ATTACHMENT C

THEORETICAL SEWER CAPACITY ANALYSIS

Farmstead at Long Meadow Ranch Lodging

Sherwood Design Engineers May 2, 2017



Theoretical Sewer Capacity Analysis

FOR

Farmstead at Long Meadow Ranch Lodging

1000 Mills Lane

St. Helena, CA 94574

PREPARED FOR:

CITY OF ST. HELENA DEPARTMENT OF PUBLIC WORKS

1480 MAIN STREET

ST. HELENA, CA 94574

PREPARED BY:

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May 2, 2017



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I. Background & Introduction

The Farmstead at Long Meadow Ranch Lodging project is the proposed construction of lodging and related amenities on a 10-acre parcel fronting on Mills Lane. LMR Property Acquisition Partners LLC is applying for a use permit to allow for the proposed uses of the project.

The property slated for improvements, formerly known as the Doumani parcel, is currently vacant land. The proposed project will include 65 guest rooms and suites, a multi-purpose building, including meeting, kitchen, reception, and housekeeping uses, and a fitness center with a pool and spa. A portion of the parcel is zoned for agricultural use and will be operated as a production vegetable farm. Two small barns will be constructed to serve as the farming facility.

The project includes a proposed connection to the nearby 10" sewer main in La Fata Street at the manhole located at the intersection of Dowdell Lane and La Fata Street. See Appendix A for the location of the proposed project point of connection shown on the City of St. Helena Sewer System Map. To ensure that the sewer main has adequate capacity for the increased flows due to the proposed project, a sewer capacity analysis of the sewer main downstream of the project point of connection was performed.

II. Existing Sewer System Capacity

The sewer main that is the focus of this study is the section running from the manhole at the intersection of Dowdell Lane and La Fata Street to the manhole at the intersection of Vintage Avenue and La Fata Street where it connects with the sewer main in Vintage Avenue.

A nearby project, the St. Helena Custom Crush Facility, is also planning to connect to the 10" sewer main in La Fata Street at the Dowdell Lane manhole. Delta Consulting & Engineering completed a sewer capacity study for the project titled "Theoretical Sewer Capacity Analysis for



the St. Helena Custom Crush Facility," dated April 6, 2016. Per this report, this section of sewer main is a 10" diameter PVC pipe sloped at approximately 0.5%. See Appendix C for the full report.

Per City of St. Helena standards, maximum sewer main capacity is to be based on a 2/3-full flow depth. Using the Hydraflow Express program, which solves for pipe capacity at a known depth using Manning's equation, the existing sewer main capacity was found to be 1.576 cubic feet per second = 707 gallons per minute. See Appendix B for the Hydraflow report.

III. Existing and Approved Development Flow

Under existing conditions, the only source of wastewater into the 10" sewer main in La Fata is the Napa Valley Wine Waterhouse. Two new projects have recently been approved to also connect to the 10" sewer main, the Redmon Ranch Winery and the St. Helena Custom Crush Facility projects.

Per the report prepared by Delta Consulting & Engineering titled "Theoretical Sewer Capacity Analysis for the St. Helena Custom Crush Facility," dated April 6, 2016, the peak wastewater flows for each of these sources are the following:

Source	Peak Flow (gpm)
Napa Valley Wine Waterhouse [Existing]	3
Redmon Ranch Winery [Approved]	40
St. Helena Custom Crush Facility [Approved]	4.2
TOTAL	47.2

The total existing and approved peak flow into the sewer main is 47.2 gallons per minute.

IV. Proposed Project Flow

Per the report prepared by Sherwood Design Engineers titled "Water Use Analysis Report for Farmstead at Long Meadow Ranch Lodging," the proposed project is anticipated to use 5,148 gallons of water per day. Using the conservative assumption that all of the water demand results in wastewater flow, the proposed project daily wastewater generation is assumed to be 5,148 gallons per day.



Averaging the daily wastewater generation over 16 hours gives the average flow of 5.4 gallons per minute.

Applying a peaking factor of 2.5 results in the proposed project peak flow of 13.4 gallons per minute. The resulting total flow in the 10" sewer main in La Fata Street is the following:

Source	Peak Flow (gpm)
Existing and Approved Development	47.2
Farmstead at Long Meadow Ranch	13.4
TOTAL	60.6

V. Conclusion

The existing 10" sewer main in La Fata Street has the capacity of 707 gallons per minute when flowing 2/3-full. The proposed project peak flow combined with the existing and approved development peak flow is 60.6 gallons per minute. Therefore, the existing sewer main has capacity for the increased flows due to the proposed project and will still have 91% capacity remaining after the completion of the project.

VI. Appendix

Appendix A – City of St. Helena Sanitary Sewer System Map

Appendix B – Hydraflow Pipe Capacity Report

Appendix C – Delta Engineering St. Helena Custom Crush Facility Sewer Capacity Report



Appendix A

City of St. Helena Sanitary Sewer System Map





Appendix B

Hydraflow Pipe Capacity Report

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

10in Sewer Main 2/3 Full Flow Capacity

Circular		Highlighted	
Diameter (ft)	= 0.83	Depth (ft)	= 0.56
		Q (cfs)	= 1.576
		Area (sqft)	= 0.39
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.08
Slope (%)	= 0.50	Wetted Perim (ft)	= 1.59
N-Value	= 0.010	Crit Depth, Yc (ft)	= 0.57
		Top Width (ft)	= 0.78
Calculations		EGL (ft)	= 0.81
Compute by:	Known Depth		
Known Depth (ft)	= 0.56		





Appendix C

Delta Consulting & Engineering. Theoretical Sewer Capacity Analysis for the St. Helena Custom Crush Facility. April 6, 2016. DELTA CONSULTING & ENGINEERING OF ST. HELENA



THEORETICAL SEWER CAPACITY ANALYSIS

FOR THE

ST. HELENA CUSTOM CRUSH FACILITY USE PERMIT

PROJECT LOCATED AT

890 DOWDELL LANE ST. HELENA, CA 94574

> COUNTY: NAPA APN: 009-660-004

INITIAL SUBMITTAL: APRIL 6, 2016

PREPARED FOR REVIEW BY:

CITY OF ST. HELENA 1480 MAIN STREET ST. HELENA, CA 94574



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I. BACKGROUND & INTRODUCTION

St. Helena Custom Crush is applying to the City of St. Helena for a Use Permit to construct and operate a custom crush facility. As part of submitting a complete application, the project is required to conduct a capacity analysis of a portion of the existing City of St. Helena sewer system in the project vicinity. This report describes the sewer main layout in the project vicinity and analyzes the capacity of the existing 10-inch gravity sewer main in La Fata Street, the existing peak daily flow rate demand, and the proposed peak daily flow rate demand based on the proposed development at the St. Helena Custom Crush. A review of the City's sewer system map identified a 10-inch diameter sewer main in La Fata Street as the downstream sewer main affected by the proposed development and this section of the main shall be analyzed.

The existing sewer main information presented in this study is based on the following:

- 1. The City of St. Helena Sewer System Map dated October 2003.
- 2. A field survey of 890 Dowdell Lane prepared by Richers Spence and Associated dated December 2015.
- 3. Project site meeting with Bryan Jackson, Delta Consulting & Engineering and Glenn Price, City of St. Helena Street and Sewer Division Supervisor on December 9, 2015.

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II. EXISTING SEWER SYSTEM & SEWER MAIN CAPACITY

A. System Layout

Based on the sources described above, the existing 10" sewer main installed in La Fata Street flows from a manhole located at the cross section of Dowdell and La Fata streets in a south east direction to a manhole located at the cross section of La Fata and Vintage Avenue. At this intersection, the La Fata Street sewer main joins the Vintage Avenue sewer main which then flows northeast towards the City of St. Helena Wastewater Treatment Plant. Please reference **Appendix 1**-*Sewer System Map* for a schematic of the existing sewer mains described above.

The St. Helena Custom Crush is proposing to connect to the La Fata Street sewer main at the manhole in Dowdell Lane, the section of La Fata Street sewer main immediately downstream of the manhole will be considered for the capacity analysis. This section of sewer main is a 10-inch diameter PVC pipe, sloped at approximately 0.005. Currently, the only wastewater source upstream of this section of sewer main is the Napa Valley Wine Warehouse (NVWW) located at 410 La Fata Street.

B. System Capacity

According to direction provided by City of St. Helena, the maximum capacity of the existing sewer main should be based on the pipe flowing 2/3 full. Based on industry standards, Manning's Equation can be used to calculate the flow rate of water through a partially full pipe in gravity flow conditions. See the sewer capacity calculations below for the 10-inch gravity sewer main:

Manning's Equation

 $Q = (1.49 / n) * A * R_h^{(2/3)} * S^{(1/2)}$ $R_h = A / P_w$

Where:

 $\begin{array}{l} \mathsf{Q} = \mathsf{Flow} \; \mathsf{Rate} \; (\mathsf{Cubic} \; \mathsf{Feet} \; / \; \mathsf{Second}) \\ \mathsf{1.49} = \mathsf{Constant} \; (\mathsf{When} \; \mathsf{using} \; \mathsf{English} \; \mathsf{Units}) \\ \mathsf{n} = \mathsf{Manning's} \; \mathsf{Coefficient} \; (\mathsf{Based} \; \mathsf{on} \; \mathsf{Pipe} \; \mathsf{Material}) \\ \mathsf{A} = \mathsf{Cross-Sectional} \; \mathsf{Area} \; \mathsf{of} \; \mathsf{Water} \; \mathsf{in} \; \mathsf{Pipe} \; (\mathsf{Square} \; \mathsf{Feet}) \\ \mathsf{R}_{\mathsf{h}} = \mathsf{Hydraulic} \; \mathsf{Radius} \; (\mathsf{Feet}) \\ \mathsf{P}_{\mathsf{w}} = \mathsf{Wetted} \; \mathsf{Perimeter} \; (\mathsf{Feet}) \\ \mathsf{S} = \mathsf{Slope} \; (\mathsf{Feet} \; / \; \mathsf{Feet}) \end{array}$

Manning's Equation Component Calculations - Circular Pipe Flowing Partially Full (More than Half)

 $\Theta = 2 * \arccos [(r - h) / r]$ $A = \pi * r^2 - [r^2 * (\Theta - \sin\Theta)] / 2$ $P_w = 2 * \pi * r - r * \Theta$



 Θ = Angle between radial lines from pipe center to the two high water level points in pipe (Radians) π = 3.14 (Pi Constant)

h = Distance between pipe crown and high water level in pipe (Feet)

r = Radius (Feet)

Solved Manning's Equation for 2/3 Full Flow in 10-inch Sewer Main in La Fata Street:

Known Components n = 0.01 (PVC Pipe – Smooth Inner Walls) r = 0.4167 Feet (Radius of 10-inch Diameter Pipe) h = 0.277 Feet (Upper 1/3 Vertical Distance of 10-inch Diameter Pipe) S = 0.005 Feet / Feet

Inputting Known Components into Above Component Calculations Yields: $\Theta = 2.462$ Radians A = 0.387 Square Feet $P_w = 1.592$ Feet $R_h = 0.243$ Square Feet

Q = 1.586 Cubic Feet / Second Q = 710 Gallons / Minute

Based on the above calculations, the 10-inch sewer main on Dowdell Lane has the capacity to convey 1.586 cubic feet per second (CFS) or 710 gallons per minute (GPM) when the pipe is flowing 2/3 full.

III. EXISTING SEWER MAIN DEMAND

Currently, the only source of wastewater flowing to the manhole at the La Fata Street and Dowdell Lane intersection and corresponding downstream 10-inch sewer main is the Napa Valley Wine Warehouse at 410 La Fata Street. The NVWW consists of several different businesses, all of which are served from a single water meter in Dowdell Lane. The entire building is plumbed to a single sewer main exiting the west side of the building. The building's sewer main conveys wastewater west via gravity flow to a manhole in La Fata Street located approximately 300 feet northwest of the manhole located in the cross section of Dowdell and La Fata. An 8-inch gravity flow sewer main conveys wastewater from the manhole in La Fata Street to the manhole at the intersection of La Fata Street and Dowdell Lane.

Karen Ames, General Manager of Napa Valley Wine Warehouse, managing tenant of 410 La Fata Street, provided the 2015 annual water use in monthly readings for the entire building. See **Appendix 3** for the breakdown of the monthly water usage for 2015. The Napa Valley Wine Warehouse is approved under the Use Permit Amendment 96-114 to generate up to 2, 500 gallons per day. Based on the water meter readings provided, the peak water use of 35,156 gallons occurred in the month of March. This translates to roughly 1,172 gallons per day (GPD) or 3 gallons per minute (GPM). The average estimated GPD and GPM are based on water use occurring during a typical 8-hour work day. Currently the NVWW is only generating about half of their approved wastewater amount. The current



10-inch sewer main flow rate capacity of 710 GPM vastly exceeds the currently generated peak flow rate of 3 GPM from the NVWW.

IV. PROPOSED SEWER MAIN DEMAND

The proposed increase in wastewater flows entering the 10-inch gravity sewer main on La Fata Street comes from the St. Helena Custom Crush wine production activities. The employees at St. Helena Custom Crush are not considered in the wastewater calculations because the St. Helena Custom Crush office employees will replace the Britton Tree Services Incorporated employees. St. Helena Custom Crush proposes fewer employees than Britton Tree Services Incorporated, therefore the wastewater generated at NVWW is assumed to remain the same.

St. Helena Custom Crush is applying for a use permit for the capacity to produce 120,000 gallons of wine per year. Calculations to develop wastewater flow rates based on the above production capcity are described in the projects Septic Feasibility Report prepared by this office dated April 6th 2016, and was submitted with this Use Permit Application. The report estimated an additional peak daily wastewater flow generation from St. Helena Custom Crush to be 5,700 GPD.

The peak daily flow was averaged over a typical harvest day which is spread over twelve (12) hours, and this resulted in a peak flow rate of approximately 8 GPM. The Septic Feasibility Report noted herein describes the process wastewater will flow into a Lyve pre-treatment unit where it will then be pumped via a lift station at 4.2 GPM into the existing 8-inch gravity sewer main in Dowdell Lane. Based on this analysis, wastewater generated at the St. Helena Custom Crush site will result in a flow rate of 4.2 GPM entering the 10-inch sewer main in La Fata Street.

Delta Consulting & Engineering preformed a similar Sewer Capcity Analysis, for the pending Use Permit of the Redmon Ranch Winery, which proposes to contribute flows to the same 10-inch sewer main in La Fata Street. The Redmon Sewer Capcity Analysis was submitted to the City of St. Helena on January 21, 2016 and estimated peak discharge flows from the Redmon Ranch Winery to range between 10 GPM and 40 GPM. The discharge range is due to the pending pump design for the Redmon Ranch Winery project.

Assuming max flow rates a combined wastewater discharge of 44.2 GPM will be added to the Sewer Main in La Fata Street.

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V. CONCLUSION

The capacity of the existing 10-inch sewer main in La Fata Street, on the downstream side of a manhole at the intersection of La Fata Street and Dowdell Lane, was analyzed in this report. This 10-inch sewer main has been identified as the concentration point of all wastewater generated upstream of the proposed St. Helena Custom Crush development. Based on an analysis using Manning's Equation, the 10-inch sewer main has the capacity to convey 710 GPM when the pipe is flowing 2/3 full.

The current wastewater flowing through this pipe comes from the existing NVWW at 410 La Fata Street. An analysis of wastewater flows generated at 410 La Fata estimates an average flow rate of 3 GPM into the sewer system. St. Helena Custom Crush proposes to connect to the sewer system at a rate of 4.2 GPM. Redmon Ranch Winery is estimated to contribute an additional max peak flow of 40 GPM. A summation of the existing and proposed wastewater generation results in a total peak flow of 47.2 GPM

Based on this analysis, the existing 10-inch sewer main in La Fata Street is adequate to accommodate the proposed wastewater flows from the St. Helena Custom Crush development. The 10-inch sewer main in La Fata will have an additional 662.8 GPM or 93% capacity after development.