Analysis of Extended Collection System

Technical Memorandum 10

Paradise Sewer Project

March 31, 2022

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Revision Log:

Revision No.	Date	Description of Changes	Author	Reviewed	Approved

1. Introduction

The Town of Paradise (Town) is implementing the Paradise Sewer Project (Project), which involves identifying and implementing a long-term solution for collection, treatment, and reuse/disposal of its wastewater. HDR is under contract to assist the Town with the first two phases of the Project—final selection of a wastewater alternative (Phase 1), and preparation of an Environmental Impact Report (EIR) covering the selected alternative (Phase 2). This technical memorandum (TM) is part of the Phase 2 effort.

A sewer collection system was developed to serve the sewer service area (SSA) (see HDR, TM 3—Evaluation of Collection System, November 2020); this system is now termed the Core Collection System. Since preparation of TM 3, the Town identified the potential that, in the future, it might want to serve additional parcels within the Town but outside of the SSA (likely parcels close to the boundaries of the SSA). Therefore, the Town asked HDR to analyze the impacts of additional parcels (and pipelines) being added that would connect to the Core Collection System. These potential additional pipelines are termed the Extended Collection System. By its nature, the specific locations of these additional Extended Collection System pipelines are not known at this time. Therefore, this TM focuses on analyzing the potential impact of an assumed additional flow from the Extended Collection System on the Core Collection System.

The Core Collection System, serving the Town's sewer service area (SSA), was originally estimated to have a build-out average flow of 0.448 mgd (see HDR, TM 2—Design Criteria, November 2020); the SSA was later increased slightly in size (see HDR, TM 2A—Analysis of Additions to SSA, September 2021), resulting in a revised build-out flow for the SSA of 0.464 mgd. The build-out flow from the Extended Collection System is not known at this time, but for hydraulic analysis purposes, it was estimated to equal the flow from the Core Collection System, or an additional 0.448 mgd. This results in an estimated potential future average wastewater flow from within the Town of Paradise of 0.896 mgd. It is the impact of this additional Extended Collection System average flow of 0.448 mgd on the Core Collection System that is analyzed in this TM. (The impact of the additional Extended Collection System flows on the Export Pipeline System are analyzed in TM 8 – Export Pipeline Analysis.)

2. Description of the Extended Collection System

The Extended Collection System would consist of similar facilities as the Core Collection System system; however, those facilities could extend from the SSA out to the limits of the Town of Paradise

jurisdictional boundaries (see Figure 1). No sewer service connection would be considered outside of the Town of Paradise jurisdictional boundaries. The Extended Collection System would consist of 2- to 4-inch-diameter force mains, 8-inch-diameter gravity trunk lines, and additional pump stations, all generally constructed within public right-of-way (ROW). At individual parcels (residential dwellings and businesses), private sewer laterals (typically 4 inches in diameter) would extend from the sewer main to the parcel's sanitary sewer line as it leaves the dwelling. The Extended Collection System would connect to the Core Collection System at various locations along the periphery of the Core Collection System.

Connection of any parcels in the Extended Collection System to the Core Collection System would require Town analysis and approval. As part of that approval, the Town will track its total wastewater flow, and compare it to the contractual total flow to the City of Chico's Water Pollution Control Plant (WPCP), currently agreed in principle as 0.464 mgd.

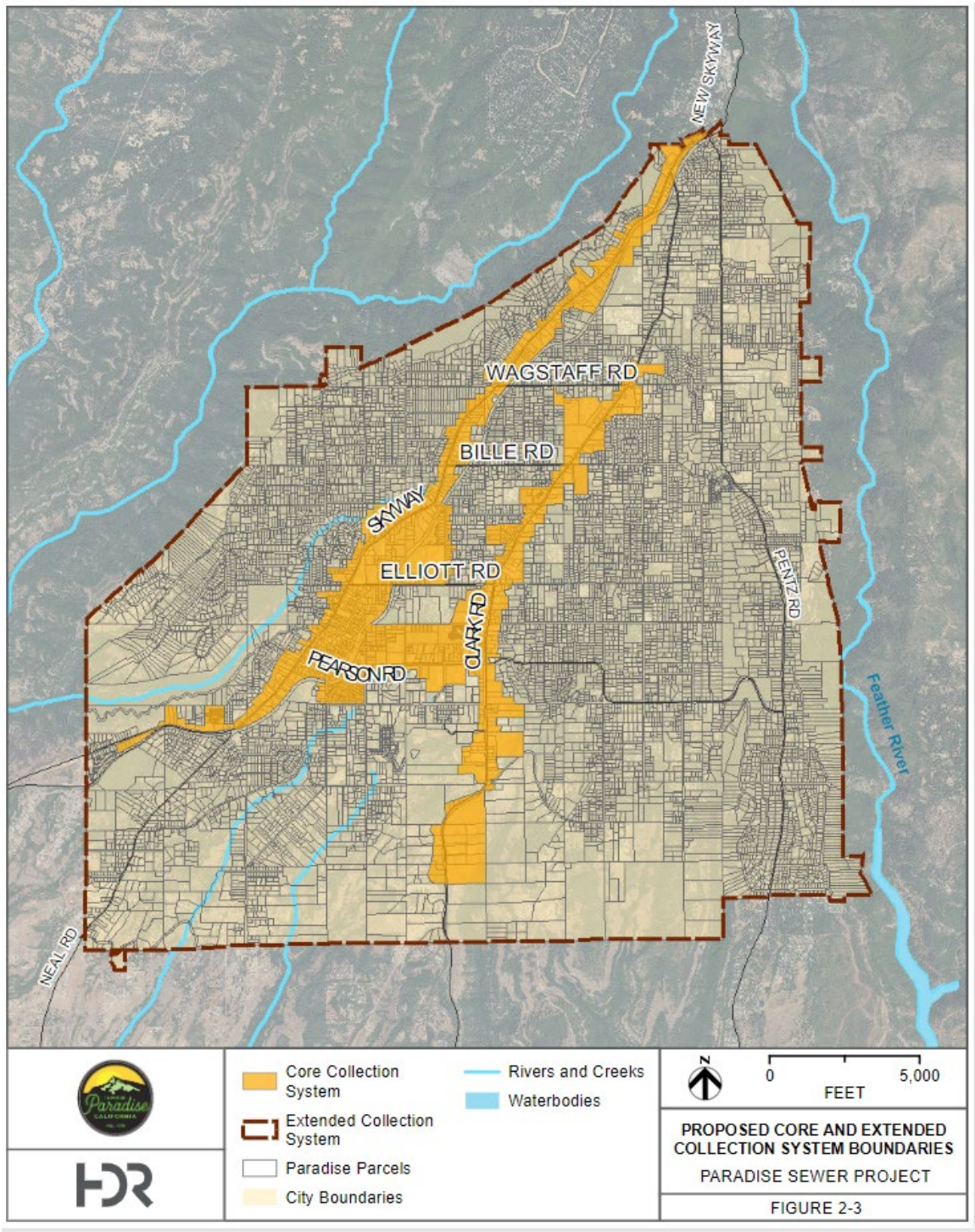

Figure 1. Core Collection System and Extended Collection System

3. Analysis of Impact on Core Collection System

The potential impact of Extended Collection System flows on the Core Collection System were evaluated by doubling the assumed flows within the Core Collection System. (In other words, it was assumed that the Extended Collection System would connect at disperse locations around the periphery of the Core Collection System.)

The first step was to analyze the impacts on the Core Collection System pipelines. Table 1 has been condensed to show major tributary trunk lines in each segment of the Core Collection System. The table includes:

- Core Collection System design flows,
- Design flows to account for the addition of the Extended Collection System (assumed to be twice the need of the original Core Collection System),
- Calculated diameter required to carry the doubled design flows, and
- Pipe diameter currently selected for the Core Collection System design.

The calculated diameter required for the increased flow for the Extended Collection System in most cases is still significantly smaller than the minimum trunk diameter of 8-inches used in laying out the Core Collection System. The additional flows only approach the hydraulic carrying capacity of the Core Collection System (without surcharging) in the final reaches of the Lower Skyway trunk lines.

The second step was to analyze the impact on the Core Collection System pump stations. Table 2 shows the Core Collection System pump station sizing. If flow in the backbone collection system were to be double the original estimate, then there will need to be a capacity increase at four of the eight trunk system pump stations: C1-PS-2, P1-PS-2, P1-PS-3, and P1-PS-1. They could be increased by increasing the size of their pumps, from an assumed Jensen 472 series to a Jensen 696 series. In addition, the discharge force mains would be upsized from 4-inch to 6-inch.

4. Conclusion

The Core Collection System pipeline and pump station sizes were not dramatically affected by increasing the proposed design flows. The proposed 8-inch minimum diameter for the trunk lines can accommodate doubling the proposed design flow without surcharging. However, there will be a pumping capacity increase required at four of the eight trunk system pump stations: C1-PS-2, P1-PS-2, P1-PS-3, and P1-PS-1, and their related discharge force mains.

Overall, the increased capacity associated with planning for an extended collection system which could serve broader reaches of parcels in the Town of Paradise provides significant benefits to the community and uncertain recovery without materially altering the baseline approach with the original Sewer Service Area.

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Table 1. Trunk Sewer Capacity Sizing

Pipe Segment	Reference Alignment	Start Station	Flow (gal/ day)	Flow (CFS)	Doubled Flow	Calculated Diameter (inches)	Design Diameter (inches)	Comments
Bille Rd (West)								
B1-Pipe - (05)	Clark	42+42.74'	461	0.0007	0.0014	0.6	8.0	Add into C1-Pipe - (17)
Bille Rd (East)								
B1-Pipe - (06)	Clark	40+73.86'	4016	0.0062	0.0124	1.4	8.0	Add into C1-Pipe - (17)
Clark Rd								
C1-Pipe - (03)	Clark	6+89.40'	1548	0.0024	0.0048	1.0	8.0	Add in C1-Pipe - (07) through C1-FM-A, no parcels directly connected
C1-Pipe - (04)	Clark	9+44.23'	9147	0.0142	0.0283	1.8	8.0	Add in C1-Pipe - (07) through C1-FM-A
C1-Pipe - (07)	Clark	17+19.71'	11140	0.0172	0.0345	1.9	8.0	
C1-Pipe - (72)	Clark	193+45.96'	181583	0.2810	0.5619	5.9	8.0	Add to P1-Pipe - (25) through C1-FM-B
Wagstaff Rd (West)								
W1-Pipe - (03)	Clark	9+44.23'	511	0.0008	0.0016	0.7	8.0	Add to C1-Pipe - (04)

Pipe Segment	Reference Alignment	Start Station	Flow (gal/ day)	Flow (CFS)	Doubled Flow	Calculated Diameter (inches)	Design Diameter (inches)	Comments
Wagstaff Rd (East)								
W1-Pipe - (04)	Clark	8+56.07'	88	0.0001	0.0003	0.3	8.0	Add to C1-Pipe - (04)
Elliot								
E1-Pipe - (13)	Elliot	101+29.90'	8	0.0000	0.0000	0.1	8.0	Add to E1-Pipe - (11) through E1-FM-B
E1-Pipe - (11)	Elliot	107+00.00'	534	0.0008	0.0017	0.5	8.0	
E1-Pipe - (07)	Elliot	113+50.00'	1866	0.0029	0.0058	0.8	8.0	Add to E1-Pipe - (04) (1) through E1-FM-A
E1-Pipe - (04)	Elliot	120+86.38'	2826	0.0044	0.0087	1.4	8.0	No parcel directly connected
E1-Pipe - (06)	Elliot	116+61.16'	30520	0.0472	0.0944	2.1	8.0	Add to E1-Pipe - (04) (1) through E1-FM-A
E1-Pipe - (04) (1)	Elliot	122+39.13'	32544	0.0504	0.1007	2.4	8.0	
E1-Pipe - (01)	Elliot	129+99.99'	37053	0.0573	0.1147	3.0	8.0	Add to S1-Pipe - (115)
Pearson								
P1-Pipe - (25)	Pearson	101+01.20'	181597	0.2810	0.5619	5.2	8.0	
P1-Pipe - (16)	Pearson	125+50.46'	195388	0.3023	0.6046	6.2	8.0	Add to P1-Pipe - (13) through P1-FM-C. No parcel directly connected
P1-Pipe - (15)	Pearson	127+82.00'	4025	0.0062	0.0125	1.0	8.0	Add to P1-Pipe - (13) through P1-FM-C
P1-Pipe - (13)	Pearson	132+50.57'	199412	0.3085	0.6171	4.3	8.0	No parcel directly connected

Pipe Segment	Reference Alignment	Start Station	Flow (gal/ day)	Flow (CFS)	Doubled Flow	Calculated Diameter (inches)	Design Diameter (inches)	Comments
P1-Pipe - (08)	Pearson	145+35.39'	247636	0.3832	0.7663	6.7	8.0	Add to P1-Pipe - (04) through P1-FM-B. No parcel directly connected
P1-Pipe - (07)	Pearson	146+58.76'	8945	0.0138	0.0277	1.4	8.0	Add to P1-Pipe - (04) through P1-FM-B. No parcel directly connected
P1-Pipe - (04)	Pearson	152+05.20'	271651	0.4203	0.8406	5.2	8.0	
P1-Pipe - (02)	Pearson	155+97.53'	272932	0.4223	0.8446	4.7	8.0	Add to S1-Pipe - (106)
P1-Pipe - (01)	Pearson	157+97.53'	385	0.4229	0.8458	5.2	8.0	Add to S1-Pipe - (106)
Bille Rd (West)								
B1-Pipe - (01)	Skyway	143+02.01'	217	0.0003	0.0007	0.5	8.0	Add to S1-Pipe - (58)
Bille Rd (East)								
B1-Pipe - (02)	Skyway	142+24.64'	946	0.0015	0.0029	0.8	8.0	Add to S1-Pipe - (58)
Wagstaff Rd (West)								
W1-Pipe - (01)	Skyway	110+99.72'	17	0.0000	0.0001	0.2	8.0	Add into S1-Pipe - (46)
Wagstaff Rd (East)								
W1-Pipe - (02)	Skyway	109+03.93'	3182	0.0049	0.0098	1.0	8.0	Add into S1-Pipe - (46)

Pipe Segment	Reference Alignment	Start Station	Flow (gal/ day)	Flow (CFS)	Doubled Flow	Calculated Diameter (inches)	Design Diameter (inches)	Comments
Skyway								
S1-Pipe - (07)	Skyway	13+79.78'	5550	0.0086	0.0172	1.3	8.0	Add to S1-Pipe - (10) through S1-FM-A
S1-Pipe - (09)	Skyway	19+03.96'	174	0.0003	0.0005	0.4	8.0	
S1-Pipe - (08)	Skyway	15+97.59'	787	0.0012	0.0024	0.7	8.0	Add to S1-Pipe - (10) through S1-FM-A
S1-Pipe - (10)	Skyway	22+32.50'	9201	0.0142	0.0285	2.0	8.0	
S1-Pipe - (58)	Skyway	143+02.01'	61853	0.0957	0.1914	3.1	8.0	No parcel directly connected
S1-Pipe - (115)	Skyway	197+27.03'	149950	0.2320	0.4640	4.2	8.0	
S1-Pipe - (106)	Skyway	222+21.21'	441232	1.10	2.2100	7.7	8.0	
S1-Pipe - (81)	Skyway	299+45.24'	488055	1.1798	2.3595	7.9	8.0	Total Flow from entire system

Table 2. Trunk System Pump Station Capacity Sizing

Pump Station Name	Average Flow into Pump Station (gal/day)	Flow into Pump Station with Peaking Factor of 3.0 (gal/min)	Force Main Diameter (inches)	Jensen Pump Series
S1-PS-1	12,673	26.4	2	248
E1-PS-2	15.9	0.03	2	248
C1-PS-1	21,389	44.6	2	248
E1-PS-1	64,772	135	3	360
C1-PS-2	363,167	757	6	696
P1-PS-2	513,163	1,069	6	696
P1-PS-3	398,825	831	6	696
P1-PS-1	546,634	1139	6	696