APPENDIX N

VANDEN MEADOWS PROJECT SEWER MODELING STUDY AND TECHNICAL MEMORANDUM

City of Vacaville

Vanden Meadows Project

Sewer Modeling Study

January 2011

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This report is an update to the West Yost and Associates (WYA) report titled "Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Area Master Plan" dated July 29, 2005. The WYA report analyzed the developed sewer flow generated by existing and future projects within the Southtown area. The Vanden Meadows development was accounted for utilizing the best available data at the time that the report was prepared. This study will modify the WYA sewer analysis to reflect the current Vanden Meadows Land Use Plan.

This report will serve as a technical memorandum to determine the sewer flow generated by Vanden Meadows development and compare the flow based upon the new land use vs. the values stated in the 2005 WYA study. Any changes from the WYA study will be noted and reviewed to determine if any of the original recommendations made by WYA will require modification. A summary of the study findings is presented below.

1.0 BACKGROUND

The total Vanden Meadows area comprises 260 ± acres and is bounded by Nut Tree Road on the west, the Southtown Project to the north, the railroad property to the east and the Vacaville/ Fairfield buffer to the south. The 260 ± acre boundary is identical to the tributary areas considered in the WYA 2005 study. The interior tributary areas have been modified to reflect the land use areas described below.

The Vanden Meadows Specific Plan establishes a comprehensively planned community that is designed to work with the Southtown project to the north. The Land Use component of the Specific Plan is primarily residential with the non-residential uses comprising the school(s) and park. The property comprises 5 land owners (See Figure 1.1).

The Vanden Meadows area is divided into 13 subareas (See Figure 1.2). Each subarea has a different land use designation. Table 3.1 details each of the subareas.

Subareas A, B, C, D, and E comprise approximately 59± acres and are owned by the Hockett group. This property is located between Nut Tree Road and Vanden Road with the Travis Unified School District (TUSD) property comprising a portion of its northern boundary and the Montgomery property, SID canal, and Fairfield-Vacaville buffer comprising its southern boundary.

Subarea F is approximately 11± acres and is owned by Evon Papin. The property is bounded by Southtown to the north, the TUSD property to the west, Vanden Road to the east and the Hockett property to the south.

Subareas G, H, and I are owned by Belmont Homes and Park Lane Apartments (collectively referred to as the Zocchi Property). These areas are bounded by Southtown to the north, Vanden Road to the west and Leisure Town Road (Jepson Parkway) to the east and south.

Subareas J and K comprise approximately 21± acres and are owned by the Montgomery group and are bounded by the Fairfield-Vacaville buffer to the south, Nut Tree Road to the west, and the Hockett property to the north and east.

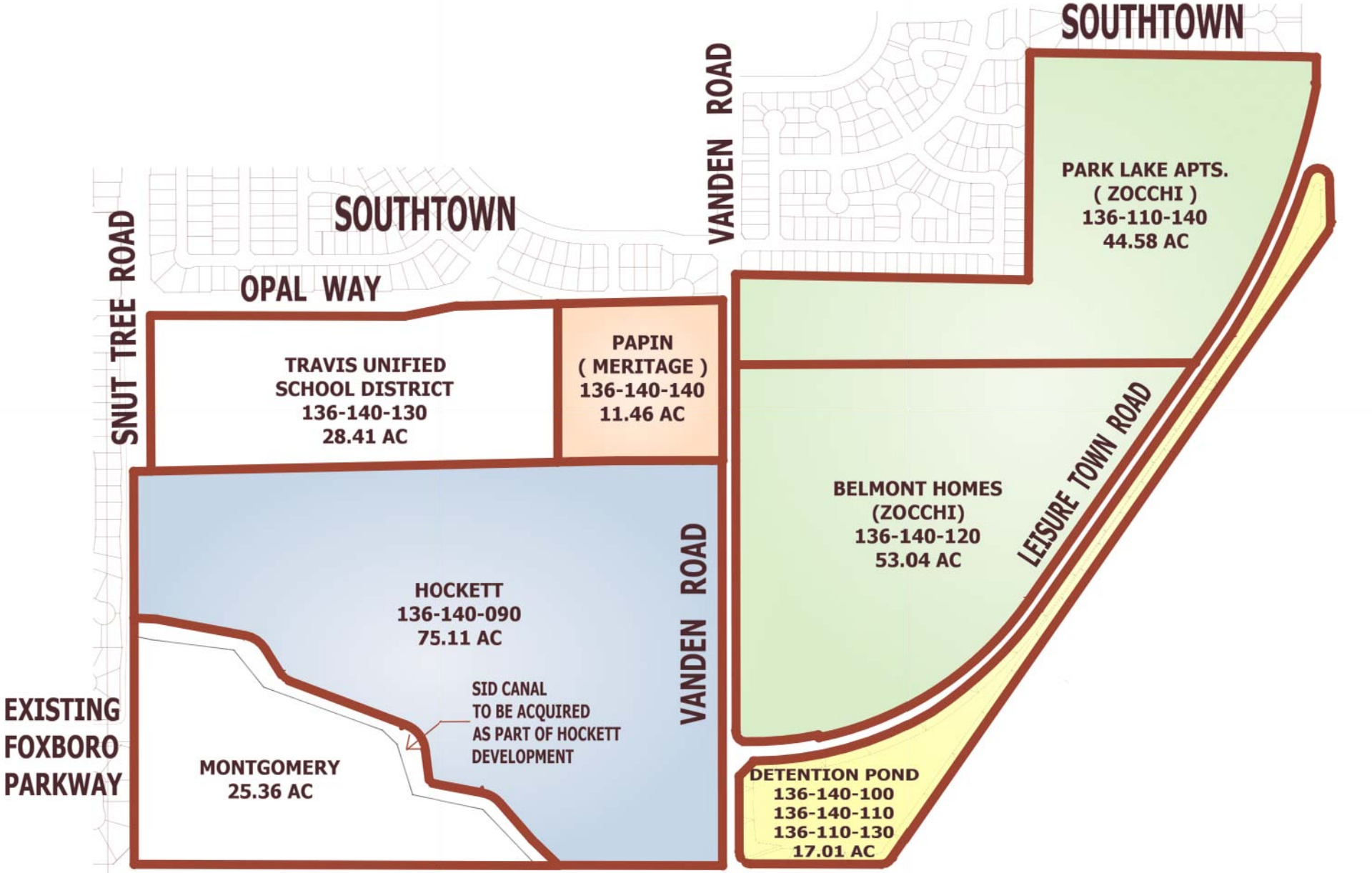
Subarea L comprises approximately 7± acres and is designated as a future park and is currently owned by the Hockett group. Subarea M is owned by the TUSD and is designated for future school(s). Subarea N is currently owned by various entities and is designated as trails, landscaping and agricultural buffer. Lastly, Subarea O is designated as Detention Basin (Community Facility).

TABLE 1.1 – VANDEN MEADOWS LAND USE SUMMARY

(Refer to Figures 1.1 and 1.2 for Location of Areas)

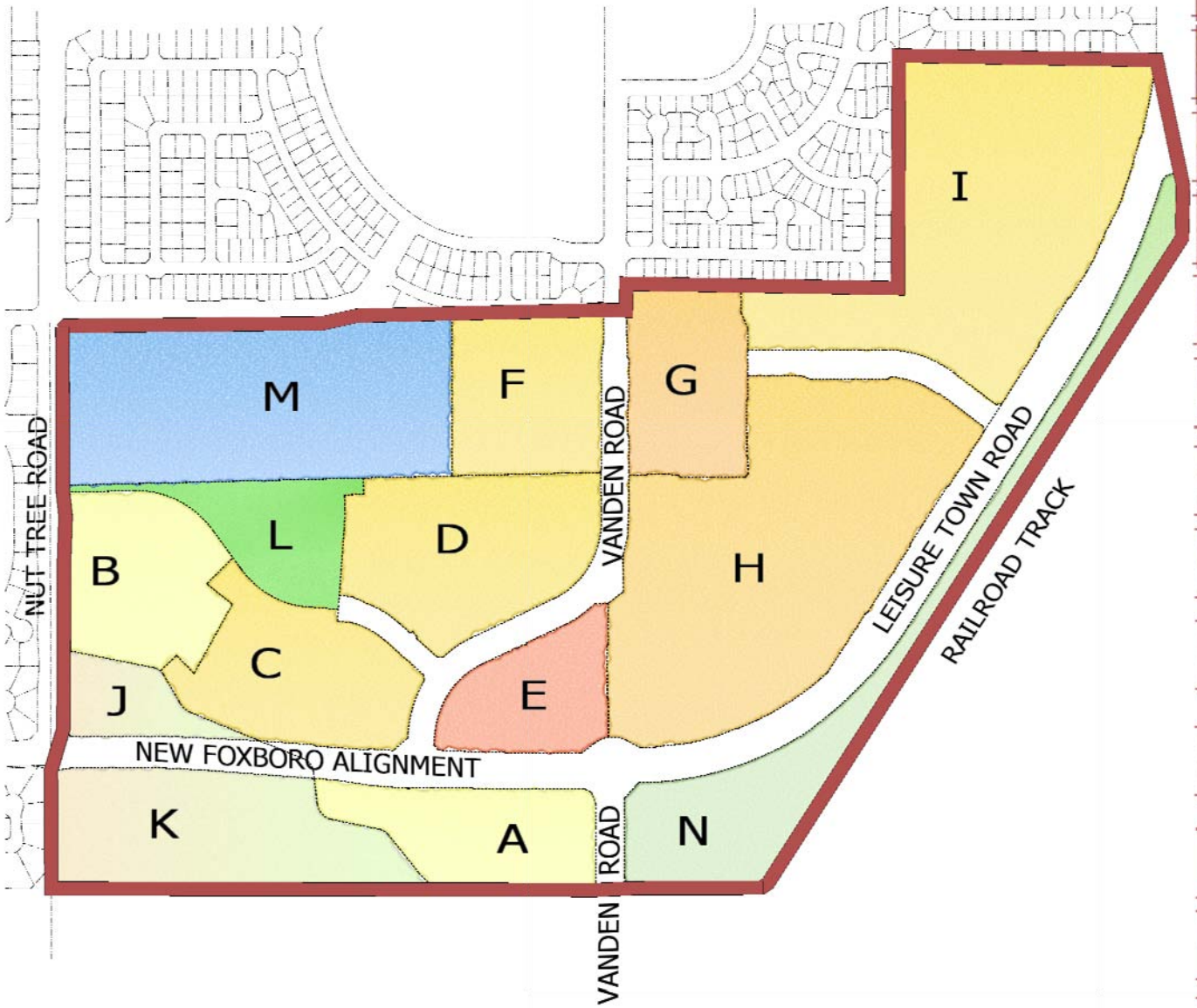
Sub Area	Land Use	Proposed Zoning	Approximate Area (Acres)	Residential Units	Density (Units/Acre)	Non Residential Uses
A	RE	RE-10	10.28	26	2.53	
B	RE	RE-10	9.78	25	2.56	
C	RLD	RLD-6	14.50	52	3.59	
D	RLD	RLD-5	16.19	74	4.57	
E	RHD	RH	8.17	192	23.50	
F	RLD	RLD-6	11.01	50	4.54	
G	RMD	RMD	10.27	97	9.44	
H	RLMD	RLMD-4.5	38.92	209	5.37	
I	RLD	RLD-6	33.96	157	4.62	
J	RE	RE-10	4.33	11	2.54	
K	RE	RE-10	16.82	46	2.73	
L	CF	CF	7.42			PARK
M	CF	CF	28.41			SCHOOL
N	CF	CF	31.31			TRAILS & LANDSCAPING (including AG Buffer)
O	CF	CF	17.01			DETENTION BASIN
TOTAL			**258.38**	**939**	**4.56***	

* - Total Land Use Density Excludes the School Property (28.41 Ac), the Ag Buffer (6.93 Ac), and the Detention Basin (17.01 Ac).



OWNERSHIP MAP

FIGURE 1.1 VANDEN MEADOWS
SEWER MODELING STUDY



A - RESIDENTIAL ESTATE
ACREAGE: 10.28±

B - RESIDENTIAL ESTATE
ACREAGE: 8.97±

C - RESIDENTIAL LOW DENSITY
ACREAGE: 15.07±

D - RESIDENTIAL LOW DENSITY
ACREAGE: 16.20±

E - RESIDENTIAL HIGH DENSITY
ACREAGE: 8.14±

F - RESIDENTIAL LOW DENSITY
ACREAGE: 11.01±

G - RESIDENTIAL MEDIUM DENSITY
ACREAGE: 10.27±

H - RESIDENTIAL LOW MEDIUM DENSITY
ACREAGE: 38.92±

I - RESIDENTIAL LOW DENSITY
ACREAGE: 33.94±

J - INTERIM: AGRICULTURE
FUTURE: RE
ACREAGE: 4.06±

K - INTERIM: AGRICULTURE
FUTURE: RE
ACREAGE: 16.61±

L - CF
ACREAGE: 7.42±

M - CF
ACREAGE: 28.41±

N - CF
ACREAGE: 17.06±

TRAIL /LANDSCAPE THROUGHOUT SITE (CF)
ACREAGE: 23.2±

PROPOSED LAND USE

FIGURE 1.2 VANDEN MEADOWS
SEWER MODELING STUDY

2.0 CONSISTENCY WITH LAND USE PLAN

The build out of the Vanden Meadows project is to be consistent with the Specific Plan for the Vanden Meadows project as well as the City of Vacaville General Plan.

The sanitary sewer collection system in Vanden Meadows shall be consistent with the most current edition of the City of Vacaville's Sewer Master Plan, the Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Area Master Plan prepared by WYA, and the most current edition of the City of Vacaville's Standard Specifications and Drawings.

3.0 SEWER MODEL FLOW CALCULATION METHODOLOGY

3.1 SEWER FLOW FACTORS

The sewer flow factors used to calculate average dry weather flow, Q_a, for the proposed Vanden Meadows project can be found in Table 3.0 below. The flow factors in table 3.0 are consistent with the Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Area Master Plan report.

Table 3.0 Sanitary Sewer Flow Factors

		Flow Factor, Q_a	
Use	Units	Existing and Approved	New Growth
Residential	gpd/du	200	240
Commercial - Retail	gpd/ac	1600	1900
Commercial - Service	gpd/ac	1600	1900
Secondary School	gpd/student	25	30
Elementary School	gpd/student	20	25
Public - Low Water Use	gpd/ac	0	0
Parks	gpd/ac	0	0
Open Space	gpd/ac	0	0

3.2 SEWER PEAK DRY WEATHER FLOW

The peaking factor used for the design of 12-inch and larger trunk sewer pipelines was taken from WYA's Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Master Plan report. The peaking factor is a function of Q_a. When the peaking factor is applied to Q_a , the peak dry weather flow can be calculated as follows:

$$Q_{pdwf}=2.1xQ_a^{0.943}$$

Since the peak dry weather flows are only a function of the average dry weather flow the peak dry weather flows are not additive.

3.3 INFILTRATION AND INFLOW

The Infiltration and Inflow (I&I) used for this report was taken from the City of Vacaville's Standard Specifications and is 1,000 gallons/acre/day. The I&I value is applied to the gross area served by the sewer collection system.

3.4 DESIGN FLOW

The design flow rate, Q_d , is the sum of the peak dry weather flow and the I&I. Q_d is used to properly size the new pipelines and determine if there is adequate capacity in

the existing downstream CSP-S trunk sewer. Pipeline sizing and capacity analysis is performed per the City of Vacaville's Standard Specification requirements.

3.5 PIPE CAPACITY

The projected design flow is used to determine whether a pipeline has sufficient capacity. The Manning's equation is used in accordance with the City of Vacaville's standards as follows:

- For pipes less than 12-inches in diameter, the allowable flow capacity is 70% of the full pipe flow.
- For pipes 12 to 18-inches in diameter, the allowable flow capacity is 80% of the full pipe flow.
- For pipes larger than 18-inches in diameter, the allowable flow capacity is 90% of the full pipe flow.

4.0 SANITARY SEWER SYSTEM MODEL

The sewer system near the vicinity of the proposed Vanden Meadows project includes the existing 21-inch and 24-inch CSP-S trunk sewer lines in Nut Tree Road, future Street A, the future park, and Vanden Road. The CSP-S trunk sewer conveys wastewater flows to the Easterly Waste Water Treatment Plant (EWWTP). The Vanden Meadows project will also include the construction of new 8 and 10-inch collection mains and 12-inch trunk mains. All residential properties will be served by 4-inch sewer laterals. The proposed sewer system does not include any lift stations, pump stations, force mains, or siphons.

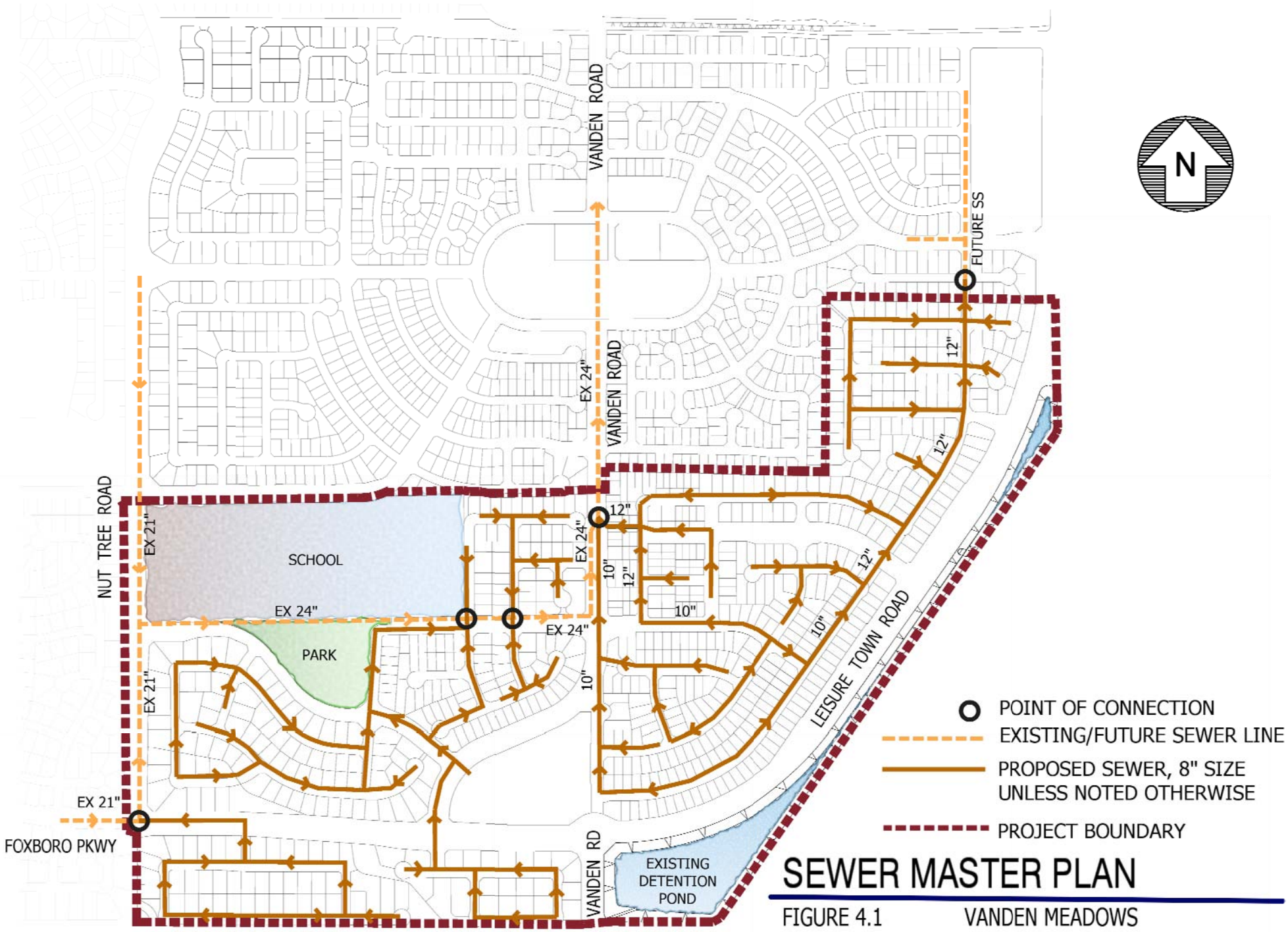
The Vanden Meadows sewer model assumes that the necessary downstream 15-inch and 12-inch Southtown trunk sewer pipelines are constructed prior to the construction of Vanden Meadows. In the event that the 12-inch and 15-inch Southtown trunk sewer pipelines are not constructed, the Vanden Meadows development will be responsible for constructing the necessary offsite trunk sewer pipeline needed to make the connection to the existing CSP-S trunk sewer.

The existing flow rate generated upstream of the Vanden Meadows project in the CSP-S trunk pipeline was obtained from the WYA report as Q_a=1.357 million gallons per day (MGD) and Q_d=3.615 MGD.

Figure 4.1 shows the sewer system proposed by the Vanden Meadows development. The sewer main sizes range between 8-inches and 15-inches. The analysis contained herein is intended for the purpose of determining the impact to the Southtown trunk sewer and CSP-S trunk sewer and is not intended to determine the sizing of the in-tract sewer network.

Figure 4.2 shows the sewer shed areas created in the Southtown and Vanden Meadows developments tributary to the 15-inch Southtown trunk sewer and CSP-S trunk sewer. The land uses in Southtown and Vanden Meadows are primarily residential with some commercial, park, and school uses.

Using the land use and sewer shed information, Phillippi Engineering calculated the build out sewer design flow rates in the CSP-S trunk sewer and the Southtown trunk sewer. The calculated flow rates were then compared to the WYA July 2005 report for consistency.



SEWER MASTER PLAN

FIGURE 4.1 VANDEN MEADOWS
SEWER MODELING STUDY

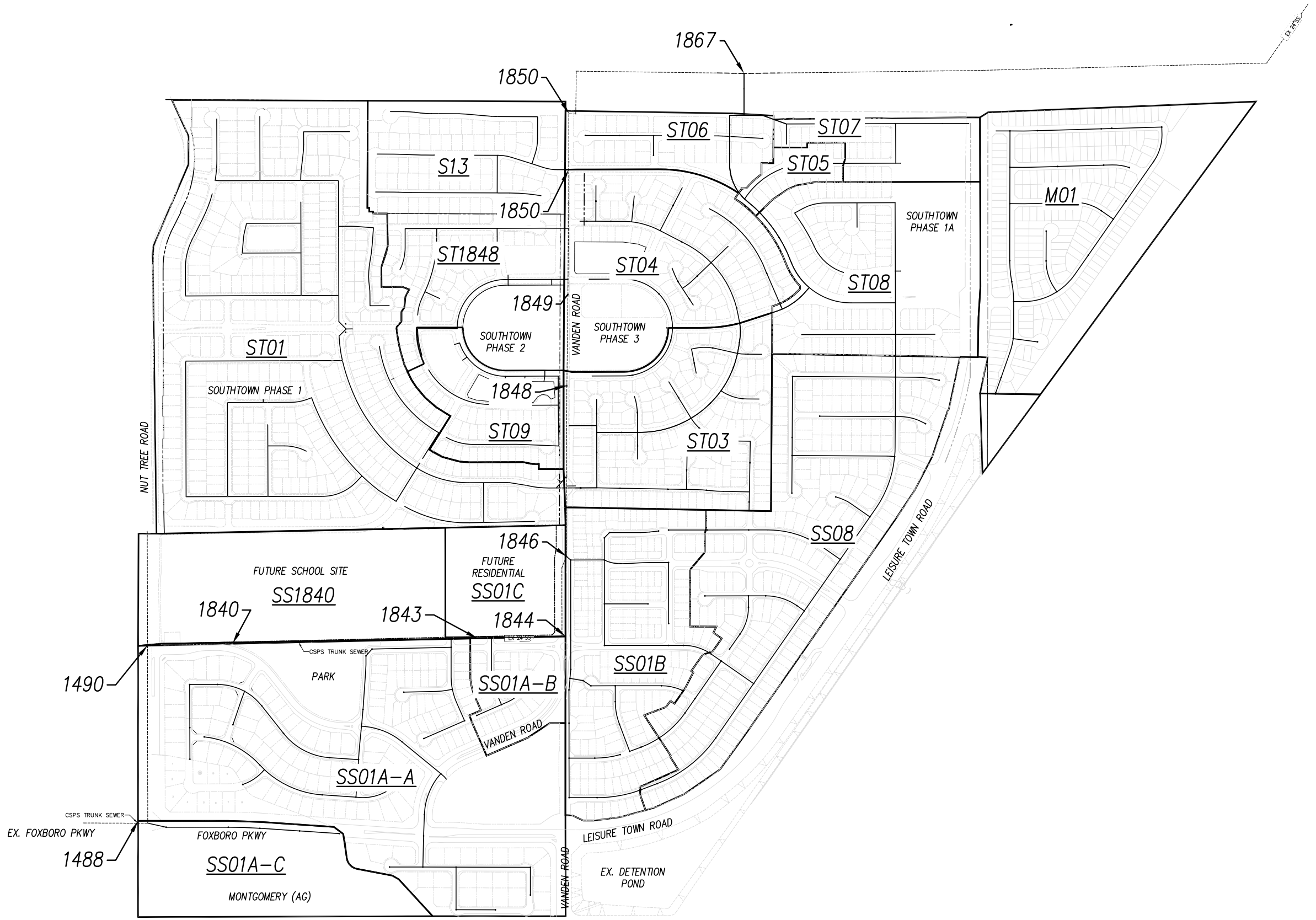


FIGURE 4.2

280280 Master Sewer Plan – Gen Plan

N

SCALE:
HORIZ.: 1"=300'
VERT.: N/A

APPROVED BY:
CITY ENGINEER — DATE OF APPROVAL

CE NO.: 43105

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EXHIBIT

DESIGNED BY: VAB
DRAFTED BY: VAB
CHECKED BY: APH, II

PROJECT NAME/LOCATION:
VANDEN MEADOWS
Vacaville California

DRAWING TITLE:
MASTER SEWER PLAN

REVISIONS:

NO.	DESCRIPTION	DATE

DRAWING FILE:
280280/MASTER UTIL PLANS/

ISSUE DATE: 01/23/11
SHEET NO.: SS-1
PROJECT NO.: 280280
OF 1

5.0 PROJECT SEWER MODELING ANALYSIS

This modeling analysis includes the complete build out of all areas tributary to the CSP-S pipeline including the Vanden Meadows projects. The proposed pipe and node map for this project, Scenario 1, is presented in figure 5.1. The build out flow rates for all areas tributary to the CSP-S trunk sewer are presented in Table 5.1.

MODELING RESULTS

Vanden Meadows will make 4 new connections to the CSP-S trunk sewer at nodes 1488, 1840, 1843, and 1846. A summary of the design flows calculated is presented below:

Table 5.2. Design Flow Rates

Node	Shed(s)	Q_d (MGD)
1488	SS01A-C	0.057
1840	SS1840	0.17
1843	SS01A-A, SS01A-B, SS01C	0.339
1846	SS01B	0.154

Vanden Meadows will make 1 new connection to the 12-inch Southtown trunk sewer at the interface of shed area ST08 and SS08. The total design flow, Q_d flow added to the Southtown trunk sewer from sewer shed SS08 is 0.209 MGD.

The total projected design flow, Q_d in the CSP-S trunk sewer just downstream of the 15-inch Southtown trunk sewer connection is 5.770 MGD at build out of all areas tributary to the CSP-S trunk sewer.

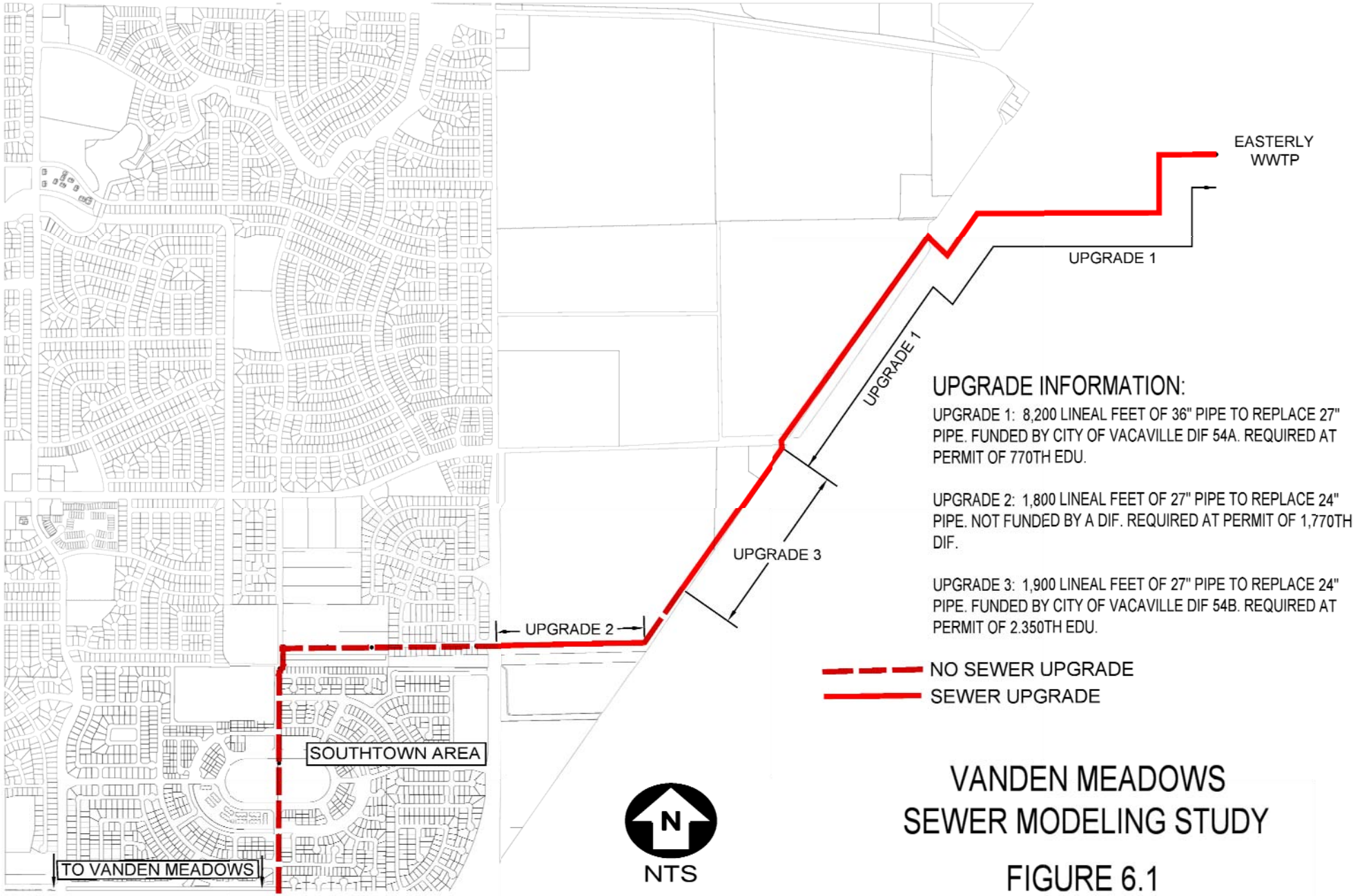
6.0 PRELIMINARY FINDINGS

The updated sewer model shows that the proposed Vanden Meadows project is in conformance with the WYA report “Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Area Master Plan” dated July 29, 2005.

The design flow, Q_d , for areas tributary to the 15-inch Southtown trunk sewer just downstream of the Moody trunk sewer has decreased from 1.192 MGD to 0.937 MGD. This is largely due to the fact that sewer shed ST01 is no longer proposed to be tributary to the Southtown trunk sewer; rather, it be directly tributary to the 24-inch CSP-S trunk sewer. The allowable capacity of the 15-inch Southtown trunk sewer is 1.30mgd; therefore, no additional mitigation measures are required on the 12-inch and 15-inch Southtown trunk sewer.

The design flow, Q_d ,for the flat capacity limiting section of the 24-inch CSP-S trunk sewer from nodes 1844 to 1846 is 4.090 MGD. This is a reduction from the 4.28 MGD as shown in the WYA. This is largely due to the fact that sewer shed SS01B (Q_d=0.154 MGD) is now injected at node 1846, which is downstream of the capacity limiting section of the 24-inch CSP-S trunk sewer. The maximum allowable flow in the CSP-S sewer from nodes 1844 to 1846 is 4.12 MGD; therefore, no additional mitigation measures are required in this area.

The total projected sewer flow rate in the CSP-S trunk sewer just downstream of the Southtown 15-inch trunk sewer connection is 5.770 MGD. This is a slight reduction from the WYA report total of 5.865 MGD. The updated development sewer model does not show any significant deviation from the original model produced by WYA in July 2005; therefore, the three phases of recommended downstream improvements to the CSP-S trunk sewer pipeline will still need to be constructed in conformance with the WYA July 2005 report. **See Figure 6.1.**



VANDEN MEADOWS SEWER MODELING STUDY

FIGURE 6.1

OFF-SITE SEWER IMPROVEMENTS

WEST YOST ASSOCIATES

MEMORANDUM

DATE: August 24, 2011

TO: Trenton Wilson, AES

CC: Cal Teraura, City of Vacaville

FROM: Jeffrey D. Pelz, R.C.E. #C46088

SUBJECT: Vanden Meadows Sanitary Sewer Impact Analysis

This memorandum provides comments on and confirms an analysis of sanitary sewer impacts associated with the proposed Vanden Meadows project (Proposed Project). Sewer capacity issues were evaluated as described in the Vanden Meadows Specific Plan, dated September 2009, prepared by Phillippi Engineering, Inc. (Specific Plan). West Yost verified the findings presented in the Specific Plan using the city-wide collection system model maintained by the Utilities Department. The Specific Plan adequately identifies the impacts on sewer facilities and mitigation measures, with the minor comments and corrections noted in the following paragraphs.

Section 7.3

1. The Specific Plan, Section 7.3, describes the three offsite trunk sewer improvements that will eventually be needed to accommodate the Proposed Project and cumulative development in adjacent areas. One of the three improvements (Upgrade 1, which is sewer DIF Project 54A) will be funded through the City's development impact fee (DIF) program. The remaining two projects (Upgrades 2 and 3) have been assigned DIF program numbers 54D and 54B, respectively. However, neither of these two projects will be funded through the DIF program. They will require funding by the developers of the Vanden Meadows or adjacent growth areas as the identified improvement triggers are reached.
2. The triggers for the offsite sewer improvements are cited as a number of building permits which is only partially correct. The applicable triggers are actually the number of equivalent dwelling units (edu's). Each residential dwelling unit will count as an edu, but non-residential uses will count for multiple edu's under a single building permit. Timing of the future improvements will be based on the cumulative number of edu's added in the service area of the impacted trunk sewer. The service area includes the Vanden Meadows and Southtown plan areas, as well as relatively minor amounts of infill development in areas already connected to the wastewater collection system.

   To mitigate impacts in the offsite trunk sewer, no building permit that would result in a cumulative edu count exceeding the stated edu limit should be issued until the trunk sewer improvement is completed and in service. Furthermore, the developers of the Proposed

Project could be required to notify the City of the anticipated date the trigger edu count would be reached to allow adequate time for design and construction of the improvements.

3. The dollar amounts cited as the cost for the three offsite improvements are expressed in 2005 dollars, which should be noted. Costs will generally escalate with time so actual project costs will likely be different from the quoted cost estimates.

The Specific Plan does not address treatment plant capacity. The Proposed Project will be served by the City's Easterly Wastewater Treatment Plant. The treatment plant has a dry weather base flow capacity rating of 15 million gallons per day (mgd). Current flows to the treatment plant are approximately 8 mgd. Based on the land uses and flow factors listed in Table 1, the Proposed Project would have an average sanitary base flow (Qa) of approximately 275,000 gallons per day (0.28 mgd). Therefore, Easterly Wastewater Treatment Plant has adequate capacity to accommodate the Proposed Project in isolation. However, the treatment plant will ultimately need one or more capacity expansions in order to serve the full amount of development allowed under the 1990 General Plan, in accordance with previous treatment plant planning documents[1].

Sub Area	Land Use	Proposed Zoning	Approximate Area (acres)	Residential Units	Use Quantity	Units	Flow Factor (gpd/unit)	Qa (gpd)
A	RE	RE-10	10.28	26	26	Dwelling Units (DU)	240	6,240
B	RE	RE-10	9.78	25	25	DU	240	6,000
C	RLD	RLD-6	14.50	52	52	DU	240	12,480
D	RLD	RLD-5	16.19	74	74	DU	240	17,760
E	RHD	RH	8.17	192	192	DU	240	46,080
F	RLD	RLD-6	11.01	50	50	DU	240	12,000
G	RMD	RMD	10.27	97	97	DU	240	23,280
H	RLMD	RLMD-4.5	38.92	209	209	DU	240	50,160
I	RLD	RLD-6	33.96	157	157	DU	240	37,680
J	RE	RE-10	4.33	11	11	DU	240	2,640
K	RE	RE-10	16.82	46	46	DU	240	11,040
L	PARK	CF	7.42		7.42	Acres	0	-
M	School	CF	28.41		2,000	Students	25	50,000
N	Trails & Landscaping	CF	24.38		24.38	Acres	0	-
	Ag buffer	CF	6.93		6.93	Acres	0	-
O	DETENTION BASIN	CF	17.01		17.01	Acres	0	-
TOTAL			**258.38**	**939**				**275,360**

a Land Uses and unit counts based on Table 3.1 of the Specific Plan
b Value of 2,000 students is based on Section 8.4 of the Specific Plan

[1] *Easterly Wastewater treatment Plant Tertiary Treatment Project Facilities Plan*; West Yost Associates, April 2010.