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
## Domestic Water Demand (Indoor Use)

<table>
<thead>
<tr>
<th>Hydrozone #1 - Low Water Use</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population* (person)</td>
<td>708</td>
<td>57</td>
<td>40,356</td>
<td>56,300</td>
<td>85%</td>
<td>0.10</td>
</tr>
<tr>
<td>Hydrozone Area (SF)</td>
<td>52.5</td>
<td>0.3</td>
<td>0.9</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>ETO - Evapotranspiration in/yr</td>
<td>52.5</td>
<td>0.3</td>
<td>0.9</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>PF - Plant Factor</td>
<td>0.37</td>
<td>0.3</td>
<td>0.9</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>IE-Irrigation Efficiency factor</td>
<td>0.97</td>
<td>0.3</td>
<td>0.9</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>Conversion factor to gal per sq ft</td>
<td>0.62</td>
<td>0.3</td>
<td>0.9</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>Project</td>
<td>56,300</td>
<td>85%</td>
<td>0.10</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>Peak Hour Domestic Water Use</td>
<td>56,300</td>
<td>85%</td>
<td>0.10</td>
<td>0.62</td>
<td>0.35</td>
<td>1.5</td>
</tr>
<tr>
<td>Peak Day Inside Use</td>
<td>40,356</td>
<td>28</td>
<td>40,356</td>
<td>28</td>
<td>50</td>
<td>14.7</td>
</tr>
<tr>
<td>Peak Day</td>
<td>40,356</td>
<td>28</td>
<td>40,356</td>
<td>28</td>
<td>50</td>
<td>14.7</td>
</tr>
<tr>
<td>Annual</td>
<td>40,356</td>
<td>28</td>
<td>40,356</td>
<td>28</td>
<td>50</td>
<td>14.7</td>
</tr>
<tr>
<td>INSIDE USE TOTALS</td>
<td>40,356</td>
<td>28</td>
<td>40,356</td>
<td>28</td>
<td>50</td>
<td>14.7</td>
</tr>
</tbody>
</table>

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

### Fire Flows

<table>
<thead>
<tr>
<th>Fire Flow</th>
<th>Duration (hrs)</th>
<th>Residential hi-density</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,500</td>
<td>3</td>
<td>5,92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26%</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Project Area (acres)</th>
<th>Percent Landscape (%)</th>
<th>Landscape Area (acres)</th>
<th>Peak day Application (in/day)</th>
<th>Peak day Application (gpd)</th>
<th>Peak day Irrigation Window (hrs/day)</th>
<th>Peak day Applic rate (gpm)</th>
<th>Assumed PH/PD=</th>
<th>Peak Hr Applic rate (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.92</td>
<td>26%</td>
<td>1.5</td>
<td>0.1255</td>
<td>5,181</td>
<td>8</td>
<td>11</td>
<td>2.0</td>
<td>22</td>
</tr>
</tbody>
</table>

**NOTES**

1. Unit demands are based on the Draft Water Supply Assessment prepared for the City of Davis by Brown and Caldwell, January 2015.
2. PF for Peak Day domestic water use is assumed to be 1.2. Expected to remain substantially consistent year-round.
3. PF for Peak Hour domestic water use is assumed to be 1.8 per City of Davis standards.
4. 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.
## Sewer Loading

<table>
<thead>
<tr>
<th>Population* (person)</th>
<th>ADD (gpd)</th>
<th>Total ADD (gpd)</th>
<th>Total ADD (mgd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>708</td>
<td>57</td>
<td>40,356</td>
</tr>
<tr>
<td>Project Total</td>
<td>708</td>
<td></td>
<td>40,356</td>
</tr>
</tbody>
</table>

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

\[
\text{PF} = [7.67 \times (\text{ADDF})^{-0.093}] \\
\text{PDWF} = \text{ADDF} \times \text{PF} \\
\]

### Infiltration and Inflow

<table>
<thead>
<tr>
<th>Land Area (ac)</th>
<th>Per unit I&amp;I (gpd/ac)</th>
<th>Total I&amp;I (gpd)</th>
<th>Total I&amp;I (mgd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.92</td>
<td>600</td>
<td>3,552</td>
<td>0.004</td>
</tr>
</tbody>
</table>

\[
\text{PWWF} = \text{PDWF} + \text{I&I} \\
\]

### NOTES

1. For preliminary planning purposes, it is assumed that inside water use is equivalent to sewer use. Unit demands are based on 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 4

Storm Drainage Outflows:

“EXIST” = Existing Condition

“DEV” = Developed Condition

“Reservoir-1” = Proposed Detention Basin (downstream of Developed Condition)
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.
<table>
<thead>
<tr>
<th>Pipe Reach</th>
<th>Total Area (AC)</th>
<th># of Lots (Lot EDU)</th>
<th>Total Rate (mgd)</th>
<th>Gross Acres</th>
<th>Peak Rate (mgd)</th>
<th>FA %</th>
<th>Flow Rate (gpd/AC)</th>
<th>Area (AC)</th>
<th>Final Rate (mgd)</th>
<th>FA %</th>
<th>Flow Rate (gpd/AC)</th>
<th>Area (AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West main line</td>
<td>6</td>
<td>47</td>
<td>1.45</td>
<td>14%</td>
<td>7</td>
<td>0.07</td>
<td>84%</td>
<td>0.00</td>
<td>0.00</td>
<td>84%</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>East main line</td>
<td>6</td>
<td>47</td>
<td>1.45</td>
<td>14%</td>
<td>7</td>
<td>0.07</td>
<td>84%</td>
<td>0.00</td>
<td>0.00</td>
<td>84%</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Notes and assumptions:
1. Areas calculated and land use derived from City of Davis sewer, land use and zoning maps.
2. Existing areas within City assumed built out per General Plan.
3. House numbers and shed boundaries are shown on Lincoln 40 Sewer Study Shed Map.
4. Design flow criteria:
   - Single Family Residential: 36 gpd (Assume 65 gallon/day and 2.71 capita/employee from Terry, June 10/16)
   - Multi-Family Residential: 90 gpd (Assume 65 gallon/day and 2.71 capita/employee from Terry, June 10/16)
   - Multi-Family Residential density: 15 gpd/acre (COD site)
   - New Multi-Family Residential: 51 gpd/cap (Brown and Caldwell Water Supply Assessment, January 2015)
   - Retail/Commercial: 0.05 gpd/lot (5 gpm/1000 sq ft)
   - Industrial: 0.9 gpd (15 gpm/1000 sq ft)
5. Infiltration and Inflow (I+I) = 65 gal per acre per day (COD site)
6. Peaking Factor (PF) = 7.64 ADP - 0.693 (COD site)