
APPENDIX T

TECHNICAL MEMORANDUM

DATE: April 23, 2024

Project No.: 011-60-23-01

SENT VIA: EMAIL

TO: Stan Gryczko, Public Works Utilities and Operations Director

CC: John Alexander, Wastewater Division Manager

FROM: Patrick Johnston, PE, RCE #59028

REVIEWED BY: Chris Malone, PE, RCE #51009

SUBJECT: Collection System Impacts of Proposed Village Farms Development



This technical memorandum (TM) summarizes the findings and conclusions of a West Yost hydraulic evaluation to assess the sewer impacts of the proposed Village Farms development (proposed Development). Key topics covered in this TM include:

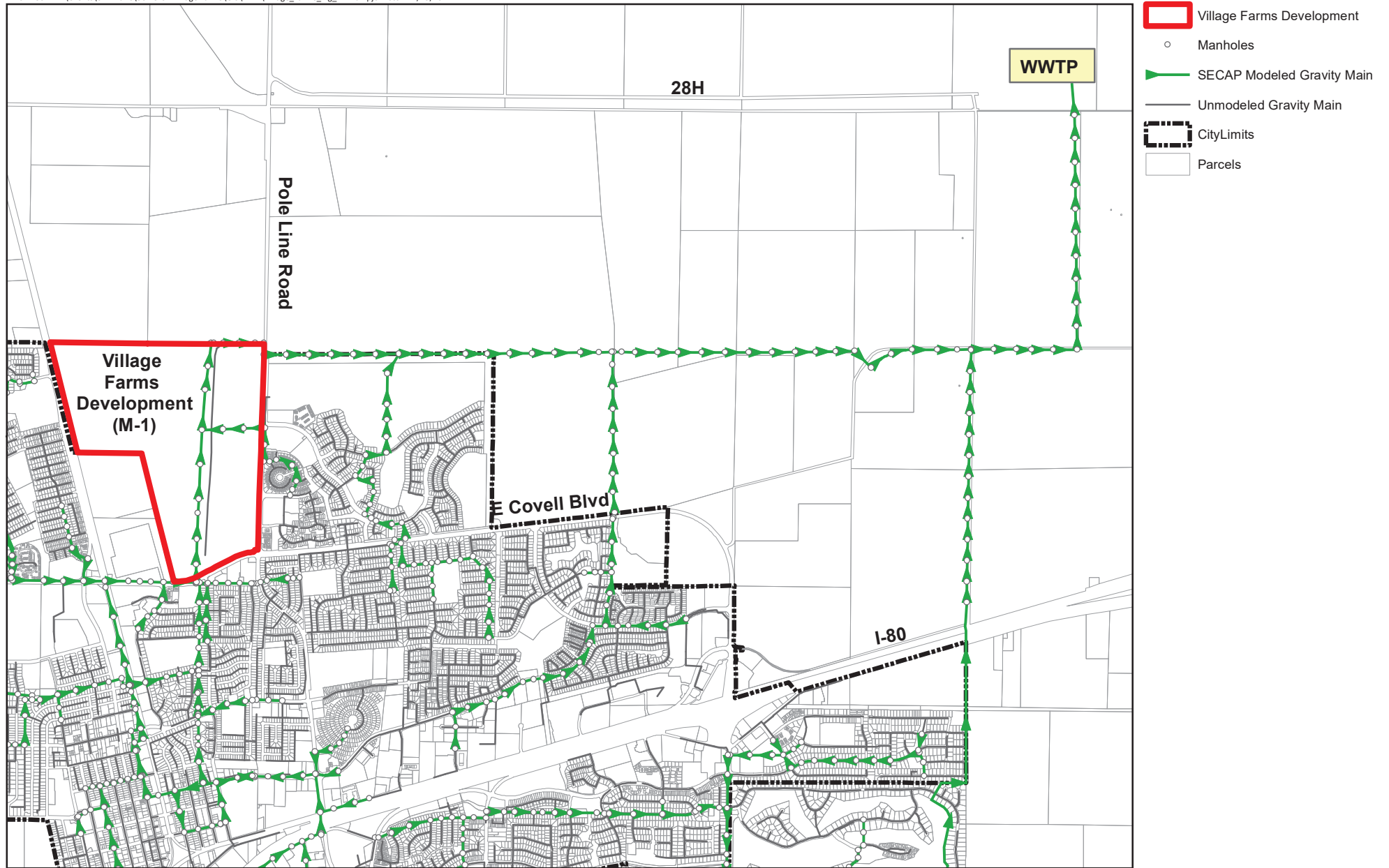
- Development Information
- Planning/Modeling Criteria
- Updated Per Capita ADWF
- Wastewater Influent Flows
- Wastewater Flow Calculation
- Analysis and Findings
- Conclusions and Recommendations

DEVELOPMENT INFORMATION

The proposed Development consists of 390.5 acres of housing, public areas, natural habitat, parks, and neighborhood services on a currently undeveloped area in northern Davis. The area in question is bounded by Covell Boulevard on the south, Pole Line Road on the east, the City-owned property leased to Blue Maxx Raceway and Davis Paintball on the north, the California Northern Railroad adjacent to F Street on the northwest and the northern and eastern boundaries of The Cannery neighborhood on the remaining western boundary. The proposed Development would include 1,800 housing units and is shown on Figure 1.

The downstream sewer trunk mains impacted by the proposed Development include the following:

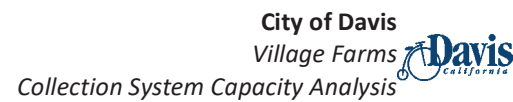
- The 42-inch diameter gravity main that runs north through the proposed Development site from East Covell Boulevard between J Street and L Street
- The continuation of the same 42-inch diameter gravity main from the northern boundary of the proposed Development east to the Wastewater Treatment Plant (WWTP)



Prepared by:



Prepared for:



**Collection System
Facilities Analyzed**

Figure 1

PLANNING/MODELING CRITERIA

The following planning/modeling criteria were used to analyze the collection system capacity impacts associated with the proposed Development. These criteria were established based on the City's 2018 System Evaluation and Capacity Assurance Plan (SECAP) project and on the Davis Public Works Revised Design Standards (September 1991):

1. Gravity mains are considered to have sufficient capacity when peak wet weather flows (PWWF) do not cause the maximum ratio of flow depth (d) to pipe diameter (D) (d/D ratio) to exceed 0.6.
2. A synthetic design storm with a 10-year recurrence interval and 24-hour duration is commonly used to evaluate wastewater collection systems in northern California and was used for the evaluation in this analysis. According to the National Oceanographic and Atmospheric Administration (NOAA) rainfall atlas, the 10-year/24-hour storm used for the PWWF analysis totals 3.40-inches of rainfall.

UPDATED PER CAPITA ADWF

An analysis completed by West Yost in 2022 established a then-current per capita average dry weather flow (ADWF) of 62 gallons per day (gpd) per capita (gpd/capita), based on WWTP influent flow data for non-drought years 2012, 2013 and 2017 through 2019. Since then, another non-drought year occurred in 2023. With the addition of 2023 flows to the analysis, the updated current ADWF per capita flow is found to be slightly lower at 61 gpd/capita.

For purposes of the current analysis, the preferred methodology for establishing service area population is as follows:

1. The population density is assumed to be 2.4 persons per equivalent dwelling unit (EDU), based on a review of recent U.S. Census information for the City and on discussions with City staff.
2. The service area population for the existing sewer connections is estimated from the 2.4 persons/EDU times the number of EDUs. The actual service area population may be slightly lower (based on recent census data); however, this approach adds an appropriate level of conservatism to the analysis.

WWTP INFLUENT FLOWS

Based on discussions with the City, several previously approved developments need to be considered in the current analysis. These proposed developments include the following:

- Nishi development, located in the triangle between Interstate-80, the Union Pacific Railroad, and the western end of Olive Drive;
- Bretton Woods development, located in west Davis north of Covell Boulevard and west of Sutter Davis Hospital;
- Davis Innovation and Security Campus (DISC) 2022 development, which includes the Mace Triangle property and is located on the northeast side of the City, north of I-80 and east of Mace Boulevard;

- Shriners development, located north of East Covell Boulevard and east of the Wildhorse agricultural area; and
- Palomino Place, located at the southeast corner of the Wildhorse Ranch.

Palomino Place is within the existing City limits, and wastewater generation from this area is already accounted for in the City's existing sewer system model. Therefore, Palomino Place does not require further consideration.

The other four developments will consist of 700, 240, 460 and 1,200 residential EDUs, respectively. The DISC 2022 development also includes 58 acres of non-residential development, equivalent to 257 EDUs using 2.4 persons per EDU and 61 gpd/capita from the West Yost analysis combined with a unit wastewater flow factor of 647 gpd per acre from the Mace Ranch Water Supply Assessment and a study on the Impacts of Innovation Center/Nishi Property Development on WWTP Capacity. For purposes of this TM, the combination of existing sewer connections plus connections from these four developments, all of which are outside the existing City Limits, will be referred to as “buildout” conditions.

To evaluate the specific impact on the WWTP of adding the Village Farm connections, the following development scenarios were considered:

- Scenario 1: Existing development conditions (within City Limits)
- Scenario 2: Existing development conditions plus Nishi, Bretton Woods, DISC 2022 and Shriners (i.e. buildout conditions)
- Scenario 3: Existing development conditions plus Village Farms
- Scenario 4: Buildout conditions plus Village Farms

Total EDUs for each of these scenarios can be established from the EDU values listed above in conjunction with a City staff-derived estimate for the total existing unit count within the City limits of 28,553 EDUs. Corresponding service area populations are established by multiplying the total EDUs by 2.4 persons per EDU. Those populations are then multiplied by the current ADWF per capita of 61 gpd/capita to obtain estimates of the ADWF for each scenario. (As noted above, the actual service area population may be slightly lower; however, this approach adds an appropriate level of conservatism to the analysis.)

Table 1. Total EDUs, Service Area Populations and ADWFs for Development Scenarios of Interest			
Development Scenario	Total Dwelling Units, EDUs	Estimated Service Area Population,^(a) persons	ADWF,^(b) mgd
Existing within City Limits ^(c)	28,553	68,530	4.2
Buildout ^(d)	31,410	75,380	4.6
Existing plus Village Farms	30,353	72,850	4.4
Buildout plus Village Farms	33,210	79,700	4.9
(a) Population = EDUs x 2.4 persons per EDU (b) Based on a detailed unit count conducted by City staff. (c) ADWF = population x 61 gpd/capita (d) Buildout = existing connections plus Nishi, Bretton Woods, DISC 2022 and Shriners residential connections and DISC 2022 non-residential connections			

In the case of the wastewater collection system, the City does not maintain an existing conditions model. All hydraulic modeling to date only considers buildout flow conditions. Accordingly, for this analysis, the only conditions modeled for the collection system are Scenario 2 (buildout conditions) and Scenario 4 (buildout conditions plus Village Farms).

WASTEWATER FLOW CALCULATION

The developer has estimated that the ADWF for the proposed Development will be 444,470 gpd, or 0.444 mgd. The developer's analysis is presented in Attachment A of this TM. However, to align with the calculations for the WWTP capacity analysis, West Yost used the proposed 1,800 EDUs planned for Village Farms, 2.4 persons per EDU and 61 gpd/capita to obtain an ADWF of 0.264 mgd to use for this analysis.¹

The model developed as part of the City's SECAP project contains flow projections for buildout conditions in the City of Davis, which includes flows for the Nishi, Bretton Woods, DISC 2022 and Shriners developments. Buildout flows in the model also included flows for other developments such as Palomino Place, University Mall, Oxford Chiles, 1037 Olive Drive, and a part of the Downtown Davis Specific Plan. The buildout ADWF in the hydraulic model totaled 4.27 mgd, whereas the buildout ADWF from the WWTP capacity analysis totaled 4.32 mgd. To align the two analyses, the buildout flows in the hydraulic model were scaled up to match the buildout flow value from the WWTP capacity analysis.

Contributing flows for buildout conditions are broken down into sewershed areas. The ADWF for the proposed Development of 0.264 mgd is assigned to sewershed M-1. As part of the model simulation, the diurnal patterns used in the SECAP analysis are applied to the ADWF to calculate the peak dry weather flows (PDWF). Accordingly, the proposed ADWF flow was assigned the SECAP diurnal pattern developed for the Area M-1 sewershed.

PWWF values were calculated using the RTK method with the parameters developed as part of the SECAP project. The RTK parameters include:

- The rainfall (R) falling on a given sewershed area
- The time (T) from the onset of rainfall to the peak of the system response
- The ratio (K) of the "time to recession" to the "time to peak" of the hydrograph, where the time-to-recession is defined as the time from the peak of the system response to the time where there is no longer any appreciable system response

The existing hydraulic model already includes an assumption that the entire M-1 sewershed is contributing inflow and infiltration. Accordingly, no adjustments were made to the model for the purposes of calculating inflow and infiltration.

ANALYSIS AND FINDINGS

The impacts of the proposed Development on the City's wastewater collection system are described in this section. Only gravity mains are affected; there are no lift stations or force mains downstream of the proposed development.

¹ The results presented in Table 1 indicate an ADWF contribution of Village Farms of 0.2 mgd (not 0.264 mgd) due to showing the total ADWF values to one decimal place.

The modeled buildout PWWF values and d/D results, both with and without the proposed Development, are shown in Table 2 for each of the gravity mains between Covell Boulevard and the WWTP. The gravity mains with d/D ratios of greater than 0.6 are highlighted to identify an exceedance of the City's design criteria.

As shown in Table 2, there are four gravity main segments that meet the criteria without the proposed Development but exceed the criteria after the flows from the proposed Development are added to the system. However, as the impact of the proposed Development is very slight (increasing from a d/D of 0.60 to 0.61), no system improvements are justified.

Table 2. Modeled Buildout Results							
System ID			Existing Pipe Diameter, in	Modeled PWWF, mgd		d/D Results	
Gravity Main	Upstream Node	Downstream Node		Buildout	Buildout + Village Farms	Buildout	Buildout + Village Farms
O14-004.1	O14-004	N14-004	42	8.07	8.05	0.41	0.41
N14-004.1	N14-004	N14-003	42	8.07	8.05	0.41	0.41
N14-003.1	N14-003	N14-002	42	8.07	8.05	0.41	0.41
N14-002.1	N14-002	N14-001	42	8.06	8.04	0.41	0.41
N14-001.1	N14-001	M14-004	42	8.06	8.04	0.48	0.48
M14-004.1	M14-004	M14-003	42	8.04	8.02	0.65	0.66
M14-003.1	M14-003	M14-002	42	8.06	8.48	0.65	0.66
M14-002.1	M14-002	M14-001	42	8.04	8.46	0.59	0.60
M14-001.1	M14-001	L14-001	42	8.15	8.45	0.54	0.55
L14-001.1	L14-001	L14-002	42	8.15	8.45	0.53	0.54
L14-002.1	L14-002	L14-003	42	8.15	8.45	0.51	0.52
L14-003.1	L14-003	L14-004	42	8.14	8.45	0.44	0.45
L14-004.1	L14-004	M15-001	42	8.14	8.45	0.42	0.43
M15-001.1	M15-001	M15-002	42	8.14	8.44	0.60	0.61
M15-002.1	M15-002	M15-003	42	8.13	8.44	0.60	0.61
M15-003.1	M15-003	M15-004	42	8.13	8.43	0.47	0.48
M15-004.1	M15-004	M15-005	42	8.12	8.43	0.47	0.48
M15-005.1	M15-005	M15-006	42	8.12	8.42	0.47	0.48
M15-006.1	M15-006	M16-001	42	8.11	8.41	0.48	0.49
M16-001.1	M16-001	M16-006	42	8.10	8.41	0.49	0.50
M16-006.1	M16-006	M16-002	42	8.94	9.23	0.49	0.50
M16-002.1	M16-002	M16-003	42	8.93	9.23	0.49	0.50
M16-003.1	M16-003	M16-004	42	8.93	9.22	0.49	0.50
M16-004.1	M16-004	M16-005	42	8.92	9.21	0.48	0.49
M16-005.1	M16-005	M17-001	42	8.92	9.21	0.47	0.48
M17-001.1	M17-001	M17-002	42	8.91	9.20	0.47	0.48
M17-002.1	M17-002	M17-003	42	8.91	9.20	0.47	0.48
M17-003.1	M17-003	M17-004	42	8.90	9.19	0.47	0.49
M17-004.1	M17-004	M17-005	42	8.90	9.18	0.48	0.50
M17-005.1	M17-005	M18-012	42	8.89	9.18	0.50	0.52
M18-012.1	M18-012	M18-006A	42	8.89	9.17	0.50	0.52
M18-006A.1	M18-006A	M18-006	42	9.79	10.44	0.50	0.52
M18-006.1	M18-006	M18-007	42	9.78	10.44	0.49	0.51
M18-007.1	M18-007	M18-008	42	9.78	10.43	0.49	0.51
M18-008.1	M18-008	M18-009	42	9.78	10.43	0.49	0.51
M18-009.1	M18-009	M18-010	42	9.77	10.43	0.49	0.51
M18-010.1	M18-010	M18-011	42	9.77	10.42	0.49	0.51
M18-011.1	M18-011	M19-001	42	9.77	10.42	0.48	0.49
M19-001.1	M19-001	M19-002	42	9.76	10.41	0.48	0.49
M19-002.1	M19-002	M19-003	42	9.76	10.41	0.48	0.50
M19-003.1	M19-003	M19-004	42	9.76	10.41	0.48	0.50
M19-004.1	M19-004	M19-005	42	9.75	10.40	0.49	0.51
M19-005.1	M19-005	M20-001	42	9.75	10.40	0.50	0.52
M20-001.1	M20-001	M20-002	42	9.75	10.40	0.50	0.52
M20-002.1	M20-002	M20-003	42	9.74	10.61	0.48	0.51
M20-003.1	M20-003	M20-004	42	9.74	10.61	0.48	0.50
M20-004.1	M20-004	M20-005	42	9.74	10.61	0.47	0.50
M20-005.1	M20-005	M20-006	42	9.73	10.61	0.44	0.46
M20-006.1	M20-006	M20-007	42	9.73	10.60	0.43	0.45
M20-007.1	M20-007	L21-001	42	10.80	11.68	0.56	0.59
L21-001.1	L21-001	L21-002	42	10.79	11.67	0.58	0.61
L21-002.1	L21-002	L21-003	42	10.78	11.66	0.60	0.63
L21-003.1	L21-003	L21-004	42	10.78	11.66	0.64	0.67
L21-004.1	L21-004	L21-005	42	10.77	11.65	0.64	0.67
L21-005.1	L21-005	L21-006	42	10.76	11.65	0.53	0.56
L21-006.1	L21-006	L21-007	42	10.76	11.64	0.54	0.56
L21-007.1	L21-007	L21-008	42	10.75	11.63	0.54	0.56
L21-008.1	L21-008	L21-009	42	10.75	11.63	0.54	0.56
L21-009.1	L21-009	L21-010	42	10.74	11.62	0.53	0.56
L21-010.1	L21-010	K21-001	42	10.74	11.62	0.53	0.56
K21-001.1	K21-001	K21-002	42	10.73	11.61	0.53	0.56
K21-002.1	K21-002	K21-003	42	10.73	11.61	0.53	0.56
K21-003.1	K21-003	K21-004	42	10.72	11.60	0.53	0.55
K21-004.1	K21-004	K21-005	42	10.72	11.60	0.52	0.54
K21-005.1	K21-005	J21-WWTP	42	10.72	11.60	0.50	0.52

CONCLUSIONS AND RECOMMENDATIONS

The sewer flows from the proposed Development can be accommodated by existing collection system infrastructure with minimal impacts. Accordingly, no system improvements are recommended.



Attachment A

Developer's Analysis

WASTE WATER / SEWER

INTRODUCTION

This waste water system technical evaluation provides information to support the proposed 390.5 acre Village Farms Davis development by North Davis Land Company. The proposed site is adjacent to the City of Davis municipal sewer system, and will connect to the City system for sanitary sewer services.

EXISTING WASTE WATER INFRASTRUCTURE

The City of Davis sewer collection system for this portion of Davis consists of a 42" diameter trunk main which runs south to north through the center of the project site, before heading east to the City of Davis Waste Water Treatment Plant approximately 3 miles east of Pole Line Road/County Road 102.

SEWER DEMAND

The City of Davis Average Day Sewer Generation Rates for Residential, Neighborhood Commercial Services ("Retail"), Office and Schools are summarized below:

Unit Wastewater Demand Factors		
Type of Use	Design Flow (gallons)	Unit
Single Family Residential	330	Gallons Per DU
Multiple Family Residential	230	Gallons Per DU
Retail	15	Employee
Office	15	Employee
School	11	Gallons per Student
School w/ Cafeteria	16	Gallons per Student

Table 2-1: City of Davis Public Works Design Standards - September 1991

These generation rates are based on 1991 typical usage within the City of Davis.

As identified in the water system technical evaluation, the proposed project will pursue water efficient fixtures and water conservation throughout the development in accordance with the 2022 California Green Building Standards Code as adopted by the City of Davis. The project does not anticipate any high use facilities or functions that will generate a large amount of waste water.

As a result of this effort, the project is pursuing an alternate to the City of Davis 1991 water demand factors and a similar reduction of 20% is proposed for the sewer generation rates, based on a reduction to the City Standard generation rates (not to exceed the water demand factors). Table 2-2 below summarizes the proposed wastewater unit demand factors for the proposed Village Farms Davis development.

Village Farms *Davis*

Unit Wastewater Demand Factors		
Type of Use	Design Flow (gallons)	Unit
Single Family Residential	264	Gallons Per DU
Multiple Family Residential	174	Gallons Per DU
Neighborhood Retail	2,400	Gallons per Acre
Public Safety Center	2,400	Gallons per Acre
School	9	Gallons per Student
School w/ Cafeteria	13	Gallons per Student

Table 2-2: 20% reduction in City of Davis Public Works Design Standards – September 1991

WASTE WATER GENERATION SUMMARY

The proposed unit generation factors identified above represent the Average Day Demand for the proposed project. The Maximum Day peaking factor is based on the peaking equation ($PF=7.67 \times ADDF - 0.093$) in accordance with the City of Davis Public Works Design Standards. Infiltration and Inflow allowance has also been accounted for at 600 gallons per acre per day. The Peak Daily Wet Weather Flow for the proposed project is summarized in Table 2-3 below.

Land Use Designation	Acres	Average Daily Dry Weather Flows (gpd)	Infiltration and Inflow Allowance (gpd)	Peak Daily Wet Weather Flows (gpd)
Neighborhood Retail	2.8	6,700	1,700	24,300
Educational Farm	2.8	270	1,700	2,900
Public Day School	2.4	1,300	1,400	6,500
Public Safety Center	2.5	6,000	1,500	22,000
HDR-West Park	13.8	52,200	8,300	154,100
HDR-North Park Apartments	11.6	34,800	7,000	107,900
MDR-Parkside Village West	15.1	39,600	9,100	122,600
MDR-Parkside Village East	16.1	39,600	9,700	123,200
LDR-North Village	64.8	58,080	38,900	199,500
LDR-East Village	39.6	58,080	23,800	184,400
LDR-South Village	53.0	63,360	31,800	205,600
MDR Central Village	40.0	84,480	24,000	249,600
Major Roads	21.3	-	12,800	12,800
Total	286.0	444,470	171,700	1,415,400

Based on the proposed peak wet weather flows for the Village Farms Davis development of 1.415 MGD and the available capacity within the City of Davis 42" trunk main located on-site, no offsite sewer improvements are anticipated of the project. This assumption requires confirmation by the City of Davis Public Works Department, who we understand maintains a model of the City's sewer collection and conveyance system.

WASTE WATER / SEWER TREATMENT

Waste water treatment for the project area is provided by the City of Davis Public Works Department. The City's waste water treatment plant was modified in 1989 to accommodate an average dry weather flow rate (ADWF) of 7.5 MGD and a peak wet weather flow (PWWF) of 12.6 MGD. In 2014, work began on upgrading the waste water treatment plant to provide additional levels of treatment to address State regulations for higher quality wastewater effluent. These upgrades decreased the capacity of the plant to 6.0 MGD ADWF but increased the PWWF to 18 MGDⁱ. In 2015, the 5 year average of ADWF to the plant was approximately 4.34 MGD and 5.05 MGD for General Plan Buildout. The available capacity and ability for the existing wastewater treatment plant to serve the proposed project will require evaluation by the City of Davis.

WASTE WATER / SEWER INFRASTRUCTURE

Figure S1 attached identifies the preliminary sewer infrastructure layout for the proposed Village Farms Davis project. The sewer infrastructure onsite will utilize 8", 10" and 12" pipes to serve the development, with connections to existing manholes along the existing 42" city trunk main.

A future study will need to be conducted to further refine the proposed pipe sizes throughout the development in order to meet the peak flows and to evaluate capacity within existing facilities. The triggers for the proposed infrastructure will also be defined in this future study to confirm adequate flow can be provided with each phase of the development.

Attachments:

Figure S1 – Sewer Infrastructure Exhibit

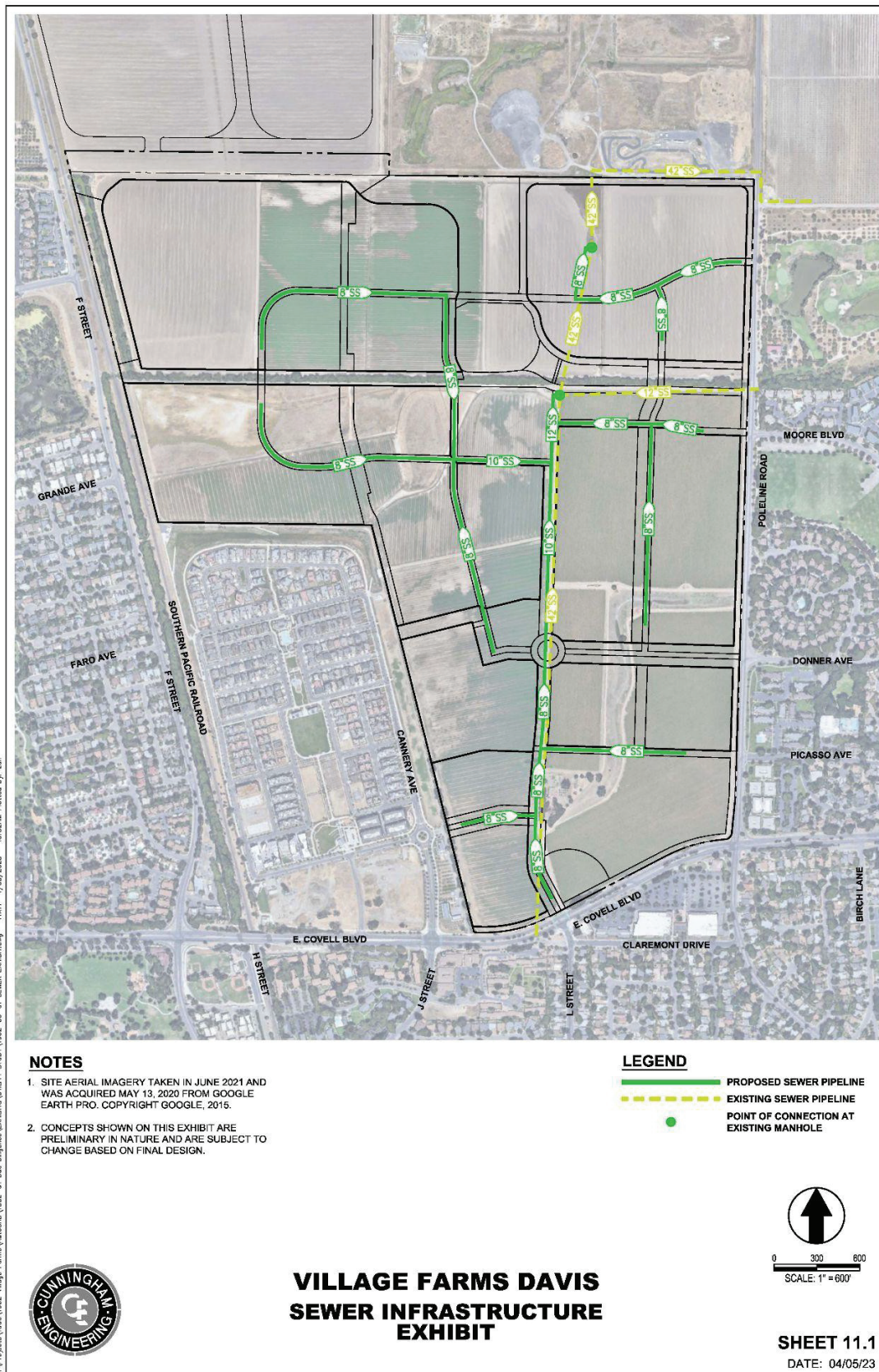
Table S1 – Waste Water Demand

ⁱ <http://daviswwtp.org/wp-content/uploads/2014/06/DB-Contract-WWTP-STI-Project-June-2014.pdf>
(Appendix 10 - Basis of Design)

ⁱⁱ West Yost Associates. (February 27, 2015). Impacts of Innovation Center/Nishi Property Development on Waste water Treatment Plant Capacity. Prepared for Michael Lindquist, City of Davis. Accessible at <http://cityofdavis.org/home/showdocument?id=4697>

Village Farms Davis

Figure S1 - SEWER INFRASTRUCTURE EXHIBIT



Not to scale. See **Addendum A** for scaled exhibit.

Table S1 – WASTE WATER DEMAND

TABLE S1 Waste Water Demand									
Land Use Designation	Land Use	Acres	Dwelling Units/ Students	Average Day Generation ⁽¹⁾ (gallons per unit)	Average Dry Weather Flow (gpd)	Peaking Factor ⁽²⁾	Peak Dry Weather Flow (gpd)	Inflow and Infiltration Flow ⁽³⁾ (gpd)	Peak Wet Weather Flow (gpd)
Neighborhood Retail	Neighborhood Retail	2.8	-	2,400	6,700	3.38	22,600	1,700	24,300
Public/Semi-Public	Educational Farm	2.8	30	9	270	4.56	1,200	1,700	2,900
	Public Day School	2.4	100	13	1,300	3.94	5,100	1,400	6,500
	Public Safety Center	2.5	-	2,400	6,000	3.42	20,500	1,500	22,000
High Density Residential	West Park	13.8	300	174	52,200	2.79	145,800	8,300	154,100
	North Park Apartments	11.6	200	174	34,800	2.90	100,900	7,000	107,900
Medium Density Residential	Parkside West	15.1	150	264	39,600	2.87	113,500	9,100	122,600
	Parkside East	16.1	150	264	39,600	2.87	113,500	9,700	123,200
	Central Village	40	320	264	84,480	2.67	225,600	24,000	249,600
Low Density Residential	North Village	64.8	220	264	58,080	2.77	160,600	38,900	199,500
	East Village	39.6	220	264	58,080	2.77	160,600	23,800	184,400
	South Village	53	240	264	63,360	2.74	173,800	31,800	205,600
	Major Roads	21.3	-	-	-	-	-	12,800	12,800
Total		285.8			444,470		1,243,700	171,700	1,415,400

(1) Based on City of Davis Design Standards, Section VII.C, includes 20% reduction (not to exceed potable water demands)

(2) City of Davis Design Standards, Section VII.E.a; $PF = 7.67 * ADDFA - 0.093$

(3) City of Davis Design Standards, Section VII.F; I&I = 600 gallons per gross acre per day