APPENDIX G

Wastewater Technical Memorandum

WEST YOST ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: October 31, 2016

Project No.: 001-19-16-63
SENT VIA: EMAIL

TO: Steve Sawyer, City of Vacaville

CC: Justen Cole, City of Vacaville

FROM: Chris Malone, PE, RCE #51009

REVIEWED BY: Jeff Pelz, PE, RCE #46088

SUBJECT: Roberts' Ranch Wastewater Utility Impacts Analysis

This technical memorandum (TM) has been prepared by West Yost Associates (West Yost) at the request of the City of Vacaville to document potential impacts on the City's wastewater collection and treatment system from the Roberts' Ranch development project (Project). The major topics covered in this TM include:

- Basis of the Analysis
- Flow Projection
- Impact Analysis
- Wastewater Treatment Facilities

BASIS OF THE ANALYSIS

The basis for the analysis presented in this TM includes the following:

- Roberts' Ranch Specific Plan
- Wastewater Collection System Master Plan – In Progress
- Preliminary Design for DIF 54A: CSP-S Trunk Sewer Upsizing

Roberts' Ranch Specific Plan

The Project is described in the Roberts' Ranch Specific Plan[1] (Specific Plan) and further in the draft Project Description[2] prepared for the Environmental Impact Report. The approximately

[1] *Roberts Ranch Specific Plan*, Vacaville California; June 1, 2015;
[2] *AD_Project_Description 4-8-16CLEAN.docx*; file received by West Yost on April 8, 2016 from the City of Vacaville. "March 2016" in the footer.

248-acre Project site is located in northern Solano County adjacent to the southeastern corner of the City of Vacaville, bounded by Leisure Town Road on the west, Alamo Drive extension and Fry Road on the South, the Southern Pacific Railroad right of way on the east, and the approved Brighton Landing project in the City of Vacaville to the north. Topographic data for the Project site are not available for this analysis; however, per visual observation the site topography is generally flat. Surveys of the sewer system in adjacent streets and easements performed by the City in the early 2000s indicate that the ground surface generally falls from west to east. West Yost has not been provided a grading plan for the Project, but has drawn general conclusions about the potential depth of proposed wastewater collection facilities based on existing ground surface elevations in the Project vicinity and known elevations in existing sewers.

Planned land uses as shown in the City's General Plan Land Use Designations figure[3] designates various portions of the Project site Residential Low Density (3.1–5.0 units/acre,), Residential Low-Medium Density (5.1–8.0 units/acre), Schools, Agricultural Buffer, and Public Open Space. The Specific Plan identifies 798 residential units with an average density of 3.2 dwelling units/acre (du/ac), parks, approximately 25 acres of open space and trails, and a future 16-acre school site. The Specific Plan generally indicates that the wastewater collection system will deliver flow to existing trunk sewers, that a portion of the development area can be accommodated without offsite sewers improvements, and that offsite trunk sewer improvements will be needed to accommodate buildout of Project.

Wastewater Collection System Master Plan – In Progress

The City has developed a database of existing and future land uses reflecting the City-adopted 2015 General Plan. The database serves as the basis for an updated wastewater collection system hydraulic model being prepared by West Yost. Data from the model is presented in this TM and compared to the Project description to verify consistency.

The model previously reflected the conceptual collection system plan presented on Figure PUB-5 of the General Plan[4], attached, and has been updated to reflect the assumptions of the Specific Plan. The City is currently preparing an updated wastewater collection system master plan (Master Plan), based on the results of the updated hydraulic model. The model is a tool used to compare current and projected flows to existing trunk sewer capacity, and to determine what facility improvements are needed to provided capacity for the growth identified in the General Plan.

Preliminary Design for DIF 54A: CSP-S Trunk Sewer Upsizing

In March 2015, West Yost submitted a draft Predesign Report (draft PDR) for the Development Impact Fee (DIF) Program-funded sewer improvement project known as DIF 54A. Completion of the draft PDR was placed on hold pending adoption of the General Plan update and subsequent preparation of an updated sewer model and master plan. The previous plan for DIF 54A, which is reflected in the General Plan Figure PUB-5, included upsizing the CSP-S Trunk

[3] *City of Vacaville General Plan*; August 11, 2015; Figure LU-6.
[4] *City of Vacaville General Plan*; August 11, 2015; Figure PUB-5

Sewer from Fry Road to Easterly Wastewater Treatment Plant (WWTP)[5]. The PDR is currently in the process of being updated and finalized to reflect current information, including the proposed connection point of the Roberts Ranch Specific Plan area, and the City-wide hydraulic model.

Under the DIF 54A PDR, the project will include the following three phases:

Phase 1: Will extend from just upstream of the CSP-S Trunk Sewer crossing under the railroad tracks (north of Fry Road) to the Easterly WWTP approximately along the alignment of the existing CSP-S Trunk Sewer

Phase 2: Will extend from the proposed point of connection of the Project to the upstream end of Phase 1

Phase 3: Will extend from the CSP-S Trunk Sewer crossing under Fry Road to the proposed point of connection of the Project

Phase 1 of DIF 54A will accommodate the combined flows from both the CSP-S Trunk Sewer and the Alamo/Fry Trunk Sewer, as well as flow from a new trunk sewer extension serving Brighton Landing and other areas to the north. Phase 1 will include two new junction structures, one at the point where the Brighton Landing trunk sewer will connect, and the other where the Alamo/Fry and CSP-S Trunk Sewers are combined, at the upstream end of the DIF 54A project. Under the current schedule for DIF 54 A, Phase 1 is expected to be completed by the end of 2018.

Phase 2 will involve upsizing the 27-inch diameter CSP-S Trunk Sewer to a 30-inch diameter pipe from the proposed point of connection for the Project to the upstream end of Phase 1. Phase 2 is needed to accommodate flows the Project as well as other development to the south, and should be constructed by the time flows are generated within the Project area; however, in the absence of flow from the Project, Phase 2 could be deferred. The schedule for Phase 3 of DIF 54A, which is planned to accommodate growth in development areas south of Fry Road, is also not yet established. The City will need to continue to monitor the pace of development in the DIF 54A service area to determine the necessary timing of Phases 2 and 3.

FLOW PROJECTION

Table 1 lists the land uses from the Specific Plan and the current City sewer model, along with the projected sewer flows from the Project area. Flows are expressed in terms of the average dry weather flow (Q_a), peak dry weather flow (Q_{pdwf}), and the peak design flow (Q_d). The Q_a flow projection is based on the planned land uses and the wastewater flow generation rates specified in City standards[6]. Peaking factors used to determine Q_{pdwf} are based on the exponential peaking factor equation used for past and ongoing collection system planning and design in Vacaville. The

[5] *Southtown Area Sewer Plan Evaluation and CSP-S Trunk Sewer Service Area Master Plan*; West Yost Associates for the City of Vacaville; July 29, 2005.
[6] *Design Standards, Section DS 6, Sanitary Sewer System;* downloaded 6 June 2016, http://www.ci.vacaville.ca.us/modules/showdocument.aspx?documentid=778

following peaking factor equation is applied to cumulative Q_a values to produce a value for Q_{pdwf}, where all the flow values are expressed in units of million gallons per day (mgd):

$$Q_{pdwf} = 2.1 \cdot Q_a^{0.943}$$

The Q_d flow includes an allowance of 1,000 gallons per day per gross acre for wet weather infiltration and inflow in accordance with City standards.

IMPACT ANALYSIS

Topics discussed in this section include:

- Proposed Point of Connection
- Analysis of Flows
- Available Fall
- Trunk Sewer Funding Through Development Impact Fees

Proposed Point of Connection

As per the Specific Plan, on-site 8-inch diameter or larger sewer lines within Project streets would collect wastewater within the Project area and deliver it to the CSP-S Trunk Sewer at a point located east of the site, north of Fry Road, and immediately south of a new stormwater detention basin, as indicated in Figure 1. A connection point north of the detention basin is considered infeasible due to hydraulic conflicts with a 72-inch diameter storm drain line entering the detention basin from the north.

The Specific Plan uses the assumption that, to the extent existing trunk sewers have available capacity, the flow would be delivered to the Alamo/Fry Trunk Sewer or the CSP-S Trunk Sewer. The CSP-S Trunk Sewer and the Alamo/Fry Trunk Sewer run in parallel in the vicinity of the point of connection. Wastewater from the Project could be conveyed to either line if available capacity exists. City standards require that connections to a trunk sewer be made at a manhole.

Analysis of Flows

Table 2 summarizes simulated flow conditions in the two relevant existing trunk sewers. As shown in the table, there is no available capacity for the Project within the Alamo/Fry Trunk Sewer, based on the comparison of existing Q_d flows and allowable flow capacity. As also shown in the table, looking only at existing flow conditions, some available capacity still remains in the CSP-S Trunk Sewer; however, the available capacity remaining in the CSP-S Trunk Sewer will be consumed by approved development in the Southtown/Vanden Meadows area located south of New Alamo Creek on both sides of Leisure Town Road. Any future development activity that increases flows in the CSP-S Trunk Sewer above its design capacity will trigger the need for the upsizing of that trunk sewer.

Table 1. Project Flow Projection

Proposed Development	Parcel Acres	I&I Area, ac	Land Use		Flow Factor		ADWF (Qa,gpd)	I&IFlow, gpd[(b)]	Qpdwf, gpd[(c)]	PWWF, Qd gpd[(d)]
			Quantity	Units	Value	Units				
Residential – Low Density	128.9	128.9	547	du	240	gpd/du	131,280	128,900		
Residential – Low Medium Density	49.5	49.5	251	du	240	gpd/du	60,240	49,500		
Public School – Elementary[(a)]	16.2	16.2	726	students	25	gpd/student	18,150	16,200		
Park	2.5	2.5	2.5	ac	0	gpd/acre	0	2,500		
Right of Way and Parkways	25.9	25.9	25.9	ac	0	gpd/acre	0	25,900		
Agricultural Buffer / Active Open Space, Public Low Categories)	25.3	–	–	ac	0	gpd/acre	0	0		
Totals (flow values rounded)	248.3	223.0					209,670	223,000	481,000	704,000

(a) Estimated student enrollment; assumes all students associated with General Plan growth will be evenly distributed among four future elementary schools, one located in Roberts' Ranch.

(b) Inflow/Infiltration (I&I) Factor = 1,000 gpd/acre

(c) Peak Dry Weather Flow = 2.1 x Qa0.943, with flow in units of mgd. Applies to flow from the Project if accumulated in a single (hypothetical) pipeline not shared by others. Because this equation is exponential, component Qpdwf values will not be arithmetically additive.

(d) Design Peak Wet Weather Flow (PWWF, or Qd) = Average Dry Weather Flow (ADWF) x Peaking Factor + I&I Area x I&I Factor. Applies to flow from the Project if accumulated in a single (hypothetical) pipeline not shared by others. Qd attributed to the Project will be lower when flows are combined with other sources. Because this flow is calculated using the Qpdwf value, Qd values will not be arithmetically additive.

Table 2. Trunk Sewer Capacities and Flow

Sewer Reach	Flow, mgd				
	Allowable Flow[a]	Existing Q_d[b]	Existing Available Capacity	Buildout Q_d w/out Roberts Ranch	Buildout Available Capacity w/out Roberts' Ranch
Fry Road Trunk Sewer					
Leisure Town Road to UPRR	3.72	4.10	0	4.28	0
Fry Road to Phase 1 of DIF 54A[c]	3.95	4.10	0	4.28	0
CSP-S Trunk Sewer					
Fry Road to Phase 1 of DIF 54A	5.09	4.51	0.58	5.86	0

[a] Based on average slope for the sewer reach in question. Per City standards, for larger diameter trunk sewers, allowable flow equals 90 percent of full-pipe capacity.

[b] Based on existing land uses and standard flow factors, with CSP-S discharging at is permitted capacity. Does not include flow from approved projects that are not yet developed, primarily in the Southtown/Vanden Meadows area.

[c] Phase 1 of DIF 54A will begin at a junction structure located near the northeast corner of the recently constructed stormwater detention basin.

Available Fall

Due to the flatness of the site, there is some question about whether there exists adequate fall to connect to the existing sewer system without the use of a lift station. Surveys of the adjacent trunk sewers performed in the early 2000s indicate that the ground surface at the proposed connection point is about 83 feet (NAVD88 datum), and the pipe crown elevation of the CSP-S Trunk Sewer at that location is about 68 feet. The surface elevation at the intersection of Fry Road and Leisure Town Road (near the southwest corner of the Project site) is about 90 feet. If a minimum cover for sewer pipe of 6 feet below grade is assumed, then there is a total available fall of 16 feet, assuming that the sewer pipe serving Roberts' Ranch matches crowns with the CSP-S Trunk Sewer, as per City Standards.

The longest likely run of sewer line from the southwest corner of the site to the connection point at the upstream end of the DIF 54A project would likely be about 6,000 lineal feet of pipe. The overall flow pathway would consist of a combination of 8-inch and 10-inch diameter sewers, and may also include a 12-inch diameter line at the downstream end. Per City standards, minimum standard sewer pipe slopes are 0.0035 feet per foot (ft/ft) for an 8-inch diameter pipe, 0.0025 ft/ft for a 10-inch diameter pipe, and 0.0020 ft/ft for a 12-inch diameter pipe.

If half of the longest possible flow pathway (3,000 lineal feet) is assumed to consist of 8-inch diameter pipe and the other half is assumed to consist of 10-inch diameter pipe, then the total required fall would be 18 feet, which exceeds the estimated available fall by 2 feet. If a 5,000 lineal foot flow path is assumed, split evenly between 8-inch and 10-inch diameter pipes, a total required fall of 15 feet is needed, which is within the amount of available fall.

As a result, there is some question about whether the available fall is adequate for the proposed point of connection. If adequate fall does not exist, either a point of connection further upstream on the CSP-S Trunk Sewer, or a new lift station serving the proposed development area, may be required. All such conclusions will need to be verified based on ground surveys, proposed Project ground surface elevations, and proposed sewer piping configurations.

Trunk Sewer Funding Through Development Impact Fees

Based on the collection system planning studies cited in this memorandum, Phase 1 of the DIF 54A improvement is needed before any development beyond previously approved projects is allowed to connect. Therefore, the first phase of DIF 54A must be constructed prior to occupancy of the Project. It is unclear when the second phase of DIF 54A would be needed, as it depends on the relative pace of the Project and of development in the Southtown/Vanden Meadows area located further upstream.

DIF 54A is a connection-fee funded project, and therefore payment of connection fees is the only mitigation measure necessary to address the capacity limitations in the DIF 54A project. The City already conducts the routine flow monitoring and master planning necessary to identify when subsequent phases of the DIF 54A project will need to be constructed. Mitigation of Project collection system impacts upstream of DIF 54A consists of constructing all onsite and offsite mains and trunk sewers necessary to convey wastewater to the point of connection on the CSP-S Trunk Sewer.

WASTEWATER TREATMENT FACILITIES

The City operates Easterly WWTP under a National Pollutant Discharge Elimination System permit, No. CA0077691, administered by the California Regional Water Quality Control Board, Central Valley Region. The permit stipulates water quality and other requirements established to protect the environment and public health.

Existing wastewater flows and organic loading delivered to Easterly WWTP are well below the 15.0 mgd rated design capacity of the plant. The Project, along with other planned development, will eventually result in flows and loads that exceed the current plant capacity. As identified in the General Plan (see Figure PUB-5), the plant will be expanded to accommodate planned growth, with a projected buildout capacity of 16.2 mgd. The City is obligated under its existing discharge permit to annually estimate when flows are expected to reach the plant capacity. When the projections indicate capacity will be reached within four years, a plan to address the capacity limitation must be developed and submitted to the Central Valley Water Board within 120 days[7]. Operation of the Easterly WWTP subject to the requirements of the regulatory authorities will adequately mitigate the impacts associated with increases in flow associated with the Project and other planned growth.

[7] *Order R5-2014-0072-01, as amended*; Standard Provision VI.A.2.k; California Regional Water Quality Control Board, Central Valley Region; adopted October 9, 2014.

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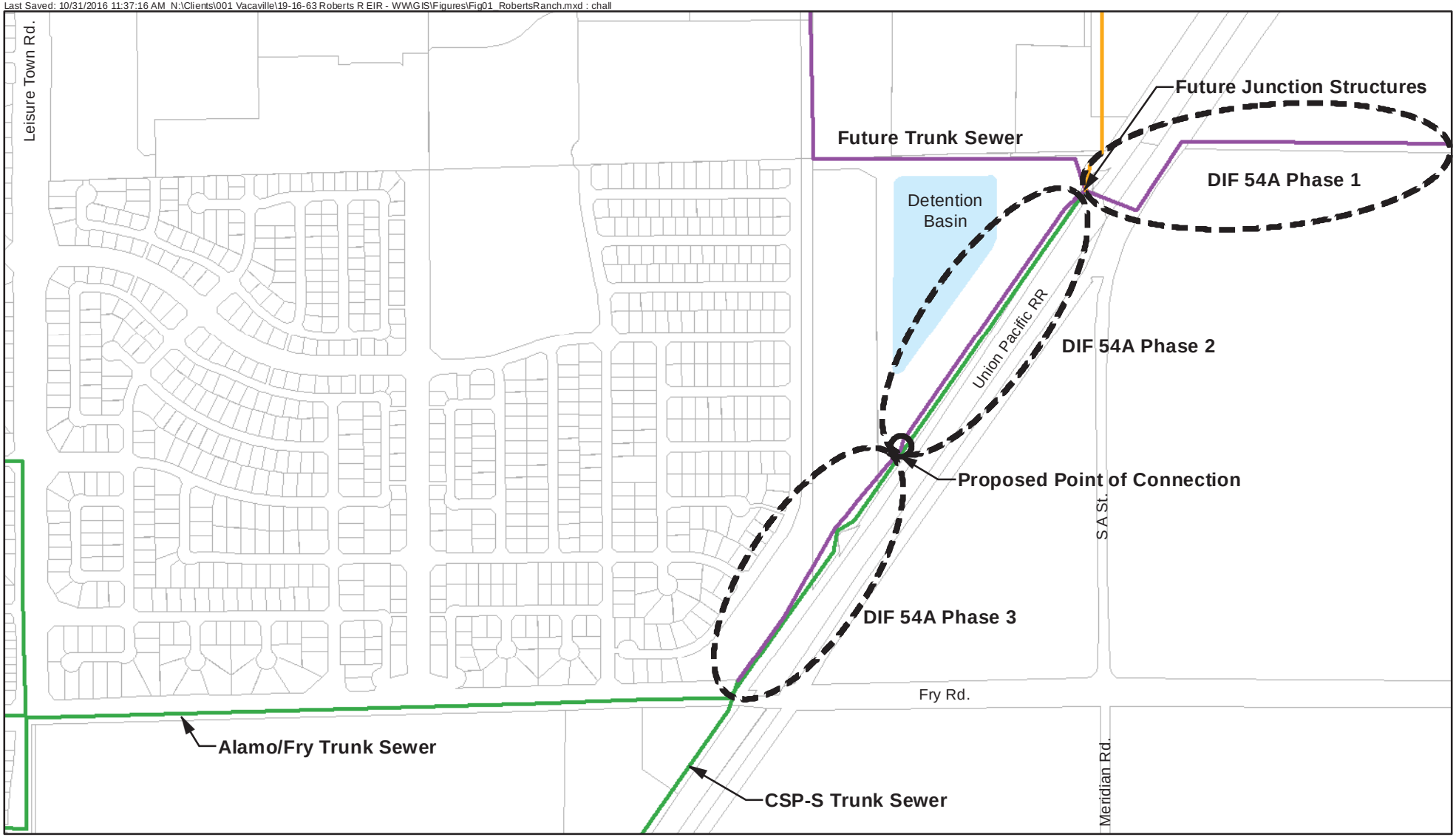

Symbology

- Existing Trunk Sewer
- Future Trunk Sewer
- Existing Trunk Sewer to be Abandoned

N

0 350 700

Scale in Feet

VACAVILLE

WEST YOST ASSOCIATES

Figure 1

Proposed Roberts Ranch Sewer Connection

City of Vacaville
Roberts Ranch EIR Analysis