Final Utility Report
for
Compark Village South Filing No. 1 and No. 2

Located in the S ½ of Section 6, Township 6 South, Range 66 West, of the 6th Principal Meridian, Town of Parker, County of Douglas, State of Colorado

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TABLE OF CONTENTS

I. INTRODUCTION

This final utility report has been prepared by Manhard Consulting for Compark Land Company, for Compark Village South Filing No. 1 & 2 in Parker, Colorado. The proposed Compark Village South Filing 1 & 2, henceforth referred to as "project", is located in part of the S ½ of Section 6, Township 6 South, Range 66 West, of the 6th Principal Meridian, Town of Parker, County of Douglas, State of Colorado. The proposed land use will include 36.23-acres of commercial, 9.07-acres of retail, and 56.58-acres of mixed residential (single-family & duplexes). The project includes associated infrastructure improvements, water, sanitary sewer, and storm sewer improvements. The site is bounded by E-470 to the north, South Chambers Road to the east, South Peoria Street to the west, and Grandview Estates subdivision to the south.

Project Location Map

NOT TO SCALE

Based on the geotechnical report (Ref. 2) for the site, the subsurface conditions consist of a variable thickness fill, top soil, clay, sand and gravel overlying sedimentary bedrock. Claystone and/or sandstone bedrock was encountered at depths ranging from 4 to 28 feet below ground surface.

Groundwater was encountered at depths ranging from 2 to 13 feet in nine of the 25 borings. It was noted that shallow groundwater is related to the bore holes proximity to the Green Acres Tributary (GAT) bisecting the site. The seasonal flows in the GAT flow from the south to the

north and ultimately discharges into Cherry Creek.

This study is intended to analyze the proposed water and sanitary sewer infrastructure, and describe the process of sizing the public water and sanitary sewer mains associated with the project.

II. EXISTING UTILITY INFRASTRUCTURE

Water

An 8" public water main exists on the north side of E-470 within American Way loop road and a 12" public water main exists on the east side of Happy Canyon Creek just south of E-470.

Sanitary Sewer

A 12" public sanitary sewer main will be constructed with Compark Village Filing 8 (located on the north side of E-470) that runs north along the west side of Happy Canyon Creek and outfalls into the Compark Lift Station located in the northwest portion of the Stonegate Village Metropolitan District (SVMD), accessed off of Canyon Rim Circle. The lift station pumps the wastewater through a 6-inch force main along Chambers Road and outfalls to the gravity collection system approximately 3,000 feet to the south of the lift station. Per the *Compark Lift Station Design Evaluation and Flow Characterization by Colorado Water System, LLC dated October 15, 2013* (Ref. 2), Table II-I itemizes the lift station parameters.

Table II-I:

Design Values for Compark Lift Station	
Paramter	**Value**
Ultimate Number of SFEs	1,343
Average Daily Flow per SFE	275
Average Daily Flow (gpd)	369,325
Average Flow Rate (gpm)	256
Peaking Factor	2.8
Peak Flow Rate (gpd)	1,034,110
Peak Flow Rate (gpm)	718

III. PROPOSED UTILITY INFRASTRUCTURE

Proposed Water

The proposed water infrastructure will be designed to accommodate the planned developments within the project. The planned developments are itemized in Table III-I.

A 12" water line loop with two connection points is planned to serve the project's water demands. The first connection point will be to the existing 12" public water main on the east side of Happy Canyon Creek just south of E-470. The second connection will be to the existing 8" public main in American Way loop road in Compark Filing 3 on the north side of E-470 (via

bore). The 12" water main will be looped through the project via Belford Ave.

Planning Areas PA-13 to PA-18 will be served by 8" water mains that connect to the 12" water main loop. The water distribution system is designed to convey anticipated flows to all Planning Areas as well as anticipated fire flows.

Table III-I: Proposed Building/Lot Size and Water Demand

Planning Area	Size	Use	Utility Report Demand (SFE)	SVMD Master Plan Water Model Demands* (SFE)
PA-13	26.4-ac	Commercial	77	30
PA-14	9.07-ac	Retail	26	8
PA-15	9.86-ac	Commercial	29	16
PA-16	13.76-ac	Duplexes	75	75
PA-17	21.08-ac	Duplexes	36	92
PA-18	21.74	Single-Family/Duplexes	156	96
		TOTAL	**399****	**317**

*SVMD Master Plan water model values for Compark South came from the CBCMD Inventory Map 2015.
**Water SFEs based upon Amended and Restated Regional Water and Wastewater Service Agreement dated October 11, 2016. Per the service agreement a total of 533 SFE are available to the south side of E470, this includes 134 SFE for High Pointe.
+High Pointe was not listed separately in the Utility Report but the demand information used in the SVMD Master Plan water model was 250 SFE from the same source (CBCMD Inventory Map 2015) as the other areas in Compark South. Adding the 250 SFE High Pointe to the 317 SFE listed in the table above gives a demand of 567 SFE, which is the demand used for Compark South in the SVMD Master Plan water model.

Proposed Sanitary

The proposed sanitary infrastructure is designed to accommodate the six Planning Areas within the project. The Planning Area information can be found in Table III-II. The project will connect into the existing 12" sewer main located within Compark Village Filing 8 (north side of E-470 and just west of Happy Canyon Creek). The proposed sanitary sewer system will consist of 12" PVC pipe in the lower portion ≈1,500 lf of the sanitary sewer system. The majority of the sanitary sewer system will consist of 8" PVC in accordance with Stonegate Village Metropolitan District (SVMD) standards (Ref. 1).

Table III-II: Proposed Building/Lot Size and Sanitary Sewer Demand

Planning Area	Utility Report Sewer Demand (SFE)	Utility Report Water Demand (SFE)
PA-13	77	77
PA-14	26	26
PA-15	29	29
PA-16	75	75
PA-17/PA-18	192	192
High Pointe*	134	134
TOTAL	**533****	**533**

*The Utility Report did not include the modeling associated with the High Pointe area, but this table assumed the demand for water in the High Pointe area would be the same as the sewer demand value.
**Sanitary Sewer SFEs based upon Amended and Restated Regional Water and Wastewater Service Agreement dated October 11, 2016. Wastewater SFE Map provided in the Appendix.

IV. UTILITY SYSTEM DESIGN CRITERIA

Water

The water system was designed and analyzed using the following criteria. Demands for the project were obtained using criteria outlined in Table IV-I. A sample calculation is as follows for a 50,000-sf Retail/Commercial project.

Average Daily Demand (AD) = (50,000 sf) x (0.1 GPD/sf) = 5,000 GPD
=3.47 gpm

Max Day Demand =AD x Max Day Factor
=3.47 x 2.6
=9.02 gpm

Max Hour Demand =AD x Max Hr Factor
=3.47 x 3.9
=13.53 gpm

Table IV-I: Estimated Water Loading Criteria

Future Phase	Average Day Demand	Max Day Factor*	Max Hour Factor*
Single-Family (3.0 ppl/DU)*	405 GPD	2.6	3.9
Duplex (2.1 ppl/DU)	284 GPD	2.6	3.9
Commercial & Retail	0.1 GPD/SF	2.6	3.9

*Per SVMD Master Water Model by TST 6/24/2016 (Ref.4)

The proposed water main was designed using the following constraints:

Table IV-II: Maximum and Minimum Water Design Constraints

Flow Scenario	Minimum Static Pressure	Maximum Static Pressure	Maximum Velocity
Average Daily	43 psi	140 psi	5 fps
Max Day + Fire Flow	20 psi**	N/A	15 fps
Max Hour	35 psi	N/A	10 fps

**Minimum residual pressure during fire flow

Fire flow requirements were obtained using the 2015 International Fire Code (Ref. 5). For a potential 150,000 square foot, fire sprinklered, Type IIA and IIB building, 4,000 gpm and 4 fire hydrants – or 1000 gpm per hydrant - are required. Residential areas require 1,500 gpm and one fire hydrant. See Appendix A.

Existing pressures were provided by the SVMD, and are outlined below:

1. Static Pressure 102.91 psi and Average Day Demand Pressure 100.37 psi – at Compark Village Filing 3 (American Way loop road). Node N24 in the District Master Water model by TST.
2. Static Pressure 131.51 psi and Average Day Demand Pressure 128.97 psi – at Happy Canyon Creek and E-470. Node N71.1 in the District Master Water model by TST.

Sanitary Sewer

The sanitary sewer system was designed and analyzed using the following criteria. Demands for the project were obtained using criteria outlined in Table IV-III. A sample calculation is as follows for 50 single-family lots.

Average Daily Demand (AD) = (50 single-family lots) x (275 gal/day) = 13,750 GPD
=0.213 cfs

Peak Flow Demand =AD x PF
=(.213 cfs) x 2.8
=.596 cfs

Table IV-III: Estimated Sanitary Sewer Loading Criteria

Future Phase	Average Day Demand
Residential/Single Family	242.4 gal/day
Residential/Duplex	164.2 gal/day
Commercial/Retail	705.8 gal/acre/day

Note: Single Family= 3.1 ppu; Duplexes= 2.1 ppu

Sewers 10" in diameter and smaller are to be designed to carry the peak design flow at a maximum flow depth of 80% of the pipe diameter. The minimum velocity at the peak design flow shall be 2 feet per second.

V. UTILITY ANALYSIS AND RESULTS

WaterCAD Analysis

Bentley WaterCAD Version V8i was used to model the proposed water system. The anticipated demands used in the model can be found in Table V-I. Three scenarios were modeled for analysis of the system. Descriptions of each scenario are as follows:

- Average Daily Demand – Includes average daily demands at each Planning Area.
- Max Day Demand + Fire Flow – includes Max Day demands at each planning area plus the required fire flow of 1,500 gpm in the residential/duplex area and 4,000 gpm in the commercial/retail area. The proposed system satisfies the fire flow requirements with a 20 psi residual pressure.
- Max-Hour Demand – includes max-hour demands at each planning area.

Table V-I: Anticipated Water Demands by Planning Area

Planning Area	Average Daily Demand (GPM)	Max Daily Demand (GPM)	Max-Hour Demand (GPM)
PA-13	21.67	56.35	84.53
PA-14	5.13	13.35	20.03
PA-15	8.22	21.36	32.04
PA-16	14.75	38.35	57.52
PA-17	7.03	18.28	27.42
PA-18	36.79	95.67	143.50

WaterCAD Results

The results are summarized in this section. Refer to Appendix B for detailed results and figures. Table V-II illustrates that the proposed water system is sufficiently sized with respect to the criteria described in Table IV-II with exception to the head loss requirement during Max Hour and Fire Flow. The head loss during this event does not adversely affect the operating pressure.

Table V-II: Water Loop Results

Scenario	Minimum Pressure (psi)	Maximum Pressure (psi)	Maximum Velocity (fps)
Average Daily Demand	95.5 @ J-27	124.0 @ J-6	3.93 @ P-13
Max Day Demand	95.2 @ J-27	123.9 @ J-6	4.18 @ P-13
Max Hour Demand	94.9 @ J-27	123.9 @ J-6	4.38 @ P-13
Max Day + Fire Flow*	45.3 @ J-25	123.3 @ J-6	15.28 @ P-15

*Fire Flow – 4000 gpm at J-11, J-13, J-14 & J-15; all other Junctions tested at 1,500 gpm

Sanitary Sewer Analysis

Bentley Flowmaster Version V8i was used to model the proposed sanitary system. The anticipated demands used in the model can be found in Table V-III.

Table V-III: Anticipated Sanitary Sewer Demands by Building/Lot

Phase	Average Day* Demand (cfs)	Peak Factor	Peak Flow* (cfs)
PA-13	0.049	2.8	0.121
PA-14	0.017	2.8	0.042
PA-15	0.018	2.8	0.045
PA-16	0.020	2.8	0.047
PA-17/18	0.107	2.8	0.274
PA-A, PA-B, PA-C	0.110	2.8	0.349

*Includes infiltration of 500 gal per acre per day.

Flowmaster Results

The sanitary sewer results are summarized in this section. Refer to Appendix B for detailed results and figures. Due to constraints associated with the existing sanitary invert elevations and the site grading, the proposed sanitary sewer system is anticipated to slope at a minimum 0.22% in a few areas. This is to provide the maximum depth possible in order to best serve the planning areas, and avoid utility conflicts. Theses constraints result in sanitary sewer velocities below the required 2 feet per second for the sanitary sewer stub serving the Chambers Highpoint development (Design Pt 7; PA-A, PA-B, PA-C).

Calculations are included in the Appendix that calculates the minimum and maximum peak flow through the proposed sanitary sewer system. The proposed system does not reached the maximum 80% capacity, as required by the City standards. The calculations show that the system flows at a maximum of 43.3% full. A summary of the velocities are found in the table below:

Table V-IV: Sanitary Sewer Results

Minimum Velocity	1.54 fps	Design Point 7
Maximum Velocity	3.91 fps	Design Point 9

VI. CONCLUSION

The proposed water infrastructure to be constructed with Compark Village South Filing 1 and 2 includes one 12” water main loop feeding an 8” distribution system. The results of this study show that, according to the criteria set forth by Stonegate Village Metropolitan District, the proposed water infrastructure is adequately sized.

The majority of the proposed sanitary sewer infrastructure is 8” PVC, that includes some 12” C900 downstream. Due to site constraints, the sanitary sewer system is anticipated to slope at a minimum 0.50% and 0.22% for 8” PVC and 12” C900 respectfully. The proposed sanitary sewer system sufficiently serves the project.

VII. REFERENCES

1. Stonegate Village Metropolitan District (SVMD) Design Standards
2. Compark Lift Station Design Evaluation and Flow Characterization; Colorado Water System, LLC, October 15, 2013
3. Geotechnical Study for Proposed Roadway, Drainage, and Utility Improvements Compark Village South Belford Avenue Between South Peoria Street and South Chambers Road, Parker and Douglas County, Colorado; A. G. Wassenaar, Inc., March 18, 2016.
4. SVMD Master Water Model; TST, 6/24/2016
5. International Fire Code; International Code Council, 2015
6. City and County of Denver Department of Public Works Sanitary Sewer Design Technical Criteria Manual, revised March 2008

APPENDIX A

DEMANDS

Compark Village South
Parker, CO
CLCPKC3.02

Potable Water Distribution System Design Criteria

Hazen Williams	120		8"-12" PIPE
Operating Pressures			
Minimum Static Pressure	43	psi	
Maximum Static Pressure	140	psi	
Minimum Dynamic Pressure			
Max Hr Demand + fire flow	20	psi	(per jurisdiction)
Maximum Velocities			
Max Pipe Velocity (Max Hour)	10	fps	
Max Pipe Velocity (Max Day + FF)	15	fps	
Max Pipe Velocity (Max Day)	5	fps	
Headloss	2	ft per 1000'	
Fire			
Fire Hydrant Demand (PA-13)	3000	gpm	(per IFC 2015, 404,106 sf Type I A w/ sprinklers)
Fire Hydrant Demand (PA-14)	3000	gpm	(per IFC 2015, 72,867 sf Type II B w/ sprinklers)
Fire Hydrant Demand (PA-15)	4000	gpm	(per IFC 2015, 150,927 sf Type II B w/ sprinklers)
Fire Hydrant Demand (PA-16)	1500	gpm	(per IFC 2015, 3,600 sf Single Family or separted by Fire Walls)
Fire Pressure Residual	20	psi	(per jurisdiction)
Fire Duration	2	Hr	(per IFC / Fire Dept)

Domestic Water Demand per Land Classification

Land Use	Average Day		SFE		Max Day Ratio*	Max Hour Ratio*
Residential Single Family	405	(gpd)	1.00	/dwelling	2.60	3.90
Duplexes	284	(gpd)	0.70	/dwelling	2.60	3.90
Commercial	0.1	(gpd/sf)	0.0002	/SF	2.60	3.90
Retail	0.1	(gpd/sf)	0.0002	/SF	2.60	3.90

- Per SVMD Master Water Model by TST: Average Day Demand = 135 gpcd (includes irrigation)
- Single Family Detached = 3.0 ppl/DU
- Single Family Duplex = 2.1 ppl/DU
- 0.0002 SFE/sf, Per THK Tap Allocation spreadsheet 12/21/2015.

* Per SVMD Master Water Model by TST 6/24/2016

Demand

Parcel**	Land Use	Area (Acre)	FAR	Units or Square Footage		SFE	Average Day (GPM)	Max Day (GPM)	Max Hour (GPM)
PA-13	Mixed Use	26.4	0.34	385,246	sf	77	21.67	56.35	84.53
PA-14	Retail	9.07	0.33	130,380	sf	26	5.13	13.35	20.03
PA-15	Mixed Use	9.86	0.34	146,031	sf	29	8.22	21.36	32.04
PA-16	Duplexes	13.76	-	107	units	75	14.75	38.35	57.52
PA-17	Duplexes	21.08	-	51	units	36	7.03	18.28	27.42
PA-18	Duplexes	-	-	120	units	84	16.54	43.01	64.51
PA-18	Single Family	21.74	-	72	units	72	20.25	52.66	78.99
Total		101.91				399	93.60	243.36	365.03

** Number of SFE per Amended and Restated Regional Water and Wastewater Service Agreement dated October 11, 2016.

Existing Distribution System Pressure

Node #	Static Pressure (psi)***	Static Pressure Elevation (ft)	Average Day Demand Pressure (psi)**	Average Day Demand Elevation (ft)
N24 (West Connection)	102.91	237.38	100.37	231.52
N71.1 (East Connection)	131.51	303.35	128.97	297.49

***Existing distribution system pressure provided by TST (*Compark South Pressures from Buildout System Modeling 6/7/2016*)

Compark Village South Filing No. 1
Parker, CO
CLCPKC3.02

Sewer Demand per Land Classiification

Land Use	Average Day (gpd)	Peak Factor
Residential Single Family (gpd/du)	242.4	2.8
Duplexes (gpd/du)	169.7	2.8
Compark Commercial (gpd/ac)	705.8	2.8
Compark Retail (gpd/ac)	705.8	2.8
High Pointe Retail (gpd/ac)	330	2.8
High Pointe Hotel (gpd/ac)	1773	2.8
Compark Filing 4 & 8	219.75	2.8

Notes:

Single Family Detached Residential demand =	3.0	ppl/DU
Multi-Family residential demand (apts) =	2.1	ppl/DU
Single Family Duplex Residential demand =	2.1	ppl/DU (Duplex)
Residential demand =	80.80	GPD/ ppl
Mixed Commercial =		Based on historical data

Infiltration = Area * 500 gal per acre per day
Peaking Factor - Per *Compark Lift Station Design Evaluation and Flow Characterization* ; Colorado Water System, LLC, October 15, 2013

Demand

ID	Total Area (ac)	Resid. Single Family	Resid. Multi Family/Duplex		Commercial Acres	Ave. Flow (gpd)	SFE	Resid. Ave. Flow (cfs)	Comm. Ave. Flow (cfs)	Ave Flow (cfs)	Cumulative flow (cfs)	Peak Factor	Infiltration (cfs)	Peak Flow (cfs)	Cumulative Peak Flow (cfs)
Compark South															
PA-13 (Flex Office)	26.40	0	0		26.40	18,633	77	0.000	0.029	0.029	0.03	2.80	0.02	0.10	0.10
PA-16 (Residential)*	13.76	0	107		0.00	18,156	75	0.028	0.000	0.028	0.06	2.80	0.01	0.09	0.19
PA-17/18 (Residential)*	42.82	72	172		0.00	46,638	192	0.072	0.000	0.072	0.13	2.80	0.03	0.24	0.43
PA-14 (Retail)	9.07	0	0		9.07	6,402	26	0.000	0.010	0.010	0.14	2.80	0.01	0.03	0.46
PA-15 (Flex Office)	9.86	0	0		9.86	6,959	29	0.000	0.011	0.011	0.15	2.80	0.01	0.04	0.50
Subtotal	101.91	72	279	**351**	45.33	96,787	**399**	0.10	0.05		0.15		0.08		0.50
High Pointe															
PA-A (Residential MF Apts)	11.48	0	60		0.00	10,181	42	0.016	0.000	0.016	0.02	2.80	0.01	0.05	0.05
PA-B (Retail)	10.00	0	0		10.00	3,300	14	0.000	0.005	0.005	0.02	2.80	0.01	0.02	0.08
PA-C (Hotel-300 Rooms)	10.70	0	0		10.70	18,971	78	0.000	0.029	0.029	0.05	2.80	0.01	0.09	0.17
Subtotal	32.18	0	60	**60**	20.70	32,452	**134**	0.02	0.03		0.05		0.02		0.17
Compark South S.F.E. Total							**533**								
Offsite															
Compark Village Filing 4	54.50	0	0		54.50	11,976	49	0.000	0.019	0.019	0.02	2.80	0.04	0.09	0.09
Compark Village Filing 8	17.20	0	0		17.20	3,780	16	0.000	0.006	0.006	0.02	2.80	0.01	0.03	0.12
Subtotal	71.70	0	0	**0**	71.70	15,756	**65**	0.00	0.02		0.02		0.04		0.12

Hydraulics

Des. Pt.	Tributary Basins at Design Point	Pipe size (in.)	Min Pipe slope	Q Ave Day (cfs)	Q Peak Flow (cfs)	Q full (cfs)	V peak (ft/s)	Peak Flow d (ft)	Capacity Status
2	PA-13	8	2.89%	0.05	0.10	2.46	3.41	0.09	O.K.
5	PA-16	8	4.00%	0.04	0.09	2.89	2.92	0.05	O.K.
1	PA-17/18	8	0.57%	0.11	0.24	1.09	2.48	0.21	O.K.
3	PA-13, PA-14, PA-17/18	8	0.60%	0.17	0.37	1.12	2.85	0.27	O.K.
4	PA-13, PA-14, PA-15, PA-17/18	12	0.22%	0.19	0.41	1.97	1.98	0.31	O.K.
6	PA-13, PA-14, PA-15, PA-16, PA-17/18	12	0.50%	0.23	0.50	2.98	2.81	0.28	O.K.
8	PA-A, PA-B, PA-C, PA-13, PA-14, PA-15, PA-16, PA-17/18	12	0.22%	0.31	0.77	1.97	2.36	0.43	O.K.
9	Compark Filing 4 & 8	12	0.79%	0.34	0.89	3.74	3.91	0.33	O.K.
7	PA-A, PA-B, PA-C	12	0.22%	0.08	0.17	1.97	1.54	0.20	O.K.

Compark Village South Filing No. 2
Parker, CO
CLCPKC3.02

Sewer Demand per Land Classiification

Land Use	Average Day (gpd)	Peak Factor
Residential Single Family (gpd/du)	242.4	2.8
Duplexes (gpd/du)	170	2.8
Commercial (gpd/ac)	705.8	2.8
Retail (gpd/ac)	705.8	2.8

Notes:

Single Family Detached Residential demand =	3	ppl/DU
Multi-Family residential demand (apts) =	2.1	ppl/DU
Single Family Duplex Residential demand =	2.1	ppl/DU (Duplex)
Residential demand =	80.80	GPD/ ppl from historical data
Mixed Commercial =		Based on historical data

Infiltration = Area * 500 gal per acre per day
Peaking Factor - Per *Compark Lift Station Design Evaluation and Flow Characterization* ; Colorado Water System, LLC, October 15, 2013

Demand

Manhole	Single Family lots	Duplexes	Average Day Flow (GPD)	Average Day Flow (cfs)	SFE	Peak Flow (cfs)	Cumlative Average Flow (cfs)	Cumulative Peak Flow	Pipe Size (in)	Manning	Min Pipe Slope	Depth D (ft)	Q full (cfs)	V Peak (ft/s)
Red Hawk Lane KB21 - KB13	47	0	11392.8	0.018	47	0.049			8	0.011	0.50%	0.10	1.02	1.49
Red Hawk Lane Phase 2 - KB13	0	31	5260	0.008	22	0.023			8	0.011	0.85%	0.06	1.33	1.41
Hummingbird St. KB13 - KB1	47	31	16,653		69		0.026	0.072	8	0.011	4.00%	0.07	2.89	3.46
Alley 1 KB12A - KB12	0	8	1357	0.002	6	0.006			8	0.011	1.13%	0.03	1.54	1.05
Alley 2	0	8	1357	0.002	6	0.006			8	0.011	1.33%	0.03	1.67	1.12
Meadowlark Ln. KB11 - KB10	2		485	0.001	2	0.002								
Meadowlark Ln. KB11 - KB10						0.000	0.005	0.014	8	0.011	1.32%	0.04	1.66	1.40
Alley 3		8	1357	0.002	6	0.006			8	0.011	1.44%	0.03	1.74	1.15
Meadowlark Ln. KB10 - KB8	2		485	0.001	2	0.002								
Meadowlark Ln. KB10 - KB8							0.008	0.022	8	0.011	0.78%	0.06	1.28	1.35
Alley 4	0	8	1357	0.002	6	0.006			8	0.011	1.33%	0.03	1.67	1.12
Meadowlark Ln. KB8 - KB7	3		727	0.001	3	0.003								
Meadowlark Ln. KB8 - KB7							0.011	0.031	8	0.011	1.00%	0.07	1.45	1.64
Alley 5	0	8	1357	0.002	6	0.006			8	0.011	1.38%	0.03	1.70	1.13
Meadowlark Ln. KB7 - KB6	3		727	0.001	3	0.003								
Meadowlark Ln. KB7 - KB6							0.014	0.040	8	0.011	1.00%	0.08	1.45	1.78
Alley 6	0	8	1357	0.002	6	0.006			8	0.011	1.40%	0.03	1.71	1.14
Meadowlark Ln. KB6 - KB5	2		485	0.001	2	0.002								
Meadowlark Ln. KB6 - KB5							0.017	0.048	8	0.011	1.00%	0.08	1.45	1.88
Alley 7	0	8	1357	0.002	6	0.006			8	0.011	1.43%	0.03	1.73	1.15
Meadowlark Ln. KB5 - KB4	4		970	0.002	4	0.004								
Meadowlark Ln. KB5 - KB4							0.021	0.058	8	0.011	1.00%	0.09	1.45	1.99
Alley 8	0	8	1357	0.002	6	0.006			8	0.011	1.40%	0.03	1.71	1.14
Meadowlark Ln. KB4 - KB3	3		727	0.001	3	0.003								
Meadowlark Ln. KB4 - KB3							0.024	0.067	8	0.011	1.00%	0.10	1.45	2.07
Alley 9	0	8	1357	0.002	6	0.006			8	0.011	1.43%	0.03	1.73	1.15
Meadowlark Ln. KB3 - KB2	4		970	0.002	4	0.004								
Meadowlark Ln. KB3 - KB2							0.028	0.077	8	0.011	1.00%	0.10	1.45	2.16
Alley 10	0	8	1357	0.002	6	0.006			8	0.011	1.46%	0.03	1.75	1.16
Meadowlark Ln. KB2 - KB1	2		485	0.001	2	0.002								
Meadowlark Ln. KB2 - KB1	25	80	19,634	0.030	81		0.030	0.085	8	0.011	2.25%	0.09	2.22	3.01
Alley 15	0	8	1357	0.002	6	0.006			8	0.011	1.00%	0.03	1.45	1.00
Phase 2		7	1188	0.002	5	0.005								

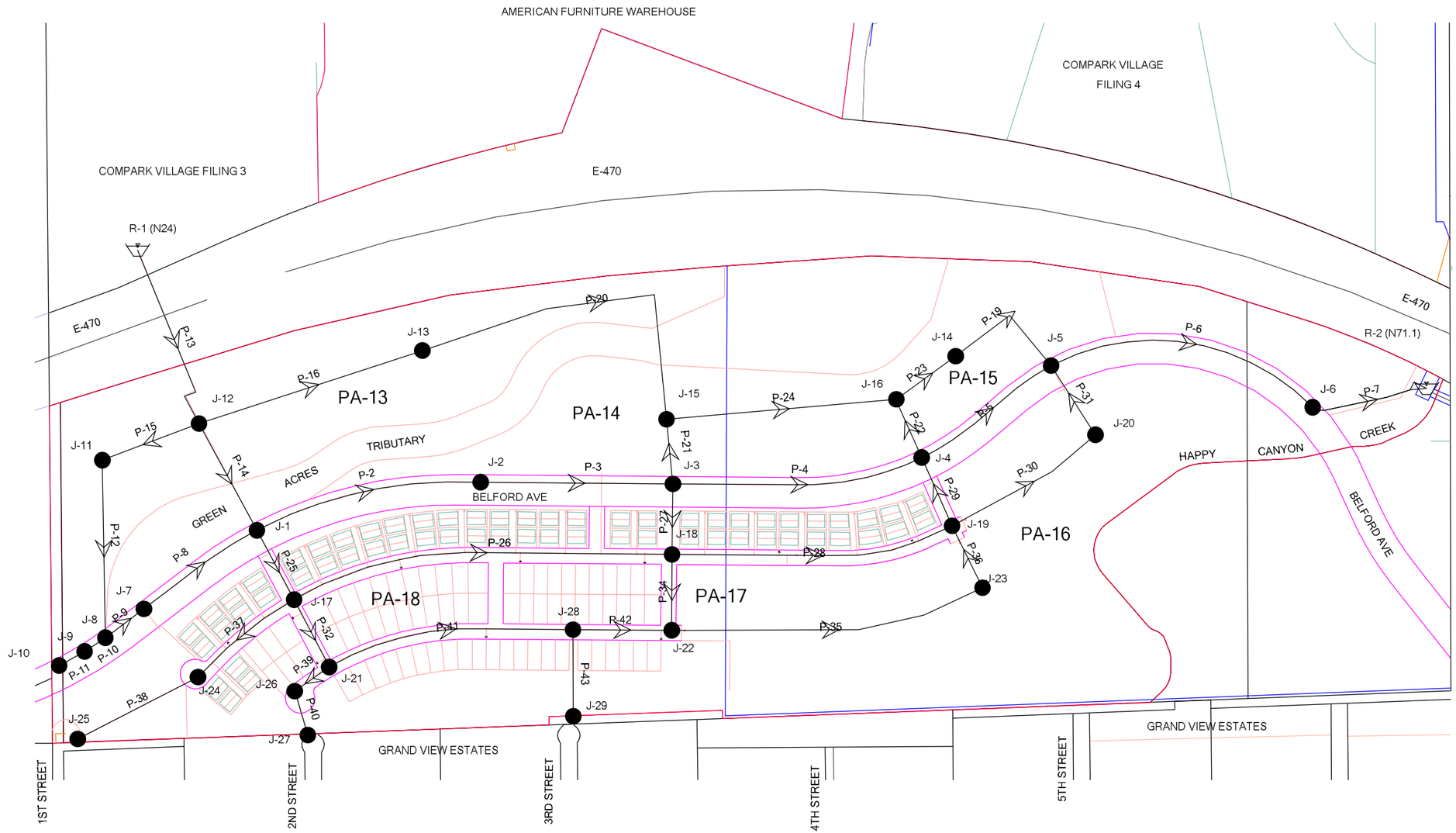
Manhole	Single Family lots	Duplexes	Average Day Flow (GPD)	Average Day Flow (cfs)	SFE	Peak Flow (cfs)	Cumlative Average Flow (cfs)	Cumulative Peak Flow	Pipe Size (in)	Manning	Min Pipe Slope	Depth D (ft)	Q full (cfs)	V Peak (ft/s)
Meadowlark Ln. KB25 - KB26							0.004	0.011	8	0.011	0.50%	0.05	1.10	0.95
Alley 14	0	8	1357	0.002	6	0.006			8	0.011	3.34%	0.02	2.64	1.53
Phase 2		7	1188	0.002	5	0.005								
Meadowlark Ln. KB24 - KB25							0.008	0.022	8	0.011	0.50%	0.07	1.02	1.16
Alley 13	0	8	1357	0.002	6	0.006			8	0.011	5.09%	0.02	3.26	1.75
Phase 2		6	1018	0.002	4	0.004								
Meadowlark Ln. KB23 - KB24							0.012	0.032	8	0.011	0.50%	0.08	1.02	1.30
Alley 12	0	8	1357	0.002	6	0.006			8	0.011	4.22%	0.02	2.97	1.69
Phase 2		6	1018	0.002	4	0.004								
Meadowlark Ln. KB22 - KB23							0.015	0.043	8	0.011	0.50%	0.09	1.02	1.42
Alley 11	0	8	1357	0.002	6	0.006			8	0.011	3.03%	0.02	2.52	1.48
Phase 2		6	1018	0.002	4	0.004								
Meadowlark Ln. KB1 - KB22	0	72	12217	0.02	50		0.019	0.053	8	0.011	0.50%	0.10	1.02	1.51
Hummingbird St. KB1 - EX 14A	72	183	48,504	0.049	200		0.075	0.210	8	0.011	0.71%	0.19	1.22	2.58

APPENDIX B

WaterCAD & Flowmaster Results

Active Scenario: Base

Scenario: Base



Active Scenario: Base
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	5,832.70	<Collection: 0 items>	0.00	6,080.29	107.1
34	J-2	5,822.98	<Collection: 0 items>	0.00	6,078.94	110.7
36	J-3	5,818.33	<Collection: 0 items>	0.00	6,077.82	112.3
38	J-4	5,827.17	<Collection: 0 items>	0.00	6,076.48	107.9
40	J-5	5,811.11	<Collection: 0 items>	0.00	6,075.31	114.3
42	J-6	5,783.81	<Collection: 0 items>	0.00	6,070.46	124.0
45	J-7	5,842.07	<Collection: 0 items>	0.00	6,080.36	103.1
47	J-8	5,845.38	<Collection: 0 items>	0.00	6,080.38	101.7
49	J-9	5,847.14	<Collection: 0 items>	0.00	6,080.38	100.9
51	J-10	5,849.19	<Collection: 0 items>	0.00	6,080.38	100.0
53	J-11	5,853.27	<Collection: 1 items>	10.84	6,081.01	98.5
55	J-12	5,843.85	<Collection: 0 items>	0.00	6,081.41	102.8
59	J-13	5,815.92	<Collection: 1 items>	10.84	6,079.94	114.2
62	J-14	5,817.40	<Collection: 1 items>	8.22	6,076.05	111.9
65	J-15	5,810.42	<Collection: 1 items>	5.13	6,077.82	115.7
68	J-16	5,807.48	<Collection: 0 items>	0.00	6,076.48	116.4

Active Scenario: Base
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
72	J-17	5,834.19	<Collection: 1 items>	9.02	6,079.22	106.0
74	J-18	5,820.40	<Collection: 1 items>	9.71	6,077.82	111.4
77	J-19	5,822.06	<Collection: 1 items>	10.14	6,076.62	110.1
80	J-20	5,810.83	<Collection: 1 items>	7.38	6,075.72	114.6
83	J-21	5,843.43	<Collection: 1 items>	6.60	6,078.96	101.9
85	J-22	5,830.42	<Collection: 1 items>	9.71	6,077.82	107.0
88	J-23	5,830.12	<Collection: 1 items>	3.52	6,076.83	106.7
103	J-24	5,841.05	<Collection: 1 items>	2.07	6,079.22	103.0
105	J-25	5,841.00	<Collection: 0 items>	0.00	6,079.22	103.1
107	J-26	5,845.33	<Collection: 1 items>	0.42	6,078.96	101.1
109	J-27	5,858.25	<Collection: 0 items>	0.00	6,078.96	95.5
111	J-28	5,833.23	<Collection: 1 items>	0.00	6,078.14	106.0
114	J-29	5,853.00	<Collection: 0 items>	0.00	6,078.14	97.4

Active Scenario: Base

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
35	P-2	837	J-1	J-2	12.0	PVC	120.0	722.76	2.05	0.002
37	P-3	695	J-2	J-3	12.0	PVC	120.0	722.76	2.05	0.002
39	P-4	914	J-3	J-4	12.0	PVC	120.0	687.60	1.95	0.001
41	P-5	575	J-4	J-5	12.0	PVC	120.0	820.71	2.33	0.002
43	P-6	1,025	J-5	J-6	12.0	PVC	120.0	1,292.40	3.67	0.005
44	P-7	424	J-6	R-2 (N71.1)	12.0	PVC	120.0	1,292.40	3.67	0.005
46	P-8	498	J-1	J-7	12.0	PVC	120.0	-189.62	0.54	0.000
48	P-9	174	J-7	J-8	12.0	PVC	120.0	-189.62	0.54	0.000
50	P-10	90	J-8	J-9	12.0	PVC	120.0	0.00	0.00	0.000
52	P-11	105	J-9	J-10	12.0	PVC	120.0	0.00	0.00	0.000
54	P-12	640	J-8	J-11	8.0	PVC	120.0	-189.62	1.21	0.001
56	P-13	710	R-1 (N24)	J-12	12.0	PVC	120.0	1,386.00	3.93	0.005
57	P-14	438	J-12	J-1	12.0	PVC	120.0	926.59	2.63	0.003
58	P-15	373	J-11	J-12	8.0	PVC	120.0	-200.46	1.28	0.001
60	P-16	849	J-12	J-13	8.0	PVC	120.0	258.95	1.65	0.002
64	P-19	479	J-14	J-5	8.0	PVC	120.0	242.76	1.55	0.002
66	P-20	1,318	J-13	J-15	8.0	PVC	120.0	248.12	1.58	0.002
67	P-21	234	J-15	J-3	8.0	PVC	120.0	-5.76	0.04	0.000
69	P-22	233	J-4	J-16	8.0	PVC	120.0	2.23	0.01	0.000
70	P-23	265	J-16	J-14	8.0	PVC	120.0	250.98	1.60	0.002
71	P-24	833	J-15	J-16	8.0	PVC	120.0	248.75	1.59	0.002
73	P-25	284	J-1	J-17	8.0	PVC	120.0	393.44	2.51	0.004
75	P-26	1,396	J-17	J-18	8.0	PVC	120.0	193.18	1.23	0.001
76	P-27	254	J-18	J-3	8.0	PVC	120.0	-29.40	0.19	0.000
78	P-28	1,031	J-18	J-19	8.0	PVC	120.0	208.18	1.33	0.001
79	P-29	270	J-19	J-4	8.0	PVC	120.0	135.34	0.86	0.001
81	P-30	616	J-19	J-20	8.0	PVC	120.0	236.31	1.51	0.001
82	P-31	297	J-20	J-5	8.0	PVC	120.0	228.93	1.46	0.001
84	P-32	274	J-17	J-21	8.0	PVC	120.0	189.17	1.21	0.001
87	P-34	274	J-22	J-18	8.0	PVC	120.0	-4.69	0.03	0.000

Active Scenario: Base

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
89	P-35	1,150	J-22	J-23	8.0	PVC	120.0	177.13	1.13	0.001
90	P-36	249	J-23	J-19	8.0	PVC	120.0	173.61	1.11	0.001
104	P-37	447	J-17	J-24	8.0	PVC	120.0	2.07	0.01	0.000
106	P-38	488	J-24	J-25	6.0	PVC	120.0	0.00	0.00	0.000
108	P-39	152	J-21	J-26	8.0	PVC	120.0	0.42	0.00	0.000
110	P-40	165	J-26	J-27	6.0	PVC	120.0	0.00	0.00	0.000
112	P-41	905	J-21	J-28	8.0	PVC	120.0	182.15	1.16	0.001
113	P-42	357	J-28	J-22	8.0	PVC	120.0	182.15	1.16	0.001
115	P-43	312	J-28	J-29	6.0	PVC	120.0	0.00	0.00	0.000

Active Scenario: Max Day
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	5,832.70	<Collection: 0 items>	0.00	6,079.73	106.9
34	J-2	5,822.98	<Collection: 0 items>	0.00	6,078.30	110.5
36	J-3	5,818.33	<Collection: 0 items>	0.00	6,077.12	112.0
38	J-4	5,827.17	<Collection: 0 items>	0.00	6,075.81	107.6
40	J-5	5,811.11	<Collection: 0 items>	0.00	6,074.71	114.0
42	J-6	5,783.81	<Collection: 0 items>	0.00	6,070.29	123.9
45	J-7	5,842.07	<Collection: 0 items>	0.00	6,079.79	102.9
47	J-8	5,845.38	<Collection: 0 items>	0.00	6,079.82	101.4
49	J-9	5,847.14	<Collection: 0 items>	0.00	6,079.82	100.7
51	J-10	5,849.19	<Collection: 0 items>	0.00	6,079.82	99.8
53	J-11	5,853.27	<Collection: 1 items>	28.18	6,080.47	98.3
55	J-12	5,843.85	<Collection: 0 items>	0.00	6,080.95	102.6
59	J-13	5,815.92	<Collection: 1 items>	28.18	6,079.26	113.9
62	J-14	5,817.40	<Collection: 1 items>	21.37	6,075.38	111.6
65	J-15	5,810.42	<Collection: 1 items>	13.34	6,077.12	115.4
68	J-16	5,807.48	<Collection: 0 items>	0.00	6,075.81	116.1

Active Scenario: Max Day
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
72	J-17	5,834.19	<Collection: 1 items>	23.45	6,078.51	105.7
74	J-18	5,820.40	<Collection: 1 items>	25.25	6,077.09	111.1
77	J-19	5,822.06	<Collection: 1 items>	26.36	6,075.92	109.8
80	J-20	5,810.83	<Collection: 1 items>	19.19	6,075.06	114.3
83	J-21	5,843.43	<Collection: 1 items>	17.16	6,078.21	101.6
85	J-22	5,830.42	<Collection: 1 items>	25.25	6,077.09	106.7
88	J-23	5,830.12	<Collection: 1 items>	9.15	6,076.11	106.4
103	J-24	5,841.05	<Collection: 1 items>	5.38	6,078.51	102.7
105	J-25	5,841.00	<Collection: 0 items>	0.00	6,078.51	102.8
107	J-26	5,845.33	<Collection: 1 items>	1.09	6,078.21	100.8
109	J-27	5,858.25	<Collection: 0 items>	0.00	6,078.21	95.2
111	J-28	5,833.23	<Collection: 1 items>	0.00	6,077.40	105.6
114	J-29	5,853.00	<Collection: 0 items>	0.00	6,077.40	97.1

Active Scenario: Max Day

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
35	P-2	837	J-1	J-2	12.0	PVC	120.0	744.71	2.11	0.002
37	P-3	695	J-2	J-3	12.0	PVC	120.0	744.71	2.11	0.002
39	P-4	914	J-3	J-4	12.0	PVC	120.0	678.47	1.92	0.001
41	P-5	575	J-4	J-5	12.0	PVC	120.0	791.12	2.24	0.002
43	P-6	1,025	J-5	J-6	12.0	PVC	120.0	1,230.26	3.49	0.004
44	P-7	424	J-6	R-2 (N71.1)	12.0	PVC	120.0	1,230.26	3.49	0.004
46	P-8	498	J-1	J-7	12.0	PVC	120.0	-193.27	0.55	0.000
48	P-9	174	J-7	J-8	12.0	PVC	120.0	-193.27	0.55	0.000
50	P-10	90	J-8	J-9	12.0	PVC	120.0	0.00	0.00	0.000
52	P-11	105	J-9	J-10	12.0	PVC	120.0	0.00	0.00	0.000
54	P-12	640	J-8	J-11	8.0	PVC	120.0	-193.27	1.23	0.001
56	P-13	710	R-1 (N24)	J-12	12.0	PVC	120.0	1,473.62	4.18	0.006
57	P-14	438	J-12	J-1	12.0	PVC	120.0	973.63	2.76	0.003
58	P-15	373	J-11	J-12	8.0	PVC	120.0	-221.45	1.41	0.001
60	P-16	849	J-12	J-13	8.0	PVC	120.0	278.54	1.78	0.002
64	P-19	479	J-14	J-5	8.0	PVC	120.0	229.04	1.46	0.001
66	P-20	1,318	J-13	J-15	8.0	PVC	120.0	250.36	1.60	0.002
67	P-21	234	J-15	J-3	8.0	PVC	120.0	-8.42	0.05	0.000
69	P-22	233	J-4	J-16	8.0	PVC	120.0	4.97	0.03	0.000
70	P-23	265	J-16	J-14	8.0	PVC	120.0	250.41	1.60	0.002
71	P-24	833	J-15	J-16	8.0	PVC	120.0	245.43	1.57	0.002
73	P-25	284	J-1	J-17	8.0	PVC	120.0	422.19	2.69	0.004
75	P-26	1,396	J-17	J-18	8.0	PVC	120.0	194.00	1.24	0.001
76	P-27	254	J-18	J-3	8.0	PVC	120.0	-57.82	0.37	0.000
78	P-28	1,031	J-18	J-19	8.0	PVC	120.0	206.27	1.32	0.001
79	P-29	270	J-19	J-4	8.0	PVC	120.0	117.62	0.75	0.000
81	P-30	616	J-19	J-20	8.0	PVC	120.0	229.30	1.46	0.001
82	P-31	297	J-20	J-5	8.0	PVC	120.0	210.11	1.34	0.001
84	P-32	274	J-17	J-21	8.0	PVC	120.0	199.36	1.27	0.001
87	P-34	274	J-22	J-18	8.0	PVC	120.0	-20.30	0.13	0.000

Active Scenario: Max Day

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
89	P-35	1,150	J-22	J-23	8.0	PVC	120.0	176.16	1.12	0.001
90	P-36	249	J-23	J-19	8.0	PVC	120.0	167.01	1.07	0.001
104	P-37	447	J-17	J-24	8.0	PVC	120.0	5.38	0.03	0.000
106	P-38	488	J-24	J-25	6.0	PVC	120.0	0.00	0.00	0.000
108	P-39	152	J-21	J-26	8.0	PVC	120.0	1.09	0.01	0.000
110	P-40	165	J-26	J-27	6.0	PVC	120.0	0.00	0.00	0.000
112	P-41	905	J-21	J-28	8.0	PVC	120.0	181.11	1.16	0.001
113	P-42	357	J-28	J-22	8.0	PVC	120.0	181.11	1.16	0.001
115	P-43	312	J-28	J-29	6.0	PVC	120.0	0.00	0.00	0.000

Active Scenario: Max Hour
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	5,832.70	<Collection: 0 items>	0.00	6,079.26	106.7
34	J-2	5,822.98	<Collection: 0 items>	0.00	6,077.77	110.2
36	J-3	5,818.33	<Collection: 0 items>	0.00	6,076.54	111.7
38	J-4	5,827.17	<Collection: 0 items>	0.00	6,075.26	107.3
40	J-5	5,811.11	<Collection: 0 items>	0.00	6,074.23	113.8
42	J-6	5,783.81	<Collection: 0 items>	0.00	6,070.15	123.9
45	J-7	5,842.07	<Collection: 0 items>	0.00	6,079.33	102.7
47	J-8	5,845.38	<Collection: 0 items>	0.00	6,079.35	101.2
49	J-9	5,847.14	<Collection: 0 items>	0.00	6,079.35	100.5
51	J-10	5,849.19	<Collection: 0 items>	0.00	6,079.35	99.6
53	J-11	5,853.27	<Collection: 1 items>	42.28	6,080.02	98.1
55	J-12	5,843.85	<Collection: 0 items>	0.00	6,080.57	102.4
59	J-13	5,815.92	<Collection: 1 items>	42.28	6,078.71	113.7
62	J-14	5,817.40	<Collection: 1 items>	32.06	6,074.83	111.4
65	J-15	5,810.42	<Collection: 1 items>	20.01	6,076.54	115.1
68	J-16	5,807.48	<Collection: 0 items>	0.00	6,075.26	115.9

Active Scenario: Max Hour
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
72	J-17	5,834.19	<Collection: 1 items>	35.18	6,077.92	105.4
74	J-18	5,820.40	<Collection: 1 items>	37.87	6,076.49	110.8
77	J-19	5,822.06	<Collection: 1 items>	39.55	6,075.34	109.6
80	J-20	5,810.83	<Collection: 1 items>	28.78	6,074.53	114.1
83	J-21	5,843.43	<Collection: 1 items>	25.74	6,077.60	101.3
85	J-22	5,830.42	<Collection: 1 items>	37.87	6,076.48	106.5
88	J-23	5,830.12	<Collection: 1 items>	13.73	6,075.52	106.2
103	J-24	5,841.05	<Collection: 1 items>	8.07	6,077.91	102.5
105	J-25	5,841.00	<Collection: 0 items>	0.00	6,077.91	102.5
107	J-26	5,845.33	<Collection: 1 items>	1.64	6,077.60	100.5
109	J-27	5,858.25	<Collection: 0 items>	0.00	6,077.60	94.9
111	J-28	5,833.23	<Collection: 1 items>	0.00	6,076.80	105.4
114	J-29	5,853.00	<Collection: 0 items>	0.00	6,076.80	96.8

Active Scenario: Max Hour

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
35	P-2	837	J-1	J-2	12.0	PVC	120.0	761.38	2.16	0.002
37	P-3	695	J-2	J-3	12.0	PVC	120.0	761.38	2.16	0.002
39	P-4	914	J-3	J-4	12.0	PVC	120.0	670.78	1.90	0.001
41	P-5	575	J-4	J-5	12.0	PVC	120.0	765.94	2.17	0.002
43	P-6	1,025	J-5	J-6	12.0	PVC	120.0	1,177.73	3.34	0.004
44	P-7	424	J-6	R-2 (N71.1)	12.0	PVC	120.0	1,177.73	3.34	0.004
46	P-8	498	J-1	J-7	12.0	PVC	120.0	-195.83	0.56	0.000
48	P-9	174	J-7	J-8	12.0	PVC	120.0	-195.83	0.56	0.000
50	P-10	90	J-8	J-9	12.0	PVC	120.0	0.00	0.00	0.000
52	P-11	105	J-9	J-10	12.0	PVC	120.0	0.00	0.00	0.000
54	P-12	640	J-8	J-11	8.0	PVC	120.0	-195.83	1.25	0.001
56	P-13	710	R-1 (N24)	J-12	12.0	PVC	120.0	1,542.79	4.38	0.007
57	P-14	438	J-12	J-1	12.0	PVC	120.0	1,010.74	2.87	0.003
58	P-15	373	J-11	J-12	8.0	PVC	120.0	-238.11	1.52	0.001
60	P-16	849	J-12	J-13	8.0	PVC	120.0	293.94	1.88	0.002
64	P-19	479	J-14	J-5	8.0	PVC	120.0	217.41	1.39	0.001
66	P-20	1,318	J-13	J-15	8.0	PVC	120.0	251.66	1.61	0.002
67	P-21	234	J-15	J-3	8.0	PVC	120.0	-10.98	0.07	0.000
69	P-22	233	J-4	J-16	8.0	PVC	120.0	6.85	0.04	0.000
70	P-23	265	J-16	J-14	8.0	PVC	120.0	249.47	1.59	0.002
71	P-24	833	J-15	J-16	8.0	PVC	120.0	242.63	1.55	0.002
73	P-25	284	J-1	J-17	8.0	PVC	120.0	445.19	2.84	0.005
75	P-26	1,396	J-17	J-18	8.0	PVC	120.0	194.42	1.24	0.001
76	P-27	254	J-18	J-3	8.0	PVC	120.0	-79.62	0.51	0.000
78	P-28	1,031	J-18	J-19	8.0	PVC	120.0	203.94	1.30	0.001
79	P-29	270	J-19	J-4	8.0	PVC	120.0	102.00	0.65	0.000
81	P-30	616	J-19	J-20	8.0	PVC	120.0	223.15	1.42	0.001
82	P-31	297	J-20	J-5	8.0	PVC	120.0	194.37	1.24	0.001
84	P-32	274	J-17	J-21	8.0	PVC	120.0	207.52	1.32	0.001
87	P-34	274	J-22	J-18	8.0	PVC	120.0	-32.22	0.21	0.000

Active Scenario: Max Hour

FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
89	P-35	1,150	J-22	J-23	8.0	PVC	120.0	174.49	1.11	0.001
90	P-36	249	J-23	J-19	8.0	PVC	120.0	160.76	1.03	0.001
104	P-37	447	J-17	J-24	8.0	PVC	120.0	8.08	0.05	0.000
106	P-38	488	J-24	J-25	6.0	PVC	120.0	0.00	0.00	0.000
108	P-39	152	J-21	J-26	8.0	PVC	120.0	1.64	0.01	0.000
110	P-40	165	J-26	J-27	6.0	PVC	120.0	0.00	0.00	0.000
112	P-41	905	J-21	J-28	8.0	PVC	120.0	180.14	1.15	0.001
113	P-42	357	J-28	J-22	8.0	PVC	120.0	180.14	1.15	0.001
115	P-43	312	J-28	J-29	6.0	PVC	120.0	0.00	0.00	0.000

Active Scenario: Max Day

Fire Flow Node FlexTable: Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?	Pressure (Maximum) (psi)
J-1	True	1,500.00	1,500.00	3,499.99	20.0	99.9	89.1	J-27	True	106.9
J-2	True	1,500.00	1,500.00	3,499.99	20.0	101.7	89.5	J-27	True	110.5
J-3	True	1,500.00	1,500.00	3,499.99	20.0	104.6	89.6	J-27	True	112.0
J-4	True	1,500.00	1,500.00	3,499.99	20.0	100.6	90.4	J-27	True	107.6
J-5	True	1,500.00	1,500.00	3,499.99	20.0	107.8	91.2	J-27	True	114.0
J-6	True	1,500.00	1,500.00	3,499.99	20.0	121.2	94.0	J-27	True	123.9
J-7	True	1,500.00	1,500.00	3,499.99	20.0	92.1	89.1	J-10	True	102.9
J-8	True	1,500.00	1,500.00	3,499.99	20.0	89.6	87.9	J-10	True	101.4
J-9	True	1,500.00	1,500.00	3,499.99	20.0	87.6	86.7	J-10	True	100.7
J-10	True	1,500.00	1,500.00	3,499.99	20.0	85.4	87.6	J-9	True	99.8
J-11	True	4,000.00	4,028.18	4,528.18	20.0	68.9	87.8	J-27	True	98.3
J-12	True	1,500.00	1,500.00	3,499.99	20.0	96.4	90.2	J-27	True	102.6
J-13	True	4,000.00	4,028.18	4,528.18	20.0	61.6	88.2	J-27	True	113.9
J-14	True	4,000.00	4,021.37	4,521.37	20.0	85.1	88.1	J-27	True	111.6
J-15	True	4,000.00	4,013.34	4,513.34	20.0	94.9	87.5	J-27	True	115.4
J-16	True	1,500.00	1,500.00	3,499.99	20.0	104.2	90.3	J-27	True	116.1
J-17	True	1,500.00	1,523.45	3,523.44	20.0	90.1	80.9	J-27	True	105.7
J-18	True	1,500.00	1,525.25	3,525.24	20.0	99.8	87.5	J-27	True	111.1
J-19	True	1,500.00	1,526.36	3,526.35	20.0	98.7	89.6	J-27	True	109.8
J-20	True	1,500.00	1,519.19	3,519.18	20.0	97.3	90.6	J-27	True	114.3
J-21	True	1,500.00	1,517.16	3,517.15	20.0	76.4	70.0	J-27	True	101.6
J-22	True	1,500.00	1,525.25	3,525.24	20.0	89.6	82.1	J-29	True	106.7
J-23	True	1,500.00	1,509.15	3,509.14	20.0	85.2	88.7	J-27	True	106.4
J-24	True	1,500.00	1,505.38	3,505.37	20.0	45.3	45.3	J-25	True	102.7
J-25	True	1,500.00	1,500.00	1,937.77	20.0	20.0	81.9	J-24	True	102.8
J-26	True	1,500.00	1,501.09	3,501.08	20.0	61.4	55.8	J-27	True	100.8
J-27	True	1,500.00	1,500.00	2,958.05	20.0	20.0	71.5	J-26	True	95.2
J-28	True	1,500.00	1,500.00	3,499.99	20.0	78.0	69.4	J-29	True	105.6
J-29	True	1,500.00	1,500.00	2,465.42	20.0	20.0	87.1	J-27	True	97.1

Worksheet for Design Pt 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00570	ft/ft
Diameter	0.67	ft
Discharge	0.24	ft^3/s

Results

Normal Depth	0.21	ft
Flow Area	0.10	ft^2
Wetted Perimeter	0.80	ft
Hydraulic Radius	0.12	ft
Top Width	0.62	ft
Critical Depth	0.23	ft
Percent Full	31.9	%
Critical Slope	0.00462	ft/ft
Velocity	2.48	ft/s
Velocity Head	0.10	ft
Specific Energy	0.31	ft
Froude Number	1.11	
Maximum Discharge	1.18	ft^3/s
Discharge Full	1.09	ft^3/s
Slope Full	0.00028	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	31.87	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.21	ft
Critical Depth	0.23	ft
Channel Slope	0.00570	ft/ft
Critical Slope	0.00462	ft/ft

Worksheet for Design Pt 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.02890	ft/ft
Diameter	0.67	ft
Discharge	0.10	ft³/s

Results

Normal Depth	0.09	ft
Flow Area	0.03	ft²
Wetted Perimeter	0.51	ft
Hydraulic Radius	0.06	ft
Top Width	0.46	ft
Critical Depth	0.14	ft
Percent Full	13.8	%
Critical Slope	0.00469	ft/ft
Velocity	3.41	ft/s
Velocity Head	0.18	ft
Specific Energy	0.27	ft
Froude Number	2.39	
Maximum Discharge	2.65	ft³/s
Discharge Full	2.46	ft³/s
Slope Full	0.00005	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	13.77	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.09	ft
Critical Depth	0.14	ft
Channel Slope	0.02890	ft/ft
Critical Slope	0.00469	ft/ft

Worksheet for Design Pt 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00600	ft/ft
Diameter	0.67	ft
Discharge	0.37	ft^3/s

Results

Normal Depth	0.27	ft
Flow Area	0.13	ft^2
Wetted Perimeter	0.91	ft
Hydraulic Radius	0.14	ft
Top Width	0.66	ft
Critical Depth	0.28	ft
Percent Full	39.6	%
Critical Slope	0.00477	ft/ft
Velocity	2.85	ft/s
Velocity Head	0.13	ft
Specific Energy	0.39	ft
Froude Number	1.13	
Maximum Discharge	1.21	ft^3/s
Discharge Full	1.12	ft^3/s
Slope Full	0.00065	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	39.59	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.28	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00477	ft/ft

Worksheet for Design Pt 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00220	ft/ft
Diameter	1.00	ft
Discharge	0.41	ft^3/s

Results

Normal Depth	0.31	ft
Flow Area	0.21	ft^2
Wetted Perimeter	1.18	ft
Hydraulic Radius	0.18	ft
Top Width	0.92	ft
Critical Depth	0.26	ft
Percent Full	30.9	%
Critical Slope	0.00403	ft/ft
Velocity	1.98	ft/s
Velocity Head	0.06	ft
Specific Energy	0.37	ft
Froude Number	0.74	
Maximum Discharge	2.12	ft^3/s
Discharge Full	1.97	ft^3/s
Slope Full	0.00009	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	30.92	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 4

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.26	ft
Channel Slope	0.00220	ft/ft
Critical Slope	0.00403	ft/ft

Worksheet for Design Pt 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.04000	ft/ft
Diameter	0.67	ft
Discharge	0.04	ft³/s

Results

Normal Depth	0.05	ft
Flow Area	0.01	ft²
Wetted Perimeter	0.39	ft
Hydraulic Radius	0.04	ft
Top Width	0.37	ft
Critical Depth	0.09	ft
Percent Full	8.2	%
Critical Slope	0.00505	ft/ft
Velocity	2.92	ft/s
Velocity Head	0.13	ft
Specific Energy	0.19	ft
Froude Number	2.67	
Maximum Discharge	3.11	ft³/s
Discharge Full	2.89	ft³/s
Slope Full	0.00001	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	8.20	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 5

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.05	ft
Critical Depth	0.09	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00505	ft/ft

Worksheet for Design Pt 6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00500	ft/ft
Diameter	1.00	ft
Discharge	0.50	ft³/s

Results

Normal Depth	0.28	ft
Flow Area	0.18	ft²
Wetted Perimeter	1.11	ft
Hydraulic Radius	0.16	ft
Top Width	0.90	ft
Critical Depth	0.29	ft
Percent Full	27.7	%
Critical Slope	0.00403	ft/ft
Velocity	2.81	ft/s
Velocity Head	0.12	ft
Specific Energy	0.40	ft
Froude Number	1.11	
Maximum Discharge	3.20	ft³/s
Discharge Full	2.98	ft³/s
Slope Full	0.00014	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	27.74	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 6

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.29	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00403	ft/ft

Worksheet for Design Pt 7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00220	ft/ft
Diameter	1.00	ft
Discharge	0.17	ft³/s

Results

Normal Depth	0.20	ft
Flow Area	0.11	ft²
Wetted Perimeter	0.92	ft
Hydraulic Radius	0.12	ft
Top Width	0.80	ft
Critical Depth	0.17	ft
Percent Full	19.8	%
Critical Slope	0.00423	ft/ft
Velocity	1.54	ft/s
Velocity Head	0.04	ft
Specific Energy	0.24	ft
Froude Number	0.73	
Maximum Discharge	2.12	ft³/s
Discharge Full	1.97	ft³/s
Slope Full	0.00002	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	19.83	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 7

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.17	ft
Channel Slope	0.00220	ft/ft
Critical Slope	0.00423	ft/ft

Worksheet for Design Pt 8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00220	ft/ft
Diameter	1.00	ft
Discharge	0.77	ft³/s

Results

Normal Depth	0.43	ft
Flow Area	0.33	ft²
Wetted Perimeter	1.44	ft
Hydraulic Radius	0.23	ft
Top Width	0.99	ft
Critical Depth	0.37	ft
Percent Full	43.3	%
Critical Slope	0.00407	ft/ft
Velocity	2.36	ft/s
Velocity Head	0.09	ft
Specific Energy	0.52	ft
Froude Number	0.73	
Maximum Discharge	2.12	ft³/s
Discharge Full	1.97	ft³/s
Slope Full	0.00033	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	43.34	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Pt 8

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.37	ft
Channel Slope	0.00220	ft/ft
Critical Slope	0.00407	ft/ft

Worksheet for Filing 8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00790	ft/ft
Diameter	1.00	ft
Discharge	0.89	ft³/s

Results

Normal Depth	0.33	ft
Flow Area	0.23	ft²
Wetted Perimeter	1.23	ft
Hydraulic Radius	0.19	ft
Top Width	0.94	ft
Critical Depth	0.40	ft
Percent Full	33.2	%
Critical Slope	0.00411	ft/ft
Velocity	3.91	ft/s
Velocity Head	0.24	ft
Specific Energy	0.57	ft
Froude Number	1.40	
Maximum Discharge	4.03	ft³/s
Discharge Full	3.74	ft³/s
Slope Full	0.00045	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	33.18	%
Downstream Velocity	Infinity	ft/s

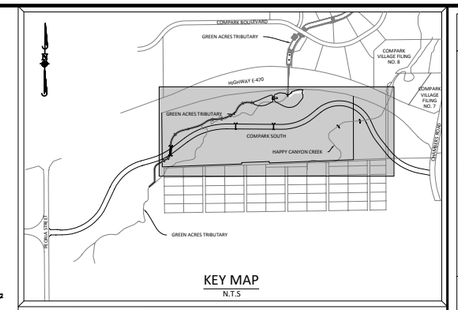
Worksheet for Filing 8

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.40	ft
Channel Slope	0.00790	ft/ft
Critical Slope	0.00411	ft/ft

APPENDIX C

Maps/Plans



KEY MAP
N.T.S

SOURCE BENCHMARKS:

DOUGLAS COUNTY BM 1.115010
A DOUGLAS COUNTY GIS MONUMENT SET IN CONCRETE LOCATED APPROXIMATELY 130 FEET SOUTHWESTERLY OF THE CENTERLINE OF CHAMBERS ROAD AND 95 FEET NORTHWESTERLY OF THE CENTERLINE OF COMPARK BOULEVARD. ELEVATION = 5752.84 (NAVD 88)

COMPARK VILLAGE FIL. NO. 3
COMPARK VILLAGE FIL. NO. 4
COMPARK VILLAGE FIL. NO. 6
E-470
GREEN ACRES TRIB
COMPARK SOUTH PA-13
COMPARK SOUTH PA-14
COMPARK SOUTH PA-15
COMPARK SOUTH PA-16
COMPARK SOUTH PA-17
COMPARK SOUTH PA-18
PA-A
PA-B
PA-C
HAPPY CANYON CREEK
GRAND VIEW ESTATES
2nd STREET
3rd STREET
4th STREET
5th STREET
D.P. 1
D.P. 2
D.P. 3
D.P. 4
D.P. 5
D.P. 6
D.P. 7
D.P. 8
D.P. 9
SSMH - 14
SSMH-13
SSMH-12
SSMH - 11
SSMH-10
SSMH-9
SSMH-8
SSMH-7
SSMH-6
SSMH-5
SSMH-18
SSMH-3
SSMH-1
SSMH-2
SSMH-19
SSMH-15
SSMH-16
8" SAN
12" SAN
EX MH

811 Know what's below. Call before you dig.

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EG		
	09/2016	B REVISED PER STONEGATE 5/17/16 LETTER
	11/2015	A 1ST SUBMITTAL

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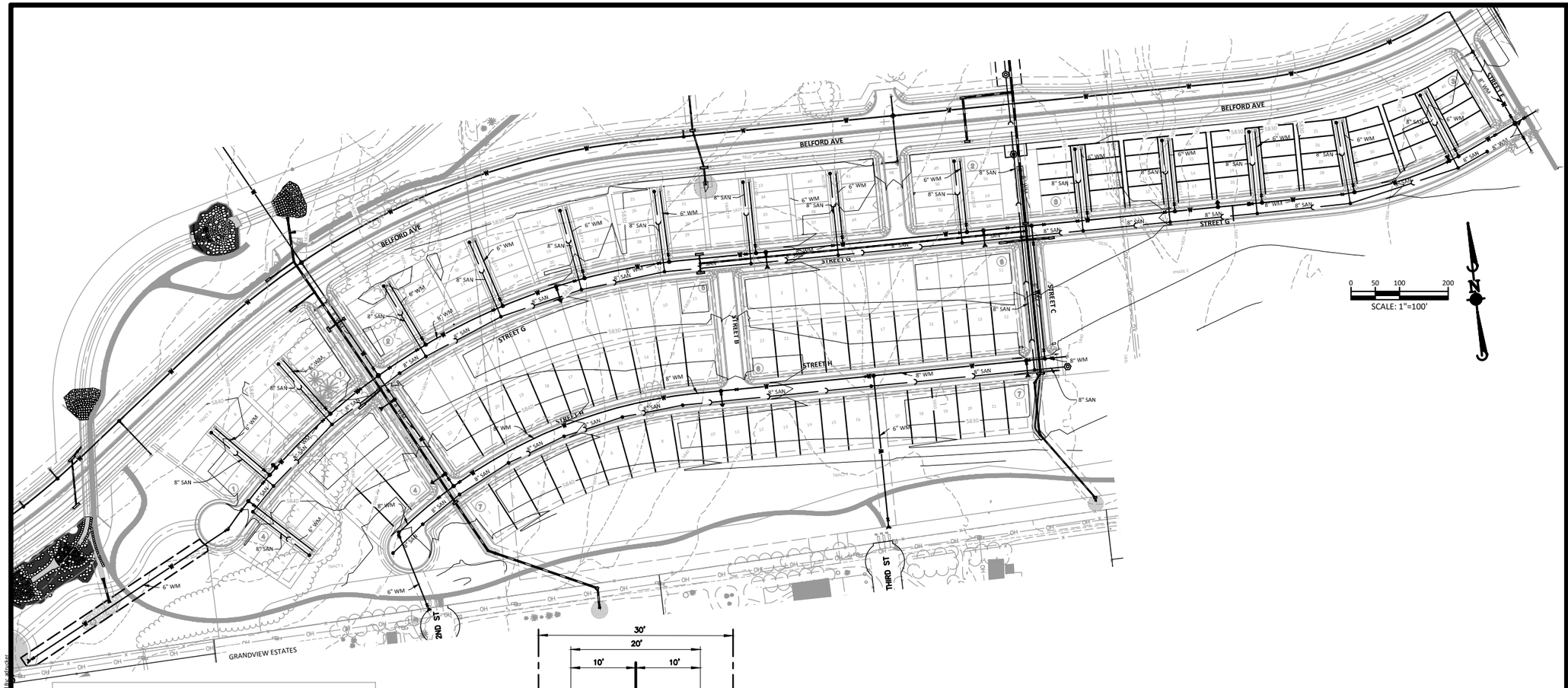
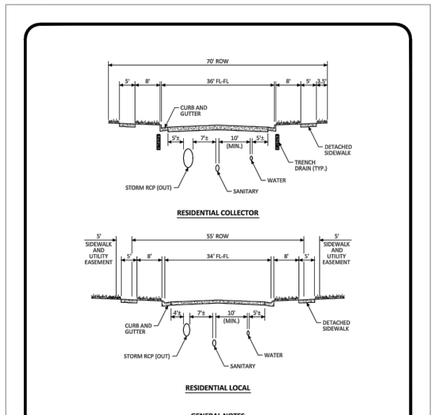
COMPARK VILLAGE SOUTH
TOWN OF PARKER, COLORADO
SANITARY SEWER EXHIBIT

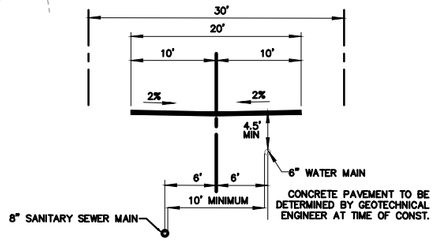
PROJ. MGR.: RLB
PROJ. ASSOC.: ASD
DRAWN BY: ETG
DATE: 11/2015
SHEET 1 OF 1
CLCPKC3

PENDING APPROVAL

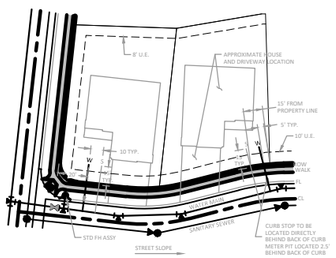
Plotted: 11/7/2016 3:43 PM Dwg Name: P:\Cipkc3\ComSouth04-Master-San & Water\Documents\Engineering\Utility Report\Sanitary Sewer\CLCPKC3-Offsite-01.dwg Updated By: dwata







TYPICAL 20' ALLEY CROSS-SECTION
N.T.S.



TYPICAL SINGLE FAMILY LOT SERVICE DETAIL
N.T.S.

NOTE:
SERVICE LOCATIONS ARE TYPICAL, UNLESS OTHERWISE NOTED. REFER TO STREET & UTILITY PLAN AND PROFILES, AND AREA GRADING PLAN FOR EXACT LOCATIONS.

TOWN OF PARKER BUILDING DEPT FIRE LIFE SAFETY APPROVAL

ALL FIRE HYDRANTS SHALL BE INSTALLED ACCORDING TO WATER UTILITY STANDARDS. THE NUMBER AND LOCATIONS OF THE FIRE HYDRANTS AS SHOWN ON THE OVERALL UTILITY PLAN ARE CORRECT AS SPECIFIED BY THE TOWN OF PARKER, COMMUNITY DEVELOPMENT DEPARTMENT.

BY:

(SIGNATURE OF FIRE CODE OFFICIAL OR DESIGNATED REPRESENTATIVE)

DATE SIGNED

NOTE: UNDERGROUND FIRE LINE (UFL) SUBMITTAL DOCUMENTS MUST MEET THE REQUIREMENTS OF NFPA 24 WHEN SUBMITTING FOR REVIEW

DISTRICT APPROVALS

THESE DESIGNS, PLANS, AND CONTRACT DOCUMENTS ARE REVIEWED FOR CONCEPT AND GENERAL CONFORMANCE TO THE DISTRICT'S MINIMUM STANDARDS ONLY, AND THE PRIMARY RESPONSIBILITY FOR DESIGN ADEQUACY IS TO REMAIN WITH THE ENGINEER OF RECORD. THIS REVIEW DOES NOT IMPLY RESPONSIBILITY BY EITHER THE STONEGATE VILLAGE METROPOLITAN DISTRICT OR THE DISTRICT ENGINEER FOR COMPLETENESS, ACCURACY OR CORRECTNESS OF CALCULATIONS. THE REVIEW DOES NOT IMPLY THAT QUANTITIES OF ITEMS INDICATED ON THE PLANS ARE THE FINAL QUANTITIES REQUIRED. THE REVIEW SHALL NOT BE CONSTRUED FOR ANY REASON AS ACCEPTANCE OF FINANCIAL RESPONSIBILITY BY THE STONEGATE VILLAGE METROPOLITAN DISTRICT FOR ADDITIONAL ITEMS AND ADDITIONAL QUANTITIES OF ITEMS SHOWN THAT MAY BE REQUIRED DURING THE CONSTRUCTION PHASE.

APPROVED FOR CONSTRUCTION WITHIN ONE YEAR OF THE EARLIEST OF THESE DATES:

BY _____ DATE _____
STONEGATE VILLAGE METROPOLITAN DISTRICT ENGINEER

BY _____ DATE _____
STONEGATE VILLAGE METROPOLITAN DISTRICT MANAGER

Manhard CONSULTING LTD
Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
Construction Managers • Environmental Scientists • Landscape Architects • Planners

COMPARK VILLAGE SOUTH FILING NO. 2
TOWN OF PARKER, COLORADO
OVERALL UTILITY PLAN

PROJ. MGR.: RJM
PROJ. ASSOC.: BRB
DRAWN BY: ETG
DATE: 12/2015

SHEET 3 OF 19
CLCPKC3

FIRST SUBMITTAL

COMPARK BUSINESS CAMPUS

Available Inventory 2016
WASTEWATER SFE MAP

Revised October 11, 2016

L.S. Cap. - 1343 SFE
WWTP Cap. - 1250 SFE
Available SFE L.P. - 250 SFE

LAND USE

- *Office and Flex Space*
- *Retail*
- *Commercial*
- *Single Family Residential*
- *Mixed Use / Residential Commercial*
- *Light Industrial*
- *Specialty Commercial / Retail*

WASTEWATER	
North Side	
In-Service	532 SFE
Available	140 SFE
	672 SFE
South Side	
Available	533 SFE
Allocated	**1205 SFE**

Plotted: 10/3/2016 3:44 PM Dwg Name: P:\Clcpkc\dwg\Eng\Utilities\SFE Map Exhibit_20160930.dwg Updated By: giwata

APPENDIX C

Reference Reports

STONEGATE

c/o Community Resource Services of Colorado, LLC
7995 E. Prentice Ave., Suite 103E
Greenwood Village, CO 80111
303-381-4960 Office
303-381-4961 fax

October 29, 2015

VIA E-MAIL
AND U.S. MAIL

Michael P. Vickers
MPV Compark Management, LLC
280 Columbine St., Suite 303
Denver, CO 80206

Re: Commitment to Serve New District in Compark South

Michael:

This letter concerns your request for a commitment to provide water and wastewater service to the area known as Compark South, through a yet to be organized metropolitan district. The Stonegate Village Metropolitan District (SVMD) commits to providing water and wastewater services to the new Compark South district consistent with terms of the Regional Facilities Agreement (RFA) between SVMD and Compark Business Center Metropolitan District, 4th Addendum. In the alternative, SVMD may provide water and wastewater service to Compark South in accordance with the terms you presented to the SVMD Board on October 21, 2015, if, after further evaluation those terms are deemed acceptable by the Board.

Of course, SVMD's commitment to serve under terms equivalent to the RFA or the new terms is subject to the parties entering into a mutually acceptable agreement.

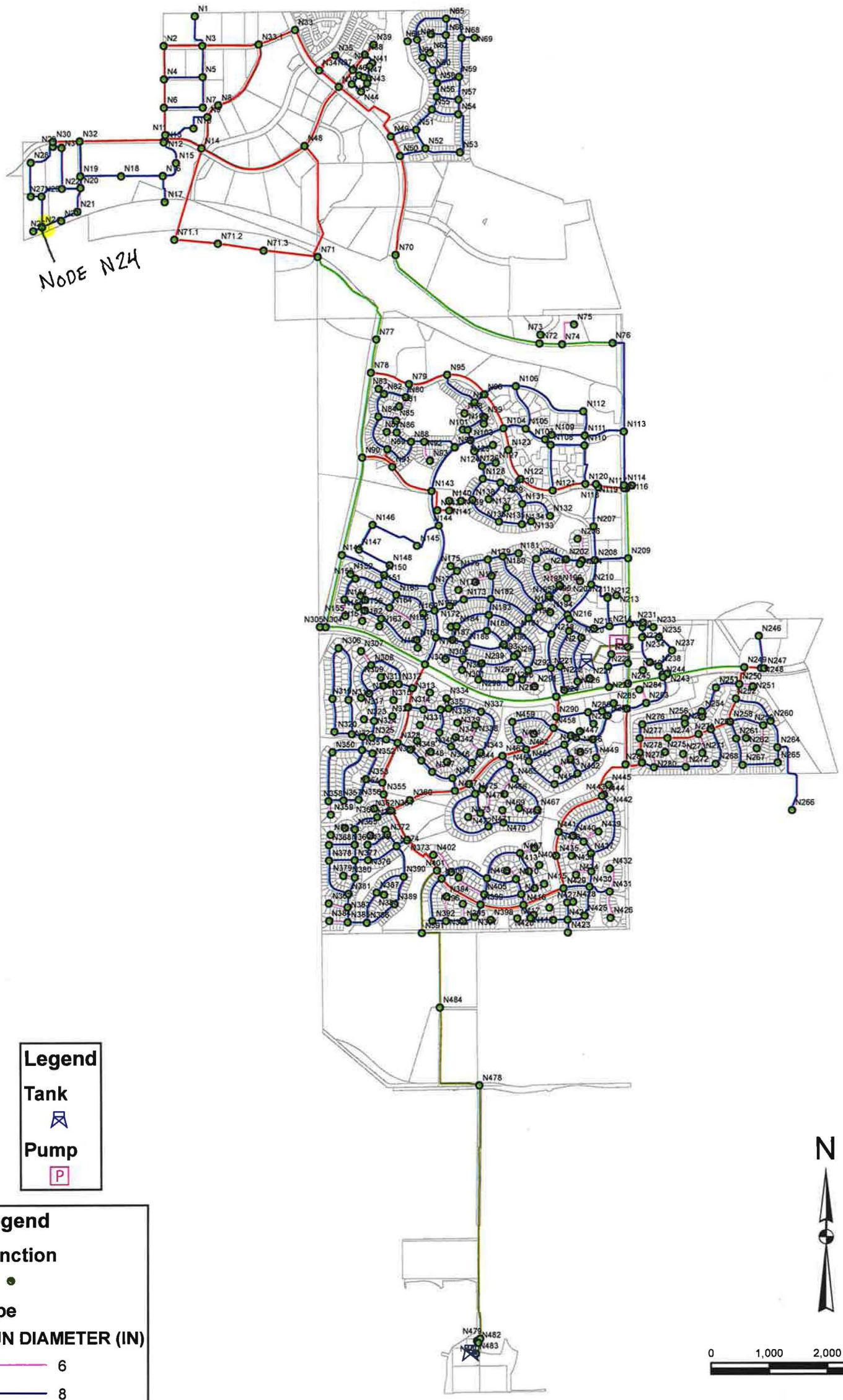
Please let me know if you have any questions.
Sincerely,

Kurt C. Schlegel
District Manager

cmp/rgc
cc: SVMD Board of Directors

Document Path: H:\Working Files\Document Files\Stonegate\040.007.00 - SVMD Master Plan\Water Model\WaterModel_Final Report_Buildout System_11x17.mxd

STONEGATE VILLAGE METROPOLITAN DISTRICT
BUILDOUT SYSTEM
OVERALL SYSTEM INFORMATION



Legend

Tank

Pump

Legend

Junction

Pipe

RUN DIAMETER (IN)

- 6
- 8
- 12
- 16
- 20
- 24

N

0 1,000 2,000 4,000 Feet

SVMD 2016 MASTER PLAN		
TST INFRASTRUCTURE, LLC CONSULTING ENGINEERS	WATER MODEL (BUILDOUT SYSTEM)	
	OVERALL SYSTEM INFORMATION	
	JOB NO. 040.007.00	DATE 1/29/2016

Stonegate Village Metropolitan District
Compark South Pressures from Buildout System Modeling
6/24/2016

Node #	SFE at Node Total	Static Pressure (psi)	Average Day Demand Pressure (psi)	Max Day Demand Pressure (psi)	Peak Hour Demand Pressure (psi)	Max Day Demand + 4000 gpm Fire Flow @ N2 Pressure (psi)
N14	48	135.41	132.87	120.54	103.91	42.80
N71	0	138.44	135.98	123.99	107.81	60.52
N71.1	189	131.51	128.97	116.64	100.01	44.49
N71.2	189	119.37	116.85	104.54	87.95	34.90
N71.3	189	129.34	126.83	114.63	98.17	47.88
N24	0	102.91	100.37	88.04	71.40	8.40

Note:

SFE = Single Family Equivalent
Static pressure based on 3.6 MG tank water level of 6067.75 ft
Average Day Demand = 135 gpcd x 3.0 people/SFE x Number of SFE
Max Day Demand = 2.6 x Average Day Demand
Peak Hour Demand = 3.9 x Average Day Demand

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Utility Operations

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Englewood, CO 80112
303-768-0179

Stonegate Village Metropolitan District
c/o Mulhern MRE
Mitch Chambers, District Manager
2 Inverness Drive East, Suite 200
Englewood, CO 80112

October 15, 2013

RE: Compark Lift Station Design Evaluation and Flow Characterization

Dear Mr. Chambers,

This letter provides a summary of Colorado Water Systems' (CWS) evaluation and recommendations for the Compark Lift Station. The purpose of the evaluation was to assess the overall condition of the lift station, and to determine the level of compliance with current regulations and guidelines. Due to the development in the area, particular focus was given to current and ultimate capacity of the lift station.

EXISTING FACILITY LOCATION & SERVICE AREA

The Compark Lift Station is located in the northwest portion of the Stonegate Village Metropolitan District (SVMD), north of Chambers Road as shown in Figure 1 – District Boundary and Vicinity Map.

The lift station receives wastewater flow from both residential and commercial sources. Currently residential sources include apartment and condominium developments to the south and east of the lift station. Commercial sources are located in the western portion of the lift station service area. The existing lift station service area is approximately 30% – 40% built out at this time. The current development of the Lift Station service area is shown on Figure 2 – Compark Lift Station Service Area.

Two Denver Basin groundwater wells are located directly south of the existing lift station.

EXISTING FACILITY DESCRIPTION

Background data and information collected as part of this evaluation included as-built drawings, Supervisory Control and Data Acquisition (SCADA) data, and operation practices. Site visits were conducted to verify as-built information as well as to perform pump draw down tests and observe influent flow rates for the wet well.

The lift station consists of an 11'-0" x 11"-0" x 24'-0" wet well with a total volume of approximately 21,723 gallons. The lift station pumps are located in a dry pit immediately south

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of the wet well. The lift station contains four (4), non-clog centrifugal wastewater pumps. The four pumps are installed in two (2) pump trains with two (2) pumps operating in series in each of the two (2) trains. Wastewater is conveyed to the lift station wet well through a 12-inch diameter gravity sewer main that enters the wet well from the east. CWS investigated the full-flow capacity of the influent gravity sewer. Existing documentation for the gravity sewer does not indicate the current slope of the influent pipe there for a minimum slope that would provide a minimum velocity of 2 feet per second (fps) was assumed. Assuming the minimum velocity of 2 fps the 12-inch diameter gravity sewer has a maximum full flow capacity of 705 gpm. This capacity is sufficient to handle the projected ultimate build-out of the lift station service area of 1,343 Single Family Equivalents (SFEs). SVMD should investigate and survey the inverts of the upstream manhole and the influent discharge into the wet well in order to verify the slope and capacity of the pipe.

The lift station pumps utilize a suction lift to draw the wastewater out of the wet well and pump it through a 6-inch diameter force main along Chambers Road and outfall to the gravity collection system approximately 3,000 feet to the south from the lift station. The Lift Station and force main are located as shown on Figure 2 – Compark Lift Station Service Area.

Pump operation is automated and based on wet well levels. Additional lift station equipment includes control panels located within the dry pit pump room, emergency generator, electrical transformer and switch panels located above ground as well as an overflow pond located to the west of the lift station. The lift station layout as well as a section view of the wet well is shown in Figure 3 – Overall Site Layout and Lift Station Exhibit. Table 1 provides a summary of the existing level set points within the set well and the volumes associated with the level set points. The level set points were collected from the set points as indicated on the control panel within the lift station.

Table 1 – Existing Level Set Points & Associated Wet Well Volumes

SET POINTS	WET WELL LEVEL* (Ft)	WET WELL VOLUME (Gal)
Overflow Invert	19.0	17,195
High Water Alarm	8.0	7,241
Lag Pump On	7.5	6,788
Lead Pump On	7.0	6,336
Pump Off	2.3	2,036

*Measured from bottom of Wet Well

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EXISTING FACILITY OPERATION

During typical lift station operation, the lead pump operates in response to wet well level. The lead pump automatically alternates between the two pumps after each pump cycle of on and off. The lag pump starts up only if flow rate into the wet well exceeds the pumping capacity of the lead pump and the wet well level continues to rise once the lead pump has started. Analysis of the SCADA data indicates that during normal flow conditions the lead pump has adequate capacity to accommodate the entire influent flow.

In the event that the lead pump is unable to keep up with the flow rate into the wet well, the lag pump would start up and both pumps would run until the wet well level was lowered to the pump off level. A natural gas powered emergency generator would provide power to the lift station if utility power was interrupted. An automatic transfer switch, located in the dry pit, would automatically transfer power supply from utility power to the emergency generator in the event of a utility power interruption.

The existing over-flow pond with an approximate capacity of 236,000 gallons provides protection and storage in the case of the lift station being unable to pump wastewater over an extended period of time.

EXISTING FACILITY FLOW RATES

The Compark Lift Station is not currently equipped with influent or effluent flow meters. As a result influent flow rate, effluent flow rate, and pump performance characteristics were estimated based on pump run time data collected from the SCADA system. Field tests were conducted to confirm and validate the results collected from SCADA data. The lift station evaluation was unable to locate an existing Operations and Maintenance (O&M) manual for the lift station or the existing pumps. Due to the lack of an existing O&M manual the pump supplier was contacted and provided a representative pump curve for the pumps that have been installed at the lift station.

Based on the evaluation of the SCADA data the inflow rates to the lift station vary between 10 to 61 gallons per minute (gpm) with an average influent flow rate of 41 gpm. A daily flow curve illustrating the flow rates into the wet well over a 24-hour period is shown in Figure 4 below.

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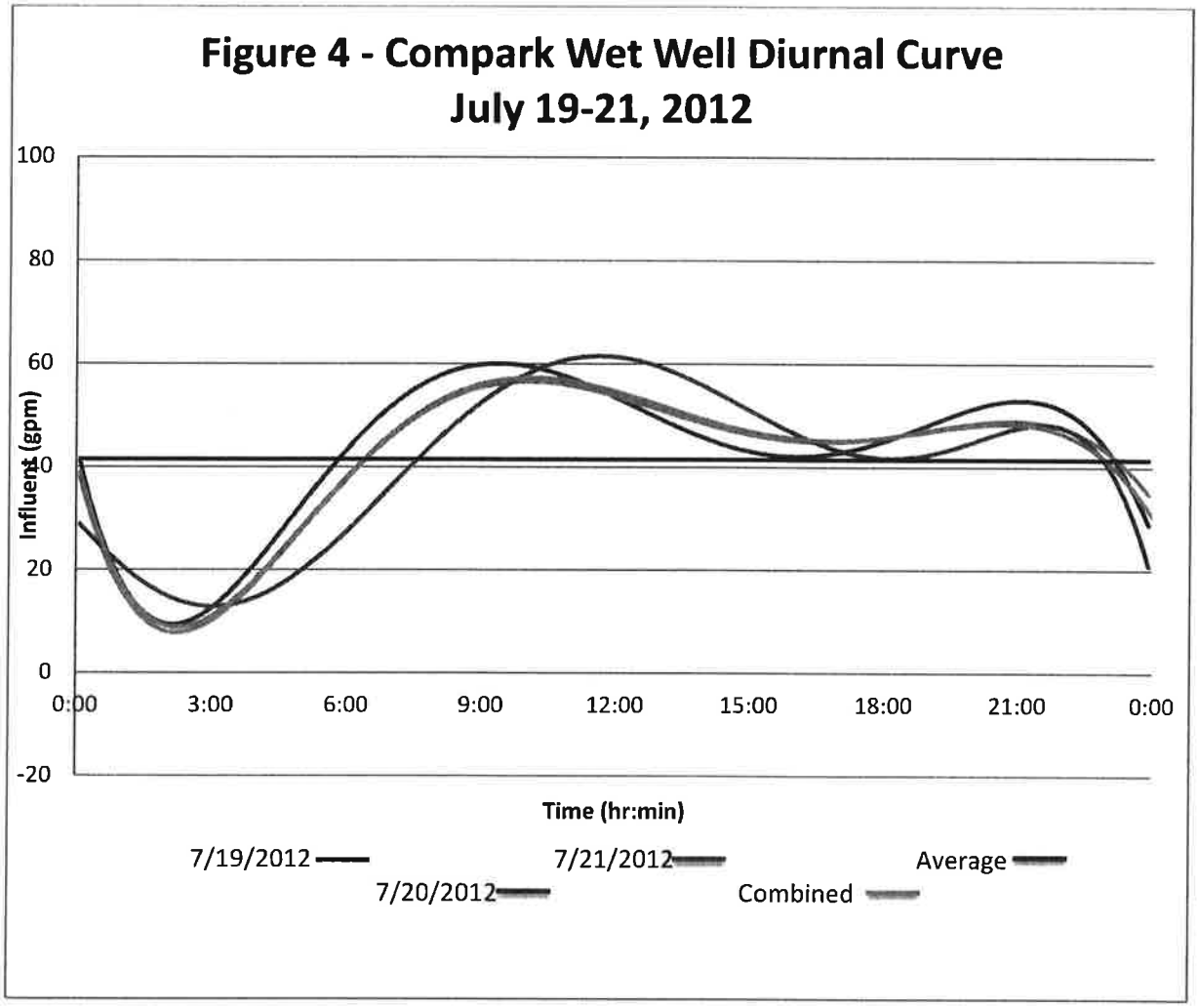

Flow data collected from the SCADA information was graphed for four selected days above. The flow rate over the 24-hour period exhibits a diurnal nature with peaks in the mid-morning and early evening hours. The low flow periods occure in the very early morning hours until the flows begin to rise at approximately 6:00 am and peak at approximately 10:00 am. Flows then remain relatively steady throughout the day until approximately 21:00 (9:00 pm) when a second peak occurs before the late evening hours when the flow diminishes. The average flow rate for the three days that were reviewed is 41 gpm.

Field observations and testing was conducted to verify SCADA data and pump capacity. Field observations included draw down tests which were completed on a week day between 9:00 am and 11:00 am. Pump draw down tests were conducted and the rate which the pumps lowered the wet well level was timed in order to calculate a pumping rate for each of the two pump

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trains. In addition, the influent flow for the wet well was calculated by observing the amount of time required to raise the wet well level with the pumps off. During the field testing the wastewater inflow ranged from 44 to 63 gpm. The influent flows estimated from the field testing are consistent with the time and flow rates developed from the SCADA data and presented on the flow rate curve in Figure 4. During the draw down testing, effluent pumping rates and suction and discharge pressure readings were collected for the two wastewater pumps. The discharge and suction pressure readings were collected from the pressure gauges mounted on the suction and discharge pipes. The pumping rates were calculated based on wet well draw down and averaged to be 476 gpm at 135 feet of head for Pump Train #1 and 468 gpm at 135 feet of head for Pump Train #2.

The wastewater effluent pumping rates and pressure readings were compared to the pump curve supplied by the pump supplier to determine if the rates were reasonable. The design point for the pumps was 450 gpm at 135 feet of head. The field measured pumping rates appear to be consistent with the original design points of the equipment supplied.

The current working volume of the wet well, which is the volume contained between the lead pump on and pump off levels in the wet well is 4,227 gallons. At an average inflow rate of 75 gpm, the time between pump runs is approximately 56 minutes. In addition, it takes approximately 9 minutes for the pumps to pump that volume of wastewater out of the wet well. This leads to approximately 22 pumping cycles in a given average day, or 11 pump runs for each pump. This developed information is consistent with the information that was gathered from the SCADA pump logs.

The recommended number of starts for pumps is at least once an hour, to meet CDPHE's recommended maximum detention time of 1 hour, and not more than 10 starts in an hour based on manufacturer's recommendations for the life of the motor and pump. The existing start and run cycles meet the criteria and will actually increase as more development occurs in the Lift Station's service area.

ANTICIPATED BUILD-OUT CONDITIONS

The Compark Lift Station was originally designed and constructed in 2000. At that time a Site Application (SA-2000) was submitted to the Colorado Department of Public Health and Environment (CDPHE). The SA-2000 identified the anticipated number of Single Family Equivalents (SFE) and average and peak flow rates for the lift station. From the anticipated flow rates, the lift station pumping capacity was determined and the wet well was sized.

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In 2012 an amendment to the original SA-2000 was submitted and approved by CDPHE for a realignment of the existing force main. The 2012 amendment states that the total number of SFEs is still anticipated to reach 1,343 at the final build out of the Lift Station service area. Currently the lift station service area is approximately 35% developed.

The anticipated number of total SFEs identified in the SA-2000 was 1,343. The SA-2000 utilized an average design flow rate of 275 gallons per day (gpd)/SFE to calculate average daily flow. The average daily flow based on the flow criteria as provided in the SA-2000 is 369,325 gpd (256 gpm). The SA-2000 that was submitted identified the average daily flow at 380,000 gpd (264 gpm), a difference of 10,675 gpd.

In addition to the average daily flow, the SA-2000 also calculated a peak flow for the lift station and its service area. The daily peak flow identified in the SA-2000 was 1,040,000 gpd, which equates to a peaking factor of 2.7 based on an average daily flow of 380,000 gpd as identified in the SA-2000.

The SA-2000 identified an additional peak flow rate of 1,100 gpm which equates to a peaking factor of 4.2 based on the average flow rate of 264 gpm, as identified in the SA-2000. It is unclear from the SA-2000 what the 1,100 gpm peak flow rate is describing, it may be an instantaneous hourly peak flow rate, but it is not described as such in the documentation. Based on the inconsistency of the design flow rates as identified in the SA-2000 it was decided to re-evaluate the design flow rates based on calculated values.

As stated above, the anticipated ultimate number of SFE's within the lift station service area is 1,343 and the average daily flow rate per SFE is 275 gpd. From the design values the calculated average daily flow rate is 369,325 gpd (256 gpm). From the calculated average daily flow rate a peaking factor can be calculated.

There are various ways to determine a peaking factor (PF) within a service area. The City and County of Denver Department of Public Works uses a formula:

$$PF = 2.6 * Qa^{-0.16}$$

Qa = Average Flow Rate in cubic feet per second (cfs)

Based on the above formula and using calculated average daily flow rate of 256 gpm (0.570 cfs) the PF for the Compark Lift Station is 2.8. Using this PF, the calculated maximum flow rate for Compark Lift Station is 1,034,110 gpd (718 gpm). The calculated flow rates are summarized below along with the values that were originally developed and submitted in the SA-2000.

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Table 2 - Comparison of Design Values for Compark Lift Station		
PARAMETER	**2000 SITE APPLICATION VALUE**	**CALCULATED REVISED VALUE**
Ultimate Number SFEs	1,343	1,343
Average Daily Flow per SFE	275	275
Average Daily Flow (gpd)	380,000	369,325
Average Flow Rate (gpm)	264	256
Peaking Factor	2.7	2.8
Peak Flow Rate (gpd)	1,040,000	1,034,110
Peak Flow Rate (gpm)	1,100	718

The existing average flow rate at the Lift Station, based on field tests and SCADA data analysis, is approximately 59,040 gpd (41 gpm). This is approximately 16% of the anticipated ultimate average flow rate of 369,325 gpd (256 gpm) as determined above.

Comparing the current developed status of the service area to the current flow rate indicates that the Lift Station has adequate remaining capacity to handle the final build out development of the service area.

ALARM CONDITIONS AND RESPONSE TIME

In the event of a high water alarm or pump failure alarm, the operation staff indicated the procedure is to proceed to the site, assess the problem and call a local pumper/vacuum truck to the site to pump down the wet well. Typically the operations staff can call for the pump truck while in route to the facility, and cancel the request if the site inspection indicates that temporary pumping is not required.

At the current flow rates, a high water alarm or pump failure assumes a pump failure at the Lift Station with the wet well level at the 'High Water' alarm set point (8.0') and a wastewater influent rate of 75 gpm. In this case the available volume within the wet well before wastewater overflows into the overflow pond is approximately 9,956 gallons. This volume provides a response time of approximately 2 hours between the time the operations staff is notified of a high water alarm and wastewater overflows in to the overflow pond. At the final build out influent flow of 256 gpm, the response time before overflow would occur is approximately 40 minutes.

The overflow pond is located immediately west of the Lift Station wet well and has a capacity of approximately 236,000 gallons. At the current average flow rate of 75 gpm, the overflow pond

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provides over 2 days of storage. At the final build out influent flow of 256 gpm, the pond provides over 15 hours of storage.

Discussions with the operations staff and the local pumper/vacuum truck companies have indicated that the typical response for a pump truck varies depending on whether the request is made during normal business hours versus after hours or weekends. The response time for a pump truck to be onsite during a weekday is typically 1 – 2 hours, after hours or on weekends the response time may be as long as 5 hours. In order to provide a measure of safety in the response time 6 hours is used to compare the amount of overflow capacity and storage.

Based on the available response times indicated above the Lift Station has adequate storage and overflow protection in the event of a complete equipment or power failure.

REGULATIONS AND CRITERIA

Regulatory requirements for lift stations are contained in CDPHE's Colorado Design Criteria for Domestic Wastewater Treatment Works, WPC-DR-1. A summary of the WPC-DR-1 criteria pertaining to Wastewater Pumping Station (Lift Stations) is provided in Table 3 below.

TABLE 3 – CDPHE CRITERIA

CDPHE CRITERIA	CRITERIA DESCRIPTION	EXISTING FACILITY MEETS CRITERIA? (Y/N)
Access & Security	Safe access for operations personnel and security to restrict unauthorized access.	Y
Alarm System (Self-Activated)	Self-activated alarm system in case of power failure, pump failure, high wet well water level, or any cause of pump station malfunction. Alarms must be transmitted to a continuously monitored location or operator.	Y
Alarm System (Audio/Visual Device)	A light or horn must be installed at the Lift Station for external observation unless disallowed by local ordinance.	N
Power Supply Backup	Power shall be from at least two independent sources (i.e., different substations or on-site backup power generation with an automatic transfer switch).	Y

?

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Utility Operations

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TABLE 3 – CDPHE CRITERIA (cont.)		
CDPHE CRITERIA	CRITERIA DESCRIPTION	EXISTING FACILITY MEETS CRITERIA? (Y/N)
Wet Well Overflow Storage	In event of an extended power outage or mechanical or electrical failure, the Lift Station must have sufficient storage to contain all wastewater inflow until the Lift Station is restored to operation or portable pumping or hauling of influent is put into place.	Y
Wet Well Redundancy	To provide the ability to remove the wet well from service for maintenance, multiple wet wells, partitions, off-line storage, bypass pumping, etc. should be incorporated into the Lift Station.	Y
Dry Pit Access	Ladder shall be provided with necessary fall prevention equipment for necessary staff.	Y
Sump Pump	Dedicated pump shall be provided to remove accumulated seepage water and water from pump seals, maintenance work and cleanup.	Y
Flow Measurement	All Lift Stations shall have suitable devices, means or methods for measuring, recording and totaling sewage flow.	N
Ventilation	Ventilation of wet wells and dry wells must be consistent with appropriate fire, electrical, and building codes for the intended personnel and equipment use with appropriate devices for continuous or intermittent operation.	Y
Pump Redundancy	No less than two pumping units shall be provided.	Y

CBCMMD to Provide

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TABLE 3 – CDPHE CRITERIA (cont.)		
CRITERIA DESCRIPTION	CRITERIA DESCRIPTION	EXISTING FACILITY MEETS CRITERIA? (Y/N)
Pump Capacity	Pump units shall be sized to accommodate initial and future operating conditions. Pumps shall have capacity to maintain wet well water surface levels below high water alarm at peak flows with largest pump out of service.	Y
Pump Intakes	Individual intakes shall be provided for each pump.	Y
Pump Operation	Pumps must operate automatically, based on wet well level, with provision for manual operation.	Y

RECOMMENDATIONS

The lift station complies with the CDPHE regulations and criteria except for the following items:

- Alarm System (Audio or Visual Device)
  - To meet CDPHE requirements, it is recommended that an alarm activated light be installed at the lift station. This would help to improve the response time un the event that the SCADA system or alarm is inoperable.

- Flow Measurement
  - The SCADA system currently records wet well levels and pump starts and stops. This does allow for a means to calculate pump and influent flow rates. In order to meet current CDPHE criteria, a flow measurement device must be installed at the lift station and flow measurements taken and recorded in the SCADA system. In addition to compliance, a flow measurement device such as a magnetic flow meter would provide accurate, real-time flow data and could be incorporated into the existing SCADA system to allow remote monitoring of pump performance by the District's operation staff. Installation of a flow meter would likely require the addition of a manhole or vault downstream of the lift station wet well.

ADDITIONAL RECOMMENDATIONS

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- Operations and Maintenance (O&M) Practices
  - District staff indicated that there are no O&M manuals or procedures for the Lift Station.
  - It is recommended that O&M manuals be developed and completed for all Lift Station equipment.
  - It is recommended that the wet well be inspected and cleaned on a regular on-going basis. This will require that the wet well be taken out of service temporarily so that personnel can enter and inspect the condition of the concrete and installed piping within the wet well. By-pass pumping will be required in order to temporarily take the wet well out of service.

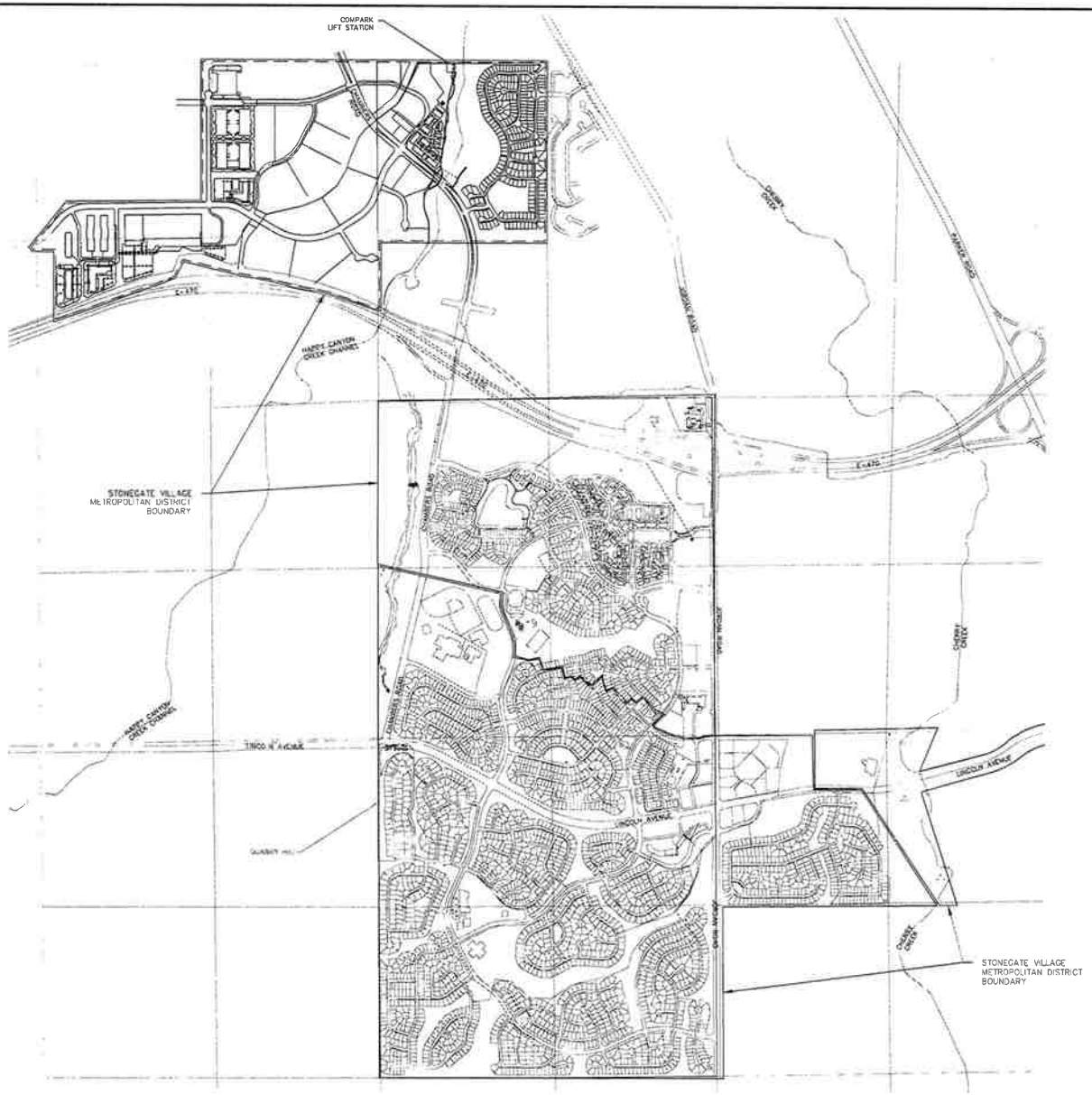
- Emergency Response Plan (ERP)
  - The Cherry Creek Basin Water Quality Authority (CCBWQA) recommends an ERP be developed and included with any Site Application submitted for review.
  - The current ERP for the Compark Lift Station is to contact one of the pumping/hauling services that the District has agreements with.
  - To meet CCBWQA recommendations, the District should develop a written ERP for the Compark Lift Station.

- Flow Measurement
  - For all new lift station installations, CCBWQA recommends differential flow measurement be provided on sewage force mains to help identify potential force main leaks and breaks.
  - To meet CCBWQA recommendations, the District should consider installing a flow measurement device close to the force main outfall. The flow measurement device would likely require the addition of a manhole or vault just prior to the outfall point of the force main.

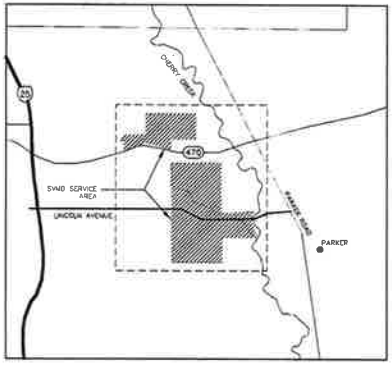
Please contact CWS with any questions.

Sincerely,
Colorado Water Systems, LLC

Dean W. Bedford, P.E.
Project Engineer

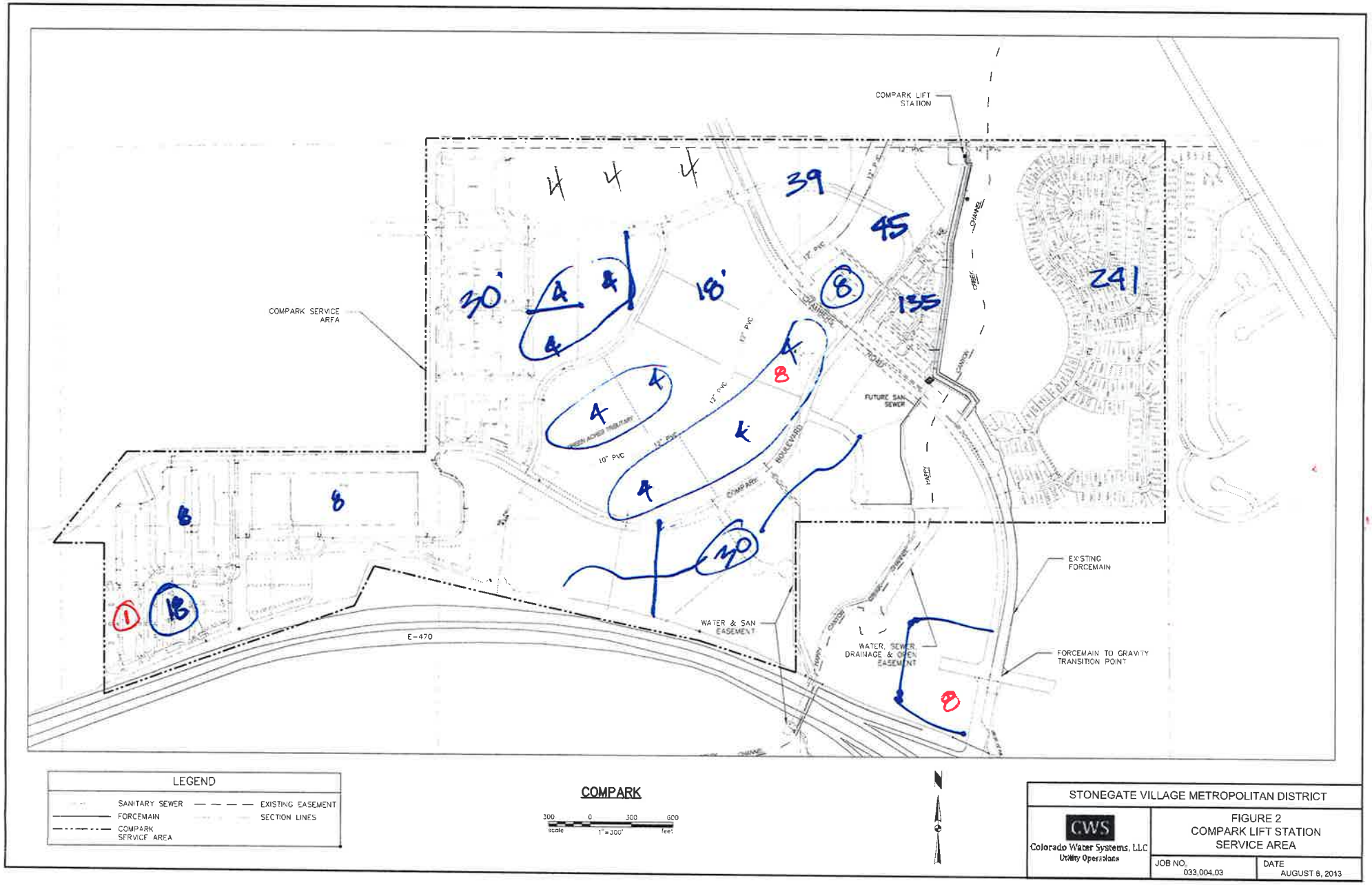


DISTRICT BOUNDARIES
NOT TO SCALE

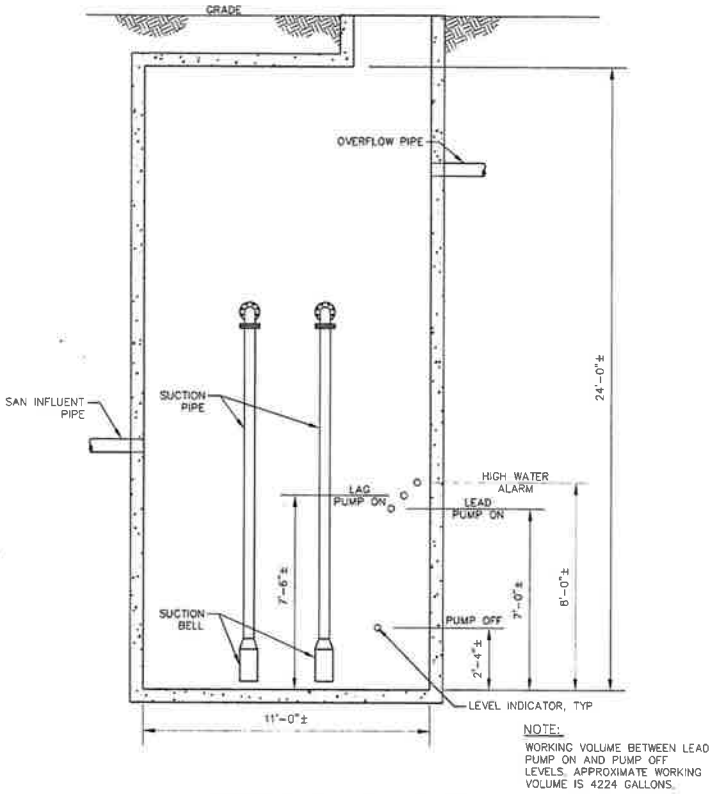


VICINITY MAP
NOT TO SCALE

STONEGATE VILLAGE METROPOLITAN DISTRICT		
CWS Colorado Water Systems, LLC Utility Operations	FIGURE 1 DISTRICT BOUNDARY & VICINITY MAP	
	JOB NO. 033.004.03	DATE AUGUST 8, 2013


COMPARK LIFT STATION
COMPARK SERVICE AREA
FUTURE SAN. SEWER
EXISTING FORCEMAIN
FORCEMAIN TO GRAVITY TRANSITION POINT
WATER & SAN EASEMENT
WATER, SEWER, DRAINAGE & OPEN EASEMENT
E-470
LEGEND
SANITARY SEWER
EXISTING EASEMENT
FORCEMAIN
SECTION LINES
COMPARK SERVICE AREA
COMPARK
300 0 300 600
scale 1" = 300' feet
STONEGATE VILLAGE METROPOLITAN DISTRICT
Colorado Water Systems, LLC
Utility Operations
FIGURE 2
COMPARK LIFT STATION
SERVICE AREA
JOB NO. 033.004.03
DATE AUGUST 8, 2013

COMPARK LIFT STATION SITE OVERVIEW
NOT TO SCALE



COMPARK WET WELL DETAIL
NOT TO SCALE

N

STONEGATE VILLAGE METROPOLITAN DISTRICT

CWS
Colorado Water Systems, LLC
Utility Operations

FIGURE 3 - SITE MAP & LIFT STATION EXHIBIT

JOB NO. 033.004.03

DATE AUGUST 8, 2013

Unofficial - waiting for confirmation of Exhibits A & B and correction of Water Service Ratio definition

AMENDED AND RESTATED REGIONAL WATER AND WASTEWATER SERVICE AGREEMENT

This Amended and Restated Regional Water and Wastewater Service Agreement is made and entered into this 11th day of October, 2016, by and between Stonegate Village Metropolitan District, acting by and through its Water and Sewer Utility Enterprise Funds, and Compark Business Campus Metropolitan District f/k/a E- 470 Business Metropolitan District.

DEFINITIONS

1. **"1997 Regional Facilities Agreement"** - the December 4, 1997 Regional Facilities Agreement between SVMD and E-470 Business Metropolitan District.

2. **"Agreement"** – this Amended and Restated Regional Water and Wastewater Service Agreement.

3. **"Annual Update"** – the annual update, revision, supplement, or review of the SVMD Water and Wastewater Master Plan to reflect the best available information on the Water System and Wastewater System, including the basis and timing of anticipated Capital Costs, as determined appropriate or necessary at the sole discretion of SVMD.

4. **"BNMD"** – Belford North Metropolitan District, a metropolitan district anticipated to be organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services to a portion of Compark South, including water and wastewater services.

5. **"Bonds"** – Collectively the Wastewater Bonds and the Water Bonds.

6. **"BSMD"** – Belford South Metropolitan District, a metropolitan district organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services to a portion of Compark South, including water and wastewater services, whose jurisdictional boundaries are shown on Exhibit A attached hereto and incorporated herein.

7. **"Capital Costs"** - Any costs incurred by SVMD necessary to meet requirements of state or federal laws and regulations, to acquire, develop or maintain a water supply, including costs associated with continued development of a renewable water supply, and for improvements, upgrades, or expansions to the Wastewater System and Water System necessary or appropriate to provide service within the SVMD Service Area. Capital Costs include previous and future payments on Debt or other financial obligations used for the same purposes. Capital Costs do not include the cost of CBCMD Constructed Facilities; which costs are the sole responsibility of CBCMD. Capital Costs include, but are not limited to costs of materials, components, labor costs, change orders, design engineering, construction engineering, landscape architecture, soil testing and inspection, line and systems testing and inspection, site and right of way acquisition costs, and all legal, accounting, and other professional costs incurred in connection with the Capital Costs.

8. **"Capital Cost Share"** – CBCMD's share of a Capital Cost, calculated as a Capital Cost associated with Wastewater System multiplied by Wastewater Service Ratio or a Capital Cost associated with the Water System multiplied by the Water Service Ratio.

9. **"Capital Cost True-Up Payment"** – A payment made by CBCMD to make up for underpayment of Capital Costs resulting from payment through service charges for currently activated SFEs instead of projected SFEs. By way of illustration, based on SVMD's 2016 payments for Wastewater Bonds and the Water Bonds and 575 SFEs of water service and 541 SFEs of wastewater service being served within the Compark Service Area in 2016, and the projected service needs in the SVMD Service Area as currently estimated in Subsection 3.1.1 of this Agreement, the Capital Cost True-Up Payment would be calculated as follows:

	2014 Wastewater Revenue Bonds	2015 Water Revenue Bonds
Estimated System Capacity	5130	5321
Compark SFE Allocation	1205	1237
Compark Portion of Capital Costs	23.5%	23.25%
2016 Bond Costs		
Principal	$ 230,000.00	$ 245,000.00
Interest	$ 537,206.00	$ 599,356.00
	$ 767,206.00	$ 844,356.00
Compark Portion	23.5%	23.25%
Total Due from Compark Service Area	$ 180,293.41	$ 196,312.77
Compark SFEs (Wastewater: 541/1205 = 44.90%) (Water: 575/1237 = 46.48%)	$ (80,951.74)	$ (91,246.18)
Capital Cost True-Up Payment	**$ 99,341.67**	**$ 105,066.59**

10. **"CBCMD"** - Compark Business Campus Metropolitan District f/k/a E- 470 Business Metropolitan District, a metropolitan district organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services, including water and wastewater services, whose jurisdictional boundaries are shown on Exhibit A.

11. **"CBCMD Constructed Facilities"** – water distribution and supply lines, pump stations, facilities, sewage collection lines, lift stations, irrigation lines, storage facilities, effluent land application facilities, storage or disposal areas and facilities, meters and data acquisition systems necessary for tele-monitoring, and any other facilities necessary, in the reasonable opinion of the SVMD, to be constructed by CBCMD and connected to the Wastewater System or Water System, pursuant to Section 4.7 of this Agreement, to connect to the Water System and Wastewater System to provide service to the Compark Service Area.

12. **"CBCMD's Excess Wastewater Service Capacity"** – a portion of the Wastewater System Capacity within the CBCMD Wastewater Service Ratio that is in excess of that needed to provide service within the boundaries of CBCMD and PMD and available for assignment to serve Compark South under this Agreement.

13. **"CBCMD's Excess Water Service Capacity"** – a portion of the Water System Capacity within the CBCMD Water Service Ratio that is in excess of that needed to provide

service within the boundaries of CBCMD and PMD and available for assignment to serve Compark South under this Agreement.

14. **"CHMD"** – Collectively, one or more metropolitan districts to be named the Chambers High Point Metropolitan District and anticipated to be organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services to a portion of Compark South, including water and wastewater services.

15. **"Compark Service Area"** – an area previously described as the "Property" by the RFA, located in Douglas County, Colorado, and which includes Compark South, and is limited to the area described in Exhibit B, attached hereto and incorporated herein.

16. **"Compark South"** – A portion of the Compark Service Area as shown on the attached Exhibit B. Compark South includes the area within the District boundaries of BSMD, and the areas anticipated to be included within the District boundaries of BNMD and CHMD, when those Districts are organized.

17. **"Connection Charge"** – a rate, fee, toll, charge or combinations thereof, for a service user to have the right to make a physical connection between a service line and the Water System or Wastewater System. Connection Charges are imposed each time a connection is made to pay the cost associated with SVMD making, inspecting, or administering the physical connection. A connection charge is imposed in addition to usage fees or charges and System Access Fees.

18. **"Debt"** – the Bonds, future bonds or other debt obligations.

19. **"Effective Date"** – the effective date of this Agreement, October 10, 2016.

20. **"First Amendment to Regional Facilities Agreement"** – the August 31, 1998 First Amendment to the 1997 Regional Facilities Agreement.

21. **"Fourth Amendment to Regional Facilities Agreement"** – the July 3, 2008 Fourth Amendment to the Regional Facilities Agreement.

22. **"Notice of Disagreement"** – a written notice given by one Party to another Party if a dispute arises under this Agreement, explaining the dispute and at least one alternative for a solution.

23. **"Party" and "Parties"** – individually or collectively the signatories to this Agreement.

24. **"PMD"** – E-470 Potomac Metropolitan District, a metropolitan district organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services, including water and wastewater services, whose jurisdictional boundaries are shown on Exhibit A.

25. **"Projected Buildout"** – projected demand for service from the Water System or Wastewater System expressed in SFEs, determined from the land use approvals and existing planning and use data in effect from the applicable municipal or county government.

26. **"RFA"** – collectively the 1997 Regional Facilities Agreement, and the First, Second, Third and Fourth Amendments.

27. **"Resolution Committee"** – the Presidents of the Board of Directors of SVMD and CBCMD involved in a Notice of Disagreement, or designees thereof, and a Colorado registered professional engineer jointly appointed by agreement of the other members, which engineer shall have knowledge of the subject matter of the dispute (i.e., if a water facility is the subject of the dispute, the engineer shall have some knowledge of water systems engineering).

28. **"Rules and Regulations"** – the Rules and Regulations of SVMD adopted, amended and enforced pursuant to §32-1-1001(1)(m), C.R.S.

29. **"Second Amendment to Regional Facilities Agreement"** – the March 15, 1999 Second Amendment to 1997 Regional Facilities Agreement.

30. **"Service Area"** – An area provided water or wastewater service through the Water System or Wastewater System. As of the Effective Date, the SVMD Service Area comprises the property within the boundaries of SVMD, the boundaries of Lincoln Park Metropolitan District, and the Compark Service Area.

31. **"Service Charges"** – reoccurring periodic charges for service provided through the Water System and Wastewater System. Service charges currently are set by SVMD 2015 Resolution dated August 19, 2015 and include water and wastewater monthly usage fees and a WISE Renewable Water Fee.

32. **"SFE"** – the equivalent water or sewer service demand associated with a single family residential unit, as from time to time set forth and revised in the Rules and Regulations. As of the Effective Date, for purposes of planning and considering water treatment plant capacity and wastewater treatment plant capacity, one SFE of Water Service corresponds to approximately 1,053 gallons per day of treated water and one SFE of wastewater service corresponds to approximately 242.4 gallons per day of wastewater treatment. The number of SFEs associated with any specific use will be determined based on a standard conversion table or Rules and Regulations adopted by SVMD and amended from time to time.

33. **"SVMD"** – Stonegate Village Metropolitan District, a metropolitan district organized and operated pursuant to the provisions of Article 1, Title 32, C.R.S., to provide services, including water and wastewater services, acting by and through its Water Utility Enterprise Fund and Sewer Utility Enterprise Fund, whose jurisdictional boundaries are shown on Exhibit A.

34. **"SVMD Water and Wastewater Master Plan"** – a master plan of the Water System and the Wastewater System that is under development by SVMD at the time of the Effective Date and which is anticipated to be adopted by SVMD in 2016. The SVMD Water and Wastewater Master Plan will include, but not be limited to, a renewable water capital plan to

identify infrastructure and water rights necessary to provide renewable water supplies within the Service Area.

35. **"System Access Fee"** – a fee imposed on an individual service user within the Compark Service Area prior to connection to enable the service user to receive service from the Water System and Wastewater System. The System Access Fee as of the Effective Date is $2,975.70 per SFE combined water and sewer tap. The System Access Fee shall be adjusted annually on September 1 of each year by the percentage increase or decrease in inflation as defined in Art. X, Sec. 20 of the Colorado Constitution, as determined by SVMD.

36. **"Termination Notice"** – written notice provided by SVMD to CBCMD of SVMD's intent to terminate or suspend additional water and wastewater connections utilizing capacity in the Water System or Sewer System by CBCMD, which shall contain at least:

a. the specific cause for the proposed termination or suspension, including a demonstrated justification therefor;

b. the duration of the proposed termination or suspension;

c. at least one reasonable cure that CBCMD may implement that would be acceptable to SVMD to avoid the termination or suspension, if possible. SVMD shall use best efforts to suggest a cure that will allow continued availability of service and new taps to CBCMD at all times, and shall, if not prohibited by law, continue to make continued service and taps available without interruption up to the capacity purchased by CBCMD if the suggested cure is actually implemented, and assuming compliance with the Rules and Regulations by the individual customer;

d. the method to be used by SVMD to continue service to taps within CBCMD previously connected to the Water System or Wastewater System, assuming continued adherence to the SVMD Rules and Regulations by the owners of such taps;

e. the name of a person who can provide more information; and

f. the effective date for commencement of the termination or suspension.

37. **"Third Amendment to Regional Facilities Agreement"** – the August 15, 2001 Third Amendment to the 1997 Regional Facilities Agreement.

38. **Wastewater Bonds"** – Wastewater Enterprise Revenue Bonds, Series 2014 issued by SVMD to improve and expand the Wastewater System.

39. **"Wastewater Service Capacity"** – the capacity of the Wastewater System, which may change from time to time, but which currently is estimated at 1,100,000 gallons per day (1.1 mgd).

40. **"Wastewater Service Ratio"** - the ratio of wastewater SFEs based on the Projected Buildout of the Compark Service Area to the SVMD Service Area, currently calculated as 23.5 % (1,205 SFEs Compark Service Area; 5,130 SFEs SVMD Service Area).

41. **"Wastewater System"** – the SVMD wastewater treatment plant, as well as related wastewater collection, conveyance, measurement, and discharge facilities, lift stations, force mains, meters, pipelines, manholes and other related appurtenances.

42. **"Water Bonds"** – Water Enterprise Revenue Bonds, Series 2015 issued by SVMD to improve or expand the Water System.

43. **"Water Service Capacity"** – the capacity of the Water System, which may change from time to time, but currently is estimated at 5,760,000 gallons per day (5.76 mgd).

44. **"Water Service Ratio"** – the ratio of water SFEs based on the Projected Buildout of the Compark Service Area, currently calculated as ~~22.6~~% (~~1,205~~ SFEs Compark Service Area; 5,321 SFEs total SVMD Service Area). 23.25% 1237

45. **"Water System"** – the SVMD water treatment plant, as well as related water collection, storage, pipelines, conveyance and measurement facilities, meters, wells, and pump stations, storage and storage rights, ground and renewable water and water rights.

RECITALS

A. WHEREAS, pursuant to Colorado Constitution, Article XIV, Section 18(2)(a) and Section 29-1-203, Colorado Revised Statutes, the Parties may cooperate and contract with each other to provide any function, services, or facilities lawfully authorized to each, and any such contract may provide for the sharing of costs, the imposition of taxes, and the incurring of debt; and

B. WHEREAS, each Party and BSMD have has a Service Plan and have received all required governmental approvals therefore, and BNMD and CHMD are only contemplated and have yet to be organized; and

C. WHEREAS, each Service Plan discloses and establishes the necessity for and desirability of intergovernmental agreements concerning the construction, operation, and maintenance of certain regional facilities and the provision of services; and

D. WHEREAS, SVMD and CBCMD were organized with the approval of the County of Douglas, State of Colorado, and with the approval of their respective electors; and

E. WHEREAS, BSMD was, and BNMD and CHMD are anticipated to be, organized with the approval of the Town of Parker, State of Colorado, and with the approval of their respective electors; and

F. WHEREAS, to provide water and wastewater services, SVMD owns, operates and maintains the Water System and Wastewater System; and

G. WHEREAS, the Parties desire to provide for the continuing construction, operation and maintenance of the Water System and Wastewater System to serve the SVMD Service Area, including the Compark Service Area, and to allocate responsibility for the

financing, ownership, construction and operation of the Water System and Wastewater System; and

H. WHEREAS, development within the Compark Service Area, including Compark South, will require CBCMD Constructed Facilities, the initial construction of which is to be financed entirely by CBCMD or private developers, and not SVMD; and

I. WHEREAS, the Parties agree that the Water System and Wastewater System and the CBCMD Constructed Facilities are needed by CBCMD and that the same will benefit the residents and property owners within the Service Area by improved utilization of the Water System and Wastewater System, economies of scale, and efficiency in terms of cost, quality and level of service; and

J. WHEREAS, SVMD and CBCMD's predecessor, E-470 Business Metropolitan District, entered into the 1997 Regional Facilities Agreement whereby SVMD allocated capacity in the Wastewater System and Water System to serve portions of the Compark Service Area. The 1997 Regional Facilities Agreement was modified by the First Amendment, the Second Amendment, the Third Amendment and the Fourth Amendment. The RFA contemplates the funding and allocation of capacity in the Wastewater System and Water System based on the demands for service within the Compark Service Area and SVMD. The First, Second and Third Amendments enlarged the service area subject to the RFA, with the Second and Third Amendments extending the service area to include Compark South. The Fourth Amendment clarified the procedures to fund and develop a renewable water capital plan, and allows CBCMD, with the approval of SVMD, to sell or assign CBCMD's excess Water Service Capacity and CBCMD's excess Wastewater Service Capacity to a third party; and

K. WHEREAS, SVMD has issued Bonds and incurred Capital Costs to improve and expand the Wastewater System and the Water System; and

L. WHEREAS, the Bonds are secured by SVMD's covenant to impose fees, rates and other charges against users of the Wastewater System and Water System adequate to pay SVMD's annual operation and maintenance expenses of such systems and annual debt service on the Bonds; and

M. WHEREAS, the Parties wish to update, amend, and restate the terms of the RFA to provide the basis for SVMD continuing to serve the Compark Service Area; and

N. WHEREAS, the Parties find and agree that the entry into and performance of this Agreement is in the best interests of each Party.

COVENANTS

NOW THEREFORE, IN CONSIDERATION of the above recitals, the mutual covenants, considerations and promises contained herein and other good and valuable consideration, the receipt and sufficiency of which are hereby mutually acknowledged, the Parties agree as follows:

ARTICLE I
INCORPORATION

1.1 **Incorporation of Definitions and Recitals.** The definitions and recitals set forth above are incorporated into the terms of this Agreement.

1.2 **SVMD Rules and Regulations.** All activities under this Agreement, including the provisions of service to the Compark Service Area shall be subject to the Rules and Regulations. CBCMD shall exercise its rule making and enforcement power to assist SVMD in enforcing the Rules and Regulations, including those made to protect the purity and safety of the water supply and to prevent waste of water; and CBCMD's assignment of any of its rights hereunder, including without limitation, all or any portion of CBCMD's excess Wastewater Service Capacity and excess Water Service Capacity to other entities is expressly contingent upon such assignee's agreement to comply with SVMD's Rules and Regulations.

ARTICLE II
PURPOSE AND TERM OF AGREEMENT

2.1 **Purpose**. The purpose of this Agreement is to amend and restate the RFA in full. Upon the Effective Date, the RFA will be of no further force and effect.

2.2 **Term of Agreement**. Except as otherwise provided herein, this Agreement shall become effective upon execution and shall continue until all Wastewater Service Capacity and Water Service Capacity allocated to CBCMD has been assigned, pursuant to Section 3.1.4 of this Agreement, or has been connected and is being served by SVMD.

ARTICLE III
WATER AND WASTEWATER
CAPACITY AND SERVICE

3.1 **Service Capacity Allocations.**

3.1.1 **Projected Service Needs.** Based on the current Projected Buildout, SVMD is anticipated to provide wastewater service to 5130 SFEs and water service to 5321 SFEs. Of those totals, the Compark Service Area is projected to require 1205 SFEs of wastewater service and 1237 SFEs of water service, with 638 SFEs of wastewater service and 670 SFEs of water service projected to be served within the CBCMD and PMD boundaries, and Compark South requiring 567 SFEs of water and wastewater service. The area within Compark South is anticipated be included within the district boundaries of BNMD, BSMD, and/or CHMD.

3.1.2 **Service Capacity.** The Water Service Capacity and Wastewater Service Capacity are currently limited primarily by the treatment capacity of the SVMD water treatment plant and wastewater treatment plant, though other portions of the Wastewater System and Water System may, from time to time, require upgrades, improvements, enlargements and other modifications to maintain or increase Water Service Capacity and Wastewater Service Capacity.

3.1.3 **Assignment of Excess Capacity**. The Parties may, by assignment in a form substantially as provided in Exhibit C, attached hereto and incorporated herein, effect an

assignment of CBCMD's excess Wastewater Service Capacity and CBCMD's excess Water Service Capacity, in which case the Wastewater Service Ratio and Water Service Ratio shall be adjusted, and similar ratios will be calculated and attributed to assignees.

3.1.4 **Service Commitment.** Contingent on satisfaction of conditions and payments as provided in this Agreement, SVMD shall make available Wastewater System Capacity in the amount of the Wastewater Service Ratios and Water System Capacity in the amount of the Water Service Ratios, to provide wastewater and water service to the Compark Service Area.

3.1.5 **Service Ratio Revisions.** The Wastewater Service Ratio and Water Service Ratio may be revised, in SVMD's reasonable discretion, without amendment of this Agreement in the event that the Projected Buildout or actual development changes. SVMD shall provide CBCMD with written notice of and the opportunity to be heard prior to any changes to the Wastewater Service Ratio and Water Service Ratio.

3.2 **No Guarantee of Service, Limitations.**

3.2.1 **Service Capacity Uncertainties.** The Parties acknowledge that there is currently Water Service Capacity sufficient to serve the Projected Buildout of the SVMD Service Area, including all of the Compark Service Area. Based on Projected Buildout, currently there is not existing Wastewater Service Capacity to serve Compark South. Historic development has generally been less than Projected Development, which may result in sufficient Wastewater Service Capacity to serve Compark South. Also, while the Compark Service Area Wastewater Service Ratio and Water Service Ratio are calculated from Projected Buildout expressed in terms of SFEs of wastewater or water service demand, until System Access Fees have been paid by CBCMD and accepted by SVMD there is no guarantee that the Wastewater Service Capacity or Water Service Capacities can be converted to any specific number of SFEs. Further, Water Service Capacity or Wastewater Service Capacity may change based on the age of facilities, regulatory changes imposed by third parties, operational changes, facility upgrades, actual development and other factors. Therefore, there is no guarantee that SVMD will have at any point in time sufficient Wastewater Service Capacity or Water Service Capacity to provide service to the Compark Service Area, Compark South, or any other user with the SVMD Service Area when requested without system improvements or expansions as provided in the Agreement.

3.2.2 **Water Supply.** Water supply for the Water System is dependent upon natural resources and sources from which the quantity is variable and beyond the control of SVMD. Similarly, the provision water and wastewater services is subject to various local, state and federal agencies. No liability shall attach to SVMD for any failure to accurately anticipate availability of the water supply, the availability of sewage treatment capacity, or the need to incur Capital Costs due to occurrences beyond the reasonable control of SVMD.

3.2.3 **Tap Curtailment.** If conditions develop such that it becomes apparent to SVMD that all areas outside SVMD's boundaries for which such services have been committed cannot be supplied adequately pursuant to this and similar agreements, SVMD reserves the right to discontinue the granting of additional taps; provided, however, SVMD shall be obligated to exercise this right of discontinuance uniformly outside and inside SVMD.

3.2.4 **Access to Service.** Access to wastewater and water service shall be on a first come first served basis, based on payment of all System Access Fees, subject to CBCMD's right of first refusal as set forth in Section 3.2.5.

3.2.5 **CBCMD Right of First Refusal**. SVMD agrees that it shall not guarantee or otherwise obligate SVMD to provide service to users in excess of 5130 SFEs with respect to the Wastewater System and 5321 SFEs with respect to the Water System prior to connecting 1205 SFEs of wastewater service or 1237 SFEs of water service within the Compark Service Area unless and until the following conditions have been satisfied:

a) Within ten (10) business days of receiving such request for service, SVMD shall provide written notice of same to CBCMD, which notice shall include the number of SFEs requested and the conditions of SVMD providing such service;

b) So long as CBCMD is not in default of its obligations under this Agreement, CBCMD shall have twenty (20) business days to provide its written intent to satisfy the same terms of service within the same time as noted in the notice provided by SVMD; and

c) In the event that CBCMD (1) does not provide written notice of its intent to pay such System Access Fees or meet such terms of service, or (2) provides notice of intent to pay System Access Fees and meet such terms of service but fails to comply with such terms, SVMD may proceed to provide service to such user under the terms of service contained in such notice.

3.2.6 **Insufficient Capacity.** SVMD may deny connection to the Wastewater System or Water System if it determines, in its reasonable discretion, that Wastewater or Water Service Capacity are insufficient, until such time as additional Wastewater or Water Service Capacity is made available as provided in this Agreement.

3.3 **Shortages and Limitations on Service.** SVMD may, in order to comply with any applicable law, rule, directive, or order, and to enable it to provide adequate services to the SVMD Service Area, as well as other customers of SVMD in times of shortage or other practical or legal limitations on the ability of SVMD to provide the services contemplated under this Agreement, limit the delivery of water and sewer services, and/or restrict the use of water delivered under this Agreement. The extent to which limitation of services may be necessary to enable SVMD to provide adequately for all users of Water System and Wastewater System is a fact to be determined by SVMD as the occasion may require. The current determination by SVMD on this subject, which will not be changed without good reason, is as follows:

"The welfare of SVMD and its inhabitants requires stable water and sewer services not only for them but also that part of the adjacent area dependent on SVMD for the delivery of water and sewer services. While it is the purpose of SVMD to maintain systems and supplies adequate to meet the needs of all dependent upon SVMD for water and sewer services, there are many elements which make it uncertain whether such services can always be adequate for all, and therefore, in times of shortage or other practical or legal limitation, water use and use of SVMD's water and wastewater systems will be curtailed