WEST YOST ASSOCIATES
Consulting Engineers

**TECHNICAL MEMORANDUM**

DATE: May 30, 2013 Project No.: 376-00-12-07

TO: Dianna Jensen, City of Davis

FROM: Jim Connell, P.E., R.C.E. #63052
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SUBJECT: Connection to North Davis Meadows



The North Davis Meadows (NDM) community is located to the north of the existing City of Davis (City) potable water distribution system, along Highway 113, as shown in Figure 1. NDM is part of the NDM County Service Area (CSA). The CSA currently provides water services to a population of approximately 250 people through 95 service connections. The CSA also provides sewer and landscaping services. The City is currently contracted to provide water system maintenance services. The NDM groundwater wells (NDM1 and NDM2) have reported nitrate levels in excess of the Maximum Contaminant Level (MCL). In 2009, the Yolo County Health Department, Environmental Health Division issued Compliance Order No: 12-09 (Compliance Order for Noncompliance with Nitrate Drinking Water Standards). Compliance Order 12-09 requires the water system to, among other requirements, submit a Source Capacity Planning Study to correct the water source capacity and water quality problem. The Study was to include the options of:

1. Drilling a new well
2. Rehabilitating existing well(s)
3. Installing treatment to existing water sources; and,
4. Connecting to other community water systems.

The City has requested West Yost Associates (West Yost) to study the feasibility and cost to connect NDM to the City's water distribution system to address item 4, listed above. This study is based on serving only domestic (*i.e.* indoor) water demands, excluding landscape demand and fire flow, and serving domestic water demand from the City potable water system. This technical memorandum (TM) presents the study findings through the following topics.

1. Estimated Domestic Water Demand
2. Hydraulic Computer Modeling
3. Recommended Infrastructure to Serve NDM
4. Engineer's Opinion of Estimated Cost
5. Environmental and Permitting Issues

West Yost did not evaluate the availability of the City's potable water supply to serve potable water to NDM.

## ESTIMATED DOMESTIC WATER DEMAND

Monthly water production data from the two NDM groundwater wells were received from the City. The production data represent the total water demand, including domestic use, landscaping, golf course irrigation, and unaccounted-for water.

The historical total water demand for NDM is presented in Table 1. While the production levels from each well varied significantly from 2002 to 2012, the total combined production for the NDM area had little fluctuation. The average annual water consumption for NDM from 2002 to 2012 was 86 million gallons (MG), with a minimum of 72 MG and a maximum of 96 MG. To estimate the maximum day and peak hour demand without real-time data to support the analysis, West Yost used industry standard maximum day and peak hour peaking factors of 2 times the average day demand and 3 times the average day demand, respectively.

**Table 1. Historical Water Production for North Davis Meadows**

| Year | NDM 1, MG | NDM 2, MG | Total, MG | Calculated Average Day Demand, gpm | Calculated Maximum Day Demand, gpm | Calculated Peak Hour, gpm |
|---|---|---|---|---|---|---|
| 2002 | 39 | 49 | 88 | 168 | 336 | 504 |
| 2003 | 40 | 49 | 89 | 169 | 339 | 508 |
| 2004 | 66 | 24 | 91 | 173 | 345 | 518 |
| 2005 | 60 | 25 | 85 | 163 | 325 | 488 |
| 2006 | 36 | 49 | 85 | 162 | 324 | 486 |
| 2007 | 43 | 52 | 95 | 180 | 360 | 540 |
| 2008 | 38 | 59 | 96 | 184 | 367 | 551 |
| 2009 | 36 | 46 | 82 | 156 | 313 | 469 |
| 2010 | 6 | 70 | 76 | 145 | 291 | 436 |
| 2011 | 29 | 43 | 72 | 136 | 272 | 409 |
| 2012 | 43 | 40 | 82 | 157 | 314 | 471 |
| Average | 40 | 46 | 86 | 163 | 326 | 489 |
| Maximum | 66 | 70 | 96 | 184 | 367 | 551 |
| Minimum | 6 | 24 | 72 | 136 | 272 | 409 |

Maximum Day Demand = Average Day Demand times 2.0.
Peak Hour Demand = Average Day Demand times 3.0.

This historical water production includes the water demand generated by outdoor irrigation, including irrigation of private landscaping and irrigation at the Davis Community Golf Course. This analysis assumes the North Davis Meadows development is fully built-out and will have no growth in the future.

It is the intent of this project that only domestic potable water demands would be served by the proposed water system to satisfy the requirements of Compliance Order No. 12-09. As discussed below, a second scenario was developed to evaluate the needed potable water infrastructure if fire flows were also met through the proposed system. Under either scenario, residential and golf course landscape irrigation demands would be met by the existing groundwater system.

To estimate the indoor, potable water demand, West Yost averaged the demands from January, February, and December of each year of record. Because these three months require minimal potable water for irrigation due to cooler temperatures and higher rainfall, the average demand for these months was set as the baseline demand the system could expect without irrigation or fire flow demands. The data from January, February, and December from 2002 to 2012 are presented in Table 2.

**Table 2. Historical Monthly Water Production for North Davis Meadows**

| Year | Total Flow, MG | | |
|---|---|---|---|
| | January | February | December |
| 2002 | 1.12 | 1.18 | 1.23 |
| 2003 | 0.85 | 1.34 | 1.31 |
| 2004 | 1.02 | 1.11 | 1.54 |
| 2005 | 1.22 | 1.28 | 1.98 |
| 2006 | 1.46 | 1.96 | 2.21 |
| 2007 | 2.98 | 2.29 | 2.44 |
| 2008 | 1.14 | 1.66 | 1.59 |
| 2009 | 1.70 | 1.20 | 2.05 |
| 2010 | 1.23 | 1.20 | 1.12 |
| 2011 | 1.11 | 1.54 | 2.02 |
| 2012 | 2.66 | 2.42 | 1.17 |
| Average | 1.50 | 1.56 | 1.69 |
| Maximum | 2.98 | 2.42 | 2.44 |
| Minimum | 0.85 | 1.11 | 1.12 |

The maximum monthly water use for the months of January, February, and December for the years of data (2002-2012) was 2.98 MG per month, which occurred in January 2007. This demand is approximately 67 gallons per minute (gpm), which represents over 1,000 gallons per day for each of the 95 water service connections. West Yost used this demand in its sizing and analysis of the new proposed pipelines. Since the indoor water demand is assumed to be approximately constant throughout the year, the maximum day demand would be approximately equal to the maximum monthly demand. The peak hour demand would likely be 1.5 times the maximum monthly demand, or approximately 100 gpm.

An estimate of the unaccounted-for water could not be completed because the individual services are not metered.

## RECOMMENDED INFRASTRUCTURE TO SERVE NDM

To evaluate the infrastructure needed to serve NDM, West Yost modified the City's existing potable water system hydraulic computer model to include the proposed NDM water system. Two scenarios were evaluated:

- Scenario 1 – Serving Indoor Domestic Water Demands Only
- Scenario 2 – Serving Indoor Domestic Water Demands and Fire Flow

These scenarios are described below.

### Scenario 1 – Serving Indoor Domestic Water Demands Only

The City Hydraulic Model was received from the City on February 20, 2013 and was updated to include infrastructure to serve NDM. Initially, a 4-inch diameter pipeline was added to connect NDM to the City system and throughout NDM because that is the City's minimum pipeline diameter for the potable water system. The proposed pipeline alignment is shown in Figure 2.

Using the estimate of domestic potable water demand, discussed above, West Yost created a NDM peak hour demand scenario by distributing the estimated 100 gpm peak hour domestic water demand among the 95 service connections. Because there was no existing peak hour scenario in the model, the maximum day demands of the existing City distribution system were multiplied by a factor of 1.5. Upon running the model, it was found that the initially assumed 4-inch diameter pipelines would not be sufficient to provide greater than 40 psi domestic service pressure throughout the NDM service area, with the West Area Tank Booster Pump Station energized. Therefore, the proposed transmission main was upsized to 6-inch diameter. The results of this simulation are shown on Figure 3.

As shown by these scenarios, the pipeline layout proposed by West Yost is sufficient to meet the City's system criteria in the NDM area under both the maximum day and peak hour demand conditions. West Yost did not conduct fire flow analysis under this scenario. The proposed infrastructure is described below.

#### Proposed Infrastructure for Scenario 1

West Yost proposes the construction of a 6-inch diameter pipeline in John Jones Road/Frontage Road to connect NDM to the existing City water distribution system. The proposed pipeline would connect to the existing 14-inch diameter pipe in John Jones Road near the entrance road to the West Area Tank. The alignment for the proposed 6-inch diameter pipe would be along John Jones Road/Frontage Road, turning west along the fence line south of the Davis Community Golf Course, and then north onto Fairway Drive. Additional 4-inch diameter pipelines would be constructed along the same alignment as the existing pipelines to distribute potable water to residential customers. Two pipes would be constructed across the existing golf course, one connecting the pipelines in Spanish Bay Place to the pipelines in Primrose Place, and the other connecting the pipelines in Larkspur Place to the pipelines in Black Hawk Place. For purposes of this study, it was assumed that the proposed water system would follow the same alignment as the existing potable water system, except as noted below.

An emergency inter-tie between the existing and proposed potable water systems would be constructed in Fairway Drive, north of Larkspur Place, in case of damage to the proposed water supply pipeline, or to re-fill the existing fire tank in the event of a fire emergency and inoperability of the existing groundwater wells. The inter-tie would be constructed with a removable spool piece to prevent accidental cross-connection.

Water meters and backflow preventers would be provided at each water service connection. Alternatively, a master meter and backflow preventer could be provided at the entrance to the Davis Community Golf Course property. The second option, however, is not recommended because of the risk of cross-connections between the existing and proposed water supply systems on customer lots.

### Scenario 2 – Serving Indoor Domestic Water Demands and Fire Flow

It is currently the intent of this study to serve only the indoor domestic water demands with the proposed water system, and to maintain the existing water system for fire flow and irrigation needs. Because the existing system is aging, it may be prudent to include fire flow capacity in the proposed potable water system. To compare the cost of the proposed water supply infrastructure to serve only NDM domestic water demands with the infrastructure necessary to provide fire flow capability in addition to serving domestic water demands, West Yost repeated the analysis described for Scenario 1 above, but conducted a fire flow analysis and upsized pipelines to deliver a minimum 1,500 gpm fire flow to each fire hydrant in the NDM system. The recommended infrastructure to serve fire flow needs is shown in Figure 4. The resulting fire flow availability is shown in Figure 5.

## ENGINEER'S OPINION OF ESTIMATED COST

The engineer's opinion of estimated cost for the infrastructure described above is provided below. The estimated construction costs include the following assumptions:

- Surface restoration of John Jones Road will require a half street overlay
- Surface restoration for streets within NDM will require only a T-trench
- Each lot will be provided a new water service, including box, cover, and meter
- Each lot will be provided a reduced pressure principle backflow device
- Scenario 2 includes new valves and hydrant runs, but hydrants and buries will not be replaced

The estimated cost of the recommended Scenario 1 infrastructure to serve domestic water demands only is shown in Table 3.

**Table 3. Scenario 1 – Engineer's Opinion of Estimated Cost (Costs in May 2013 dollars)**

| Description | Units | Quantity | Unit Price, dollars | Amount, dollars |
|---|---|---|---|---|
| Mobilization/Demobilization | LS | 1 | 85,000 | 85,000 |
| 6-inch diameter PVC water pipe in Frontage Road[(a)] | LF | 5,400 | 142 | 766,800 |
| 6-inch diameter PVC water pipe in existing NDM streets[(a)] | LF | 930 | 96 | 89,280 |
| 6-inch diameter PVC water pipe cross-country in NDM[(a)] | LF | 1,340 | 78 | 104,520 |
| 4-inch diameter PVC water pipe in existing NDM streets[(a)] | LF | 8,700 | 91 | 791,700 |
| 4-inch diameter PVC water pipe cross-country in NDM[(a)] | LF | 1,910 | 74 | 141,340 |
| 6-inch valve | EA | 4 | 1,500 | 6,000 |
| 4-inch valve | EA | 14 | 1,000 | 14,000 |
| Water Services[(b)] | EA | 95 | 4,000 | 380,000 |
| Reduced Pressure Backflow Preventer | EA | 95 | 1,500 | 142,500 |
| Water Main Tie-In at John Jones Road | LS | 1 | 6,000 | 6,000 |
| Emergency Inter-tie with existing NDM water system | LS | 1 | 10,000 | 10,000 |
| Remove/Replace Fence | EA | 2 | 1,000 | 2,000 |
| Traffic Control | LS | 1 | 54,000 | 54,000 |
| | | | Subtotal 1 | 2,593,140 |
| | | | Planning Contingency (20%) | 518,630 |
| | | | Subtotal 2 | 3,111,770 |
| | | | Construction Contingency (10%) | 311,180 |
| | | | Subtotal 3 (Estimated Cost of Construction) | 3,422,950 |
| | | | Other Project Fees (Survey, Engineering, legal, environmental, administration, and CM at 20%) | 684,590 |
| | | | **Total Estimated Project Cost (rounded)** | **$4,108,000** |

(a) Includes pipe, trenching, shoring, backfilling, compacting, and surface restoration.
(b) Includes 1 ½ inch service pipeline to property line, 1 ½ inch residential fire meter, concrete box, lid with meter reading sensor hole, and two angle stops.

The estimated cost of the recommended Scenario 2 infrastructure to serve domestic water demands and fire flow is shown in Table 4.

**Table 4. Scenario 2 – Engineer's Opinion of Estimated Cost (Costs in May 2013 dollars)**

| Description | Units | Quantity | Unit Price, dollars | Amount, dollars |
|---|---|---|---|---|
| Mobilization/Demobilization | LS | 1 | 150,000 | 150,000 |
| 14-inch diameter PVC water pipe in Frontage Road[(a)] | LF | 5,400 | 170 | 918,000 |
| 14-inch diameter PVC water pipe cross-country in NDM | LF | 1,340 | 102 | 136,680 |
| 12-inch diameter PVC water pipe cross-country in NDM | LF | 2,420 | 88 | 212,960 |
| 10-inch diameter PVC water pipe in existing NDM streets[(a)] | LF | 640 | 107 | 68,480 |
| 8-inch diameter PVC water pipe in existing NDM streets[(a)] | LF | 9,000 | 103 | 927,000 |
| 8-inch diameter PVC water pipe cross-county in NDM[(a)] | LF | 1,910 | 83 | 158,530 |
| 14-inch valve | EA | 3 | 5,000 | 15,000 |
| 12-inch valve | EA | 2 | 2,800 | 5,600 |
| 10-inch valve | EA | 1 | 2,400 | 2,400 |
| 8-inch valve | EA | 16 | 2,000 | 32,000 |
| 6-inch valve (for fire hydrant) | EA | 17 | 1,500 | 25,500 |
| Connect to existing fire hydrant | EA | 17 | 4,000 | 68,000 |
| Water Services[(b)] | EA | 95 | 5,000 | 475,000 |
| Reduced Pressure Backflow Preventer | EA | 95 | 1,500 | 142,500 |
| Water Main Tie-In at John Jones Road | LS | 1 | 6,000 | 6,000 |
| Emergency Inter-tie with existing NDM water system | LS | 1 | 10,000 | 10,000 |
| Remove/Replace Fence | EA | 2 | 1,000 | 2,000 |
| Traffic Control | LS | 1 | 54,000 | 54,000 |
| | | | Subtotal 1 | 3,409,650 |
| | | | Planning Contingency (20%) | 681,930 |
| | | | Subtotal 2 | 4,091,580 |
| | | | Construction Contingency (10%) | 409,160 |
| | | | Subtotal 3 (Estimated Cost of Construction) | 4,500,740 |
| | | | Other Project Fees (Survey, Engineering, legal, environmental, administration, and CM at 20%) | 900,150 |
| | | | **Total Estimated Project Cost (rounded)** | **$5,401,000** |

[(a)] Includes pipe, trenching, shoring, backfilling, compacting, and surface restoration.
[(b)] Includes 1 ½ inch service pipeline to property line, 1 ½ inch residential fire meter, concrete box, lid with meter reading sensor hole, and two angle stops.

Under Scenario 2, it may be possible to reduce the pipeline cost slightly by constructing 4-inch diameter pipelines in the cul-de-sacs beyond the last fire hydrant. There is up to 1,650 lineal feet of pipeline that could be downsized, if desired.

Under both scenarios, the proposed infrastructure terminates at the customer's meter. Onsite improvements may be required to separate the existing residential irrigation systems that would not be connected to the proposed system from the existing indoor domestic water system that would be connected to the proposed system. The estimated cost of this onsite infrastructure has not been estimated.

## ENVIRONMENTAL AND PERMITTING ISSUES

This section addresses environmental, permitting, and other concerns at a concept level, based on a conversation with Paul Garcia from Environmental Science Associates.

### Environmental Issues

It is likely that either an Initial Study/Mitigated Negative Declaration or Focused Environmental Impact Report would be required. If there is any possible controversy by anyone in North Davis Meadows or the City of Davis, the EIR is probably going to be the least risky route to take as it is more legally defensible. The environmental document would, at a minimum, have to include an SB 610 Water Supply Assessment to prove that the City has adequate capacity to provide service to North Davis Meadows. There would also have to be a substantial growth inducing impacts discussion to show that extension of water service would not facilitate growth beyond what is planned. Other issues like traffic, air quality, biological resources, and cultural resources would also need to be addressed for construction of facilities.

### Permitting

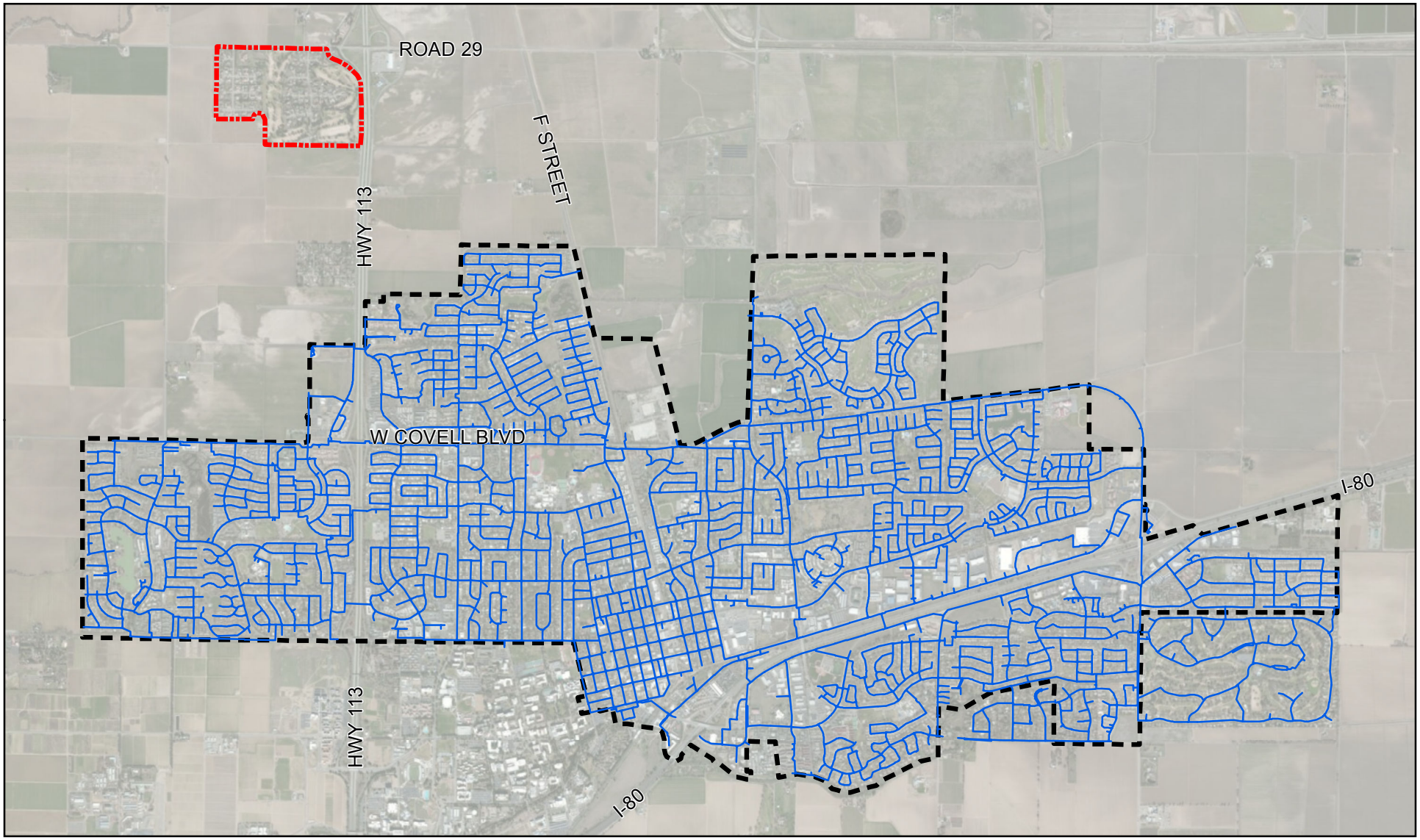
For those sections of the pipeline alignments that are cross country, there could be potential impacts to wetlands and habitat. This would likely require a nationwide permit from the Corps of engineers and consultation and approvals from the USFWS, SHPO, RWQCB and CDFW.

### LAFCo

A meeting with the Local Agency Formation Commission (LAFCo) is recommended to further detail potential issues, but this is potentially a pretty complicated LAFCo action as North Davis Meadows is served by an existing County Service Area (CSA) recognized by LAFCo. Ultimately it could require that the existing CSA be dissolved in order for some sort of annexation by the City. Some County LAFCo's require that an area be fully annexed into the city before providing service but it is not clear if Yolo County requires this. The Yolo County General plan does not show the residences in this area as part of the 10-year sphere of influence within the City of Davis (just the golf course) so LAFCO annexation for this area may be an issue.

### Water Right

The North Davis Meadows would have to become part of the City's water service area for the surface water right permits and the public water system permits.




LEGEND

- City Limits
- North Davis Meadows
- Existing City of Davis Pipelines

DRAFT

N

0 1,900 3,800

Scale in Feet

**FIGURE 1**

**City of Davis**
**North Davis Meadows**

**VICINITY MAP**

Davis California

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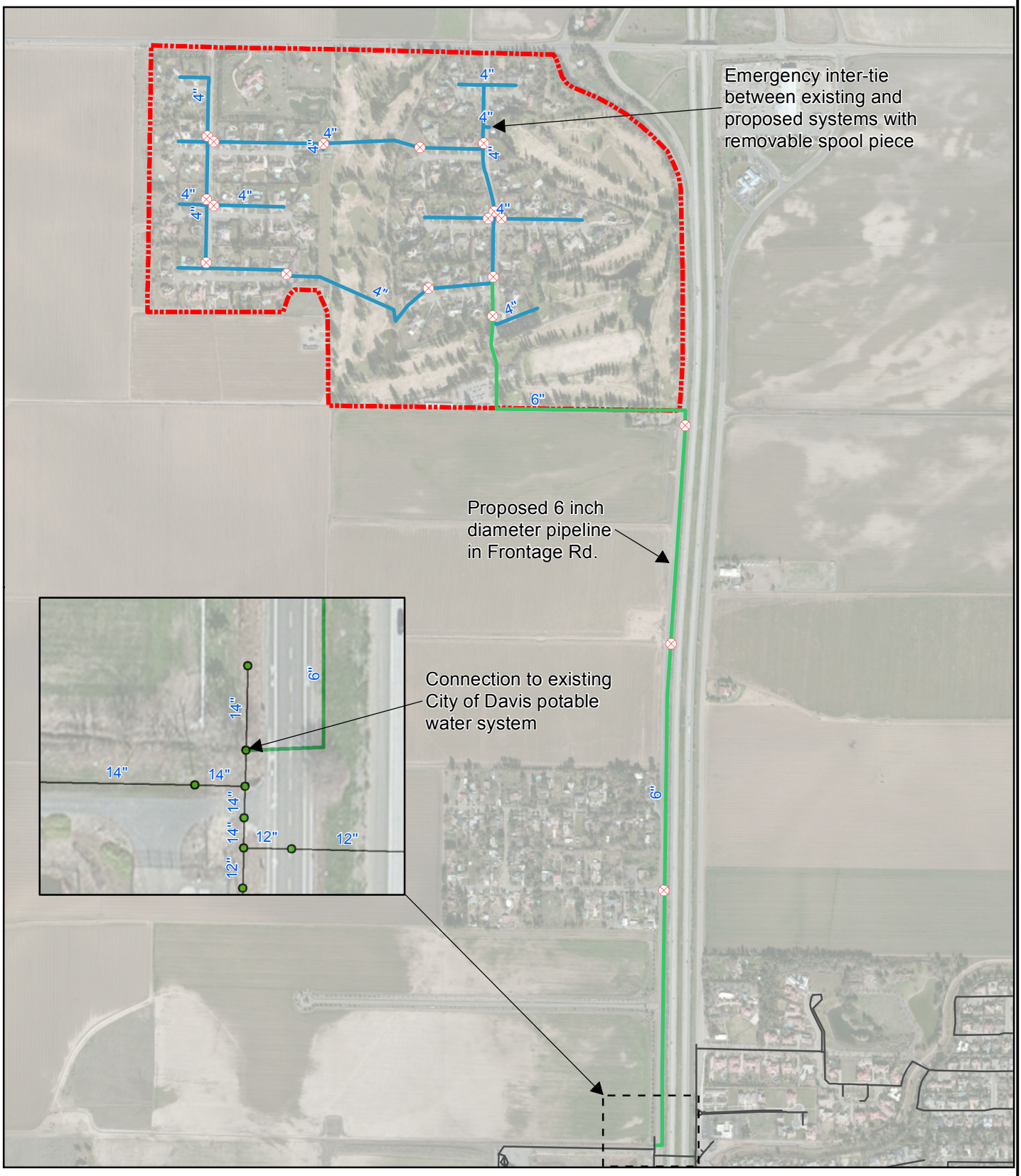
Consulting Engineers




LEGEND

- Proposed Valve
- Existing City of Davis Potable Water Pipeline
- Proposed NDM 6 inch Diameter Pipeline
- Proposed NDM 4 inch Diameter Pipeline
- North Davis Meadows

DRAFT

N

0 500 1,000

Scale in Feet

# FIGURE 2

## City of Davis
## North Davis Meadows

## SCENARIO 1
## PROPOSED POTABLE WATER SYSTEM

Davis California

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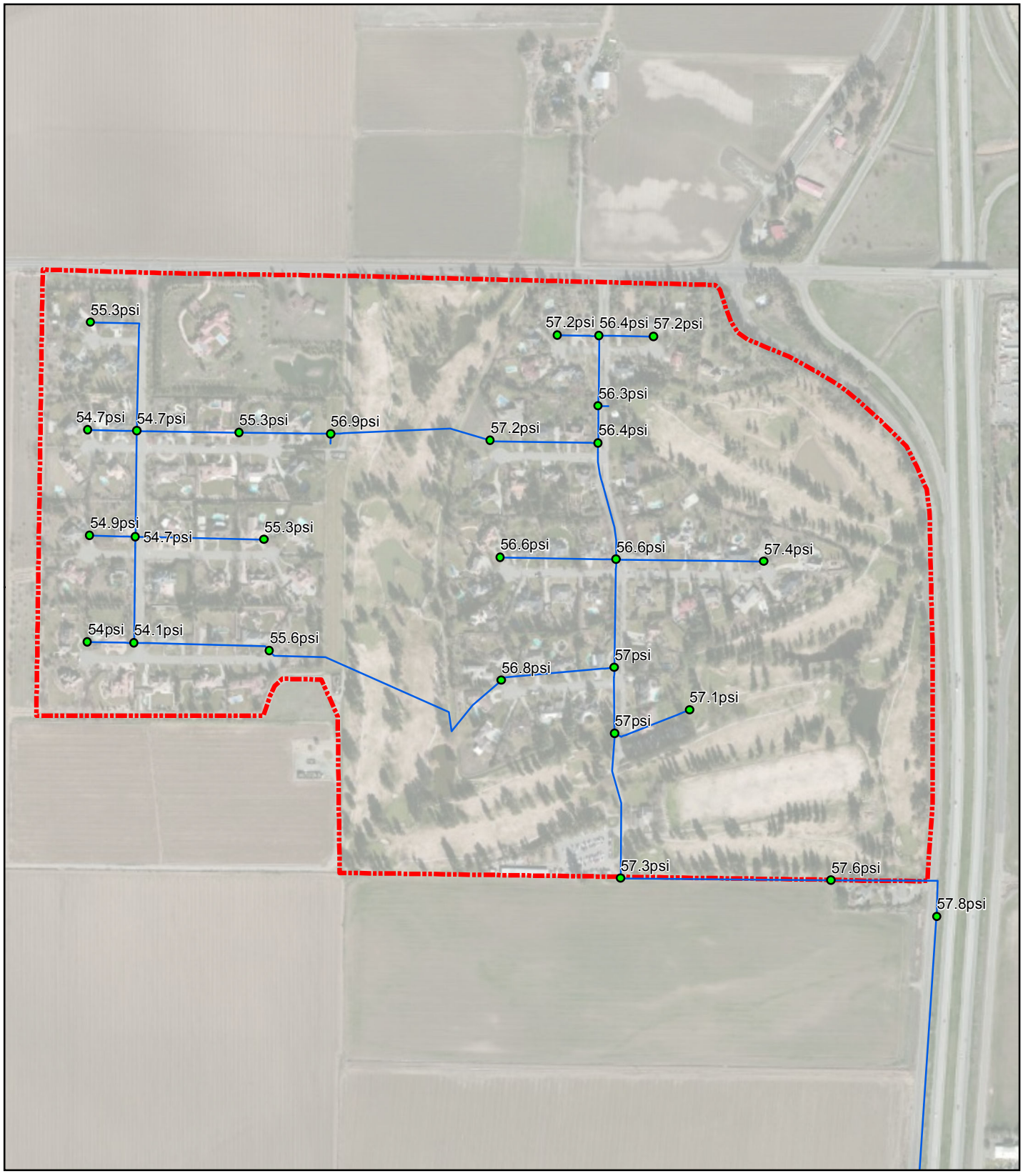


LEGEND

**Junction Pressure**

- Less than 40 psi
- Greater than 40 psi

**Pipeline Velocity**

- Less than 10 fps
- Greater than 10 gps
- North Davis Meadows

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N

0 300 600

Scale in Feet

# FIGURE 3

## City of Davis
## North Davis Meadows

## SCENARIO 1
## PEAK HOUR PRESSURES

Davis California

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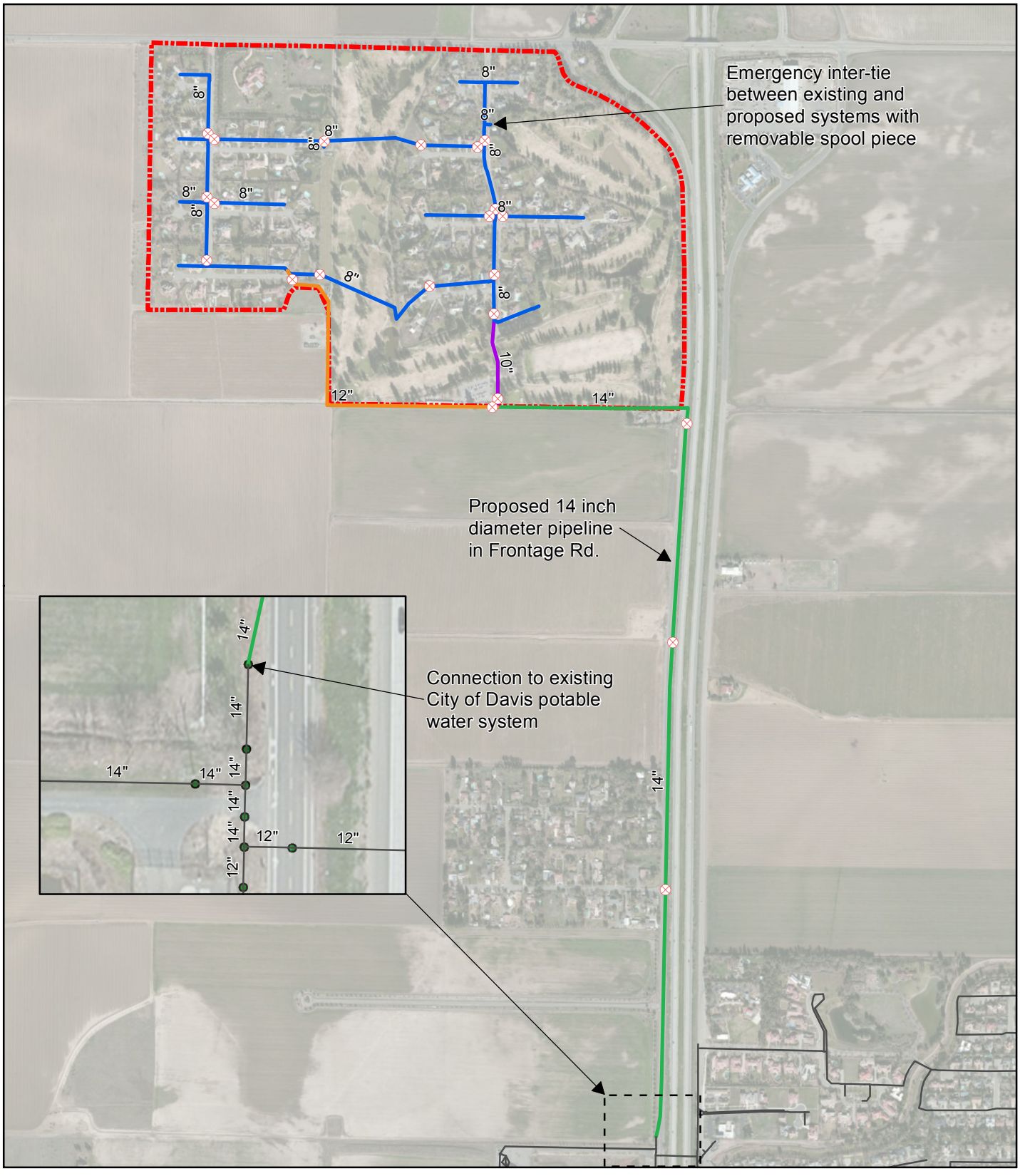
Consulting Engineers




LEGEND

- Proposed Valve
- Existing City of Davis Potable Water Pipeline
- Proposed NDM 10 inch Diameter Pipeline
- Proposed NDM 12 inch Diameter Pipeline
- Proposed NDM 14 inch Diameter Pipeline
- Proposed NDM 8 inch Diameter Pipeline
- North Davis Meadows

DRAFT

N

0 500 1,000

Scale in Feet

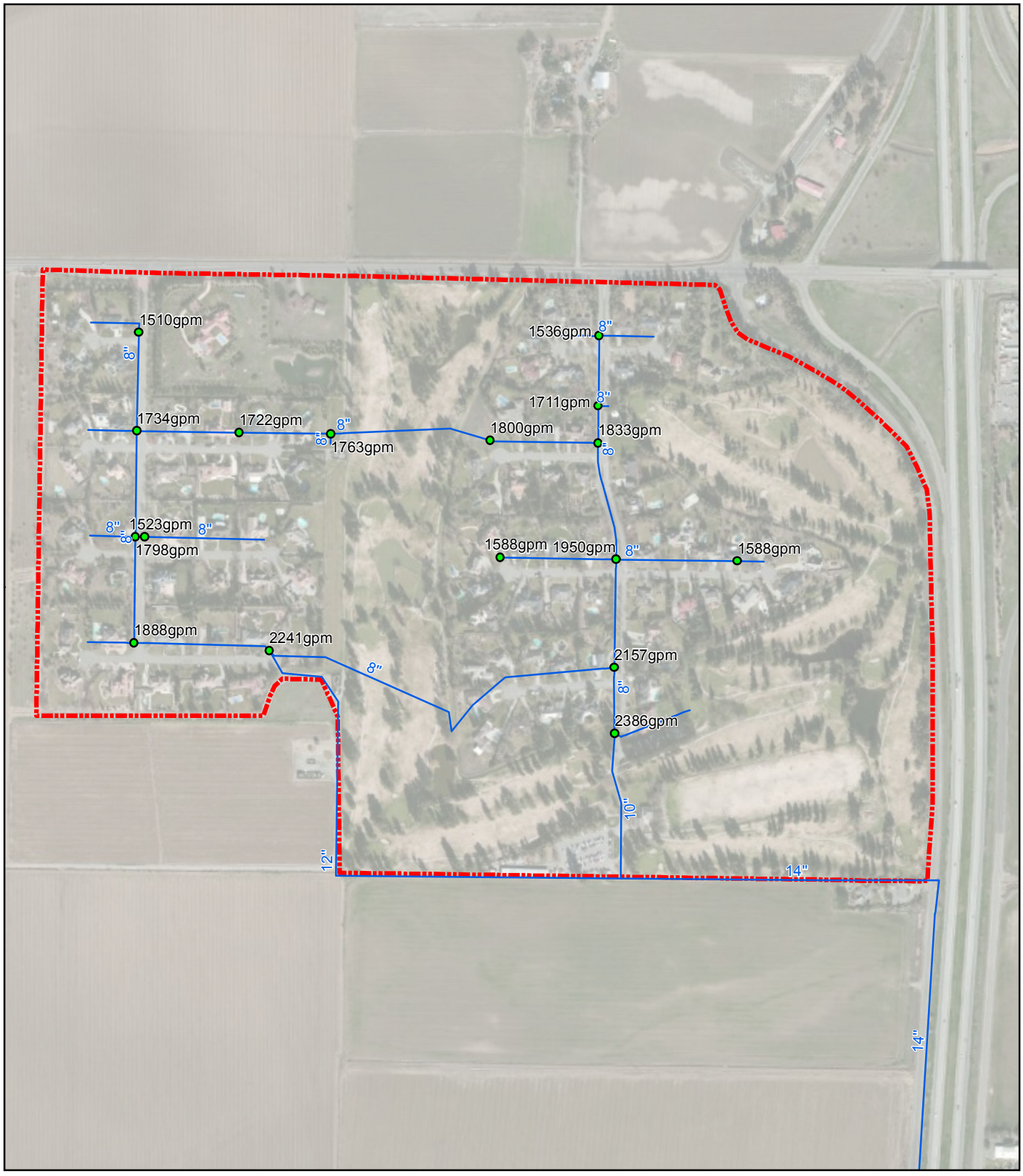
# FIGURE 4

## City of Davis
## North Davis Meadows

## SCENARIO 2
## PROPOSED POTABLE WATER SYSTEM

Davis California

WEST YOST ASSOCIATES
Consulting Engineers




LEGEND

**Available Fire Flow**

- Less than 1500 gpm
- Greater than 1500 gpm
- North Davis Meadows

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N

0 300 600

Scale in Feet

# FIGURE 5

## City of Davis
## North Davis Meadows

## SCENARIO 2
## AVAILABLE FIRE FLOW

Davis California

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