

Technical Memorandum

010-009

TO: Todd Eising, City of Folsom

FROM: Jim Crowley, J. Crowley Group

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SUBJECT: YOUNG WO PUMPING STATION CAPACITY ANALYSIS

The Young Wo wastewater pumping station (PS) serves Lake Natoma Shores, an area bounded by Lake Natoma and Folsom Boulevard (see attached Figure 1). The service area includes single-family residential units, a Veterans of Foreign Wars (VFW) lodge, and a portion of the City's corporation yard. This technical memorandum investigates the Lake Natoma Shores service area's projected wastewater flows and the system capacity. The results of the analysis validate that the existing system capacity is sufficient to handle the reasonable worst-case flow scenario. The system's actual flows have been recorded to be significantly less than the worst-case scenario, resulting in system capacity that is significantly greater than the worst-case scenario. Factoring in the additional emergency storage, the system's capacity is considered sufficient for the reasonably projected flows.

System Description

A portion of the City's Corporation Yard wastewater system flows to the Young Wo PS. That portion of the system includes five small pumping stations (CY1 through CY5). Pump station CY3 collects the flows from pump station CY1 and pump station CY2, and pump station CY5 collects the flows from pump station CY4. Pump stations CY5 and CY3 pump the wastewater from the City's corporation yard into the gravity system that feeds the Young Wo PS. The Young Wo PS pumps wastewater through a 4-inch diameter force main that transitions to a gravity system at Forrest Street, near Fong Street, which then discharges into the 27-inch line in Folsom Boulevard. See the attached Figure 1 for a map of the wastewater system.

System Capacity

Data for the Corporation Yard pump stations indicates a combined instantaneous flow capacity of approximately 146 gpm; when pumping stations CY3 and CY5 pump simultaneously. However, the pumps run for less than 30 seconds at these flow rates before shutting off at low wetwell levels. The Corporation Yard pump stations only serve bathrooms and showers, and therefore projected flows are much less than the combined pumping capacity of 146 gpm, as presented below in Table 2 – City Corporation Yard Flow Projections..

The Young Wo PS contains two submersible 5 HP pumps rated for 110 gpm at 55 feet total dynamic head. Pump capacity is based on the system head curve and friction loss in the 4-inch force main. Assuming a conservative friction factor (higher friction loss), the conservative pump capacity is estimated at 100 gpm. Industry standards list a maximum velocity of 7-10 feet per second for a force main. The existing 4-inch force main is well below these levels at 2.5-3.7 feet per second for pump discharge of 110 gpm and 150

gpm, respectively. The wet well has a total volume of 4,887 gallons. The operating volume (pump start to high level alarm elevation) is 940 gallons.

The Young Wo PS force main discharges flow into the 6-inch sewer on Forest Street and Fong Street, which then becomes an 8-inch sewer from Fong Street to the connection to the 27-inch sewer in Folsom Boulevard. Pipeline capacities based on the City of Folsom Design and Procedures Manual and Improvement Standards (May 22, 2003) are presented in Table 1.

Table 1. Gravity Sewer Pipeline Capacities

Reach	Capacity
Forest Street 6-inch	160 gpm
Fong 6-inch	160 gpm
Fong-Folsom 8-inch	330 gpm

Flow Projections

The City of Folsom Design and Procedures Manual and Improvement Standards (May 22, 2003) is used to develop the wastewater flow projections. Additional assumptions as described here are made for the City Corporation Yard and the VFW Lodge. The City Corporation Yard includes five small pumping stations. Flow from three pumping stations is delivered to pumping stations CY5 and CY3. Both these stations pump into the same force main that discharges into the Young Wo PS collection system. The only facilities connected to the Corporation Yard stations are showers, toilets, and sinks located in the trailer offices. There are a total of 2 showers, 10 toilets, and 15 sinks. Flow generation assumes 1.6 gallons per flush, 2.0 gpm showerheads, and 2.0 gpm sink faucets as summarized in Table 2. The total projected daily flow from the Corp Yard is 2,420 gpd.

Table 2. City Corporation Yard Flow Projection

Element	Units	Unit Flow	Flow
Shower	1 hour per day	2.0 gpm	60 gpd
Toilet	600 flushes per day	1.6 gpf	960 gpd
Sink Faucet	700 min. per day	2.0 gpm	1,400 gpd
Total:			2,420 gpd

The VFW Lodge current occupancy rating is 74 persons for dining and 150 total persons for gathering. The Lodge is approximately 2,000 square feet and maintains two restrooms. City Standards call for 0.3 equivalent ESD (1 ESD = 400 gpd) per 1,000 square feet for halls and lodges. Average daily flow projection is therefore 240 gpd. However, VFW staff indicates they can hold events with up to 150 persons, which would likely generate a larger peak flow than 0.3 ESD/1,000 square feet. For this analysis, a peak flow is estimated based on the City's restaurant unit flow (2.0 ESD/1,000 square feet) and an estimate of toilet/sink uses as shown in Table 3.

Table 3. VFW Lodge Flow Projection

Element	Units	Unit Flow	Flow
Restaurant Area	2,000 square feet	800 gpd/1,000 square feet	1,600 gpd
Toilet	200 flushes per event	1.6 gpf	320 gpd
Sink Faucet	300 min. per event	2.0 gpm	600 gpd
Total:			2,520 gpd

Cumulative Flow projections to the Young Wo PS are summarized in Table 4.

Table 4. Young Wo PS Flow Projections

Element	Units	Unit Flow	Flow
Residential	65	400 gpd	26,000 gpd
VFW Lodge – see Table 2	--	--	2,520 gpd
City Corporation Yard	--	--	2,420 gpd
Subtotal Dry Weather Flow:			30,940 gpd
Wet Weather Peaking Flow	Peaking factor	3.8	117,572 gpd
Groundwater Infiltration – for total gravity system tributary to Wo PS			
6-inch collection system length	5,200 ft.	50 gal/day/in-diam/mile	295 gpd
4-inch collection system length	2560 ft.	50 gal/day/in-diam/mile	97 gpd
2-inch collection system length	1,400 ft.	50 gal/day/in-diam/mile	26 gpd
Subtotal Groundwater Infiltration:			418 gpd
Total Design Flow:			117,990 gpd 82 gpm

The Young Wo PS force main discharges into a gravity system on Forest Street as shown in the attached Figure 1. Table 5 projects the additional flow from houses connected to the gravity system to the discharge point at the 27-inch interceptor in Folsom Boulevard. For conservative purposes, flow is assumed to enter the sewer at the upstream portion of each respective reach.

Table 5. Gravity System Flow Projections

Element	Units	Unit Flow	Flow
Forest Street 6-inch			
Residential	8	400 gpd	3,200 gpd
Wet Weather Peaking Flow	Peaking factor	4.0	12,800 gpd
Groundwater Infiltration	367 LF 6-inch	50 gal/day/in- diam/mile	21 gpd
Total Reach Flow:			12,821 gpd 9 gpm
Fong St. 6-inch			
Residential	4	400 gpd	1,600 gpd
Wet Weather Peaking Flow	Peaking factor	4.0	6,400 gpd
Groundwater Infiltration	260 LF 6-inch	50 gal/day/in- diam/mile	15 gpd
Total Reach Flow:			6,415 gpd 4.4 gpm
Fong St to Folsom Blvd. 8-inch			
Residential	36	400 gpd	14,400 gpd
Wet Weather Peaking Flow	Peaking factor	3.9	56,160 gpd
Groundwater Infiltration – for total gravity system tributary to Wo PS	1,200 6-inch	50 gal/day/in- diam/mile	68 gpd
Total Reach Flow:			56,228 gpd 39 gpm

Capacity Summary

This analysis utilized a conservative approach in estimating all factors of the analysis. The conservative approach provides the highest reasonably expected flows and the lowest reasonably expected system capacities within the design guidelines. The analysis presents a reasonably expected worst-case scenario to demonstrate the system’s full capacity. Operation’s data from the last two years, and other City sewer studies, indicate that actual flows are much less and system capacities are higher than assumed in the analysis. Specific assumptions and actual data are listed below.

- The estimated peak wet weather flow is 117,990 gpd. Actual daily peak wet weather flow over the last two winters (2010/11 and 2011/12) was only 21,000 gpd.
- Data from the 2010/11 and 2011/12 winter seasons, when flow is the highest, indicates the pumps only run a combined 1.5 hours per day. There are approximately 15 pump starts per day, with each start lasting about 7 minutes.
- The pump capacity analysis assuming a higher friction loss coefficient, which results in capacity of

100 gpm. Actual flow meter records indicate an average current capacity of approximately 150 gpm.

- Flow projections assume high wet weather flow peaking factors of 3.7-4.0. The City’s 2008 Sewer Capacity Study indicates an actual lower peaking factor of 3.0 for the Young Wo PS area.
- Flow projections assume maximum use of Corporation Yard bathrooms and shower facilities coinciding with the largest allowable event at the VFW Lodge, and maximum flow from every residential customer, all during a large rainstorm.
- The analysis assumes one of the two pumps has failed and is not available.
- None of the emergency storage in the Young Wo PS wetwell is utilized in the analysis.

Assuming these conservative values, the projected flows are compared to system capacities in Tables 6 and 7. Table 6 compares the actual operational data to design value for the Young Wo PS inflow and pumps. Table 7 compares the design capacities to the design values for the pumping station and downstream gravity system. As indicated in the tables, all elements of the system contain excess capacity under the reasonable worst-case scenario projected conditions.

Table 6. Young Wo Pumping Station Design Versus Actual

Element	Actual Historic Value	Worst-Case Design Flows	Excess Capacity
Maximum Daily Flow	21,000 gpd (15 gpm)	117,990 gpd (82 gpm)	Yes
Pump Output Capacity	150 gpm	100 gpm	Yes

Table 7. Capacity Comparison

Element	Capacity	Worst-Case Design Flows	Excess Capacity
Young Wo PS	100 gpm	82 gpm	Yes
Forrest St 6-inch sewer	160 gpm	109 gpm (100 gpm+9 gpm)	Yes
Fong St 6-inch sewer	160 gpm	114 gpm (109 gpm + 4.4 gpm)	Yes
Fong St./Folsom Blvd. 8-inch sewer	330 gpm	153 gpm (114 gpm + 39 gpm)	Yes

The City’s emergency response procedures and emergency storage in the Young Wo PS provide an additional layer of protection and system capacity. The pump station is fully alarmed for mechanical failures and high water level circumstances, with alarms powered by a backup emergency power generator should power fail. There are two high water level alarms. The first alarm triggers the auto dialer to notify the on-call emergency response staff. The second alarm, at 0.5 feet higher than the first alarm, signals through the SCADA, which also notifies the on-call emergency response staff. The City’s emergency operating

procedures maintain a site response in less than 30 minutes after an alarm. Once onsite, the emergency by-pass pumping can be set up and mitigate any issues.

The wetwell has a total storage volume of approximately 4,887 gallons. The emergency storage is considered to be the volume above the dialer high water level alarm sensor (a total height of 8 feet), for a volume of approximately 3,000 gallons. Assuming the worst-case flow rate of 82 gpm into the PS, this represents approximately 36 minutes of storage. When using the highest daily flow rate from the last two years of data (21,000 gpd), the emergency storage represents 200 minutes (3.3 hours) of storage.

The analysis validates that the existing system capacity is sufficient to handle the reasonable worst-case flow scenario. The system's actual flows from operations data are significantly less than the worst-case scenario, resulting in system capacity that is significantly greater than the worst-case scenario. Factoring in the additional emergency storage, the system's capacity is considered sufficient for the reasonably projected flows.

Figure 1

