



MEMORANDUM

To: Dianna Jensen and Ike Njoku

From: Chuck Cunningham and Lena Rystrom, Cunningham Engineering Corporation

Date: 17 August 2016

Subject: Lincoln 40 Utilities Demand

Recently both Public Works and Raney Planning has asked us to develop estimates of water, sewer and storm drainage demand for the project. Specifically, “Cunningham Engineering will provide water, sewer, and drainage technical memos for the project, describing on- and off-site improvements required for the project based upon existing infrastructure systems and any related deficiencies.” The purpose is for the City to evaluate potential impacts on the existing City systems and to serve as background material for preparation of the Draft EIR. Separately, we are preparing the requested Narratives for Raney’s use in developing the Project Description.

Following are discussions of potential water, sewer and storm drainage demands for the proposed project consisting of the maximum projected student population of 708. We believe the factors we have used for domestic water demand and the related sewer generation, while consistent with the Water Supply Assessment done last year for the Innovation Centers, is conservative. This is appropriate for CEQA evaluation, however, we believe the actual project demands/contributions will be less given the evolving efficiency of water fixtures and irrigation systems.

Also presented below are descriptions of proposed or potential on and off-site improvements. See Figure 5 for an exhibit showing the proposed utility connections into the existing system.

Domestic, Irrigation and Fire Water

An on-site fire water loop and hydrants will be constructed with two connection points to water mains in Olive Drive. City utility maps and record drawings indicate a 6” diameter main along the western project frontage, connecting to a 10” diameter line across the eastern frontage. We request that Public Works confirm the existence and extent of the 6” diameter line. A domestic water line connection will be made to the 6” (or larger) Olive Drive main. Please refer to Figure 5 and the City of Davis Olive Drive Storm Drain Improvement Plans from August of 1980 set for the existing location of the 6” and 10” water mains.

Based on a maximum demand of 708 beds and 57 gallons per person per day, the anticipated inside use average daily demand will be 40,356 gallons per day (gpd), with a peak hour demand of 50 gallons per minute (gpm). The peak hour landscape irrigation application rate is 22 gpm. Therefore, the combined estimated project demand is 72 gpm for the peak hour and 45,537 gpd for the average daily demand. Please

refer to Figure 1, attached.

The Davis Public Works Design Standards, Part Two recommend a fire flow of 3,500 gpm for high-density residential land uses. For sprinklered buildings, this demand may be reduced at the fire marshal's discretion. It has generally been our experience that incorporation of fire sprinklers can result in a 50% reduction in the required total fire flow.

The City fire flow test completed at Olive Drive on July 18, 2016 generated a static pressure of 48 psi, a residual pressure of 36 psi at a flow of 1,300 gpm and 20 psi at 1,720 gpm. Sufficient fire flow cannot be provided to the project at 20 psi. Please refer to Figure 3, attached. Firewater booster pumps will be required.

Sanitary Sewer

An existing 8" sewer main runs along Olive Drive and an existing 6" sewer main runs along Hickory Drive. It is anticipated that the building will be serviced by a single point of connection which will gravity flow to the main Olive Drive.

For preliminary purposes, it's been conservatively assumed that sewer flows follow will be equivalent to inside water use. Therefore the average daily sewer generation rate is 40,356 gpd. At peak, the flow will be 0.12 million gallons per day (mgd). See Figure 2, attached.

Current zoning per the Gateway/Olive Drive Specific Plan (pages 30-35) includes 49 single family units and 8,000 SF of commercial uses on the approximately 3.5 acre 'Callori Property' and an undetermined combination of multi-family residential, restaurants, office space and retail development on the approximately 2.4 acre 'Hickory Lane' EOMU designation. The existing land use generates approximately 0.04 mgd of sewer flow per Figure 6.

The incremental increase between existing land use and the proposed project should form the basis for evaluating the downstream collection system.

Stormwater and Drainage

The existing Project area is partially developed, interspersed by open space. There is an existing curb drain inlet at the end of the paved portion of Hickory Lane, as well as the end of the sidewalk, curb and gutter on the north side of Olive Drive which connects into a 24" storm drain main. All other site drainage flows overland to the east, following the site topography. The site is not located within a FEMA 100-year special flood hazard area.

Project designs seek to limit peak post-project discharge to nearby storm drain inlets to estimated existing levels. Current State Water Resources Control Board (SWRCB) requirements call for limiting the 2-year/24-hour peak discharge to pre-project levels, in order to mitigate for potential hydromodification impacts.



Since the existing Project area is partially developed and has some impervious cover, peak flows are not expected to substantially increase as a result of redevelopment. Proposed site detention storage will be within pervious pavement, bioswales and detention ponds throughout the site. The detained runoff will be discharged into the City's storm drain system through underground pipes. Detained water will flow through the city storm drain pipe system and outlet to the Davis Core Area Drainage pond.

The current runoff from the 6.0 +/- acre site in the 10 year storm is estimated by HEC-HMS to be approximately 8.9 cubic feet per second (cfs). The anticipated runoff from the developed site as generated in the HEC-HMS model is 12.5 cfs. A detention pond with 0.1 AF of storage will be required to maintain existing runoff levels. Please refer to Figure 4, attached.

Attachments:

- Figure 1 – Water Demands
- Figure 2 – Sewer Generation Rates
- Figure 3 – Water Flow Test Summary Sheet
- Figure 4 – Storm Drainage outflows
- Figure 5 – Utility Connection Points
- Figure 6 – Sewer Demands based on Existing Land Use



FIGURE 1

**Lincoln 40
Preliminary Water Demands**

Prepared by Cunningham Engineering Corporation
8/5/2016

Domestic Water Demand (Indoor Use)						
	Population* (person)	Per Person ADD (gpd)	Total ADD (gpd)			
Res - FS	708	57	40,356			
			40,356			
*Note: 708 represents a maximum number of beds to be provided by project						
		PD/AD= 1.0		PH/AD= 1.8		
	Avg day Demand (gpd)	(gpm)	Peak Day Demand (gpd)	(gpm)	Peak Hr Demand (gpm)	Annual Usage (mgd)
INSIDE USE TOTALS	40,356	28	40,356	28	50	14.7

Fire Flows		
	Fire Flow (gpm)	Duration (hrs)
Residential hi-density	3,500	3
	PEAK DAY PLUS 50% OF LARGEST FIRE FLOW (gpm) = 1,778	
	PEAK DAY PLUS 100% OF LARGEST FIRE FLOW (gpm) = 3,528	

Fire Flows per City of Davis standard planning-level criteria (may be able to apply 50% credit with Fire Marshal concurrence)

Irrigation - Peak Hour								
Project Area (acres)	Percent Landscape (%)	Landscape Area (acres)	Peak day Application (in/day)	Peak day Application (gpd)	Irrigation Window (hrs/day)	Peak day Applic rate (gpm)	Assumed PH/PD= 2.0	Peak Hr Applic rate (gpm)
5.92	26%	1.5	0.1255	5,181	8	11		22

NOTES

- Unit demands are based the Draft Water Supply Assessment prepared for the City of Davis by Brown and Caldwell, January 2015.
- PF for Peak Day inside use assumed to be 1.0. Expected to remain substantially consistent year round.
- PF for Peak Hour domestic water use is assumed to be 1.8 per City of Davis standards.
- For irrigation, project assumes approximately 5% high water use (0.35"/day) , 10% med water use (0.23"/day) and and 85% low water use (0.1"/day) plantings for an averaged peak day use of 0.1255"/day.

Hydrozone # 1 - Low Water Use			
Hydrozone Area (SF)	56,300	Low water use	
ETO - Evapotranspiration in/yr	52.5		
PF - Plant Factor	0.3		
IE-Irrigation Efficiency factor	0.9	% of	Pk day
Conversion factor to gal per sq ft	0.62	total	App Rate
EWU	610,855 GAL/YR	85%	(in/day)
			0.10
Hydrozone # 2 - Medium Water Use			
Hydrozone Area (SF)	6,620	Medium water use	
ETO - Evapotranspiration in/yr	52.5		
PF - Plant Factor	0.5		
IE-Irrigation Efficiency factor	0.75	% of	Pk day
Conversion factor to gal per sq ft	0.62	total	App Rate
EWU	143,654 GAL/YR	10%	(in/day)
			0.23
Hydrozone # 3 - High Water Use			
Hydrozone Area (SF)	3,310	High water use	
ETO - Evapotranspiration in/yr	52.5		
PF - Plant Factor	0.9		
IE-Irrigation Efficiency factor	0.7	% of	Pk day
Conversion factor to gal per sq ft	0.62	total	App Rate
EWU	138,524 GAL/YR	5%	(in/day)
			0.35
Total	0.9 MGY		

FIGURE 2

Sewer Loading

	Sewered Population* (person)	Per Person ADD (gpd)	Total ADD (gpd)	Total ADD (mgd)
Residential	708	57	40,356	0.04
Project Total	708		40,356	0.04

*Note: 708 represents a maximum number of beds to be provided by project

Total ADDF	0.04 mgd
PF=[7.67*(ADDF)^-0.093]	2.86
PDWF=ADDF*PF	0.12 mgd

Infiltration and Inflow

Land Area (ac)	Per unit I&I (gpd/ac)	Total I&I (gpd)	Total I&I (mgd)	
5.92	600	3,552	0.004	3%

PWWF = PDWF + I&I **0.12** mgd

NOTES

- 1 For preliminary planning purposes, it is assumed that inside water use is equivalent to sewer use. Unit demands are based the Draft Water Supply Assessment prepared for the City of Davis by Brown and Caldwell, January 2015.
- 2 Peaking factor equation per City of Davis standards
- 3 I&I unit flows are per City of Davis standard values

Figure 3

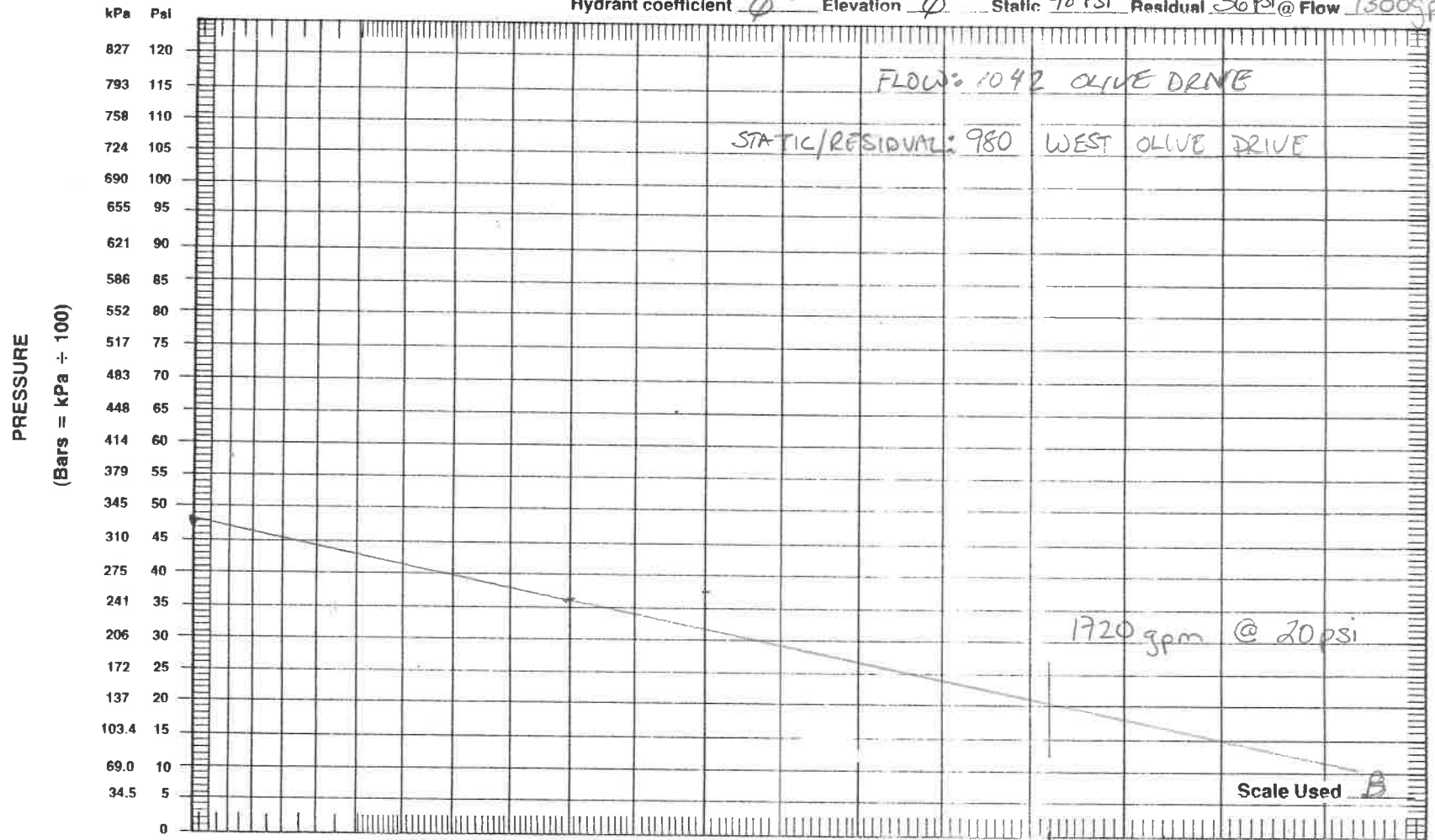
A72

Hose Monster

outlet size 4 1/2 inch ~~pitot~~ reading 16 psi

Water Flow Test Summary Sheet

Conducted by ANNIS/George Location OLIVE DRIVE Date 7/11/16
 Hydrant coefficient Ø Elevation Ø Static 48 PSI Residual 36 PSI @ Flow 1300 gpm



GPM	100	200	300	400	500	600	700	800	900	1000	Scale A
Liters	380	759	1139	1519	1899	2278	2658	3038	3418	3797	Scale B
	200	400	600	800	1000	1200	1400	1600	1800	2000	
	759	1519	2278	3038	3797	4557	5316	6075	6835	7594	Scale C
	400	800	1200	1600	2000	2400	2800	3200	3600	4000	
	1519	3038	4557	6075	7594	9113	10,632	12,151	13,670	15,188	

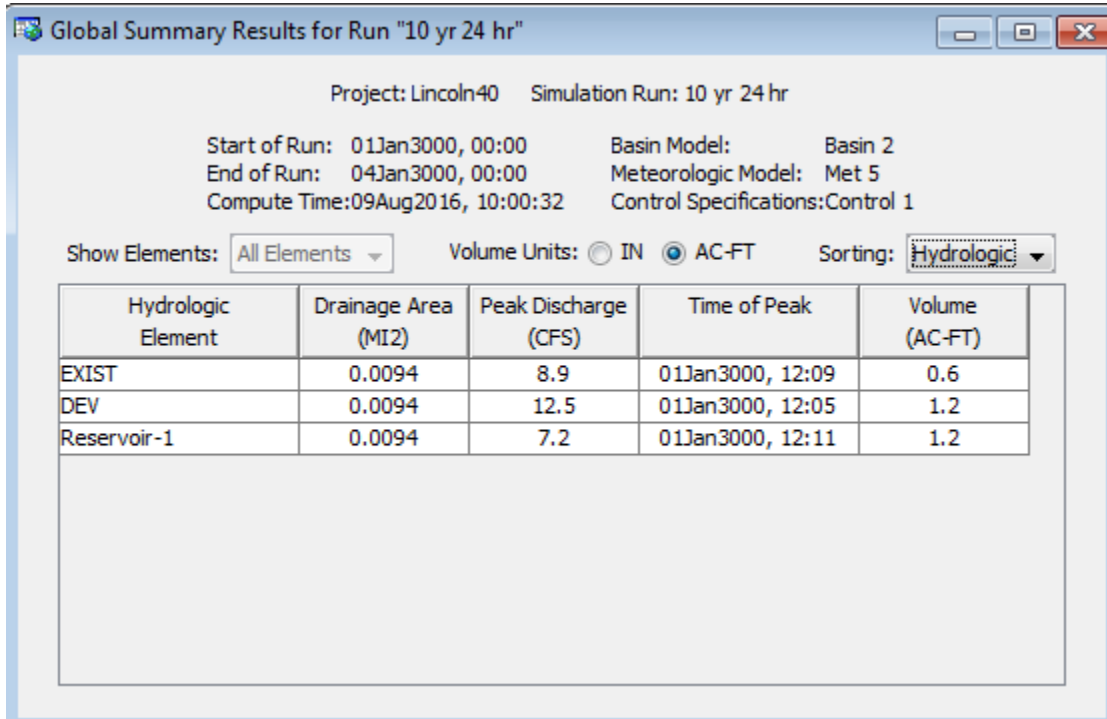
Figure 4

Storm Drainage Outflows:

“EXIST” = Existing Condition

“DEV” = Developed Condition

“Reservoir-1” = Proposed Detention Basin (downstream of Developed Condition)



Proposed Detention Basin Data:

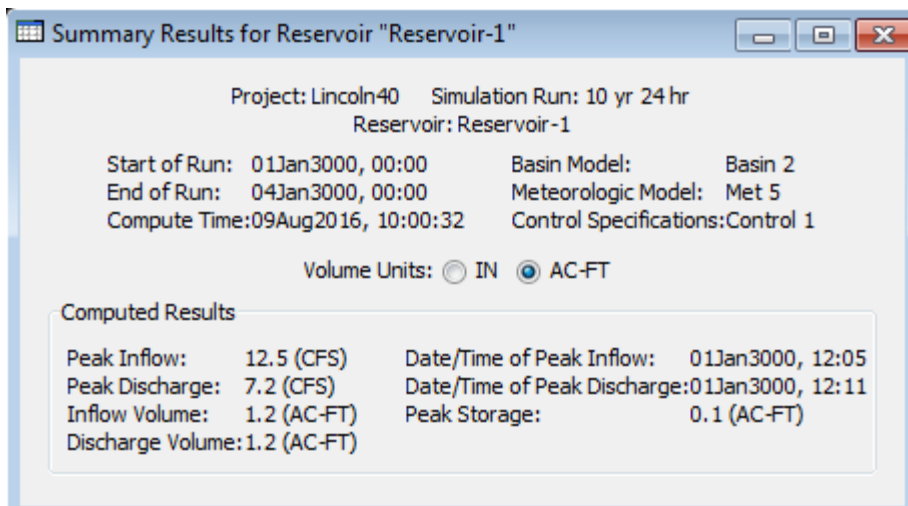
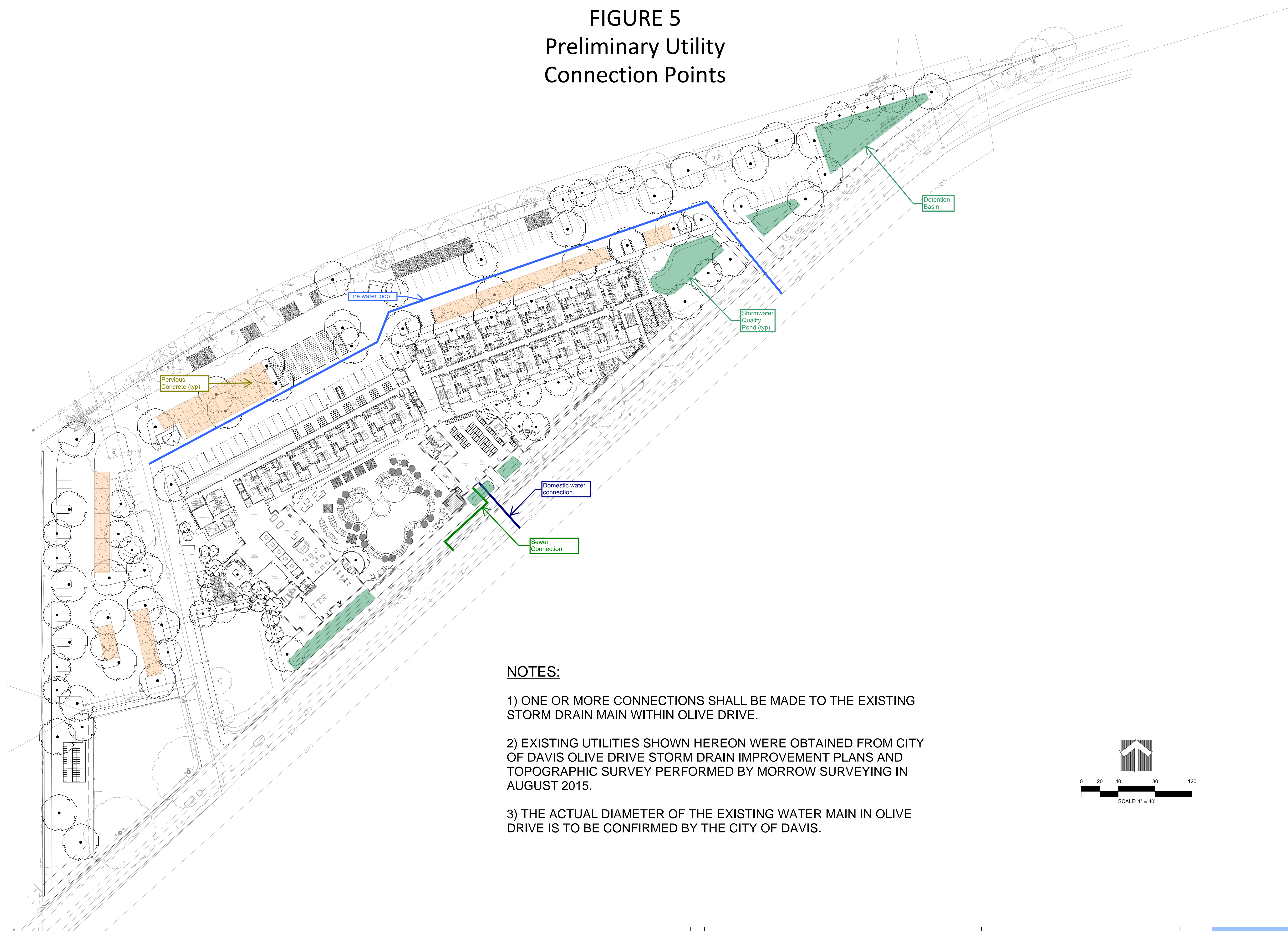


FIGURE 5
Preliminary Utility
Connection Points

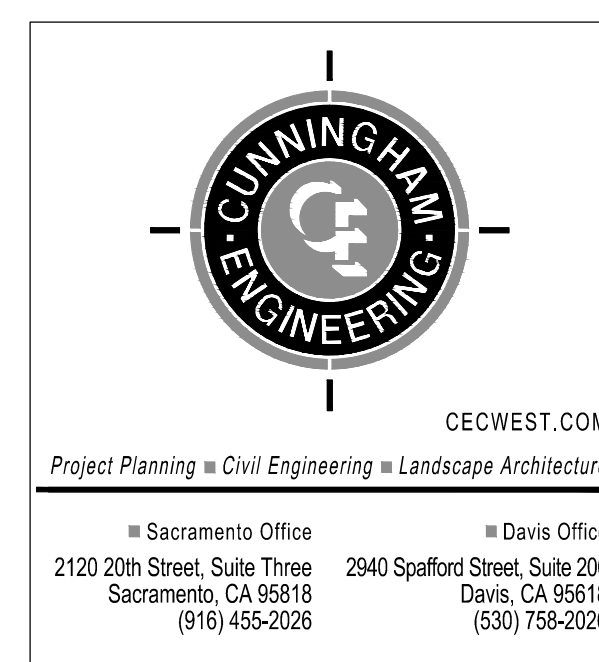


NOTES:

- 1) ONE OR MORE CONNECTIONS SHALL BE MADE TO THE EXISTING STORM DRAIN MAIN WITHIN OLIVE DRIVE.
- 2) EXISTING UTILITIES SHOWN HEREON WERE OBTAINED FROM CITY OF DAVIS OLIVE DRIVE STORM DRAIN IMPROVEMENT PLANS AND TOPOGRAPHIC SURVEY PERFORMED BY MORROW SURVEYING IN AUGUST 2015.
- 3) THE ACTUAL DIAMETER OF THE EXISTING WATER MAIN IN OLIVE DRIVE IS TO BE CONFIRMED BY THE CITY OF DAVIS.

Lincoln40 Project
 Davis Student Housing

Davis, CA



SITE PLAN

DATE: 06/08/16
 PROJECT NO: 1212-0001
 SCALE: 1" = 40'
 SHEET: L1.01



LPAS

2484 Natomas Park Drive Suite 100 Sacramento CA 95833
 916 443 0335 lpasdesign.com Architecture + Design



Cunningham Engineering Corp.
2940 Spafford Street, Suite 200
Davis, CA 95616

Project: Lincoln 40
Project No.: 1542.04
Location: Davis, CA

Date: 11-Oct-16 (2-1-17: Selected Cells reformatted)
Calc By: LR
Checked By: ML

Design Criteria:
Infiltration Rate (I+I)= 600 gal/acre/day
Mannings "n" = 0.013
Peaking factor (PF)= see table and note 6

Sheet: 1

PORTION OF CITY OF DAVIS EXISTING SHED AREA G-4

Pipe Reach		SINGLE FAMILY				MULTI-FAMILY			NEW MULTI-FAMILY		RETAIL/COMM		INDUSTRIAL/OTHER																											
From	To	Total Area (AC)	# of Lots (EDU's)	Flow Rate (gpd/lot)	Gross Acres Multiple Fam	MF EDU/ AC	# of EDU's	Flow Rate (gpd/lot)	# of beds	Flow Rate (gpd/cap)	Gross Acres	FAR	Bldg area (sf)	Flow Rate (gpd/sf)	Gross Acres	FAR	Bldg area (sf)	Flow Rate (gpd/sf)	Incr ADF (mgd)	Cumm ADF (mgd)	PF	Incr I&I (mgd)	Cum I&I (mgd)	Peak Cum Flow (mgd)	Peak Cum Flow (cfs)	Pipe Dia. (in)	Pipe Slope (ft/ft)	Total Capacity Qcap(cfs)	Available Capacity (Qcap-Qp) (cfs)	Qp/Qcap (%)	d (ft)	d/D (%)	V (ft/s)	Vel. @ Q-Full (ft/s)	Length (ft)	Invert Up	Invert Down			
West Olive Drive	A	22	0	176	5.0	15	75	176	0	57	16.1	25%	174,787	0.06	0.0	40%	0	0.06	0.0238	0.024	3.00	0.013	0.013	0.084	0.13	8	0.0033	0.69	0.56	18.8%	0.19	29.0%	1.56	1.99	1,528	41.47	36.43			
A	B	22	1	176	13.7	15	206	176	708	57	2.5	25%	26,769	0.06	0.0	40%	0	0.06	0.0785	0.102	2.62	0.013	0.026	0.295	0.46	8	0.0033	0.69	0.24	65.7%	0.39	59.0%	2.13	1.99	800	36.43	33.79			
East Olive Drive	B	8	0	176	4.2	15	64	176	0	57	3.9	25%	42,281	0.06	0.0	40%	0	0.06	0.0137	0.014	3.16	0.005	0.005	0.048	0.07	6	0.005	0.40	0.32	18.8%	0.15	29.0%	1.58	2.02	1,240	40.16	33.96			
B	C	0	0	176	0.0	15	0	176	0	57	0.0	25%	0	0.06	0.0	40%	0	0.06	0.0000	0.116	2.59	0.000	0.031	0.332	0.51	8	0.0035	0.71	0.20	71.9%	0.41	62.0%	2.26	2.05	40	33.79	33.65			
2nd Street	C	23	0	176	0.0	15	0	176	0	57	0.0	25%	0	0.06	22.9	40%	398,886	0.06	0.0239	0.024	3.00	0.014	0.014	0.086	0.13	8	0.0035	0.71	0.58	18.5%	0.19	29.0%	1.58	2.05	630	35.85	33.65			
C	D	0	0	176	0.0	15	0	176	0	57	0.0	25%	0	0.06	0.0	40%	0	0.06	0.0000	0.140	2.55	0.000	0.045	0.402	0.62	8	0.0035	0.71	0.09	86.9%	0.47	71.0%	2.34	2.05	510	33.65	31.86			
D	E	31	152	176	5.5	15	83	176	0	57	5.7	100%	247,086	0.06	1.7	40%	29,162	0.06	0.0580	0.198	2.47	0.019	0.064	0.552	0.85	12	0.0049	2.49	1.64	34.2%	0.40	40.0%	2.91	3.18	1,990	31.53	21.78			
Totals		106	153		29		428		708		490,923						428,048		0.198		2.47	0.064		0.552	0.9											6,738				
ADF Totals (mgd)			0.027				0.075		0.040		0.029								0.198																					
% of Total ADF			14%				38%		20%		15%						13%		100%																					

Notes and assumptions:

- Areas calculated and land use derived from City of Davis sewer, land use and zoning maps
- Existing areas within City assumed built-out per General Plan
- Node numbers and shed boundaries are shown on Lincoln40 Sewer Study Shed Map
- Design flow criteria:
 - Single-Family Residential 176 gpd/lot [Assume 65 gal/cap-day and 2.71 capita/lot per email from Terry Jue on 10/6/16]
 - Multi-Family Residential 176 gpd/lot [Assume 65 gal/cap-day and 2.71 capita/lot per email from Terry Jue on 10/6/16]
 - Multi-Family Residential density 15 DU/gross acre (COD stds)
 - New Multi-Family Residential 57 gpd/cap [Brown and Caldwell Water Supply Assessment, January 2015]
 - Retail/Commercial 0.06 gpd/sf [15 gpd/employee with 1 empl per 250 sf (net), and FAR=1.0 (Core Area); FAR=0.25 (elsewhere)] (COD stds)
 - Industrial 0.06 gpd/sf [15 gpd/employee and 1 empl per 250 sf (net) and FAR=0.4] (COD stds)
- Infiltration and Inflow (I+I) Rate = 600 gal per acre per day (COD stds)
- Peaking Factor (PF) = 7.67*ADF^0.093 (COD stds)