

APPENDIX K2

SEWER SYSTEM ANALYSIS

SEWER SYSTEM ANALYSIS

The Gateway Project City of Grand Terrace, California



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INTRODUCTION

1.1 PURPOSE OF STUDY

The Gateway Project (Project) is located within the City of Grand Terrace and sewer service for this area is provided by the City of Colton. The purpose of this report is to provide projected sewer flows for the Project and evaluate the impacts of the project on the City of Colton existing sewer facilities that provide service to the area.

1.2 PROJECT DESCRIPTION

The Project land use plan includes commercial, residential, parks, open space, drainage, and roads on approximately 109.3 acres. The Project is located on the east side of Interstate 215 with development proposed north and south of Van Buren Street. **Appendix A** provides a location map for the Project.

The Project is generally bounded by Interstate 215 on the west and mostly developed properties on the south, east, and west. There is a school site to the south of the project and commercial/industrial and residential development to the east and north of the Project.

The project site consists of mostly vacant land with a few structures that are to be removed when the project is developed. The site is characterized by relatively flat topography that generally flows from east to west.

The proposed development plan for the site consists of commercial uses totaling a maximum of approximately 373,000 square feet of building space. Residential uses on the property are proposed as high density residential with a density of 20 units per acre and a maximum total unit count of 798. The maximum development projections have been assumed in this study for estimating sewer flows from the Project to be conservative.

1.3 RELATED STUDIES

The City of Colton July 2016 Sewer Master Plan, prepared by Carollo Engineers, provides a regional study identifying existing and proposed major sewer facilities within the City's ultimate service area. The master plan also presents design criteria to be utilized in sizing gravity sewer lines, sewer lift stations, and force mains; and provides information on the City's sewer generation rates that can be applied to determine projected average and peak wastewater flows. The master plan reports also identifies deficiencies in the City's Sewer System and discusses the City's future planned Capital Improvement Projects to mitigate for these system deficiencies.

PLANNING CRITERIA AND PROJECTED SEWAGE FLOWS

This section presents the planning criteria used to estimate the sewage flows and evaluate the recommended sewer system improvements required for the Project. The criteria utilized in this study are in accordance with the July 2016 City of Colton Sewer Master Plan.

2.1 SEWAGE FLOWS

The sewage generation factors used to estimate the average daily flows for the Project are listed in **Table 2-1**. The 2016 Master Plan assumes a per capita sewer generation rate of 75 gpd/person and uses 4.2 people per single family home per data in the 2010 Urban Water Management Plan, resulting in a residential sewer generation factor of 315 gpd/unit. Multi-family residential units typically have less residents per unit and a lower sewer generation factor. Census data for 2016 to 2020 indicates that the average number of people per household in the City of Colton is 3.27. Using this factor and the per capita sewer generation factor of 75 gpd/person results in a residential sewer generation factor of 245 gpd/unit. For the purposes of this study a residential sewer generation factor of 250 gpd/unit has been used to estimate flows from the high density residential units on the Project.

TABLE 2-1

Recommended Unit Sewage Generation Factors	
Land Use category	Sewer Generation Factor
High Density Residential (20 du/ac)	250 gpd/unit
Commercial	2,000 gpd/ac
Park/Recreation	500 gpd/ac ¹

¹ Assumed based on data from other agencies

To convert average dry weather daily flows to peak wet weather flows, a factor of 2.7 was utilized.

2.2 GRAVITY SEWERS

All gravity sewers have been designed to convey peak wet weather flow. **Table 2-2** lists the maximum depth-to-diameter ratio (d/D) in pipes at peak wet weather flow for existing and proposed gravity sewer lines. Manning's Equation with an "n" value of 0.013 was used to size all

gravity sewers. All new sewers were designed to maintain a minimum velocity of two feet per second at design capacity to prevent the deposition of solids. To minimize excessive wear and tear of the pipe, pipes shall be designed to not exceed a maximum velocity of 8 feet per second. All pipes will be installed with a minimum of 7 feet of cover. **Table 2-3** lists the minimum slope requirements for various pipe sizes. When minimum velocities are not able to be met, minimum pipe slopes shall be maintained.

TABLE 2-2

d/D Criteria	
Pipe Description	Max d/D Peak Wet Weather Flow
Existing	0.92
Proposed 10-inch diameter or smaller	0.50
Proposed 12-inch to 18-inch diameter	0.67
Proposed larger than 18-inch diameter	0.75

TABLE 2-3

Minimum Slope Requirements	
Sewer Pipe Size (in)	S (ft\ft)
8	0.0033
10	0.0025
12	0.0019
15	0.0014
18	0.0011
21	0.0009
24	0.0008

2.3 FORCE MAINS

All force main sewers will be designed to convey peak wet weather flow. The Hazen-Williams Equation with a friction coefficient “C” value of 130 is used to size all force main sewers. All force mains were designed to maintain a minimum velocity of three feet per second at the minimum design pumping capacity to prevent the deposition of solids. To minimize excessive wear and tear of the pipe, pipes shall be designed to not exceed a maximum velocity of 8 feet per second velocity.

2.4 LIFT STATIONS

All lift stations should be sized to accommodate the influent peak wet weather flows. A minimum of two pumps of equal size should be provided to provide adequate standby capacity if one pump is out of service. Pumps should be able to pass 3-inch minimum solids. The wet well should be sized to limit the number of pump cycles to no more than 6 per hour. Lift stations are to be equipped with submersible pumps in a wet well, a separate meter/valve vault, above ground pump controls housed in an enclosure, telemetry (dialer system at a minimum), and a backup diesel generator.

2.5 PROJECTED SEWAGE FLOWS

Table 2-4 provides the projected average sewer flow for the Project. Using the peaking factor of 2.7, the projected peak wet weather flow for the Project is 741,029 gpd (0.74 mgd).

TABLE 2-4

The Gateway - Projected Sewage Flows				
Planning Area	Land Use	Quantity	Sewer Generation Factor	Average Flow
				gpd
1	Commercial	9.18 ac	2,000 gpd/ac	18,360
2	Commercial	3.05 ac	2,000 gpd/ac	6,100
3	Commercial	3.30 ac	2,000 gpd/ac	6,600
4	Commercial	2.83 ac	2,000 gpd/ac	5,660
5	Drainage	1.91 ac	0 gpd/ac	0
6	Commercial	8.40 ac	2,000 gpd/ac	16,800
7	Commercial	0.40 ac	2,000 gpd/ac	800
8	Commercial	4.60 ac	2,000 gpd/ac	9,200
9	Commercial	4.60 ac	2,000 gpd/ac	9,200
10	Utilities	0.62 ac	0 gpd/ac	0
11	High Density Residential	247 units	250 gpd/unit	61,750
12	High Density Residential	154 units	250 gpd/unit	38,500
13	Utilities	1.26 ac	0 gpd/ac	0
14	High Density Residential	8 units	250 gpd/unit	2,000
15	High Density Residential	7 units	250 gpd/unit	1,750
16	High Density Residential	10 units	250 gpd/unit	2,500
17	Utilities	2.51 ac	0 gpd/ac	0
18	Drainage	9.24 ac	0 gpd/ac	0
19	High Density Residential	321 units	250 gpd/unit	80,250
20	High Density Residential	50 units	250 gpd/unit	12,500
21	Utilities	2.38 ac	0 gpd/ac	0
22	Park	4.97 ac	500 gpd/ac	2,485
---	Open Space	1.90 ac	0 gpd/ac	0
---	Circulation	5.08 ac	0 gpd/ac	0
---	Riverside Canal	2.45 ac	0 gpd/ac	0
Total	--	109.32 ac	--	274,455

EXISTING AND PROPOSED WASTEWATER FACILITIES

This section discusses the existing and proposed wastewater facilities as identified in the City of Colton 2016 Sewer Master Plan that are relevant to The Gateway Project. All sewer flows in the area are conveyed to the Colton Water Reclamation Facility for treatment and disposal.

3.1 EXISTING FACILITIES

There are a number of existing gravity sewer lines in the vicinity of the project. The main sewer line in the area is a 12-inch trunk sewer line in De Berry Street that conveys flow from east to west through the Project and then increases to 18-inch before it crosses Interstate 215. After crossing Interstate 215, the sewer line flows north and increases in size before reaching the Colton Water Reclamation Facility. There is also a 10-inch gravity sewer line in Commerce Way that conveys flow south to the 18-inch trunk sewer line. A 10-inch sewer line in Taylor Street conveys flow north to the 18-inch trunk sewer line. There are 8-inch gravity sewer lines in Van Buren Street and Pico Street that convey flow from east to west to the 10-inch line in Taylor Street. **Figure 2 in Appendix B** provides a map of the existing sewer lines in the vicinity of the Project.

3.2 CAPITAL IMPROVEMENT PROJECTS

The City of Colton 2016 Sewer Master Plan provides an evaluation of the sewer collection system under existing flow conditions and under future flow conditions. Improvements to correct existing deficiencies or to accommodate future planned development are identified and included in the Capital Improvement Program for the City sewer collection system. The Master Plan did not identify any deficiencies under existing or future flow conditions in the vicinity of The Gateway Project. As a result, there are no planned Capital Improvement Projects in the vicinity of the Project.

3.3 PROPOSED FACILITIES

The Project can receive sewer service by constructing onsite sewer lines and connecting to the existing sewer lines that are adjacent to the development areas. The regional sewer system has been analyzed in the 2016 Master Planned and determined to have capacity for existing and proposed flows in this area as no upgrades to the system are proposed in this area. The impact of proposed Project flows on existing local collector sewers was evaluated to confirm that local collector sewers have adequate available capacity to serve the Project.

To evaluate the capacity in existing collector sewers adjacent to the Project, the sewer modeling data for the City of Colton was obtained and reviewed. The existing flows and sewer system geometry from the City model were input into calculation tables for the local collector sewers adjacent to the Project. The calculation tables are included in Appendix C and include scenarios for existing flow conditions and for existing flows plus flows from build out of The Gateway Project. The results of the calculations indicate that the existing local collector sewers have adequate capacity to serve the project. The existing sewer lines in DeBerry Street and Rene Lane/Commerce Way will have d/D ratios of less than 0.50 with Project flows added. The existing 8-inch line in Van Buren Street is anticipated to have a maximum d/D ratio of 0.60 under peak flow conditions with Project flows added. The existing 10-inch sewer line that conveys flows north from Taylor Street is anticipated to have a maximum d/D ratio of 0.72 under peak flow conditions with Project flows added. These d/D ratios are within the maximum allowed by the City of Colton for existing sewer lines and, therefore, no upgrades to the existing are proposed.

CONCLUSIONS

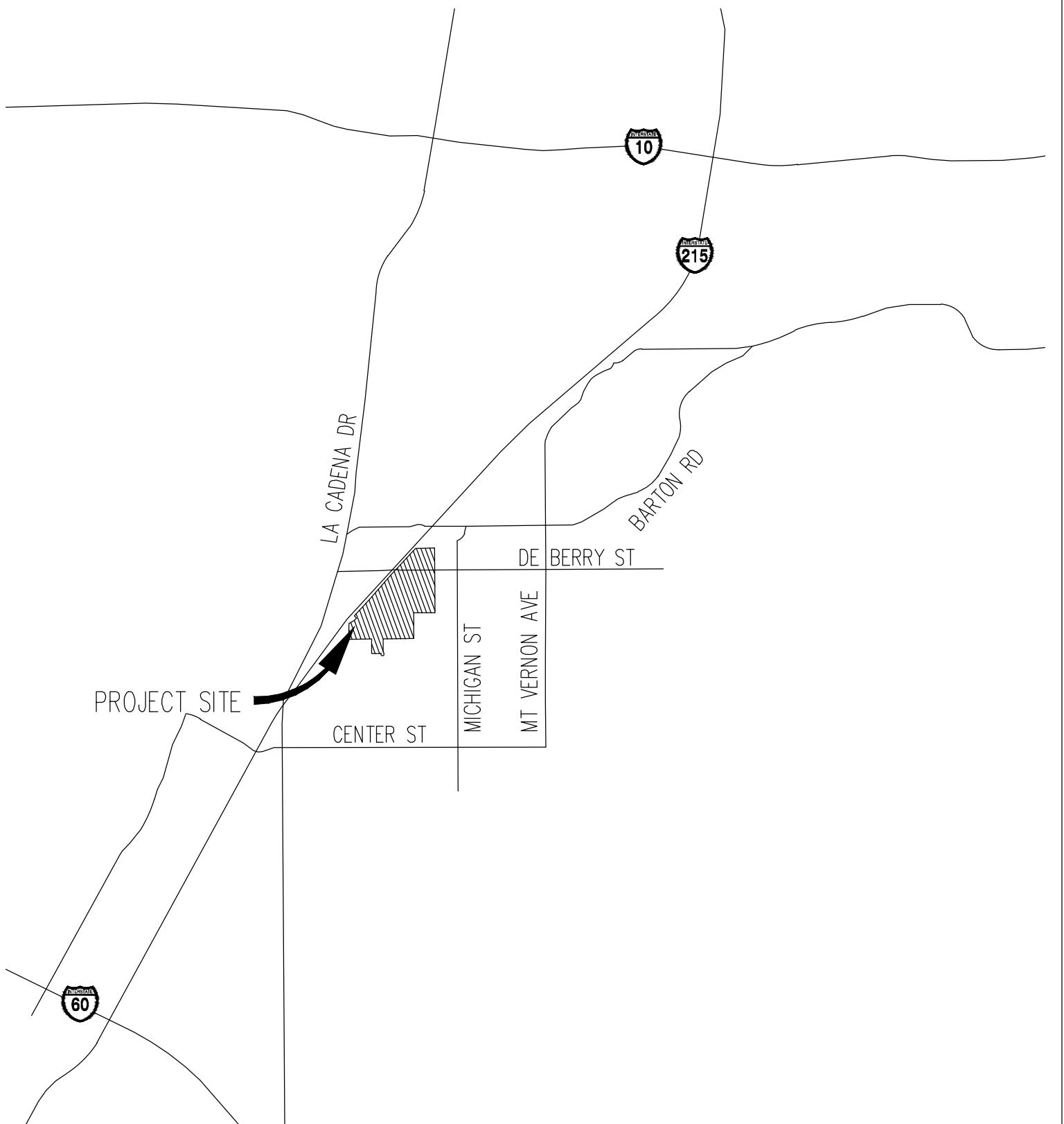
The Gateway Project is located in the City of Grand Terrace and will receive sewer service from the City of Colton sewer collection system. The Project proposes a mix of commercial and high density residential development with park and open space areas. At Project buildout, the maximum projected average daily sewer flow is 0.27 mgd.

There are several existing sewer lines adjacent to the development areas within the project. The existing sewer lines range from 8-inch to 12-inch and convey flows to an 18-inch trunk sewer located in the northwest area of the site that conveys flow across Interstate 215. The existing trunk line conveys flow north and increases in size before reaching the Colton Water Reclamation Facility. The City of Colton 2016 Sewer Master Plan prepared by Carollo Engineers evaluated the sewer system under existing and future projected flow conditions. The Sewer Master Plan did not identify any existing or future system deficiencies in the vicinity of The Gateway Project.

To evaluate the capacity in existing collector sewers adjacent to the Project, the sewer modeling data for the City of Colton was obtained and reviewed. The existing flows and sewer system geometry from the City model were input into calculation tables for the local collector sewers adjacent to the Project. The calculation tables are included in Appendix C and include scenarios for existing flow conditions and for existing flows plus flows from build out of The Gateway Project. The results of the calculations indicate that the existing local collector sewers have adequate capacity to serve the project. The existing sewer lines in DeBerry Street and Rene Lane/Commerce Way will have d/D ratios of less than 0.50 with Project flows added. The existing 8-inch line in Van Buren Street is anticipated to have a maximum d/D ratio of 0.60 under peak flow conditions with Project flows added. The existing 10-inch sewer line that conveys flows north from Taylor Street is anticipated to have a maximum d/D ratio of 0.72 under peak flow conditions with Project flows added. These d/D ratios are within the maximum allowed by the City of Colton for existing sewer lines and, therefore, no upgrades to the existing are proposed.

Appendix

A
VICINITY MAP



VICINITY MAP

FIGURE 1 VICINITY MAP

Appendix

B

PROPOSED SEWER FACILITIES MAP

THE GATEWAY PRELIMINARY CONCEPTUAL SEWER PLAN



350' 0 350' 700' 1050'
SCALE IN FEET

FIGURE 2

Appendix

C
SEWER SYSTEM CALCULATIONS

PROJECT: The Gateway Project, City of Grand Terrace														DATE: 5/31/2022	
SCENARIO: Existing Flow Scenario															
FROM MH	TO MH	IN-LINE ADWF (gpd)	CUMULATIVE ADWF (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K' (¹)	dn (feet)	dn/D ⁽²⁾	C _a for Velocity ⁽³⁾	VELOCITY (f.p.s.)	COMMENTS
						M.G.D.	C.F.S.								
Rene Lane/Commerce Way															
3361	3300	1,111	1,111	2.70	3,000	0.003	0.005	10	0.500	0.001388	0.03341	0.04	0.0105	0.63	
3300	3302	0	1,111	2.70	3,000	0.003	0.005	10	0.700	0.001173	0.03063	0.04	0.0093	0.72	
3302	3303	0	1,111	2.70	3,000	0.003	0.005	10	2.500	0.000621	0.02269	0.03	0.0060	1.11	
3303	3343	29,630	30,741	2.70	83,001	0.083	0.128	10	1.300	0.023812	0.12842	0.15	0.0769	2.41	
3343	3404	370	31,111	2.70	84,000	0.084	0.130	10	3.600	0.014481	0.10094	0.12	0.0541	3.46	
3404	3469	370	31,481	2.70	84,999	0.085	0.132	10	1.400	0.023498	0.12760	0.15	0.0761	2.49	
DeBerry Street															
3465	3466	54,445	54,445	2.70	147,002	0.147	0.227	12	2.100	0.020405	0.14302	0.14	0.0689	3.30	
3466	3468	1,111	55,556	2.70	150,001	0.150	0.232	12	3.100	0.017137	0.13156	0.13	0.0611	3.80	
3468	3469	370	55,926	2.70	151,000	0.151	0.234	12	3.100	0.017251	0.13197	0.13	0.0613	3.81	
Van Buren Street															
3669	3670	1,111	1,111	2.70	3,000	0.003	0.005	8	3.500	0.000951	0.02220	0.03	0.0081	1.29	
3670	3671	370	1,481	2.70	3,999	0.004	0.006	8	1.500	0.001936	0.03108	0.05	0.0133	1.05	
3671	3662	370	1,851	2.70	4,998	0.005	0.008	8	0.400	0.004686	0.04728	0.07	0.0247	0.71	
3662	3664	0	1,851	2.70	4,998	0.005	0.008	8	0.300	0.005411	0.05052	0.08	0.0272	0.64	
3664	3665	0	1,851	2.70	4,998	0.005	0.008	8	0.400	0.004686	0.04728	0.07	0.0247	0.71	
3665	3666	0	1,851	2.70	4,998	0.005	0.008	8	0.500	0.004192	0.04479	0.07	0.0228	0.76	
Taylor Street															
3797	3753	2,963	2,963	2.70	8,000	0.008	0.012	10	0.300	0.004778	0.05961	0.07	0.0250	0.71	
3753	3712	370	3,333	2.70	8,999	0.009	0.014	10	0.300	0.005374	0.06294	0.08	0.0271	0.74	
3712	3678	370	3,703	2.70	9,998	0.010	0.015	10	0.200	0.007313	0.07287	0.09	0.0336	0.66	
3678	3666	0	3,703	2.70	9,998	0.010	0.015	10	0.200	0.007313	0.07287	0.09	0.0336	0.66	
3666	3622	1,851	5,554	2.70	14,996	0.015	0.023	10	0.300	0.008955	0.08023	0.10	0.0387	0.86	Flow from Van Buren
3622	3578	0	5,554	2.70	14,996	0.015	0.023	10	0.300	0.008955	0.08023	0.10	0.0387	0.86	
3578	3539	372	5,926	2.70	16,000	0.016	0.025	10	0.400	0.008275	0.07728	0.09	0.0366	0.97	
3539	3510	0	5,926	2.70	16,000	0.016	0.025	10	0.300	0.009555	0.08284	0.10	0.0405	0.88	
3510	3485	0	5,926	2.70	16,000	0.016	0.025	10	0.300	0.009555	0.08284	0.10	0.0405	0.88	
3485	3469	370	6,296	2.70	16,999	0.017	0.026	10	1.100	0.005302	0.06254	0.08	0.0268	1.41	

¹ K' based on n = 0.013

² dn/D using K' in Brater King Table 7-14

³ From Brater King Table 7-4 based on dn/D

PROJECT: The Gateway Project, City of Grand Terrace														DATE: 5/31/2022	
SCENARIO: Existing Flow + Flow From The Gateway Scenario															
FROM MH	TO MH	IN-LINE ADWF (gpd)	CUMULATIVE ADWF (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K' (1)	dn (feet)	dn/D ⁽²⁾	C _a for Velocity ⁽³⁾	VELOCITY (f.p.s.)	COMMENTS
						M.G.D.	C.F.S.								
Rene Lane/Commerce Way															
3361	3300	7,711	7,711	2.70	20,820	0.021	0.032	10	0.500	0.009631	0.08316	0.10	0.0408	1.14	Flow from PA 3 Added
3300	3302	0	7,711	2.70	20,820	0.021	0.032	10	0.700	0.008140	0.07669	0.09	0.0362	1.28	
3302	3303	0	7,711	2.70	20,820	0.021	0.032	10	2.500	0.004307	0.05674	0.07	0.0232	2.00	
3303	3343	29,630	37,341	2.70	100,821	0.101	0.156	10	1.300	0.028924	0.14123	0.17	0.0881	2.55	
3343	3404	370	37,711	2.70	101,820	0.102	0.158	10	3.600	0.017553	0.11087	0.13	0.0621	3.65	
3404	3469	370	38,081	2.70	102,819	0.103	0.159	10	1.400	0.028424	0.14001	0.17	0.0870	2.63	
DeBerry Street															
3465	3466	54,445	54,445	2.70	147,002	0.147	0.227	12	2.100	0.020405	0.14302	0.14	0.0689	3.30	
3466	3468	7,211	61,656	2.70	166,471	0.166	0.258	12	3.100	0.019019	0.13828	0.14	0.0656	3.92	Flow from PA 2 Added
3468	3469	19,530	81,186	2.70	219,202	0.219	0.339	12	3.100	0.025043	0.15795	0.16	0.0796	4.26	Flow from PA 1 and 7 Added
Van Buren Street															
3669	3670	3,611	3,611	2.70	9,750	0.010	0.015	8	3.500	0.003091	0.03881	0.06	0.0184	1.85	Flow from PA 16 Added
3670	3671	38,870	42,481	2.70	114,699	0.115	0.177	8	1.500	0.055541	0.15589	0.23	0.1397	2.86	Flow from PA 12 Added
3671	3662	2,120	44,601	2.70	120,423	0.120	0.186	8	0.400	0.112923	0.22419	0.34	0.2320	1.81	Flow from PA 15 Added
3662	3664	61,750	106,351	2.70	287,148	0.287	0.444	8	0.300	0.310921	0.39993	0.60	0.4919	2.03	Flow from PA 11 Added
3664	3665	0	106,351	2.70	287,148	0.287	0.444	8	0.400	0.269265	0.36522	0.55	0.4408	2.27	
3665	3666	2,000	108,351	2.70	292,548	0.293	0.453	8	0.500	0.245367	0.34531	0.52	0.4110	2.48	Flow from PA 14 Added
Taylor Street															
3797	3753	5,448	5,448	2.70	14,710	0.015	0.023	10	0.300	0.008785	0.07949	0.10	0.0382	0.86	Flow from PA 22 Added
3753	3712	93,120	98,568	2.70	266,134	0.266	0.412	10	0.300	0.158934	0.33661	0.40	0.2973	1.99	Flow from PA 19 and 20 Added
3712	3678	370	98,938	2.70	267,133	0.267	0.413	10	0.200	0.195384	0.37772	0.45	0.3460	1.72	
3678	3666	0	98,938	2.70	267,133	0.267	0.413	10	0.200	0.195384	0.37772	0.45	0.3460	1.72	
3666	3622	108,351	207,289	2.70	559,680	0.560	0.866	10	0.300	0.334239	0.52421	0.63	0.5201	2.40	Flow from Van Buren
3622	3578	0	207,289	2.70	559,680	0.560	0.866	10	0.300	0.334239	0.52421	0.63	0.5201	2.40	
3578	3539	372	207,661	2.70	560,685	0.561	0.868	10	0.400	0.289979	0.47810	0.57	0.4657	2.68	
3539	3510	35,200	242,861	2.70	655,725	0.656	1.015	10	0.300	0.391597	0.58762	0.71	0.5916	2.47	Flow from PA 6,8,9 Added
3510	3485	5,660	248,521	2.70	671,007	0.671	1.038	10	0.300	0.400723	0.59848	0.72	0.6034	2.48	Flow from PA 4 Added
3485	3469	370	248,891	2.70	672,006	0.672	1.040	10	1.100	0.209582	0.39314	0.47	0.3645	4.11	

¹ K' based on n = 0.013

² dn/D using K' in Brater King Table 7-14

³ From Brater King Table 7-4 based on dn/D

