is not needed, but he recommended we reference the County Hydrology Manual and get further guidance for other methods.
- The county requires that the 100yr storm event is contained within the public road R/W.
- W&K needs to verify that the ultimate downstream condition is controlled.
- The WCIDS figures show an 18'' county line in Chicago Ave. The county has no record of this line being there. This is likely a city owned and maintained line and was mislabeled in the WCIDS.
- The county will require that a Water Quality Management Plan be prepared on behalf of UCR to ensure that the stormwater entering their system meets the minimum standards.

Action Items:

- W&K to get all pertinent as-built info from the county
- W&K to obtain the backup hydrology calculations from the County
- Discuss the 18'' storm drain line in Chicago Ave with the City

Call Attendees:

Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)
Everett Duckworth (Riverside County Flood Control & Water Conservation District)

MEETING MINUTES FOR THE CONFERENCE CALL WITH THE
CITY OF RIVERSIDE
For
University of California – School of Medicine

Call Date: February 18, 2009
Call Time: 3:30pm to 4:00pm

Call Attendees:
Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)
Oscar Khoury (City of Riverside – Public Utilities – Principal Engineer)
Marty McCleod (City of Riverside – Public Utilities)

Items Discussed about the Cities Water System:

- The City will not allow UCR to connect to the existing 20'' transmission line in Cranford Ave.
- The city will allow UCR to connect to the existing 10'' distribution line in Chicago Ave, but they want to make sure the 10'' line will server UCR's peak demands.
  - W&K will provide the city (Oscar K.) with our peak demand info. The city needs to know what the peak demand is as well as when it will take place.
  - W&K must also give the city the phased demand info as well as full build out demand info.
- The 8'' line shown on the WCIDS figures as connection to the 20'' transmission line in Cranford is incorrect. This 8'' line runs parallel to the 20'' line and ties into the existing 12'' line in University Ave. in a similar fashion to the configuration shown to the east at Iowa Ave.
  - The city said that we can connect to the 12'' distribution line in University Ave. pending that easements have been provided for the 8'' line, which UCR would likely upsize to serve the demands.
    - W&K to coordinate with the city to examine this option further.
- The city has a hydraulic model, which is dynamic. The City uses $H_2$0 NET for their modeling. The City cannot release the model to W&K.
  - The city is willing to share their boundary condition data with us so we can more accurately model the on-site domestic water system for UCR
- W&K needs to coordinate with the city and let them know what our limitations are with regards to the connection points so they can work with us to come up with the best solution when they are working with their model.
- W&K told the city that UCR does not need to tie into the cities' recycled water supply network because UCR already has infrastructure in place that can be utilized assuming it is modified and upgraded to meet the proposed development layout and needs.

Action Items:

- W&K to provide the phased and ultimate build out demand info to the city so they can assess if UCR's demands can be met with the existing infrastructure.
- W&K to provide information to the city regarding the preferred connection points.
- W&K to find out if UCR is willing to release a copy of the WCIDS to the city for reference.
- W&K to verify that UCR does not need to connect to the cities' recycled water system to meet the proposed irrigation demands.

MEETING MINUTES FOR THE CONFERENCE CALL WITH THE
CITY OF RIVERSIDE
For
University of California – School of Medicine

Call Date: February 19, 2009
Call Time: 2:00pm to 2:45pm

Call Attendees:
Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)
Rob Van Zanten (City of Riverside – Public Works – Principal Engineer)

Items Discussed about the Cities Storm Drain System:

- Rob has all of the existing storm and sewer design information (as it was approved) available via the cities' CADME system. He can get us any specific information he needs, but he prefers that we first attempt to get the information by downloading it off of the cities website.
- The City has a "light" version of the CADME system on available for public view.
- Rob is going to check with his CADME guy (Robin) and have him give us the layers/CAD linework we will need within 1 square mile of our project.
- There has been no storm drain master plan done by the city. These studies have been done by the county flood control district.
- The WCIDS references drawing number D319. This is an improvement plan sheet.
    - Improvement plans are on the cities website
        - Main Page =>E-services =>Survey & Land Records =>Imp. Plans (L.H.S.)
- We will use the county hydrology manual in our design.
    - Per the manual the 100yr flow can be conveyed overland, but the streets must contain it. The water spread cannot exceed the limits of the R/W.
- Water Quality Standards
    - The city and the county operate under the same MS4 permit, therefore the city will not require UCR to adhere to more stringent standards than the provisions set forth by the county flood control district. (Refer to the water quality manual on the county's website).
- Water Quantity Standards
    - Our studies must show that the system we are discharging into has the capacity to convey the new flows. Detention will only become a requirement if we need to reduce the post-development flows to meet the existing capacity requirements.
- Although the WCIDS figures don't show it, Rob's CADME system shows a 30'' pipe near the sag of Chicago Ave. north of 12th Street.
    - Rob will assist us in any way needed to determine how much flow we can divert to this 30'' pipe.

Items Discussed about the Cities Sewer System:

- Rob recalls that the city has modeled this area under a master plan back in 2002 or so.
- The city plans on upsizing the line in University Ave to a 12'' trunk line.
- Rob was wondering what the ADF's & PWWF's are. Some other questions included:
  - How do these new numbers compare with the Universities plans for development back in 2000? Rob will find out what numbers the city used.
  - When was the LRDP finished? The numbers from this study were used by the city to determine the future demands.
- W&K has design flow estimates from the WCIDS.
  - We need to compare the WCIDS flows with the cities assumed flows in the master plan.
- Rob is going to look into getting us the master sewer plan info.
  - He will also check to see if he can get us the model
- The UCR private sewer pipe in Chicago Ave. connects to the 8'' city line just north of 12th Street. A 10'' city sewer line heads north downstream of said connection. (Dwg # S-374 is referenced in his CADME and pipes were installed in 1963)
- Everything (City and UCR private sewer lines) flow to the existing 10'' line heading north in Chicago Ave.
- The city has no information on the universities private 8'' sewer line in MLK and Chicago.
- Rob is going to check with the maintenance people to see if there are any significant deficiencies in the system downstream of UCR and get back to us.
- Rob wanted to know who is handling the traffic & circulation issues on our team.

Action Items:

- W&K to download the pertinent Improvement Plans from the cities website
- W&K to verify when the LRDP was finished and notify Rob.
- W&K to send Rob the latest ADWF and PWWF flows.
- W&K to request As-Built information for the 8'' private sewer line in MLK and Chicago Ave.
- Anthony to notify Peter that Rob wants to get in contact with the people on our team handling the traffic & circulation coordination.

MEETING MINUTES FOR THE CONFERENCE CALL WITH THE
UCR Agricultural Operations

For

University of California – School of Medicine

Call Date: March 4, 2009
Call Time: 4:15pm to 4:45pm

Call Attendees:
Anthony LaMarca (Winzler & Kelly)
Steve Cockerham (UCR Ag. Ops.)

Items Discussed about the Existing Irrigation Supply:

1. Steve said that the existing irrigation lines are very old. To his knowledge the pipes are mainly concrete, transite, and steel. The age of the main pipe lines range from 50yrs to 100yrs old and the majority are probably 80yrs old or so.
2. Steve doesn't believe that these pipelines are capable of supporting the pressures the school of medicine and other future developments will require. He thinks it would be wise to replace the recycled water supply pipes all the back to the source, which is the asphalt reservoir.
3. Currently, the pipeline that feeds the future school of medicine field no. 5 is a 16'' line. Steve believes that this line could be an 80yr old steel line, but he wasn't absolutely sure. This line is fed via the asphalt reservoir, which lies on the east side of the Gage Canal. Canal water is transferred from a vault situated in the reservoir into this 16'' pipeline via a low head pump. Once the water gets into the pipeline it gravity flows down to the sprinkler pump situated at the midpoint of the proposed school of medicine site along Cranford.
4. The asphalt reservoir is connected to the dirt reservoir on the other side of the Gage Canal via an underground pipe (inverted siphon). The dirt reservoir provides extra storage capacity and also serves as a convenient location to store transfer the reclaimed irrigation water, which comes from the salvage reservoir no. 1 located adjacent to Chicago Ave.
5. Steve elaborated on comment 2 made in the 2-13-09 meeting minutes regarding the orchard fields that become unusable next to a new development. He said that the chemicals researchers are using on the trees may be perceived as harmful. This perception could be further exaggerated when the adjacent development is a medical center. Also, he restated that the research requires collection of time elapsed data and researches may not be willing to risk losing the end of their data because the trees have been cleared for a planned development. Although he feels it is unnecessary to keep trees in the path of a phased development irrigated, he clearly stated that he does not have the authority to make this call.
6. Steve said that a good person for us to speak with regarding any of the existing irrigation infrastructure is Barney Power. Barney is a part-time retiree and is the most familiar with the current system. He may be able to locate drawings and as-builts. He is only in the office on Monday and Friday. We are more than welcome to schedule a meeting with him.

Action Items:

- W&K to schedule a meeting with Barney Power if we feel more information is required.

SUMMARY OF EMAIL CORRESPONDENCE WITH
UCR Agricultural Operations
For
University of California – School of Medicine

Email Delivery On: 3-5-09 at 1:19 pm
Email Response On: 3-5-09 at 4:36pm

Email Sent By:
Anthony LaMarca (Winzler & Kelly)

Email Response By:
Steve Cockerham (UCR Ag. Ops.)

Email Regarding the Existing Irrigation Supply Asphalt Reservoir Pumps:

W&K had some follow-up questions regarding the discussion we had with Ag. Ops. on Wednesday the 4th. W&K sent Steve three questions and he promptly responded as shown in blue below.

1. What is the condition of the pump that transfers the water from the vault to the gravity distribution lines? (Age, maintenance issues, etc.) *There are five pumps. All are 40 yrs or older. All are maintenance issues. One motor was rebuilt in '08 others are probably due. None have pressure bowles. This system will not be able to supply your landscape and our research blocks, so I am afraid that your landscape comes in last.*

2. Are as-builts available for the asphalt reservoir which includes information about the pump? Maybe this would be a good question for Barney Power. If that is the case, just let me know and I will call him on Friday. *No as-built drawings are available.*

3. Do you have information about the operational parameters of the pump? *Yes*. This would include info about operating pressure, horsepower, etc. *Yes. But the system is not to be considered a part of your plan so we don't plan to look up the information right now.*

Give me a call when you get this if you would like to discuss it rather than respond via email.

Thanks!

Your welcome. Sorry that we can't help you much on this.

Joint City of Riverside and UC Riverside Planning Meeting
West Campus Development / School of Medicine Infrastructure 1
March 9, 2009

Purpose of the joint UCR and City of Riverside meeting is to discuss West Campus infrastructure planning issues and questions generated from on going West Campus planning efforts, and resolve or identify ways to address outstanding areas.

Participants

UCR		
Timothy Ralston	Associate Vice Chancellor	Capital & Physical Planning
Kieron Brunelle	Director	Capital & Physical Planning
Nita Bullock	Campus Physical Planner	Capital & Physical Planning
Jon Harvey	Principal Educational Facilities Planner	Capital & Physical Planning
Richard Racicot	Assistant Vice Chancellor	Office of Design & Construction
George MacMullin	Senior Engineer	Office of Design & Construction
City of Riverside		
Rob Van Zanten	Principal Engineer	Public Works
Steve Badgett	Deputy Assistant General Manager-Energy Delivery	Public Utilities
Kevin Milligan	Assistant General Manager-Water	Public Utilities

Not in attendance

UCR		
Don Caskey	Campus Architect-Associate Vice Chancellor	Facilities
City of Riverside		
Siobhan Foster	Director	Public Works
Diane Jenkins	Principal Planner	Planning
Dave Wright	General Manager	Public Utilities

1. Status Update on UCR School of Medicine Infrastructure Planning Process
   a) Winzler & Kelly (W&K) was retained to complete the School of Medicine Infrastructure 1 project. Planning process started in January and the report is scheduled to be completed in June 2009.
   b) Project goals include: identify infrastructure requirements that are necessary to support the first School of Medicine (SOM) facilities; produce a plan to meet both the short-term needs to support SOM, and long-term needs to support the West Campus; identify surface infrastructure requirements that include campus circulation, parking, and creating a proper setting for the SOM; and, present a vision of sustainability.
   c) The project will review and update assumptions used in the 2008 West Campus Infrastructure Development Study (WCIDS). The report is available on the Campus & Physical Planning website.

2. Domestic Water
    a) Discussed the overall West Campus domestic water plan as presented in the WCIDS, and the current concepts for furnishing water to the SOM. Two proposed points of connection are University Avenue and Cranford Avenue, and Chicago Avenue and the Northwest Mall. These points would create a looped system.
    b) Connecting to the 20 inch distribution line is not possible since routine maintenance shuts service to the line.
    c) Riverside Public Utilities (RPU) preference is to stay away from looped systems, but is open to the idea with conditions. Backflow preventers will be necessary, which will reduce water pressure and require a pumping system to maintain water pressure. Further discussions between UCR consultant team and RPU are necessary to address concerns and conditions.
    d) The Campus is interested in establishing two water points of connection in case of problems with the primary line. This would be similar to the two connection points on the East Campus.
    e) W&K has requested access to RPU water model to assist with planning the system. Kevin Milligan will contact City Attorneys to establish a non-disclosure agreement with the UCR consultant, W&K.

3. Sewer
    a) The Campus is planning to increase on-campus housing along Linden by 3,500 beds, which will increase the sewer loads. The first part of the housing project provides 600 beds, and design is scheduled to begin within the next few months.
    b) Campus has concerns with the capacity of the current sewer system to handle both the current and future loads. Public Works (RPW) is planning to place an 18 inch line in University Avenue that will have the capacity to support the East and West Campus. The belief was the new line would be in addition to the current 12 inch line, which will need to be verified. Public works will investigate and report back to the group.
    c) The RPU will be starting a feasibility study for a scalping station that would be located on City property. The station would be able to collect flow from the University sewer line for treatment and reuse. Anticipate that the study will start in April 2009, and would take approximately nine month to complete. RPU will keep UCR apprised of key assumptions associated with the development of the scalping station proposal. Based on timing, UCR will make reference to this in the forthcoming W&K report.

4. Storm Water (City and County Flood Control)
    a) West Campus plans assume that Iowa Avenue widening will address storm water flow east of Iowa. Planning for the SOM and the proposed Family Housing development only considers storm water flow that occurs west of Iowa Avenue.
    b) UCR follows all state and national regulations, and coordinates development with the City. UCR is subject to the federal Clean Water Act.
    c) UCR will examine and consider current storm water management best practices that includes pervious pavement. UCR will share methodology and findings for the development of the storm water management plan with RPU.

5. Irrigation
   a) The landscape irrigation sources identified in the WCIDS is the Gage Canal, which is closed for a few weeks each year for maintenance. UCR is open to using recycled water for landscape irrigation.
   b) The recycled water source, point of connection, will be identified as part of the previously mentioned scalping station feasibility study.
   c) The RPU and UCR are interested in exploring the possibility of placing an underground recycled water reservoir under the recreation fields or at another campus location. The idea will be incorporated into the RPU feasibility study.
   d) The SOM Infrastructure 1 project will explore the feasibility of using recycled water for irrigation, and for non-potable uses in buildings, and possibly in other systems such as cooling towers.

6. Electric, substation and 69kV subtransmission line
   a) The RPU is proposing to run a 69kV subtransmission line across the West Campus to connect to the University Substation. The project will include running additional 69kV lines along the freeway to connect to other RPU substations. Placing the east-west 69kV lines underground is an option, but requires careful planning to ensure the lines do not conflict with future West Campus utilities.
   b) An existing RPU 69kV line that feeds the University Substation conflicts with the proposed West Campus Graduate and Professional Center building. Relocating this line needs to be considered with the new 69kV line.
   c) The RPU is aware of UCR West Campus development plans, and would like to work with UCR to develop an agreeable alignment for the proposed 69kV line. West Campus plans are not at a level of completion that the RPU prefers to work with when planning underground lines, which can create challenges with designing the system. The UCR consultant will work with RPU to explore alternatives to derive suitable assumptions for things like finished elevation, etc.
   d) Plans to feed the proposed SOM substation will need to be coordinated with planning the location of the subtransmission line.

7. Transportation and Parking
   a) The consultant team is working on parking and circulation plan, and conversations with the identified City contacts should begin the week of March 16.
   b) The proposed Chicago Avenue / Northwest Mall intersection is a concern given the short distances between traffic signals. Peak traffic occurs at set times, which creates backup situations at major intersections. As part of the planning process, further review of the current and future traffic conditions by UCR and Public Works may be necessary.

8. Conclusions / Action Items / Next Steps
   a) A number of agreements will need to be addressed between the RPU and UCR related to the 69kV line, utility rate structures, and possibly other areas (e.g., sewer rates).
   b) Action Items / Next Steps
      - Kevin Milligan will contact City Attorneys to establish a non-disclosure agreement with the UCR consultant, W&K.

- RPU and UCR agreed to work together to develop a mutually agreeable solution with the 69kV subtransmission lines. UCR will identify a contact person on the W&K consultant team to work with RPU.
- RPU will explore the possibility of placing a recycle water reservoir under the West Campus Recreation fields as part of the upcoming RPU feasibility study.

9. Current Campus References (available on UCR Capital & Physical Planning web site)
   a) 2005 Long-Range Development Plan
   b) 2008 Campus Aggregate Master Planning Study
   c) 2008 West Campus Infrastructure Development Plan
   d) 2008 Strategic Plan for Student Housing Update

Jon Harvey

From: Mike Delo [mike.delo@ucr.edu]
Sent: Friday, March 13, 2009 9:08 AM
To: jon.harvey@ucr.edu
Cc: Andrew Stewart
Subject: RE: SoMI 1 Parking Requirements

Sorry, Jon. Yes, it is fine.

Mike

-----Original Message-----
From: Jon Harvey [mailto:jon.harvey@ucr.edu]
Sent: Thursday, March 12, 2009 12:30 PM
To: Mike Delo
Cc: Andrew Stewart
Subject: FW: SoMI 1 Parking Requirements
Importance: High

Mike,

Please let me know early this afternoon if the SOM parking direction listed below is fine so the information can be sent to the Steering Committee and the consultant team.

Thanks

Jon

-----Original Message-----
From: Jon Harvey [mailto:jon.harvey@ucr.edu]
Sent: Tuesday, March 10, 2009 9:28 AM
To: Mike Delo
Cc: Nita Bullock; Don Caskey; George MacMullin; Kieron Brunelle; Mike Miller; Timothy Ralston; Andrew Stewart
Subject: RE: SoMI 1 Parking Requirements

Mike,

Direction to compute parking requirements have been revised to address both your comments, and those provided by Andy Steward.

The School of Medicine student population will be at the graduate level, and graduate student parking needs are viewed as being similar to faculty and staff parking requirements (per Andy). Using the higher ratio was recommended.

Proposed direction to the consultant follows.

1. Utilize population data for computing parking requirements when ever possible.
2. Faculty and staff parking requirements: 60% purchase parking permits; and peak demand is 80% of permit holders. This equals 0.48 spaces per position.
3. Student parking at the SOM would use the same ratio as listed above for faculty and staff.
4. Visitor and Patient parking space counts would be 25 percent of the

total student, faculty, and staff spaces.
5. Ambulatory care facilities parking requirements: 5 spaces for every 1,000 gsf.

Please let me know if any additional changes to the above direction are necessary.

Thanks

Jon

-----Original Message-----
From: Mike Delo [mailto:mike.delo@ucr.edu]
Sent: Friday, March 06, 2009 1:43 PM
To: jon.harvey@ucr.edu
Cc: Nita Bullock; Don Caskey; George MacMullin; Kieron Brunelle; Mike Miller; Timothy Ralston; Andrew Stewart
Subject: RE: SoMI 1 Parking Requirements

Jon,

Only 36% of the student population buys permits, Jon, and i can park students at a .50 parking space to a permit. So out of 100 students, 36 buy permits and i supply 18 parking spaces.

sounds crazy, doesn't it? But i just report the facts.

i think the 10% parking allotment for "visitors" based on number of employees is low, Jon. you have to understand that many of our students - and some employees - fill our "visitor" spaces on campus. those students who are not buying quarter or annual permits - many are paying a short-term visitor rate. they think they save money not paying for a longer term permit by just paying the short-term rate for the few times they drive to the campus.

i would feel more comfortable if that 10% were bumped up to 20% - maybe even 25%.

thanks,
mike

-----Original Message-----
From: Jon Harvey [mailto:jon.harvey@ucr.edu]
Sent: Fri 3/6/2009 1:33 PM
To: Mike Delo
Cc: Nita Bullock; Don Caskey; George MacMullin; Kieron Brunelle; Mike Miller; Timothy Ralston; Andrew Stewart
Subject: RE: SoMI 1 Parking Requirements

ProgId Word.Document Generator Microsoft Word 11 Originator Microsoft Word 11 Mike,

Thanks for the direction.

The following parking information will be forwarded to the consultant team.

1. Utilize population data for computing parking requirements when ever possible.
2. Faculty and staff parking requirements: 60% purchase parking permits; and peak demand is 80% of permit holders. This equals 0.48 spaces per

position.
3. Visitor and Patient parking is in addition to the above.

Population data for ambulatory care facilities is limited, and the constant team included two parking ratios in the materials provided to address parking needs as follows: 5 spaces for every 1,000 gsf; or 4 spaces for every 1,000 gsf of ambulatory care space.

Any comments or direction you can provided on ambulatory care ratios would be appreciated.

We will also need guidance on student parking.

Thanks

Jon

From: Mike Delo [mailto:mike.delo@ucr.edu] Sent: Friday, March 06, 2009 11:14 AM To: jon.harvey@ucr.edu; Andrew Stewart Cc: Nita Bullock; Don Caskey; George MacMullin; jon.harvey@ucr.edu; Kieron Brunelle; Mike Miller; Timothy Ralston Subject: RE: SoMI 1 Parking Requirements

Jon, First, i apologize for not getting back earlier to you on this matter. we do not think of providing parking spaces based on square footage. instead, our model is based on the demand from faculty/staff. in other words, what percentage of the faculty/staff population is going to buy parking permits? For the past four years at the East Campus, the percentage hasn't deviated from 60%. So, 60 UCR employees of every 100 are going to buy a permit at West Campus - that's my assumption. Next, i ask "how many parking spaces do i need to park 60 permit holders?" the answer isn't 60 spaces because not all permit holders park at the same time. East Campus experience tells us that 80% of permit holders park at the same time during peak parking demand. therefore, to park 60 permit holders, i only need 48 parking spaces. That's what the answer is to satisfy faculty/staff parking needs on the East Campus. But, perhaps the parking demand at West Campus will be higher because the opportunity to park on adjacent city streets for free isn't as convenient. Or, the demand may be the same because of the attractive incentives that we offer to utilize alternative transportation. who the heck knows? Please be sure to factor in visitor and patient parking at the West Campus, too. What i've told you addresses UCR employees. There will be the need to accommodate non-employee parking demand based on the activities and service at the West Campus. Let me know if this isn't helpful. Mike -----Original Message----- From: Jon Harvey [mailto:jon.harvey@ucr.edu] Sent: Thu 3/5/2009 5:29 PM To: Mike Delo; Andrew Stewart Cc: Nita Bullock; Don Caskey; George MacMullin; jon.harvey@ucr.edu; Kieron Brunelle; Mike Miller; Timothy Ralston Subject: SoMI 1 Parking Requirements Generator Microsoft Word 11 (filtered medium) Mike, Andy, The School of Medicine Infrastructure 1 consultant team has identified parking requirements based upon the preliminary School of Medicine program. The attached tables show SOM development over three phases, and associated parking requirements. Please review and provide comments on the materials no later than March 12, 2009, in order to furnish comments to the consultant on the morning of March 13. The planning process will assume that the figures are fine if a response is not received by March 12, close of business. If you have any questions, please give me a call. Thanks Jon Jon Harvey Capital & Physical Planning 951-827-6952

Campus Organization	Function / Description	Preliminary Allocation SF/Acres, GSF	Location	Comments
W&K (Consultant Team)				
Central Plant				
Substation				
Physical Plant				
Skilled Craft Shops	• Shops for carpenters, plumbers, HVAC, custodial, grounds. Place for staging maintenance effort. • Storage for extra materials	• Shops-2,400 asf • Custodial-2,400 asf • Grounds- 1,200 asf • Total 6,000 asf, 7,500 gsf • Grounds Equipment storage outside covered: 2,000 sf (2 trucks, large truck, 3 mowers) • Shop vehicles: 1,800 sf covered (4 trucks, 10 carts) • Ground storage: 8 bins, 2,400 sfl • Total: 6,200 sf	SOM Service Area	Major shop work in East Campus Corp yard. Assume 80% asf to gsf ratio
Service Yard	• Lay down area for central plant	• 20,000 sf • Temporary storage for miscellaneous equipment. • Trash container 40 yards (8x40ft), 400 sf • Total 20,400 sf	SOM Service Area	
Recycling Facility			Another West Campus location	
EH&S				
Waste Handling	• Waste Storage facility	2,500 GSF	SOM Precinct	Request additional and justification for space.
Additional Space				
Services for Students with Disabilities	• Parking spaces		SOM Precinct	

Campus Organization	Function / Description	Preliminary Allocation SF/Acres, GSF	Location	Comments
Police				
Satellite Substation	• Incorporate into first parking structure. • Temporary trailer at startup with secure parking for four vehicles	• 2,400 asf, 3,500 gsf	SOM Precinct	Assume 70% asf to gsf ratio
Secure Parking	•	• Secure parking in garage		
Material Management				
Central Supply / Storehouse	• Deliveries will be made from the East Campus • Further analysis is needed to identify size and location of a central supply warehouse.		Campus	Current Corp Yard including TAPS will require additional review and analysis.
Other				
Mail Services	Campus issue to consider one central campus location.		Campus	

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Anthony La Marca

From: Khoury, Oscar [OKhoury@riversideca.gov]
Sent: Wednesday, March 25, 2009 10:17 AM
To: Anthony La Marca
Subject: RE: UC Riverside - City Recycled Water Question

Anthony,

We are getting the information from our model for the potable data you requested. As far as the recycled water question is concerned, we will not have a definite answer at this point since we are working on our Facilities Plan, but let's assume the connections you mentioned in that order will be available. We will be working on a potential scalping plant that may provide recycled water for the campus. At this point, the study is not advanced enough to answer. We will keep you apprised of changes.

Oscar.

From: Anthony La Marca [mailto:AnthonyLaMarca@w-and-k.com]
Sent: Wednesday, March 25, 2009 8:09 AM
To: Khoury, Oscar
Subject: RE: UC Riverside - City Recycled Water Question

Hello again,

Did you get a chance to discuss this future recycled water connection point with other city staff? I believe that this and the water model boundary conditions are the only two pending items at this point.

Talk to you later.

Anthony LaMarca, PE
Civil Engineer
Winzler & Kelly
1735 North First St, Suite 301
San Jose, CA 95112
Office: (408) 451-9615 ext. 205
Fax: (408) 451-9665
Email: anthonylamarca@w-and-k.com

www.w-and-k.com/
WINZLER & KELLY

From: Anthony La Marca
Sent: Wednesday, March 18, 2009 5:10 PM
To: 'Khoury, Oscar'
Cc: McLeod, Martin
Subject: RE: UC Riverside - City Recycled Water Question

Oscar,

I just spoke with my coworker, Raymond and we decided that a connection at MLK and Iowa would be our first choice. Also, we believe that anywhere along MLK adjacent to the proposed West Campus Development would work as well. If MLK is not good for the City, then we could probably make a connection somewhere along University Ave. adjacent to the proposed West Campus Development. Please let me know what would work best for the City.

Thanks,

Anthony LaMarca, PE
Civil Engineer
Winzler & Kelly
1735 North First St, Suite 301
San Jose, CA 95112
Office: (408) 451-9615 ext. 205
Fax: (408) 451-9665
Email: anthonylamarca@w-and-k.com

www.w-and-k.com/

WINZLER & KELLY

From: Khoury, Oscar [mailto:OKhoury@riversideca.gov]
Sent: Wednesday, March 18, 2009 3:22 PM
To: Anthony La Marca
Cc: McLeod, Martin
Subject: RE: UC Riverside - City Recycled Water Question

Anthony,

Do you need to pinpoint a location at this time for potential recycled water? Do you have any preference on a location? We will have a better idea of potential pipe layout by the end of the year.

Oscar A. Khoury

Principal Engineer
Riverside Public Utilities
(951) 826-5793 (O)
(951) 826-2498 (Fax)

From: Anthony La Marca [mailto:AnthonyLaMarca@w-and-k.com]
Sent: Tuesday, March 17, 2009 12:48 PM
To: Khoury, Oscar
Cc: McLeod, Martin
Subject: RE: UC Riverside - City Recycled Water Question

Hello Oscar,

Were would be a feasible location for us to connect to The Cities' recycled water system assuming we will only be using it for irrigation of the new west campus development? (Chicago, Iowa, MLK, University, etc)

Thanks,

Anthony LaMarca, PE
Civil Engineer
Winzler & Kelly

UC RIVERSIDE UNIVERSITY OF CALIFORNIA

Academic Planning & Budget

900 University Avenue
Riverside, CA 92521-0101

March 30, 2009

Jorge Somoano
Riverside Public Utilities
3901 Orange Street
Riverside, CA 92501

Re: Initial Study/Proposed Mitigated Negative Declaration, Subtransmission Project, February 2009

Dear Mr. Somoano:

Per the subject above, the Riverside Public Utilities Subtransmission Project (STP) will reinforce the eastern side of the electrical supply network in the City of Riverside and resolve critical infrastructure and capacity deficiencies. Improvements to the 69kV subtransmission system are needed to maintain reliable electric service in this area of the City which includes the University of California Riverside (UCR) main campus.

The University of California, Riverside has reviewed the Initial Study and has several concerns. The proposed improvements include a new 69kV subtranmission line that crosses the existing UCR West Campus currently used primarily for Agricultural, Teaching and Research Fields. The new line connects the University Substation located on the eastern boundary of the West Campus adjacent to the I-215/SR 60 freeway to the Riverside Substation. The line would also connect to a proposed substation planned adjacent to the future School of Medicine near the northwestern corner of the West Campus. The proposed alignment is along the Northwest Mall as identified in the 2005 UCR Long Range Development Plan (LRDP) and the 2008 Campus Aggregate Master Planning Study (CAMPS) which articulates build-out of the area of the West Campus north of Martin Luther King, Jr. Boulevard (MLK) between Chicago Avenue on the west and the I-215/SR 60 freeway on the east. The area is planned to accommodate academic land uses including instructional, research and support facilities, student recreation facilities including recreation fields and a recreation building, student housing including family apartments and/or townhouses, graduate student apartments and facilities for the proposed UCR School of Medicine which will include administration, teaching & research facilities, ambulatory care, support services and facilities including parking structures and apartments for the medical school community. Utility services and West Campus infrastructure requirements for all of the land uses, facilities, and locations on the West Campus are identified in the 2008 West Campus Infrastructure Development Study (WCIDS).

In addition to the proposed subtransmission line traversing east west across the West Campus, another subtransmission line is shown on the west side and adjacent to the I-215 freeway alignment from south to north through the Campus to the University Substation and northward. This proposed line also is adjacent to future Campus facilities planned on the west side of the freeway including two parking structures and a new Environmental Health & Safety building and corporation yard. The building and yard are located just south of the Canyon Crest underpass. All of these buildings are identified in the CAMPS.

According to the information provided by Riverside Public Utilities (RPU) through the Initial Study, the 69kV subtransmission line would be constructed using wood or steel poles that are 65 to 80 feet tall, with a typical span length of 150 to 300 feet. Up to a 40 foot wide easement will be required for the subtransmission above ground installation.

The University has concerns with the proposed 69kV subtransmission line above ground project and disposition and location of the proposed lines and offers the following comments:

1. The WCIDS has identified the Northwest Mall as a utility corridor. Types and quantity of utility services placed along the mall alignment vary by location but are all proposed to be underground, not above ground as does the STP.
2. A future main Central Utility Plant is proposed to be located next to and west of the University Substation and infrastructure services will be distributed from this point to the academic area indicated in blue on the attached 2005 LRDP Land Use Map. Services include: electric, communication (voice/data), fire alarm, heating hot water and chilled water and are proposed to follow the Northwest Mall and be subbed out to the various facilities in the Academic Core. Domestic and irrigation water lines will also be located in this area and will also follow the Northwest Mall utility corridor. The STP could be co-located along with proposed underground utilities.
3. The future School of Medicine site includes an existing 40-acre parcel at the northeast corner of Chicago and MLK which will have a dedicated Central Utility Plant. This second West Campus Central Plant will be located in the Service Area north of the Northwest Mall and west of an extension to Cranford Avenue. Similar utility distribution lines as those mentioned for the University Sub Station will occur in this location.
4. Placing the 69kV subtransmission line above ground will clearly and negatively impact the visual quality to the adjacent Riverside multi-family and commercial community to the north of the Campus along University Avenue. In particular, it will impact the quality of life for the Campus community including the views of the Campus from the freeway, from within the Campus in the Graduate and Professional Academic Core and the School of Medicine. It will also diminish the Campus environment and quality of life as it would be in close proximity to proposed Family, Graduate and SOM student housing. The approximately 40 foot easement would also compromise and limit proposed Campus development.
5. The RPU will need to update the present license agreement that allowed the placement of the existing electrical line crossing the West Campus along the future Northwest Mall and will need to negotiate missing easements/licenses along the pathway as there is not a continuous license or easement for the entire length of the STP.

6. The disposition of the current north/south 69kV line that provides service to the University substation needs to be relocated to avoid conflicts with proposed facilities and Campus circulation for pedestrians, bicycles and vehicles.

The University strongly recommends that the STP alignment consider another route for the STP across the West Campus from the University Substation along the Gage Canal south to MLK and then along the north side of MLK to Chicago or the west side of the extension of Cranford to MLK. Important in this relocation would be the placement of the lines underground to be coordinated with Campus infrastructure plans. This undergrounding and relocation will ensure the new School of Medicine, new professional and graduate teaching and research facilities and student housing will retain the open view sheds to the mountains and to downtown Riverside that are currently available and will enhance the quality of life issues that would otherwise be compromised with overhead lines and subsequent easements.

The University is hopeful that the City will consider this request to maintain the maximum amount of land use for the planned West Campus development, enhance the quality of life, and minimize visual impacts for the West Campus Academic Core, student housing, and the UCR School of Medicine. The Campus prepared to collaborate with RPU to develop a mutually agreeable solution for the subtransmission line location that contributes to the identified West Campus development strategy

Sincerely,

Timothy D. Ralston
Associate Vice Chancellor
Capital & Physical Planning

Enclosures: 2005 UCR LRDP Land Use Map
2008 CAMPS Campus Build-Out Map

cc: RPU Utilities Deputy General Manager Badgett
RPU Principal Engineer Hill
Vice Chancellor Bolar
Associate Vice Chancellor/Campus Architect Caskey
Assistant Vice Chancellor Miller
Director Brunelle
Director Kraus
Campus Physical Planner Bullock
Principal Educational Facilities Planner Harvey

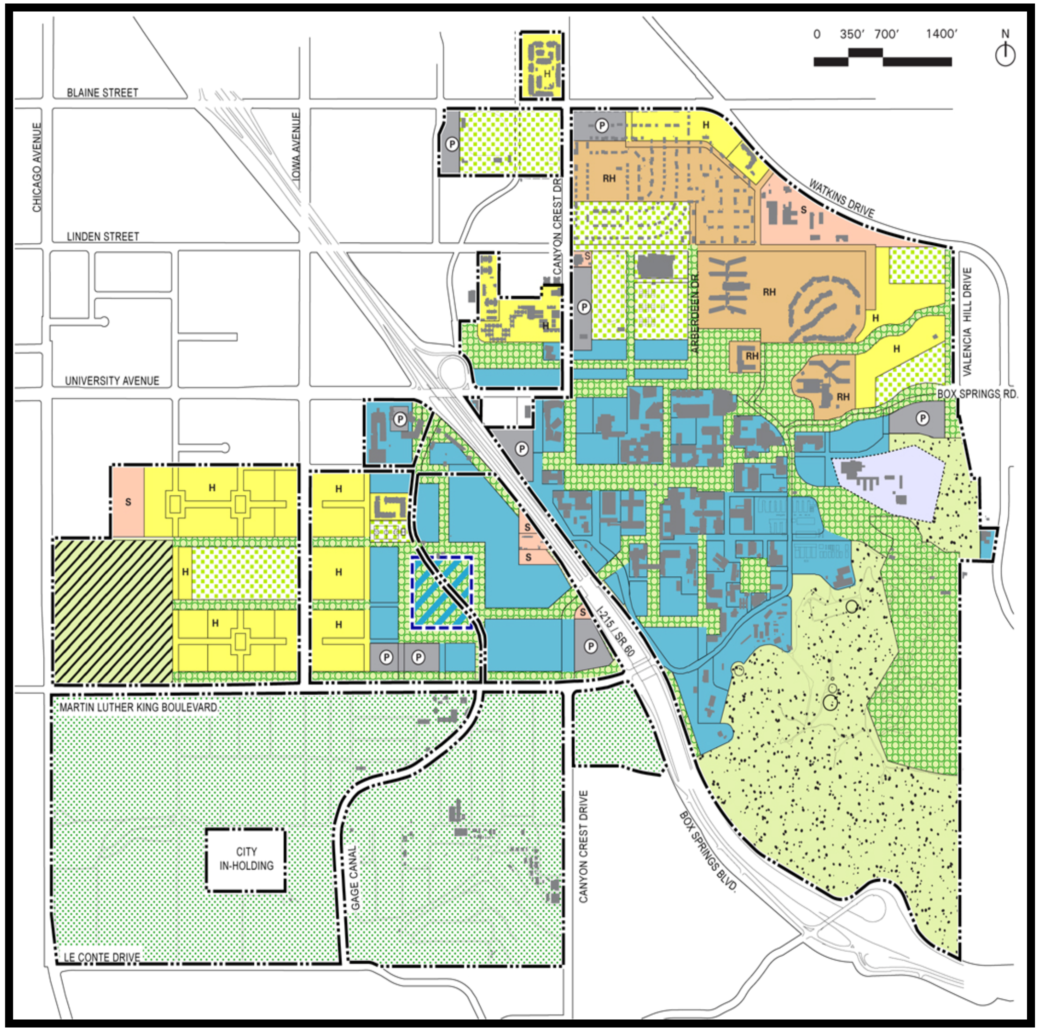
Academic

Apartments

Residence Halls

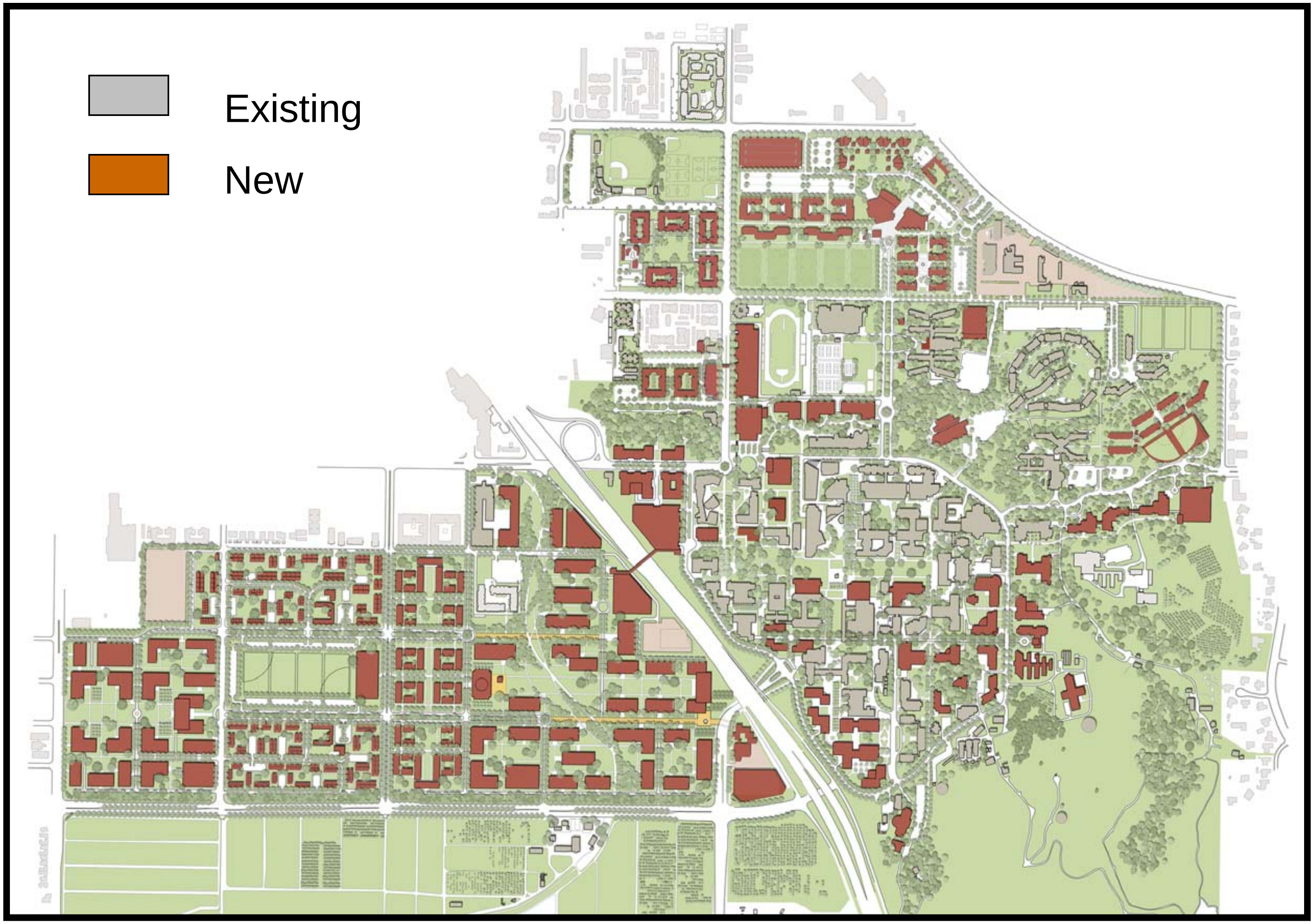
Open Space/ Recreation

Campus Reserve*



*Proposed School of Medicine

2005 UCR LONG RANGE DEVELOPMENT PLAN (LRDP)
Land Use Map



2008 CAMPUS AGGREGATE MASTER PLANNING STUDY (CAMPS)
Proposed Development

69 kV Subtransmission Network
Meeting Notes
April 9, 2009

Meeting Attendees	
Jon Harvey	University of California, Riverside (UCR)
Don Caskey	UCR
Tim Ralston	UCR
Kieron Brunelle	UCR
George MacMullin	UCR
Nita Bullock	UCR
Tim Brown	UCR
Jorge Somoana	Riverside Public Utility (RPU)
Lyle Hill	RPU
Peter Young	Winzler & Kelly (W&K)
Dick Lennig	W&K

- The current RPU plan calls for:
    - An east/west overhead alignment across the West Campus along the future NW Mall from Chicago Ave to connect to the existing north/south overhead lines along Gage Canal. This alignment would carry two circuits to connect Riverside to La Colina; and Vista to La Colina.
    - A north/south overhead alignment along the west side of the Highway 215 from the existing overhead crossing of Highway 215 to El Cerrito Dr. This alignment would connect Vista to University; and Hunter to Springs.
- The goal of the Subtransmission Project is to have the infrastructure in place by Summer 2010.
- After the plan is approved by the Riverside City Council, property/easement acquisition would proceed. RPU would like to streamline this effort in order to meet the schedule. This will require cooperation from UCR.
- RPU considered Campus development in its evaluation of the east/west overhead 69kV alignment. However, in the mitigated negative declaration (MND), the photo simulations showed the existing condition of the research orchards rather than the developed condition of housing and other campus buildings.
- UCR stated that existing north/south overhead lines on the west side of Highway 215 need to be removed to allow for development of several West Campus buildings. They carry existing RPU 69kV and 12 kV lines.
- UCR stated that overhead lines along Highway 215 within the West Campus area are not preferred since they could potentially limit the development of a number of planned University structures.
- An overhead alignment along Chicago appeared to be acceptable to UCR.
- An east/west alignment south of MLK Blvd. appeared to be preferred by UCR. Overhead appeared to be acceptable.

- An underground north/south alignment along Highway 215 is preferred by UCR. Other alignments west of the University Substation were discussed but could potentially conflict with the large number of 12kV distribution duct banks emanating from the University Substation to serve the West Campus.
- Removal of the existing north/south 69kV lines would be difficult to achieve prior to the Summer 2010 schedule goal due to long lead items that would be required for the Substation and to convert the existing lines from overhead to underground.
- UCR desired to have the 69kV and 12kV lines just north of the University Substation moved to allow for UCR's proposed building scheduled for construction by December 2010.
- A schedule that removes the existing north/south lines by December 2010 would be acceptable to UCR.
- RPU stated that the MND needs to be adopted by the Riverside City Council on May 5 in order to stay on schedule for Summer 2010.

In order to meet the RPU and UCR schedules, the following plan will be further evaluated:

- Overhead alignment along west side of Chicago Ave. from 12th St. to approximately 600' south of MLK Blvd.; then east through the agricultural fields across the Gage Canal to intercept the existing north/south overhead 69kV lines approximately 600' south of MLK Blvd.
- Maintain existing north/south overhead 69kV lines on an interim basis and intercept at Gage Canal 300' south of MLK Blvd. Construct overhead connection to Highway 215. Continue new overhead 69kV alignment to El Cerrito per original RPU plan.

Other items to consider include:

- Intercept existing north/south overhead 69kV line at Highway 215 crossing and construct new underground north/south 69kV alignment along Highway 215 to Canyon Crest Dr. and intercept overhead lines 300' south of MLK Blvd.
- Abandon existing north/south overhead 69kV lines. (Existing 12kV lines need to be addressed)
- Abandon temporary overhead line between Gage Canal and Canyon Crest Dr.
- RPU to evaluate cost differential between alternatives including value of easements from UCR to RPU.
- City's plans to widen Chicago Ave. may necessitate relocation of existing pole line in Chicago anyway.
- Future status of existing RPU 12kV overhead lines within the West Campus.
    - Existing agreements need to be reviewed

- Service to School of Medicine
  - A new School of Medicine Substation is not in the RPU plans
  - RPU indicated that the School of Medicine would likely be served from the existing University Substation
  - Full UCR (East and West Campus) development demands will be sent to RPU to evaluate the need for an additional substation.

Peter Young

From: Khoury, Oscar [OKhoury@riversideca.gov]
Sent: Wednesday, April 15, 2009 8:12 AM
To: Raymond Wong
Cc: Anthony La Marca; Peter Young
Subject: RE: UC Riverside West Campus Development

Answers below in Red underline.

Oscar A. Khoury

Principal Engineer
Riverside Public Utilities
(951) 826-5793 (O)
(951) 826-2498 (Fax)

From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 14, 2009 7:05 PM
To: Khoury, Oscar
Cc: Anthony La Marca; Peter Young
Subject: RE: UC Riverside West Campus Development

Hello Oscar,

Thank you for the information, it is very helpful for us to better understand the system. We have two follow-up questions and would appreciate your input.

1 - Are Sugarloaf Reservoir and Linden-Evans Reservoirs connected? We would like to know if the domestic water to Sugarloaf Reservoir and Linden-Evans Reservoirs are from the same water source. Sugarloaf is a 1200 Zone reservoir, which receives water from Linden-Evans via Linden Booster and thus their water sources are the same.

2 - The following are the pressure data we received from your e-mail on 3/25/2009:

Static and Residual Pressure (at 1500 gpm flow) under Max Day Demand conditions at the following locations:

- University and Cranford **(S: 118, R: 110)**
- Chicago and MLK **(S: 113, R: 95)**
- Chicago and 12th **(S: 122, R: 108)**

Since the ground elevation at Chicago/12th is at around 962 ft, at 997 ft HGL the water pressure is at around 15 psi, which is much less than the previous data. Can you please clarify the hydraulic condition at Chicago/12th? If the pressure is close to 100+ psi, based on our preliminary hydraulic analysis, the pressureseems to be sufficient for the West Campus. There are two lines at Chicago and 12th; 10" Sugarloaf 1200 Zone (pressure info provided), and 42" Gravity (997 ft). The 10" is undersized to meet demand of the West Campus and upsizing it would be a challenge regardless of who does it. Easier option will be to pump up from the 42" to the HGL UCR would like to maintain.

Thanks,
Raymond

It is our understanding that the UCR East Campus domestic water is provided from the City's 5 million gallons reservoir at University Ave and Hwy 215. We would like to know:

1 - How does the City provide domestic water to the 5 million gallons reservoir? ***Pumped from a 42" gravity zone pipeline coming from Linden-Evans Reservoirs via the Chicago Low pumps*** For example, is it by pumping from Linden reservoirs? In addition, is there any Pressure Reduce Valve at the inflow pipeline to the reservoir to break the gravity? ***No***

2 - Does the 5 million gallons reservoir provide water supply to other locations in the City? ***No***

3 - How does the City provide domestic water services to the City area adjacent to the East Campus? ***From Sugarloaf Reservoir (5 MG) at 1200 feet HGL.***

4 - How does the City provide domestic water services to the City area adjacent to the proposed Medical Center site along Chicago? ***From Sugarloaf Reservoir (5 MG) at 1200 feet HGL.***

Overall, we would like to understand the general schematic of the City's water supply configuration. If we can obtain a copy of the City water master plan, or a schematic figure of the water distribution system, it will be very helpful for us. ***Attached***

We are exploring a potential water supply option for West Campus. In builtout condition, instead of feeding from East Campus, West Campus would feed from the City connections at Cranford/University and Chicago/12th. Do you see any obviously issues that render this option infeasible? ***No but at Chicago/12th the City can provide water at 997 ft HGL, which is not sufficient for UCR Campus and UCR will need additional pumping. We don't know your project demand for your campus, both east and west but at Cranford/University, UCR could tap into the City's existing 20" Sugarloaf pipeline but this pipeline already deficient and will need to be upsized to accommodate additional flows.***

Peter Young

From: Duckworth, Everett [EDuckworth@rcflood.org]
Sent: Thursday, April 16, 2009 11:22 AM
To: Raymond Wong
Cc: Delgadillo, Don; Anthony La Marca; Peter Young
Subject: RE: UCR expansion Box Springs

Raymond, to answer your questions:

No,

We have not verified a 100-year conveyance of the pipe and the street.

The District is not planning any future facilities due to deficiencies at this time. Your study showing the 100 year flows within the pipe and the street may show deficiencies in the pipe and/or street conveyance.
If this is the case, we will require that your storm drain be restricted to only allow enough flow that can be adequately conveyed by the District pipe(s). The remaining flows that may be in excess of the street capacity will continue to operate in the same condition as it does today.

This 100 year study and criteria is important to ensure that the downstream facilities are not negatively affected. Due to other regional 100 year facilities, the District does not recognize increased runoff of 100 year flows, associated with development. Therefore, 100 year detention basins are not appropriate here. However, the use of low impact development and water quality basins are encouraged.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 14, 2009 12:19 PM
To: Duckworth, Everett
Cc: Delgadillo, Don; Anthony La Marca; Peter Young
Subject: RE: UCR expansion Box Springs

Hello Everett,

Thank you for the clarification.

Since the 100-year criteria is adopted after the old MDP, did the District verify if the system (pipe plus street overland flow) can at least provide 100-year protection under the existing condition?

If the District does not allow UCR to provide detention basin for a 100-year event, and if the 100-year event from the future development does overload the District's system (pipe plus street overland flow), then possible options may include improve the District's drainage system, or the District provides 100-year detention basins?

Regardless, it is our intention to provide the development with various Low Impact Development features, so we can provide an environmental sustainable campus and along the way minimize additional runoff impact from the development site.

Thank you Everett for your assistance.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]

Sent: Tuesday, April 14, 2009 11:36 AM
To: Raymond Wong
Cc: Delgadillo, Don
Subject: FW: UCR expansion Box Springs

Raymond,

In regards to your questions:

1. District has new 100-year criteria since the old MDP was adopted.
2. District does not allow private entities, or schools, to maintain 100-year route-down basins. We are not talking increased runoff criteria here as the County of Riverside only mitigates the 2, 5 and 10 year frequencies.
3. The criteria that was discussed previously is still required for the proposed improvements.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Friday, April 10, 2009 6:58 PM
To: Delgadillo, Don
Cc: Duckworth, Everett; Anthony La Marca
Subject: RE: UCR expansion Box Springs

Hello Don,

We have a question regarding the storm drain analysis for the UCR West Campus Development, and would appreciate your input.

Given the original hydrology analysis in the County's MDP considered the ultimate condition, the increased runoff due to the West Campus development should be already accounted for in the original hydrology analysis.

If the currently proposed future West Campus development concept generates higher runoff than the ultimate condition in the original hydrology analysis, we propose to provide on-site detention to detain any increased runoff from the existing condition (Orchard Fields), so the proposed builtout runoff leaving West Campus will be less than the ultimate condition in the original hydrology analysis. Since there is no flow increase, the County storm drain flow and street overland flow in the future will be about the same as the existing condition.

In this case, can we satisfy the County storm drain design criteria?

Since we need additional clarifications on the County's expectation on the storm drain analysis, we would like to setup a conference call so we can further discuss. We would like to better understand the County design criteria and how we can apply the criteria to this project, so our analysis can ensure the West Campus development will not adversely impact the County storm drain system.

Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC
Hydraulic Engineer
Winzler & Kelly
1735 North First Street, Suite 301
San Jose, CA, 95112
P 408.451.9615
F 408.451.9665
C 650.867.3304
raymondwong@w-and-k.com

Joint City of Riverside and UC Riverside Planning Meeting
West Campus Development / School of Medicine Infrastructure 1
April 17, 2009
Revised: May 22, 2009

Purpose of the joint UCR and City of Riverside meeting is to discuss West Campus infrastructure planning issues and questions generated from on going West Campus planning efforts, and resolve or identify ways to address outstanding areas.

Participants

UCR		
Timothy Ralston	Associate Vice Chancellor	Capital & Physical Planning
Kieron Brunelle	Director	Capital & Physical Planning
Nita Bullock	Campus Physical Planner	Capital & Physical Planning
Jon Harvey	Principal Educational Facilities Planner	Capital & Physical Planning
Don Caskey	Campus Architect-Associate Vice Chancellor	Facilities Design and Construction
Richard Racicot	Assistant Vice Chancellor	Office of Design & Construction
George MacMullin	Senior Engineer	Office of Design & Construction
Mike Miller	Assistant Vice Chancellor	Facilities
City of Riverside		
Rob Van Zanten	Principal Engineer	Public Works
Steve Badgett	Deputy Assistant General Manager-Energy Delivery	Public Utilities
Kevin Milligan	Assistant General Manager-Water	Public Utilities
Diane Jenkins	Principal Planner	Planning

Not in attendance

City of Riverside		
Siobhan Foster	Director	Public Works
Dave Wright	General Manager	Public Utilities

1. Status Update on UCR School of Medicine Infrastructure Planning Process
   a) The consultant team Winzler & Kelly (W&K) is producing the administrative draft report, and the final workshop is scheduled for May 15. The final report will be completed in June.
   b) The Campus will provide a copy of the draft report to interested Riverside Public Utilities (RPU), Public Works, and planning personnel for review prior to final publication.

2. Sewer
   a) UCR plans currently assume that sewer and storm drains will be extended along Iowa Avenue when the street is converted from two to four lanes.
   b) The concept of adding sewer and storm drain along Iowa Avenue to Martin Luther King Boulevard (MLK) was confirmed by those present. One potential problem involves the

grade changes, which will need to be examined during the street widening design process. The sewer line would be connected to the University Avenue line that will be able to accommodate projected flows. Overall sewer system capacity in the area is assumed to be adequate.

c) An 18 inch sewer line will be placed in University Avenue to address current problems and future loads. Once installed, the new sewer line will address the long-term sewer requirements for UCR.
d) Proposals for the RPU reclaimed water project are being reviewed. The project is anticipated to start in June, and will take nine months to complete. The proposed scalping station and reclaimed water reservoir will be examined as part of the project. Reservoir sites under consideration are: beneath UCR's planned West Campus Recreation fields, and the City in-holding area south of MLK. RPU needs to review specific proposals with UCR's consideration when appropriate.
e) RPU is planning to conduct a research study with Agriculture Operations to determine how citrus responds to reclaimed water. RPU is also interested in discussing non-potable water exchanges with Agriculture Operations. Subsequent conversations with Agriculture Operations after the meeting showed that there is no interest in using reclaimed water in the agriculture area. Changing water sources can impact long-term agriculture research projects.

3. Storm Water (City and County Flood Control)
   a) W&K has been reviewing storm drain design criteria with the County over the past few weeks to identify County requirements to complete a West Campus Storm Drain System Analysis. The County requested a more detailed study that includes areas outside the Campus Planning Area boundary.
   b) W&K had a conference call scheduled with the County to further discuss the requirements. Requested assistance from the City to help resolve the potential problem with the County regarding Storm Water analysis. Rob Van Zanten volunteered to talk to the County. Rob will close the loop with UCR based on that discussion.

4. Domestic Water
   a) Outstanding issues with the domestic water system are: RPU water capacity in the area; and, UCR connection points to the RPU system. The April 17, 2009, email from W&K identifying the problem was distributed at the meeting.
   b) As part of an easement agreement, UCR can connect to the 20-inch water line in Cranford. Connecting to the 42-inch line in Chicago is not possible. RPU requested that W&K contact Oscar Khoury (RPU, Principal Water Engineer) to identify the second water connection point.
   c) Status of the non-disclosure agreement RPU sent to W&K to gain access to the RPU water model was not known at the meeting. Subsequent conversation with W&K revealed that information provided by the City was meeting data requirements, and W&K no longer needed the model. The non-disclosure agreement was not completed.
   d) RPU volunteered to check W&K flow model to reconfirm findings. W&K will provide model to Oscar Khoury for review.

5. Electrical (West Campus)
   a) The following were developed prior to the joint planning meeting by senior RPU and UCR representatives (Caskey, Ralston, and Miller).
      - If RPU encounters problems with acquiring rights through UCR for the proposed STP, RPU will consider alternates which may include an above ground route south of MLK. The route along Chicago, south of MLK may be placed below ground when a possible medical center (e.g., hospital) is built sometime in the future. How to fund placement of the line below ground would be determined at that time.
      - RPU may need to take the Subtransmission project off the May 5 City Council agenda which will postpone City Council action until May 19.
   b) The proposed STP route coming from 12th and Chicago will tie with the La Colina Substation. Further discussion between UCR and RPU with the existing 69kV lines and proposed lines along the freeway are required. Both the existing 69kV and proposed STP lines conflict with UCR development plans.
   c) The cost responsibility to relocate the 69kV line north of the University Substation that conflicts with Campus development is subject to the requirements of any future contract, and RPU's Rates and Rules at the time of the relocation.
   d) Existing north/south 69kV pole line also supports a 12 kV line that feeds Agriculture Operations facilities and other RPU customers. UCR would like RPU to retain the 12kV line connection to the University Substation in the overall distribution plan. The 12kV line has been used to provide service to UCR during power outage events.
   e) School of Medicine (SOM) Substation will require further discussions. RPU is open to building and owning the substation subject to the requirements of any future contract, and RPU's Rates and Rules for the proposed development. This may include UCR paying for substation maintenance. At this time, the SOM Infrastructure 1 report will assume that the substation is in place.
      - Funding mechanism/ownership and operating arrangements for the SOM Substation requires further negotiations.
      - Estimated time to design and construct the SOM substation is 1.5 years.
      - If the station is not complete on SOM opening day, RPU can provide power via another route on an interim basis.

6. Transportation and Parking
   a) The UCR traffic impact analysis (TIA) will be part of the EIR associated with the forthcoming UCR 2005 Long Range Development Plan (LRDP) Amendment. Data obtained from the analysis will be used to determine where signalized intersections are required. The analysis will consider proposed UCR populations and corresponding traffic loads.
      - The LRDP traffic consultant will meet with the City of Riverside traffic engineers to define / review the scope of services.
      - Rob Van Zanten will be point of contact for the project.
   b) The proposed Chicago Avenue and Northwest Mall intersection will require the Northwest Mall to align with 12th Street. The requirement was addressed in the Comprehensive Aggregate Master Planning Study (CAMPS). Current plans identify the location as an all turns intersection.

c) The proposed MLK and Cranford intersection has good separation from the MLK and Chicago intersection. Turn lanes are acceptable, and the design should consider future expansion of MLK.
d) Both Cranford and the Northwest Mall will be limited access streets to reduce cut through traffic.
e) Iowa Avenue improvements are needed with the current street handling 26,000 cars per day. The street is recognized by the City as an important circulation route. The minimum distance between signal separations is 800-1,000 feet, and the need for the three proposed signalized crossings (Everton Place, Northwest mall, and Southwest Mall) will require further discussions. Heavy pedestrian and vehicle traffic is envisioned to cross Iowa, and will be considered as part of the traffic analysis. Establishing signalized crossings needs to be data driven (i.e., results of the TIA or other future studies).

7. Proposed MLK widening
   a) A change in traffic patterns has occurred with the completion of the MLK, which handles 40-45,000 cars per day. Widening the road to six lanes, three in each direction, is under consideration by the City. The change would provide a 6 lane arterial that connects the 91 freeway to the 210/60 freeway.
   b) The area south of MLK is dedicated to long-term research, and any expansions to MLK should be limited to the north.
   c) The CAMPS indicates a 100 foot wide landscape buffer along the north side of MLK within campus boundaries. A pedestrian/bicycle path is being considered for the area to link the School of Medicine to the East Campus. The concept for the pathway was supported by all, and could potentially be comprised of a multipurpose path (e.g. compacted DG) and an asphalt path for bicycles.

8. Conclusions / Next Steps
   a) RPU has no outstanding issues with the SOM Infrastructure 1 planning effort.
   b) RPU will verify that the STP routes crossing the campus by University Substation are no longer necessary and proposed lines south of the University Substation adjacent to the freeway are no longer being considered.
   c) UCR will identify potential STP route south of MLK, and will obtain Agriculture Operations approval.
   d) W&K will contact Oscar Khoury to identify second domestic water connection point, and will furnish the water model to RPU to reconfirm findings.
   e) UCR will provide RPU with the draft School of Medicine Infrastructure 1 report for review prior to final publication.
   f) Oscar Khoury, RPU Principal Water Engineer, will be invited to the next meeting.
   g) Another meeting will be scheduled to continue the planning discussions.

University of California Riverside– School of Medicine

CONFERENCE CALL NOTE

For

RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT STORM DRAIN DESIGN CRITERIA

Call Date: April 17, 2009
Call Time: 1:30pm to 2:40pm

Call Attendees:
Everett Duckworth (Riverside County Flood Control & Water Conservation District)
Don Delgadillo (Riverside County Flood Control & Water Conservation District)
Peter Young (Winzler & Kelly)
Raymond Wong (Winzler & Kelly)
Anthony LaMarca (Winzler & Kelly)

Purpose: To clarify the design method and requirements for storm drain.

W&K's Understanding:

- The 1973 Master Drainage Plan and the County pipeline system design are based on a 10-year storm design criteria. The Master Drainage Plan indicated that the balance of flow above the 10-year design flow will become street overland flow.
- Current County design standards **for flood protection criteria states that the 10-year flood shall be contained within the top of curbs, and the 100-year flood shall be contained within street Right of Way limits. Initiate a storm drain when either condition is exceeded. Special conditions or other authorities may require stricter controls; ie: for reasons of traffic (one dry lane) or pedestrian safety, lower maximum depths of flow in streets may be required.** The City should be consulted regarding these stricter controls. However, the County did not prepare a 100-year storm analysis **and Line E was designed for the 10-year flood ONLY**.
- The County wants to ensure the 10-year flow will not overwhelm the **Line E** pipeline system. All **10-year** flow in excess of the pipeline system design capacity must be **detained onsite**.
- The County assumes the detention basin at Kansas is at capacity in a 10-year event**, but does not know MLK street capacity.**
- The County believes that MLK has capacity to convey the slight increase in runoff from the future West Campus development to MLK. The County **is** not aware of any flooding issues nor flooding records at MLK.
- The County would like to maintain at least one lane in each direction open for traffic on MLK during a 100-year storm. The open lane should have no ponding water, but the City of Riverside should be consulted.
- When the District's Master Drainage Plan was prepared in 1973, the University didn't have a campus plan in the proposed West Campus area. The development

type is listed in the Master Drainage Plan. "SF" means single family housing, etc. However, the runoff coefficients used in the hydrology analysis are around 0.7, which is typically for some level of development such as low density commercial or medium density residential developments.

W&K Comments:
In addition to MLK, we think the overland flow from the proposed School of Medicine development on the western end of the West Campus will route to 12th and Chicago. In addition, as part of the proposed West Campus development, the City will expand Iowa Avenue, and will install a new storm drain pipeline along Iowa Avenue. The new storm drain pipeline will connect to Line E at Iowa and MLK. We will verify the capacity of the existing storm drain pipeline along MLK between Iowa and Cranford, because the proposed Iowa pipeline redirects flow from the east of Iowa to MLK, which the flow currently route to Line F along Cranford.

SUMMARY OF THE ANALYSIS METHODOLOGY:

10-Year Storm:

1. Estimate the 10-year runoff from the proposed West Campus development. In order to estimate potential onsite detention volume, the analysis will be based on the Synthetic Unit Hydrograph Method as defined in Section E of the District's Hydrology Manual. Note that the 1973 County Master Drainage Plan used Rational Method for hydrology analysis. Rational Method can only estimate the peak flow rate, not detention storage volume. **However, based on the MDP Rational Method peak flows, Winzler & Kelly can generate a Synthetic Unit Hydrograph that duplicates Rational Method peak flows.**
2. Compare the estimated 10-year peak runoff with the hydrology analysis results from the Master Drainage Plan **peak flow and the generated synthetic unit hydrolgraph.** .
3. If the estimated 10-year runoff **is** larger than the estimate from the Master Drainage Plan, provide a pipe inlet restriction to the County pipeline system, and/or provide on-site detention to detain the excess peak flow from a 10-year storm.
4. Check the City and County record drawings to obtain the design flow for Lines C (on 12th between Chicago and Ottawa), E (on MLK between Iowa and Chicago), and F (on Cranford between Everton and MLK). If the pipeline capacity is not shown in the record drawings, we will prepare a normal depth calculation using Manning's equation to estimate the pipeline full capacity. The District has back up hydraulics for District pipes in this area.
5. Verify the aforementioned pipeline design flow is higher than a combination of:
   - Any tributary runoff outside of West Campus as per the Master Drainage Plan, plus,
   - The estimated 10-year runoff from the proposed West Campus development that would discharge to the pipeline system.
6. Check the hydraulic capacity of Line E along MLK, between Cranford and Iowa, for the future condition with a new storm drain pipeline along Iowa. Size on-site

detention if needed to ensure the 10-year flow in the pipeline does not exceed the pipe design capacity.

100-Year Storm:

7. Estimate the base case 100-year peak flow. The base case is based on the District's Master Drainage Plan. Rational Method will be used, with the runoff coefficient from the Master Drainage Plan. The 100-year flow estimate will include both West Campus and upstream tributaries. **However, based on the MDP Rational Method peak flows, Winzler & Kelly can generate a Synthetic Unit Hydrograph that duplicates Rational Method peak flows.**.
8. Similar to 10-year storm analysis (Step 1), estimate the 100-year runoff from the proposed West Campus development using the Synthetic Unit Hydrograph Method as defined in Section E of the District's Hydrology Manual. Peak flow from the upstream tributary will be based on the **[SUH]** calculation in Step 7.
9. Subtract the pipeline capacities from the 100 year peak flows and route the flow through the 10 year flow attenuation basin as estimated in Step 3,. The result becomes the "100-year minus 10-year" flow for street overland flow.
10. Prepare simple street overland flow analysis on MLK (between Chicago and Iowa), 12th (between Chicago and Ottawa), Cranford (between Everton and MLK), and Iowa (between Everton and MLK) using HEC-RAS modeling software. The street cross sections will be obtained from the City and County record drawings, and the concept plan for the proposed Iowa Avenue widening. For the purpose of the hydraulic analysis, the beginning water surface elevation for the downstream boundary conditions will be set at the top of curb. For each street section, a hydraulic analysis will be prepared for the base case condition and the proposed West Campus builtout condition.
11. If the hydraulic analysis shows that the proposed West Campus development will significantly increase the street flooding, we will provide on-site 100-year detention to reduce the peak street overland flow.
12. It should be noted that these comments are based on plans and data submitted, which may be lacking required information, are incorrect/incomplete or otherwise deficient in places. Additional comments can be expected from the District after plans have been resubmitted and further review has taken place.

Peter Young

From: Khoury, Oscar [OKhoury@riversideca.gov]
Sent: Tuesday, April 28, 2009 6:12 PM
To: Raymond Wong
Cc: Peter Young; Anthony La Marca; jon.harvey@ucr.edu; Milligan, Kevin
Subject: RE: UCR - Domestic Water Boundary Condition

Raymond,

I am confirming the two connection points below. In the mean time, please provide me with your demand needs so I can figure out what I need to do with our system. Thanks.

Oscar A. Khoury

Principal Engineer
Riverside Public Utilities
(951) 826-5793 (O)
(951) 826-2498 (Fax)

From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Wednesday, April 22, 2009 2:20 PM
To: Khoury, Oscar
Cc: Peter Young; Anthony La Marca
Subject: RE: UCR - Domestic Water Boundary Condition

Thank you Oscar for the data. In our revised analysis, we will set the following two connection points to the City system.

Main Connection: 20" tranmission pipeline along Cranford Ave at MLK Blvd
Backup Connection: 12" pipeline along University Ave at Cranford Ave

Thanks,
Raymond

From: Khoury, Oscar [mailto:OKhoury@riversideca.gov]
Sent: Wednesday, April 22, 2009 10:42 AM
To: Anthony La Marca
Cc: McLeod, Martin; Raymond Wong; Yamamoto, Blake; McLeod, Martin; Khoury, Oscar
Subject: Re: UCR - Domestic Water Boundary Condition

Anthony,

With 3,200 gpm demand, the model shows a residual pressure of 99 psi with a static of 115 psi. Hope this helps.

Oscar Khoury
Principal Engineer
Riverside Public Utilities
3901 Orange St.

Riverside, CA 92501
(951) 826-5793

----- Original Message -----
From: Anthony La Marca <AnthonyLaMarca@w-and-k.com>
To: Khoury, Oscar
Cc: McLeod, Martin; Raymond Wong <Raymondwong@w-and-k.com>
Sent: Tue Apr 21 13:49:46 2009
Subject: UCR - Domestic Water Boundary Condition

Hello Oscar,

We need some additional information to revise our design and run our model. If possible, please provide us with the static and residual pressure for the existing 20'' line at the intersection of Cranford and MLK. Please assume 3,200gpm for the residual pressure.

Thanks,

Anthony LaMarca, PE

Civil Engineer

Winzler & Kelly

1735 North First St, Suite 301
San Jose, CA 95112
Office: (408) 451-9615 ext. 205

Fax: (408) 451-9665

Email: anthonylamarca@w-and-k.com

www.w-and-k.com/

Peter Young

From: Raymond Wong
Sent: Thursday, April 30, 2009 2:35 PM
To: Duckworth, Everett
Cc: jon.harvey@ucr.edu; Delgadillo, Don; Peter Young; Anthony La Marca
Subject: RE: Conference Call Notes

Thank you Everett. Yes, we have the same understanding on the design criteria and analysis method.

We will develop an 1 hour duration SUH and adjust the n value in the Lag time calculation to match the SUH peak flow to the MDP flow.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Thursday, April 30, 2009 11:34 AM
To: Raymond Wong
Cc: jon.harvey@ucr.edu; Delgadillo, Don
Subject: FW: Conference Call Notes

Yes,

I believe that we have the same understanding. I will clarify a little so that future plan checker's will have the same understanding:

1. (a) Use the hydrology Manual but vary the "n" value so that the SUH results are similar to the rational tabling, since you will use this value to compare to flow rates also generated by rational tabling.(b) If you use the "CivilD" software, the 1 hour SUH distribution is included already. Other softwares will need to have the attached 1-hour distribution added, since the 1 hour is not in our manual, yet.

2. Yes, the only SUH that needs to be provided is for the onsite flows in your use in determining volume and sizing of onsite basins.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Wednesday, April 29, 2009 3:07 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young; jon.harvey@ucr.edu
Subject: RE: Conference Call Notes

Hello Everett,

Thank you for the comments. We have two questions regarding the comments and would appreciate your input.

1 - Regarding the comment on Step 1 in the Summary of the Analysis Methodology, does the County require the Synthetic Unit Hydrograph method to follow:
(a) The County Hydrology Manual, or
(b) Create a hydrograph that the peak 10-year flow matches the peak flow from the MDP?

Note that if we use (a) the peak flow will likely lower than the peak flow estimated in the MDP (b).

2 - We would like to clarify that we estimate the design flow (10- and
100- year storms) in Synthetic Unit Hydrograph method only for the West Campus area in the

proposed future conditions. For the existing base case condition within West Campus area, and offsite area for both existing and future conditions, we will use Rational Methods. Is it acceptable to the County?

We are looking forward to your input, so we can complete the storm drain analysis for the School of Medicine development in West Campus. Thank you for your assistance.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Wednesday, April 29, 2009 9:27 AM
To: Raymond Wong; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Here are our comments--I have most of them in red for your use.

Thanks,

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 28, 2009 10:40 AM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Thank you Everett, we are looking forward to the comments.

Thanks,
Raymond

-----Original Message-----
From: Duckworth, Everett [mailto:EDuckworth@rcflood.org]
Sent: Tuesday, April 28, 2009 7:10 AM
To: Raymond Wong; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

I should have our comments to you by the end of today. Don and I are in a seminar, yesterday and today.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Wednesday, April 22, 2009 2:21 PM
To: Delgadillo, Don; Duckworth, Everett
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Thank you for the update Don. We are looking forward to your feedback.

Thanks,
Raymond

-----Original Message-----

From: Delgadillo, Don [mailto:DDELGADI@rcflood.org]
Sent: Wednesday, April 22, 2009 10:53 AM
To: Raymond Wong; Duckworth, Everett
Cc: Anthony La Marca; Peter Young
Subject: RE: Conference Call Notes

Raymond,

We are preparing a reply to your notes. It may be sent this afternoon.

Regards,

Don Delgadillo, P.E.
Engineering Project Manager
RCFC&WCD
951.955.4683

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, April 21, 2009 5:27 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: Anthony La Marca; Peter Young
Subject: Conference Call Notes

Hello Everett and Don,

Thank you again for your time on Friday to discuss about the District's storm drain design criteria. The attached contains the conference call notes and a summary of our analysis procedures. We would appreciate if you can please review and comment on the summary, and to confirm the analysis procedures. Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC
Hydraulic Engineer
Winzler & Kelly
1735 North First Street, Suite 301
San Jose, CA, 95112
P 408.451.9615
F 408.451.9665
raymondwong@w-and-k.com

Comments provided by EH&S regarding campus sustainability. Comments are incorporated into the report appendices for future reference during the design process. As of this writing, the draft Campus Sustainability Plan has not yet been adopted by the Campus.

Ref	Item or Page Number	Comment	Proposed Steering Committee Comments / Direction
	EH&S		
100	4	• Summary understates sustainability needs and goals; be more descriptive, specific	•
101	13	• DPP needs to refer Campus Sustainability Action Plan; though plan is still in “DRAFT” form there are many aspects to the plan that clarify mandates and goals; • State specific goals and mandates that must be met as specified by law and are described in the Campus Sustainability Action Plan • Carbon neutrality for this overall project needs to be stated, either as a specific goal of the project, or specifically offset by other developments by the campus. It cannot be left vague so that it isn’t obligated by either.	•
102	27	• Energy use reduction: needs to refer to CAP; it is state law, and we need to be VERY aggressive to meet the requirements of the law. These statements are much too passive.	•
103	31	• “although carbon neutrality is not part of this scope of work…” Why not?	•
104	Figure 9-9	• Tunnels flood eventually, especially in earthquake country. Contents, and design, should reflect that reality	• Forward to W&K
105	Figure 15-7	• Bike Lanes: avoid 90 degree intersections for bikes unless controlled intersections; or use roundabouts	• Forward to W&K
106	69	• Propane has substantial plan development and security regulatory requirements, well beyond fire code	• Forward to W&K
107	Support Yard Phase 1	• EH&S MUST be part of Phase 1; the SOM cannot legally be served from our existing location. Also, this facility requires direct truck access and a loading dock	• EH&S has not provided additional information and justification for the proposed EH&S space at the SOM location. The information request was made to EH&S via email on March 26, 2009, following the Steering Committee Support Space program review meeting.

UNIVERSITY OF CALIFORNIA, RIVERSIDE

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

ACADEMIC PLANNING & BUDGET
RIVERSIDE CALIFORNIA 92521-0101

May 12, 2009

David Wright
Riverside Public Utilities
3901 Orange Street
Riverside, CA 92501

Re: Subtransmission Project proposed alternate route for RPU consideration

Dear Dave,

This letter is to follow up on prior correspondence of March 30, 2009 to Steve Badgett, and subsequent discussions with RPU representatives on April 17th regarding the physical disposition of proposed transmission lines for RPU's 69 kV subtransmission project as they traverse UC Riverside's acreage west of the 215/60 Freeway.

In the context of the April 17th discussions, UCR was provided the opportunity to internally confirm the viability of a "southern route" for above ground transmission lines which would traverse UCR's West Campus acreage south of Martin Luther King Boulevard. UCR's due diligence in this regard has involved an initial discussion on April 27th of two potential southern route options with Don Cooksey (CNAS Divisional Dean) as well as Steve Cockerham (Superintendant of Agricultural Operations). Don and Steve met with representatives from UCR's Capital and Physical Planning and Physical Plant offices. A subsequent discussion occurred on May 1st between Steve, Capital Planning and Facilities representatives yielding a preferred "southern route" that we are jointly proposing for RPU's consideration. The map enclosed with this letter diagrammatically indicates the proposed alternative route.

In the event that RPU is able to move forward on implementing the proposed route as a component of the larger subtransmission project, UCR is offering the following for consideration:

- That any engineering/project design proposals refining the UCR's preferred route allow for input from appropriate UCR representatives, including Agricultural Operations staff; and,
- Any development of construction/implementation approaches for the preferred transmission line route also allow for UCR/Agricultural Operations input to minimize potential disruptions to operations and/or active research whenever feasible.

Lastly, in a related matter based on the above referenced April 17th discussions, UCR is still seeking confirmation of the subtransmission project component disposition involving transmissions lines along the western edge of the 215/60 Freeway. Please provide this confirmation at your earliest convenience to Principal Educational Facilities Planner Jon Harvey (951-827-6952/jon harvey@ucr edu).

We look forward to future dialogue with you on this proposal.

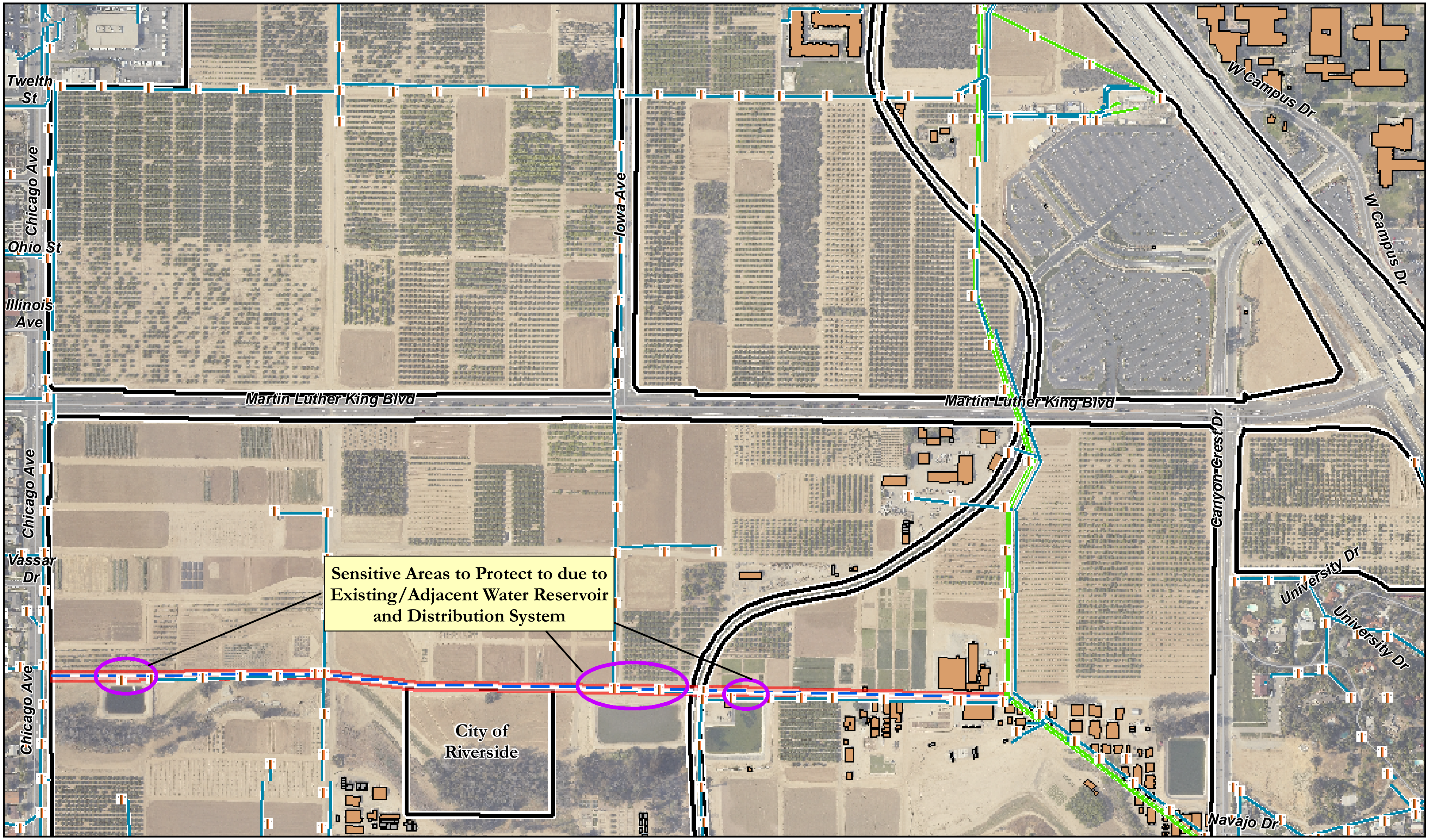
Don Caskey
Associate Vice Chancellor/Campus Architect
Facilities Design and Construction

Mike Miller
Assistant Vice Chancellor
Facilities

Timothy D. Ralston
Associate Vice Chancellor
Capital and Physical Planning

Enclosure

cc: RPU Utilities Deputy General Manager Badgett
Vice Chancellor Bolar
Vice Chancellor Diaz
Divisional Dean Cooksey
Superintendant Cockerham



Legend

- Campus Boundary
- UCR Structures
- UCR Structures (Non-Building)
- Proposed 69Kv Easements
- Proposed 69Kv Location*
- Existing City of Riverside Power Poles
- Existing City of Riverside Primary 12Kv and 7Kv Lines
- Existing City of Riverside Transmission 69Kv Line

*RPU will meet with Agriculture Operation to identify pole locations.

UCR West Campus
Riverside Public Utilities
Potential Subtransmission Line Locations
South of Martin Luther King Blvd.
Proposed Future Conditions

V:\map_docs\mxd\KJordan\WCI_CityServices\69KV_Maps\WCI-Future_69kv_Aerial8x11.mxd (05\12\09)

UC RIVERSIDE
UNIVERSITY OF CALIFORNIA

Academic Planning & Budget

900 University Avenue
Riverside, CA 92521-0101

May 13, 2009

Mayor and Members of the City Council
City of Riverside
3900 Main Street
Riverside, CA 92501

Re: May 19, 2009 Public Hearing – Construction of 69 kV Subtransmission Project (STP)

Dear Mayor and City Council Members:

The University of California Riverside (UCR) supports the goals of the STP that will reinforce the electrical distribution network for the City of Riverside. However, as originally proposed the line crossed the UCR West Campus along the future Northwest (NW) Mall in an area proposed for development of academic and research buildings, graduate and family housing and the School of Medicine campus (see Figures 3, 6 & 7). The campus had concerns regarding this location and has had discussions with David Wright and Riverside Public Utilities (RPU) staff on April 9 and 17, 2009 regarding its relocation along an existing pole line south of Martin Luther King Blvd (MLK) Mr. Wright and RPU staff have been very cooperative with the campus and share in the goal to develop a mutually agreeable solution identified above. In this context UCR is requesting further consideration of the still unresolved disposition of existing and potential north-south pole lines which interfere with future development plans. UCR is looking forward to favorable resolution of these concerns with RPU as well.

As the West Campus transitions from citrus groves into a vibrant campus community overtime, all planning efforts within this area need to consider future conditions. The campus vision is that existing and future utility lines or projects must:

1. Consider the visual impact they will have on the campus environment;
2. Reduce or eliminate conflicts with proposed campus development; and
3. That their presence does not defer a solution to a future date or compound an existing problem that would be in conflict with 1 or 2.

A series of visualization diagrams that illustrate these principles and show challenges with the 69kV subtransmission project are enclosed for your information.

UCR is looking forward to working with the City of Riverside and Riverside Public Utilities to successfully complete this and other projects and to continued collaboration with RPU to address issues with existing and potential north-south transmission line disposition as stated above.

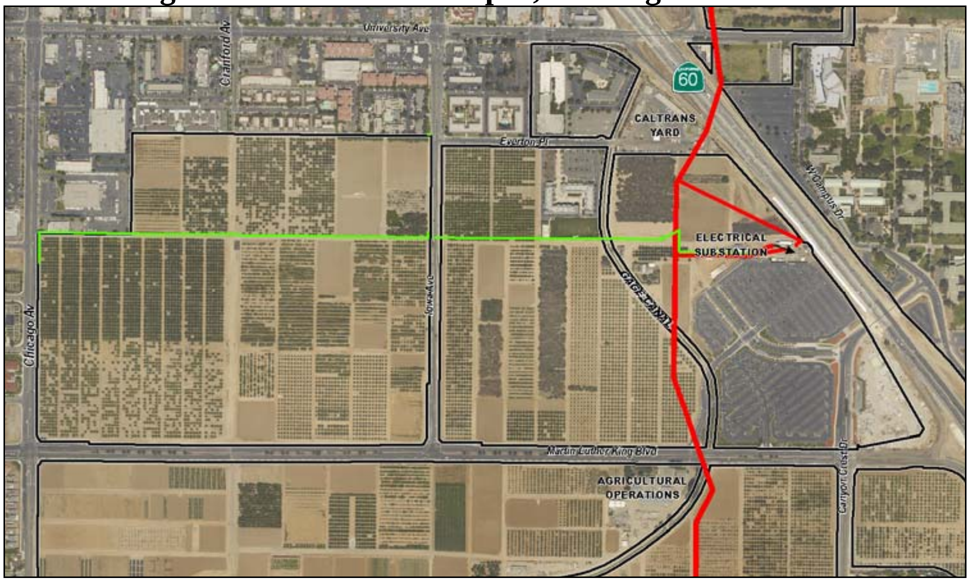
Sincerely,

Gretchen S. Bolar
Vice Chancellor, Academic Planning and Budget

Enclosures: Figures 1 - 7

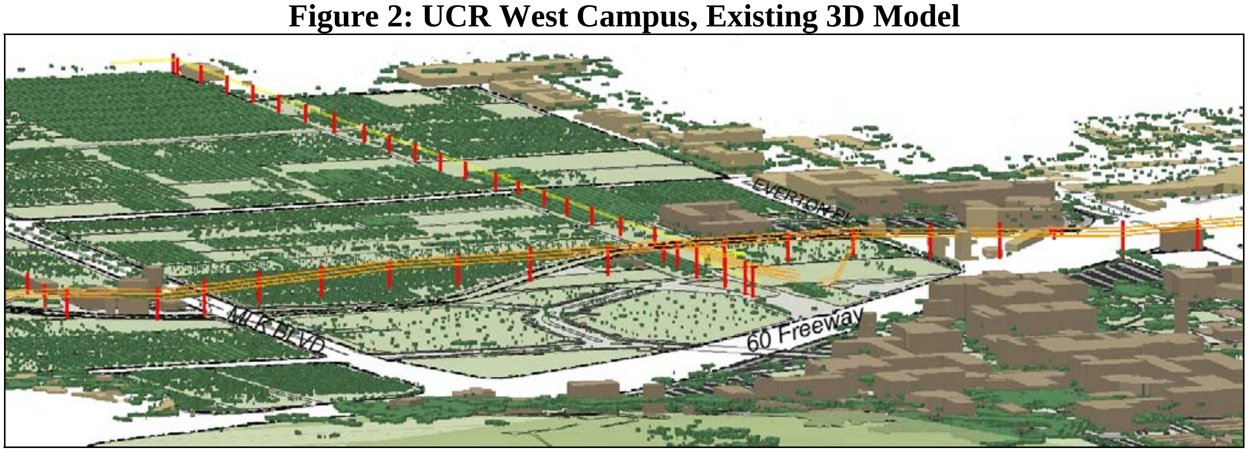
UCR Exhibits
Public Hearing, May 19, 2009: 69kV Transmission Line Located on UCR West Campus

Figure 1: UCR West Campus, Existing Power Lines



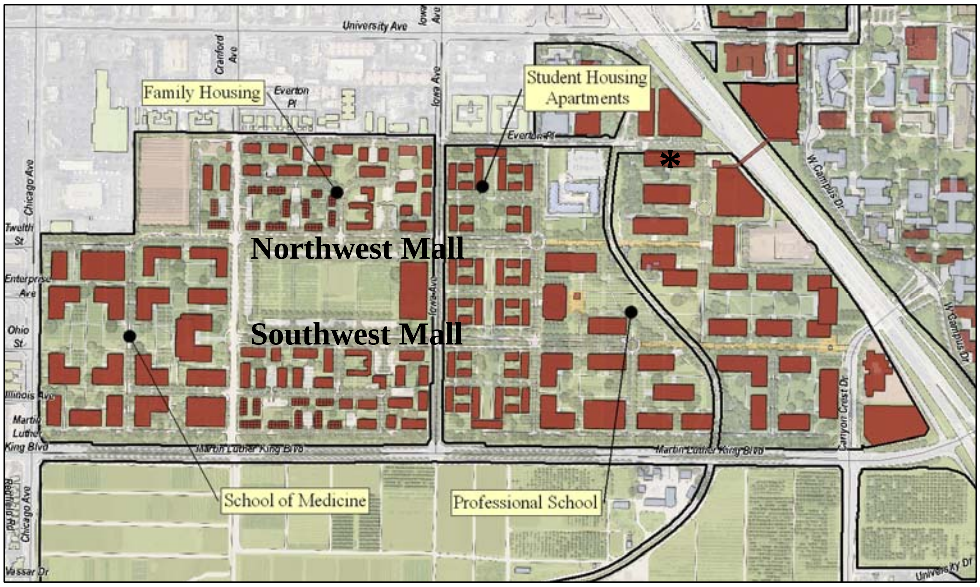
Aerial photograph shows UCR West Campus. The red line indicates the location of an existing 69kV subtransmission line. The green line is the location of a electrical distribution pole line.

Figure 2: UCR West Campus, Existing 3D Model



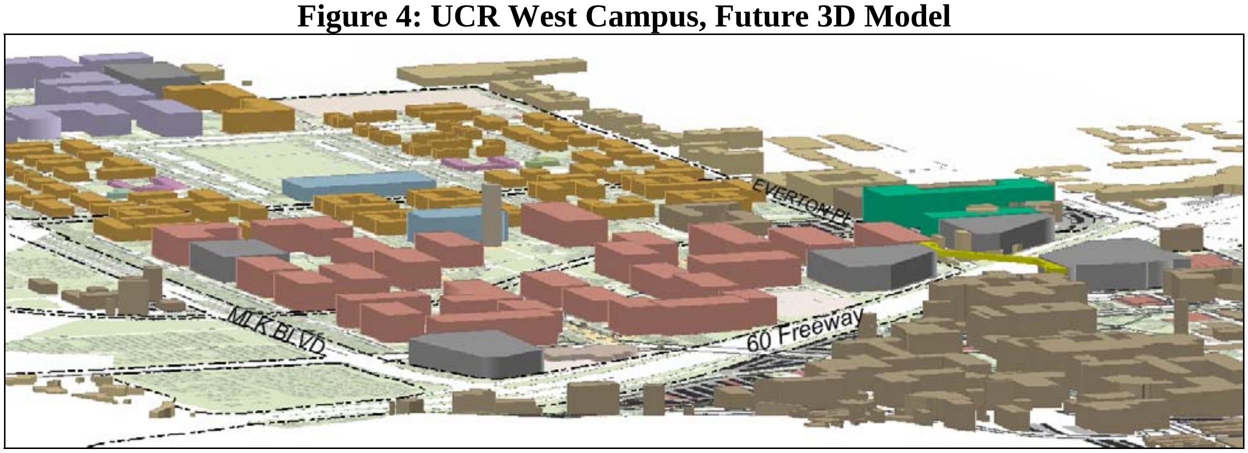
The current West Campus is comprised of agriculture fields and support facilities, a large parking lot, administrative facilities, the University Extension (UNEX) facility, and International Village student housing. Existing 69kV subtransmission lines and a electrical distribution line cross the Campus.

Figure 3: UCR West Campus, 2008 CAMPS Illustrative



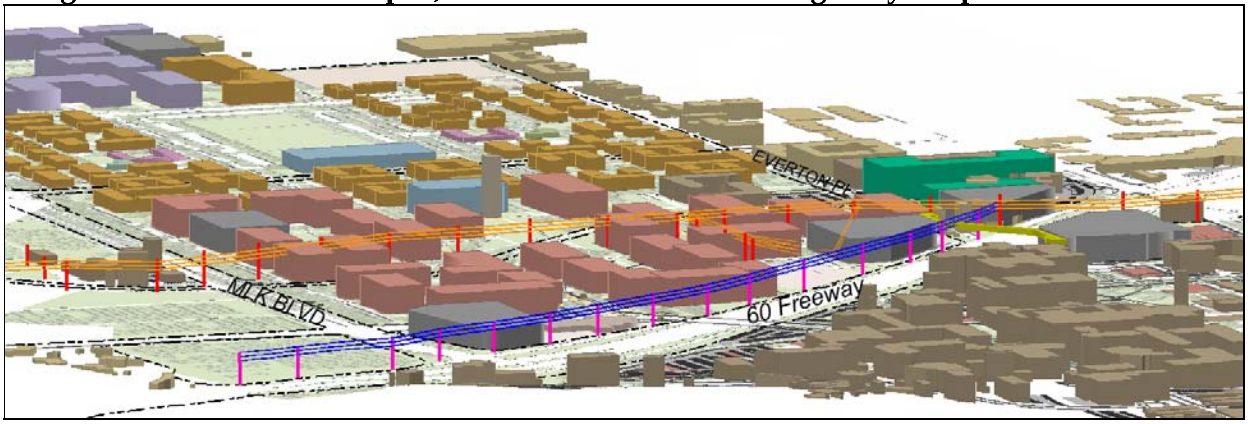
The Campus Aggregate Master Planning Study (CAMPS) illustrative shows the fully developed West Campus that is comprised of four primary land use areas: Professional Schools, Student Housing Apartments, Family Housing, and the new School of Medicine. Planning for the first academic building (West Campus Graduate and Professional Center*) is completed. UCR is currently evaluating proposals to develop Family Housing, and the School of Medicine Infrastructure 1 planning project is scheduled to be finished in June.

Figure 4: UCR West Campus, Future 3D Model



The future West Campus supports academic and research programs, housing, and support functions. A future pedestrian bridge crossing the 60 Freeway links the East and West Campuses.

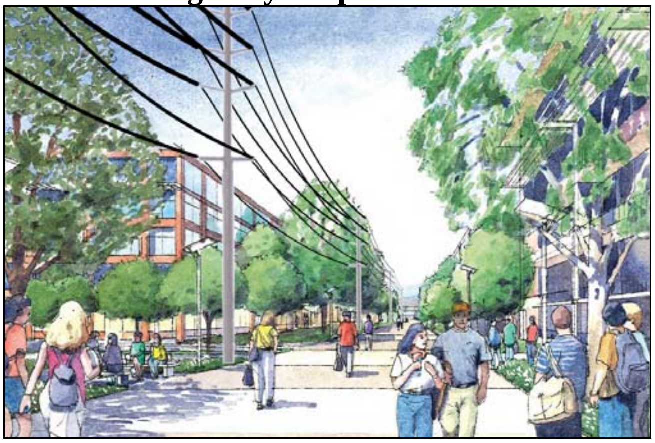
Figure 5: UCR West Campus, Future 3D Model with Originally Proposed Power Lines



The STP needs to consider future conditions to avoid the need to relocate lines as development occurs. Expanding the use of above ground pole lines or incorporating a new pole line addresses short-term needs, but does not consider the long-term consequences.

Figure 6: UCR Northwest Mall Campus Vision

Figure 7: UCR North West Mall:
With Originally Proposed Power Lines



Comments Submitted by: City of Riverside Public Utilities / Water

Ref	Figure Number or Page Number	Comments
1.	6-2	• Source of connection point information (i.e. pressures and flow rates)? In discussing with Water Development Services group, there is no record of any actual fire flow tests being performed at these locations to verify the stated pressures and flows. Was this calculated from the Water Model? The pressures listed here are ~20 psi higher than what is estimated to be available based on supplying water from the 1200 zone.
2.	6-2 to 6-4	• No comment. RPU does not review or provide guidance on water demand calculations; estimations of water demand and fire flow demand are the responsibility of the customer.
3.	6-7	• Might consider installing a new 12-inch main from Cranford Ave./University Ave. to serve both Phase I and full SOM build-out. This could be constructed within Cranford Ave. street right-of-way parallel to the existing 8-inch distribution main.
4.	6-10	• Connection for service off of the 42-inch transmission main will not be allowed.
5.	Section 7.0	• No Comment.
6.		•
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Riverside Public Utilities and UCR
69kV Subtransmission Project (STP)
June 5, 2009

Purpose of the meeting was to discuss proposed 69kV Subtransmission Project (STP) routes across the West Campus.

Participants

Name	Organization
Timothy Ralston	UCR, Capital & Physical Planning
Kieron Brunelle	UCR, Capital & Physical Planning
Jon Harvey	UCR, Capital & Physical Planning
Nita Bullock	UCR, Capital & Physical Planning
Mike Miller	UCR, Physical Plant
George MacMullin	UCR, Design and Construction
Jorge Somoano	Riverside Public Utilities
Lyle Hill	Riverside Public Utilities
Mike Torelli	Riverside Public Utilities

1. The STP Public Hearing has been rescheduled for August 25. The proposed scheduled to complete the route selection and public review period for the Mitigated Negative Declaration follows:
   a) Received revised consultant report – June 24; Finalize materials – July 1;
   b) Begin public review period – July 9; end public review – August 11; and,
   c) Public Hearing – August 25.

2. RPU provided a map in advance that showed the possible 69kV subtransmission line locations crossing the West Campus. Locations listed were: route 1 is along Chicago Avenue; route 2 crosses the campus south of MLK along existing agriculture service road (proposed by RPU); route 3 is between the Gage Canal and the freeway, south of MLK, and route 4 crosses the campus south of MLK along the service road that is adjacent to the water reservoirs. Route 4 was identified in the May 12, 2009, letter from UCR to RPU, and is UCR's preferred location.

3. Options for the Chicago Avenue section include: underground line on the east side of Chicago from 12th Street to the south side of MLK; pole line on the west side of Chicago, north of MLK; pole line south of MLK on the east side of Chicago.
   a) RPU does not typically underground 69kV even when the area is in an underground district. The City Council can declare an underground district, but it only includes distribution facilities, not subtransmission facilities.
   b) Transmission line planning will need to be coordinated with the proposed Chicago Avenue widening project.

4. Both east-west routes (2 & 4) south of MLK will be investigated. The second route (2) was proposed by RPU due to possible neighborhood concerns with extending the pole line to the

UCR preferred east-west route (4). The transmission line could impact views from the neighborhood on the west side of Chicago two blocks south of MLK.

5. The Campus is concerned with placing poles in the middle of the agriculture fields south of MLK as indicated with route 3. The field contains the Citrus Variety Collection. RPU explained that placing poles in the field is possible without harming trees. Other options mentioned included running the line through the neighborhood east of Canyon Crest. RPU did not feel that placing the line through that residential area was reasonable.

6. Campus suggested that RPU consider running the transmission line on the east side of the freeway south of the MLK interchange. However, it was later determined that UCR property only extends south of the MLK interchange a short distance.

7. The current 12kV line located in the future NW mall alignment is important to RPU. Further discussion on how to retain the line and/or relocation options will be necessary.

8. The existing transmission lines north of University substation conflict with proposed Campus development plans. The proposed STP route changes in the West Campus does not impact the current distribution system Placing the line along the freeway as a temporary measure (i.e., prior to undergrounding for parking garage) was supported by Campus. The Campus recommended that the line be undergrounded in the future due to the parking garage.

9. RPU will provide feedback on electrical costs (substation and 12kV duct bank) listed in the draft School of Medicine Infrastructure 1 (SOMI-1) DPP. A copy of the draft School of Medicine Cost Plan section containing the referenced information was provided along with the chapter describing the SOMI-1 electrical distribution system.

10. Conclusions, Next Steps
    a) Placing transmission lines on the west side of Chicago north of MKL or below ground (as requested by Campus) north of MLK will require further review by the engineers.
    b) RPU will examine both east west routes south of MLK as part of the process.
    c) A meeting with RPU engineers and Agriculture Operations will be scheduled to determine the possibility of the routes between Gage Canal and the freeway, south of MLK (completed June 10, 2009).
    d) RPU will work with Campus to relocate transmission lines north of the University Substation to eliminate conflict with the West Campus Graduate & Professional Center. The relocation will be part of the STP project costs, and the lines can be placed along the freeway. Placement will avoid initial Campus development plans.
    e) RPU is interested in leasing land from UCR for a staging area. Time required is less than 12 months, and the site requires easy access for large vehicles. Lyle Hill will provide information on the land requirement.

RPU 69kV STP Route Locations
May 19, 2009

- The Black lines depict the new lines and the white out area depict 69 kV lines that would be removed.
- The red lines depict existing 69 kV lines.

Riverside Public Utilities and UCR – Agriculture Operations
69kV Subtransmission Project (STP)
June 10, 2009

Purpose of the meeting was to discuss the possibility of constructing a transmission line across a section of the West Campus south of MLK, east of the Gage Canal. The line would be part of Riverside Public Utilities 69kV Subtransmission Project.

Participants

Name	Organization
Timothy Ralston	UCR, Capital & Physical Planning
Jon Harvey	UCR, Capital & Physical Planning
Stephen Cockerham	UCR, Agriculture Operations
Sue Lee	UCR, Agriculture Operations
Lyle Hill	Riverside Public Utilities
Mike Torelli	Riverside Public Utilities
Rick Skelton	Riverside Public Utilities
John Paez	Power Engineers
Mike Strand	Power Engineers
John McGrew	Power Engineers

1. The proposed location would cross the Citrus Variety Collection that contains unique trees. Moving or removing trees is not an option. The collection is located in two sections west of Canyon Crest, south of MLK (field 12), and east of Canyon Crest west of the freeway (field 18). Fields in the area are also used for research.

2. Constructing the line in the agriculture fields without harming trees is achievable. The size of the access roads is sufficient to support the necessary construction equipment.

3. Poles must be located outside the tree line or drip zone to avoid tree roots, and placement must not interfere with Agriculture Operation equipment access or maintenance practices. Locating poles on the side of a road is fine.

4. Spanning the Citrus Variety Collection fields west of Canyon Crest is possible by using higher poles, and would reduce the need for placing a pole in the middle of the field. Higher steel poles require larger piers to establish proper line clearance above the trees. Placing poles every three hundred feet is preferred solution.

5. The size of the hole or pier depends on the type of pole utilized and the location. Wood poles require a smaller hole, and may require guy-wires if placed on a turn. Steel poles require a larger pier and are self supporting. The cost of steel poles for corners is significantly higher than wood poles. A typical pole is 60 to 80 feet above grade.

6. Wood poles are chemically treated, and chemicals could leach into the ground. Agriculture Operations will need to determine if treated poles will harm the collection. Using non-treated poles could be an option.

7. Planning and construction needs to consider the location of existing infrastructure that includes irrigation supply and drainage lines. Potholing by hand prior to digging holes will be

done to make sure the location does not contain utility lines. If a line is located, Agriculture Operations will be immediately notified to determine type of line and alternatives. Relocating lines is an option.

8. Agriculture Operations is open to placing the transmission lines across the fields. Two routes under consideration align with the field 18 access roads, and field 12 rows 35-36 and rows 25-26. Agriculture Operations would like to get input on the two routes from researchers. RPU will provide a drawing showing the two proposed routes for Agriculture Operations review.

9. The STP will also place a pole line along the west side of Chicago from 12th Street to MLK, crossing to the east side at the Chicago-MLK intersection. The City is planning to widen Chicago, which will require additional land south of MLK. Current widening plans show the additional right-of-way is needed, and the STP pole placement would be within the proposed right-of –way adjacent to the proposed sidewalk. Poles would be placed to avoid sensitive research areas along Chicago. Timing of the widening project is unknown at this time.

10. Campus supports the east/west pole line being placed on the south side of the Agriculture Operations access road that was identified in the May 12, 2009, correspondence to RPU. The route aligns with the north side of the City in-holding.

11. RPU is interested in leasing land for use as a staging area to store poles. Basic requirement is ease of access for large trucks, and sufficient room to unload and store materials. Using agriculture fields for that use is a problem since vehicles will compact soil and could impact underground pipes. The use of the Pesticide Pits was discussed as an option that requires further investigation. There is sufficient room at the proposed site, and access to the area was viewed as reasonable.

12. Conclusions / Next Steps
    a) Agriculture Operations is open to the idea of placing the transmission line east of the Gage Canal through the Citrus Collection. Agreement on the southern alignment was approved May 1, 2009.
    b) RPU will provide a drawing showing the proposed routes for Agriculture Operations review.
    c) Once the entire route has been identified, RPU will begin design to show where the poles will be located. Agriculture Operations will have an opportunity to review proposed plans to make sure that locations do not conflict with on-going research and general operations.
    d) The proposed transmission line route is adjacent to and through the West Campus as follows: west side of Chicago from 12th street to MLK; crosses to the east side of MLK at the intersection to Chicago and MLK; east side of Chicago to the east/west Agriculture Operations Service Road adjacent to the reservoirs; and, south side of the service road between Chicago and the existing north/south transmission line east of the Gage Canal.
    e) Capital Planning will investigate the possibility of using the Pesticide Pits as a potential staging area. RPU will furnish staging area land requirements that will allow UCR to investigate other potential sites.
    f) Jon Harvey, Capital Planning, will coordinate the UCR review process.

Anthony La Marca

From: Agarwal, Gaurav [GAgarwal@riversideca.gov]

Sent: Friday, June 19, 2009 2:21 PM

To: Anthony La Marca

Cc: Khoury, Oscar; Yamamoto, Blake

Subject: RE: UCR School of Medicine - Domestic Water Demands

Hi Anthony,

Got your message. Here is the analysis. I added an avg-day demand of 1,575 gpm at both locations but in different scenarios so that one demand is applied at any given time. Our system has a global max-day peaking factor of 1.7. I assumed a peak hr/max-day ratio of 1.3 for your demand, which gives me a peak hour demand of 1575 x 1.7 x 1.3 = 3480 gpm. The demand node in the north experienced pressures between 104 and 110 psi and the node in the south (near MLK Blvd) between 95 and 105 psi. I also added a fire-flow demand of 3,000 gpm during a max-day and system saw an additional pressure drop of 10 to 12 psi at each location, which means that the system is very robust. I see that you asked for a Max-day plus fire-flow of only 3,741 gpm, which seems very low when peak hour demand is 3,482 gpm. My estimate of 3,000 gpm is more conservative. Please let me know, if you need more data. Thanks,

Gaurav Agarwal
Riverside Public Utilities
Phone: 951.826.5379

From: Khoury, Oscar
Sent: Tuesday, June 16, 2009 8:33 AM
To: Yamamoto, Blake; Agarwal, Gaurav
Subject: FW: UCR School of Medicine - Domestic Water Demands

Gaurav,

Please see the request below and talk to Blake regarding results. Blake will take it from there. Thanks.

Oscar A. Khoury
Principal Engineer - Water
City of Riverside
Public Utilities - Water Engineering
3901 Orange Street
Riverside, CA 92501
951/826-5793 Direct
951/826-2498 Fax
okhoury@riversideca.gov

From: Anthony La Marca [mailto:AnthonyLaMarca@w-and-k.com]
Sent: Mon 6/15/2009 4:16 PM
To: Khoury, Oscar
Cc: Peter Young; Raymond Wong; jon.harvey@ucr.edu
Subject: UCR School of Medicine - Domestic Water Demands

Hello Mr. Khoury,

The attached figure shows the latest School of Medicine building layout and the full build out of the domestic water system. The main and standby connections are noted along with the Peak Hour and Maximum Day plus Fire Flow demands. Based on these demands we would like you to provide us with the boundary condition and pressure at the two connection points assuming that only one connection point is operational at a time.

Let us know if you have any questions.

Thanks,

Anthony LaMarca, PE
Civil Engineer
Winzler & Kelly
1735 North First St, Suite 301
San Jose, CA 95112
Office: (408) 451-9615 ext. 205
Fax: (408) 451-9665
Email: anthonylamarca@w-and-k.com

www.w-and-k.com/

Right-click here to download pictures. To help protect your privacy, Outlook

Peter Young

From: Raymond Wong
Sent: Tuesday, June 23, 2009 11:04 AM
To: Peter Young
Cc: Anthony La Marca
Subject: UCR - Phone Discussion Summary with Rob Van Zanten

Hello Peter,

We had a phone discussion with Rob Van Zanten on Monday (6/22) afternoon regarding the proposed UCR West Campus sewer system connections to the City's sewer collection system. It was a followup discussion with Rob after we forwarded the latest design flow and connection point information to the City.

The City received a copy of the final draft report from UCR, and we presented the latest connection point and design flow information to the City. The City is going to review the design concept and the analysis, as well as evaluate how the City system may handle the sewer flow from the future West Campus development.

Thanks,
Raymond

From: Duckworth, Everett [EDuckworth@rcflood.org]
Sent: Wednesday, June 24, 2009 9:26 AM
To: Raymond Wong; Delgadillo, Don
Cc: jon.harvey@ucr.edu; Peter Young; Anthony La Marca
Subject: RE: UC Riverside West Campus Development SD Analysis TM
Attachments: Plan_Check_Deposit_Based_Fee_Worksheet.pdf

Raymond,

Thank you for allowing us to participate in this project. Please fill out the attached application with the applicable fees, to be sent in with two copies of applicable documents associated with your project.

The District does not normally recommend conditions for land divisions or other land use cases within the City of Riverside. District comments/recommendations for such cases are normally limited to items of specific interest to the District including District Master Drainage Plan (MDP) facilities, other regional flood control and drainage facilities which could be considered a logical component or extension of a master drainage plan system, and District Area Drainage Plan fees.

Note that a letter from the controlling Agency, is recommended, specifying the District's participation of the project and request for maintenance and ownership of the proposed drainage facilities.

Everett Duckworth
Associate/Planning Engineer

-----Original Message-----
From: Raymond Wong [mailto:Raymondwong@w-and-k.com]
Sent: Tuesday, June 23, 2009 2:28 PM
To: Duckworth, Everett; Delgadillo, Don
Cc: jon.harvey@ucr.edu; Peter Young; Anthony La Marca
Subject: UC Riverside West Campus Development SD Analysis TM

Hello Everett and Don,

The attached PDF file contains the working draft TM for the UC Riverside West Campus Development storm drain analysis. The analysis is based on our previous discussions to evaluate the impact of the West Campus development to the storm drain system. We are looking forward to the District's review and comments.

We would like to have a conference call with the District to discuss the analysis findings, as well as to answer any initial questions the District may have. Due to project schedule constraints, we would appreciate if we can schedule a call this week to discuss the analysis. Alternatively, if the District prefers, we maybe able to have a meeting at the District's office. Please let us know your preference.

Please let us know if you have any questions. Thank you for your assistance.

Thanks,
Raymond

Raymond Wong, PE, LEED AP, CPESC
Hydraulic Engineer
Winzler & Kelly

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