Appendix A
Flow Monitoring Sites: Data, Graphs, Information

Monitoring Site: Site 1

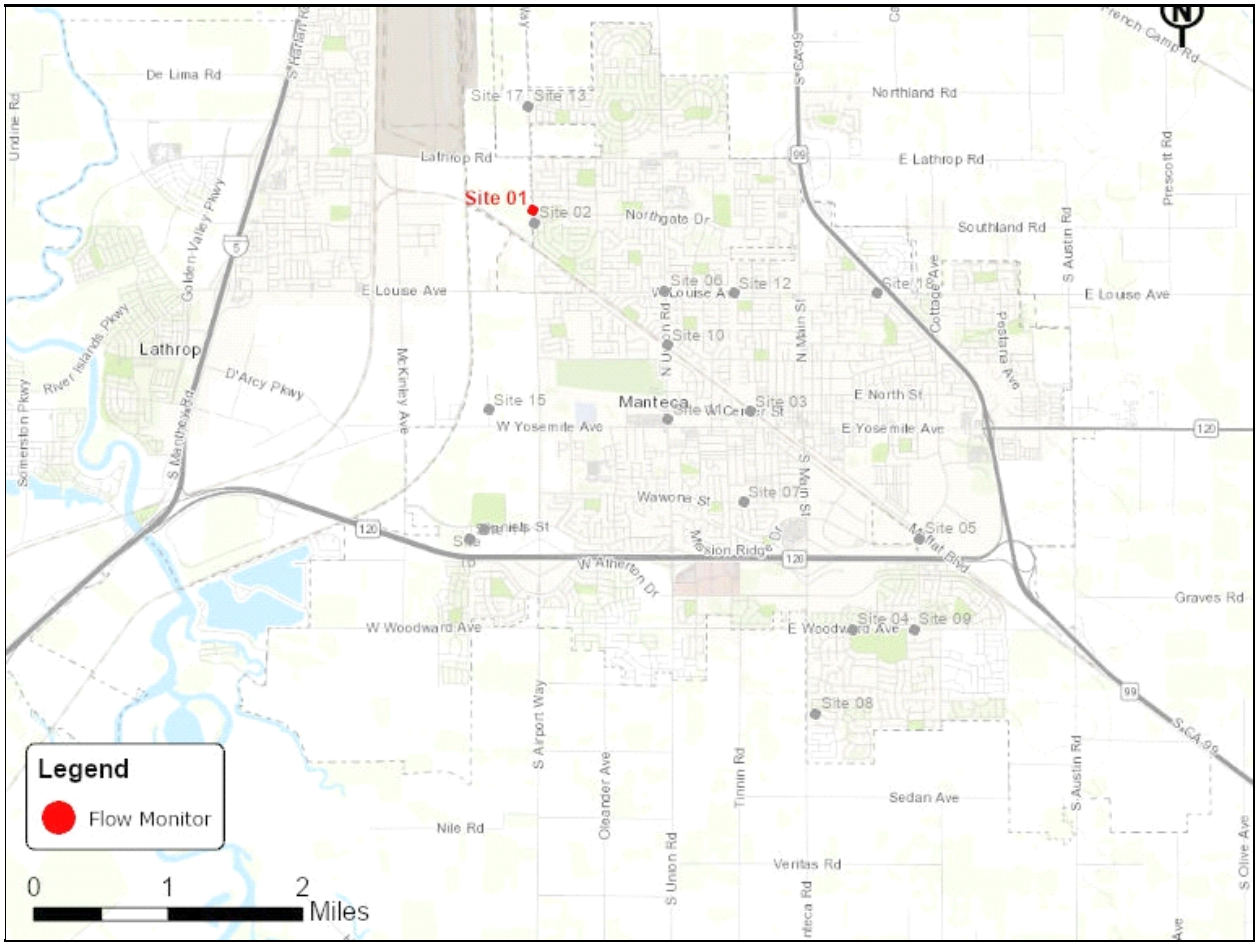
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: S. Airport Way North of Northgate Drive

Data Summary Report



Vicinity Map: Site 1

SITE 1

Additional Site Photos

Effluent Pipe

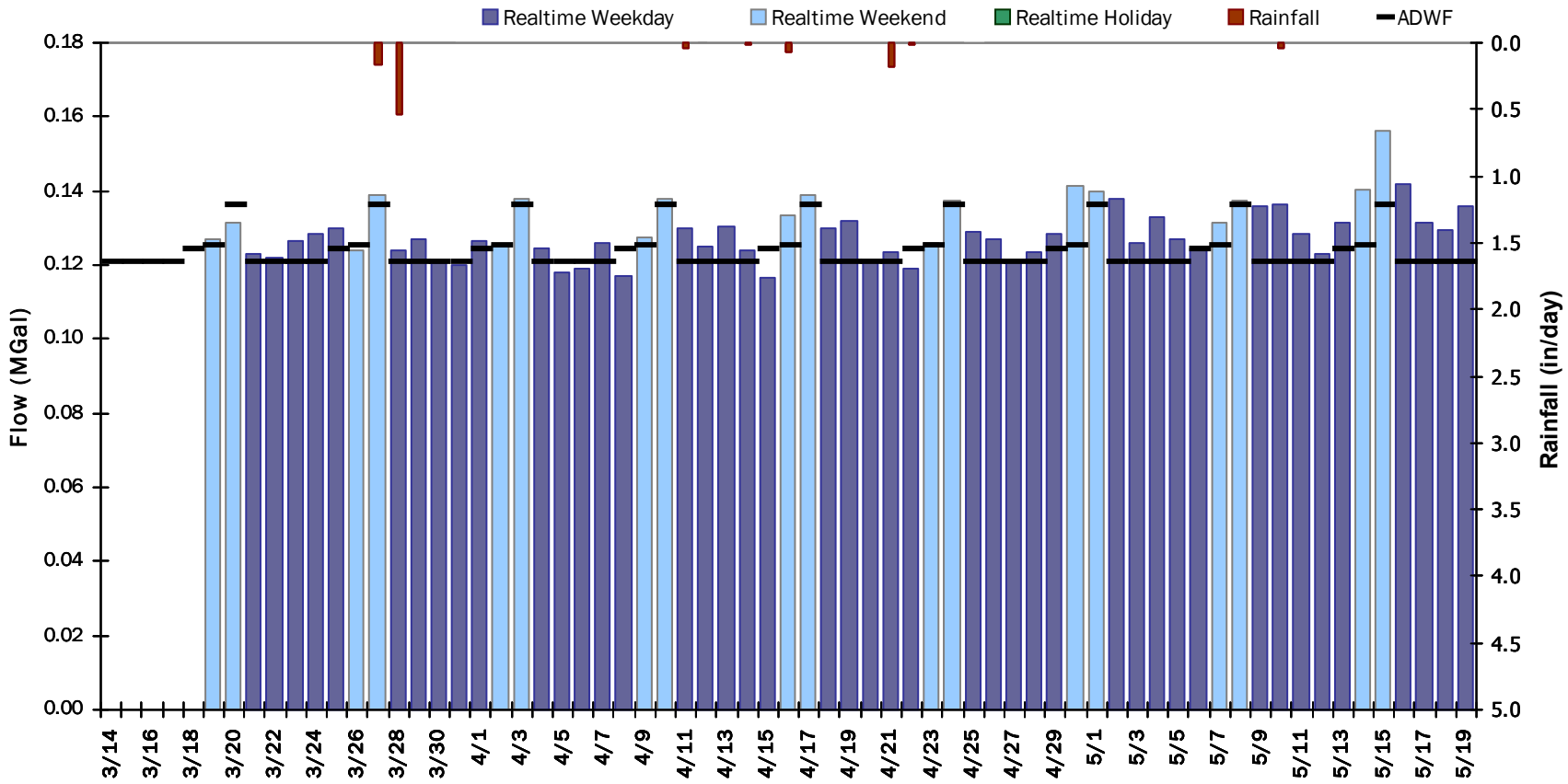
Monitored North Influent Pipe

SITE 1

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.129 MGal Peak Daily Flow: 0.156 MGal Min Daily Flow: 0.117 MGal

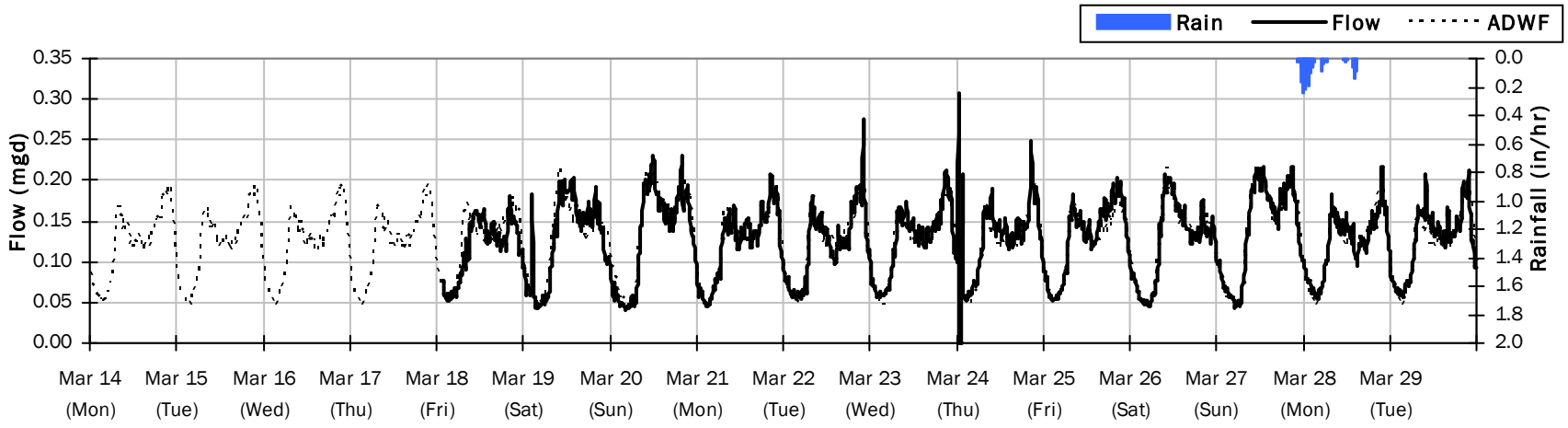
Total Rainfall: 1.07 inches

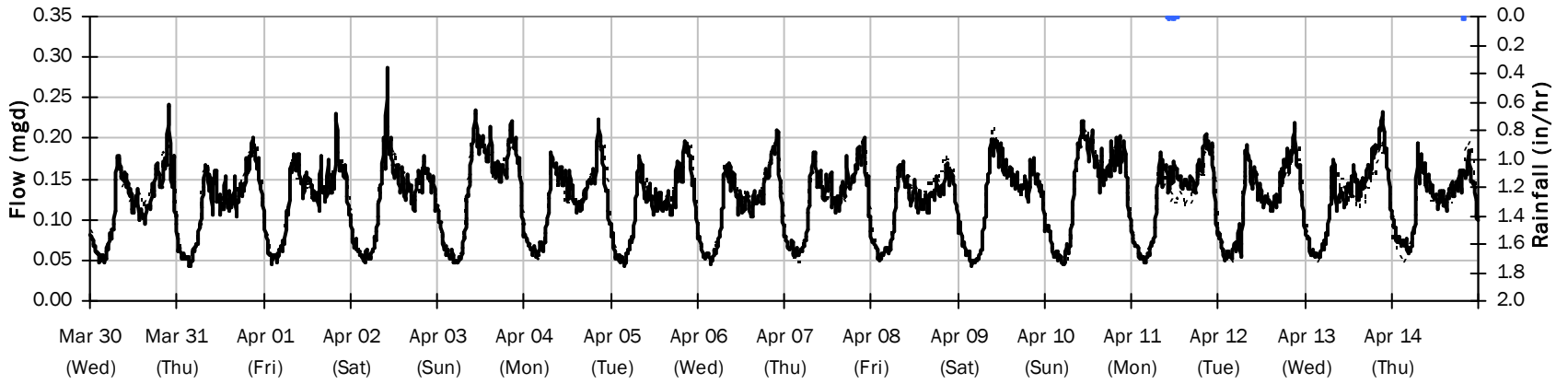


SITE 1

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.126 mgd Period Peak Flow: 0.306 mgd Period Min Flow: 0.000 mgd

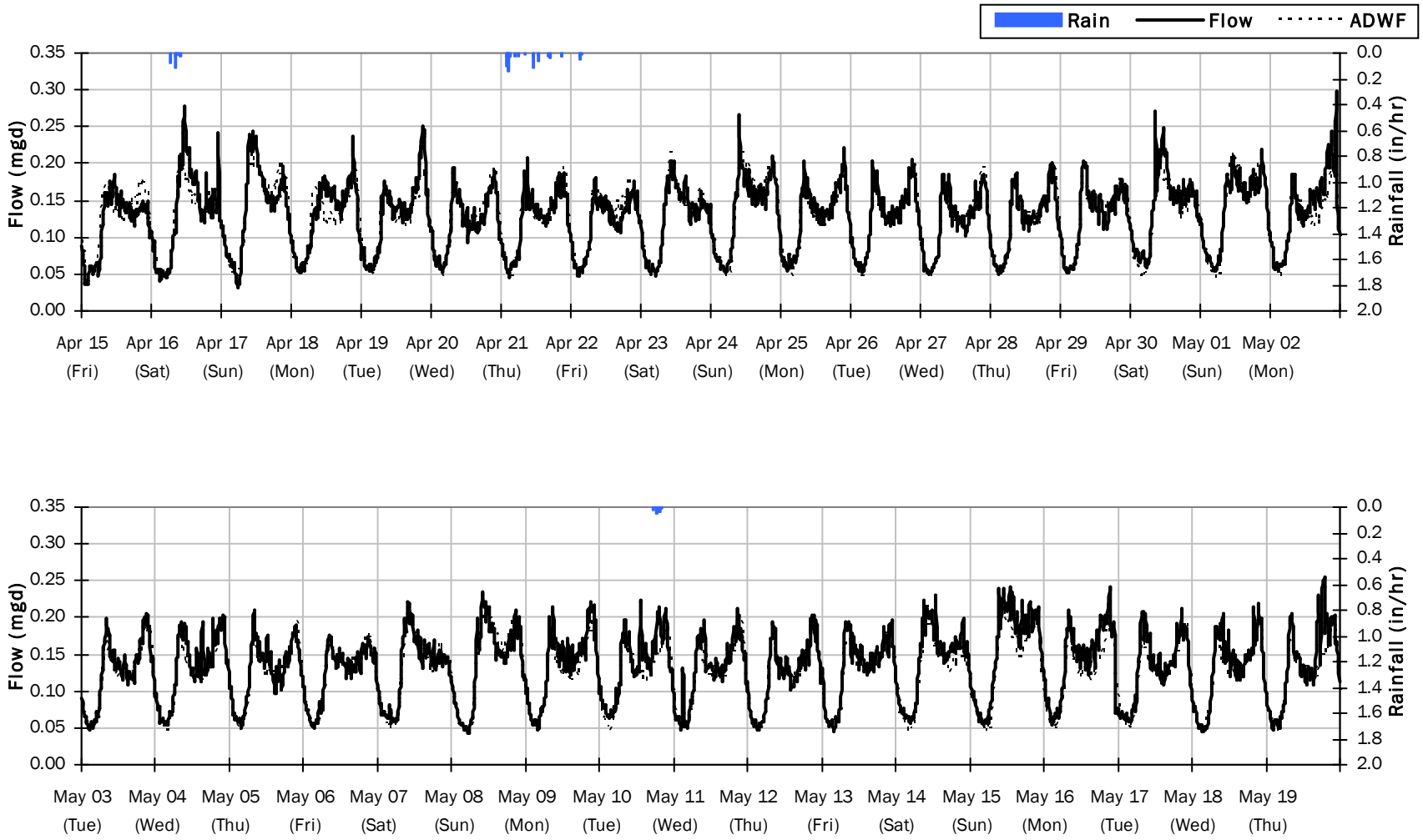




SITE 1

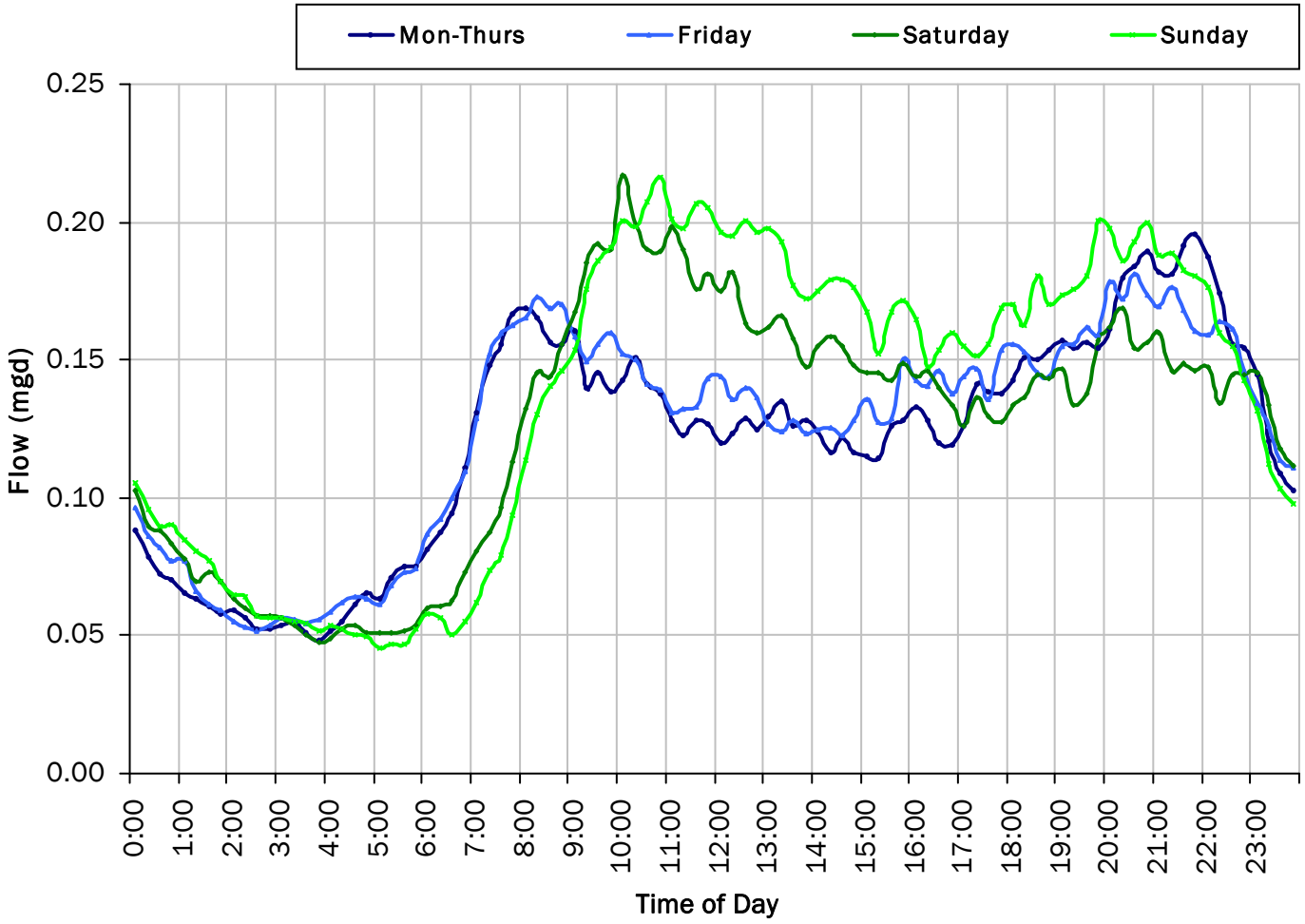
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.31 inches Period Avg Flow: 0.131 mgd Period Peak Flow: 0.298 mgd Period Min Flow: 0.032 mgd



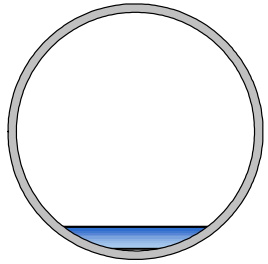
SITE 1

Average Dry Weather Flow Hydrographs



ADWF:

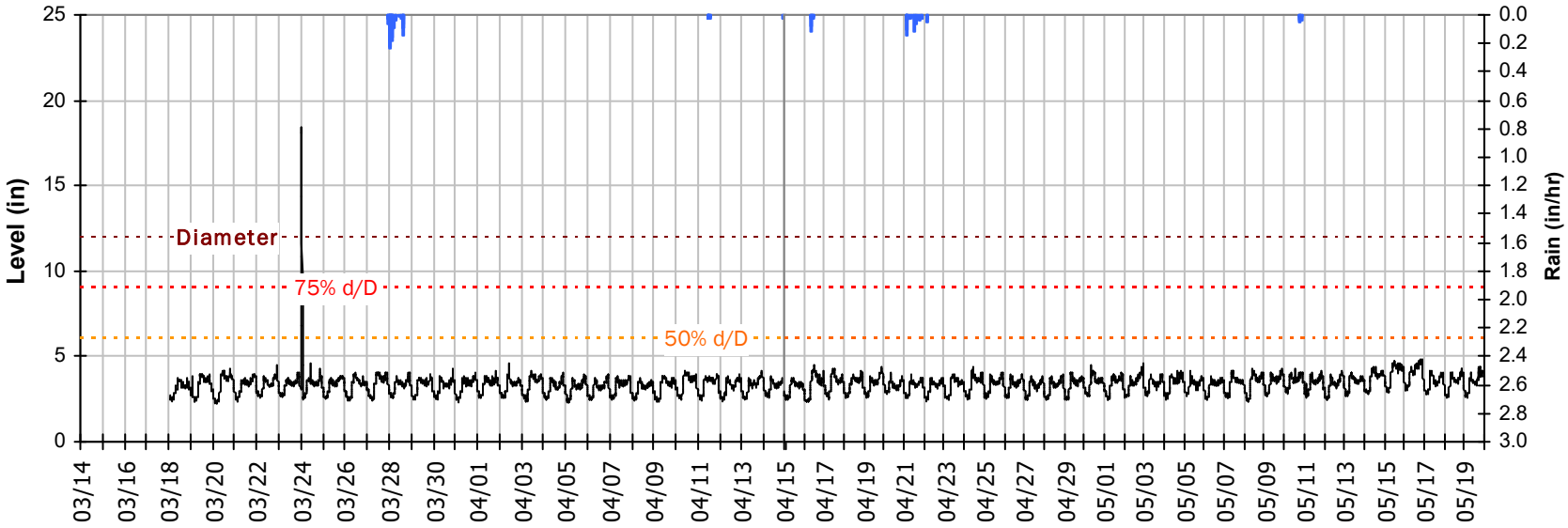
0.124 *mgd*

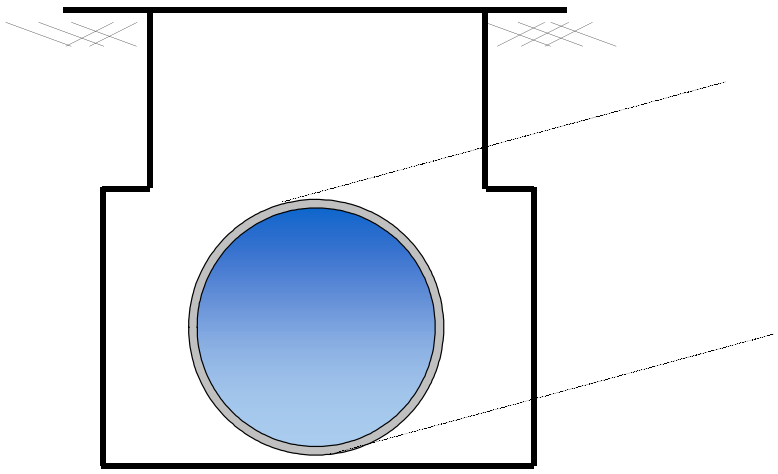


SITE 1

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





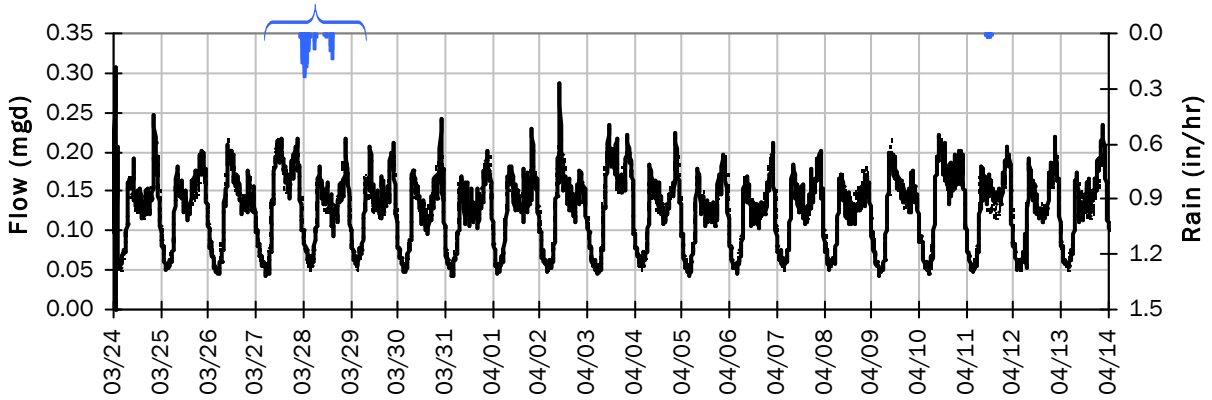
Pipe Diameter:	12	*inches*
Peak Measured Level:	18.1	*inches*
Peak d/D Ratio:	1.51	

Surcharged 6.1 inches over crown

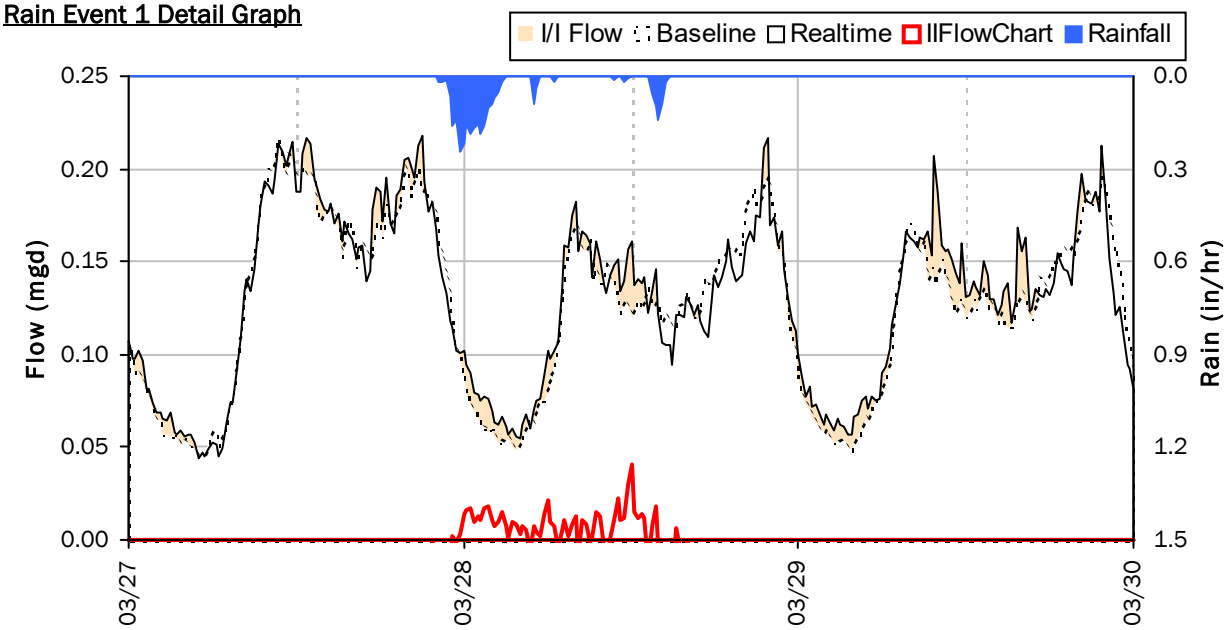
SITE 1
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Rain Event 1
Rainfall: 0.71 inches



Rain Event 1 Detail Graph



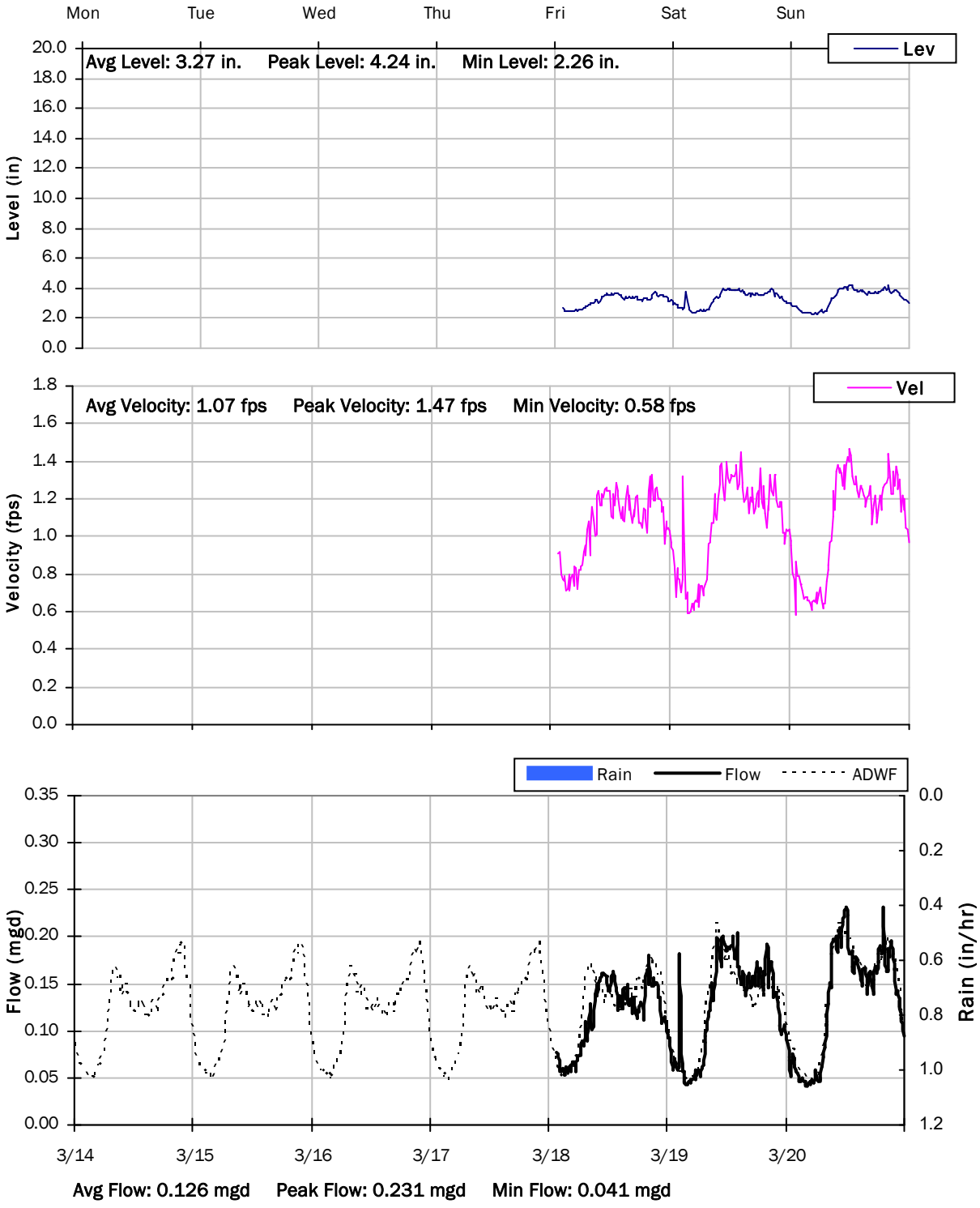
Storm Event I/I Analysis (Rain = 0.71 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.182 *mgd*	**Peak I/I Rate:**	0.041 *mgd*
PF:	1.46	**Total I/I:**	4,000 *gallons*
Peak Level:	3.82 *in*		
d/D Ratio:	0.32		

SITE 1

Weekly Level, Velocity and Flow Hydrographs

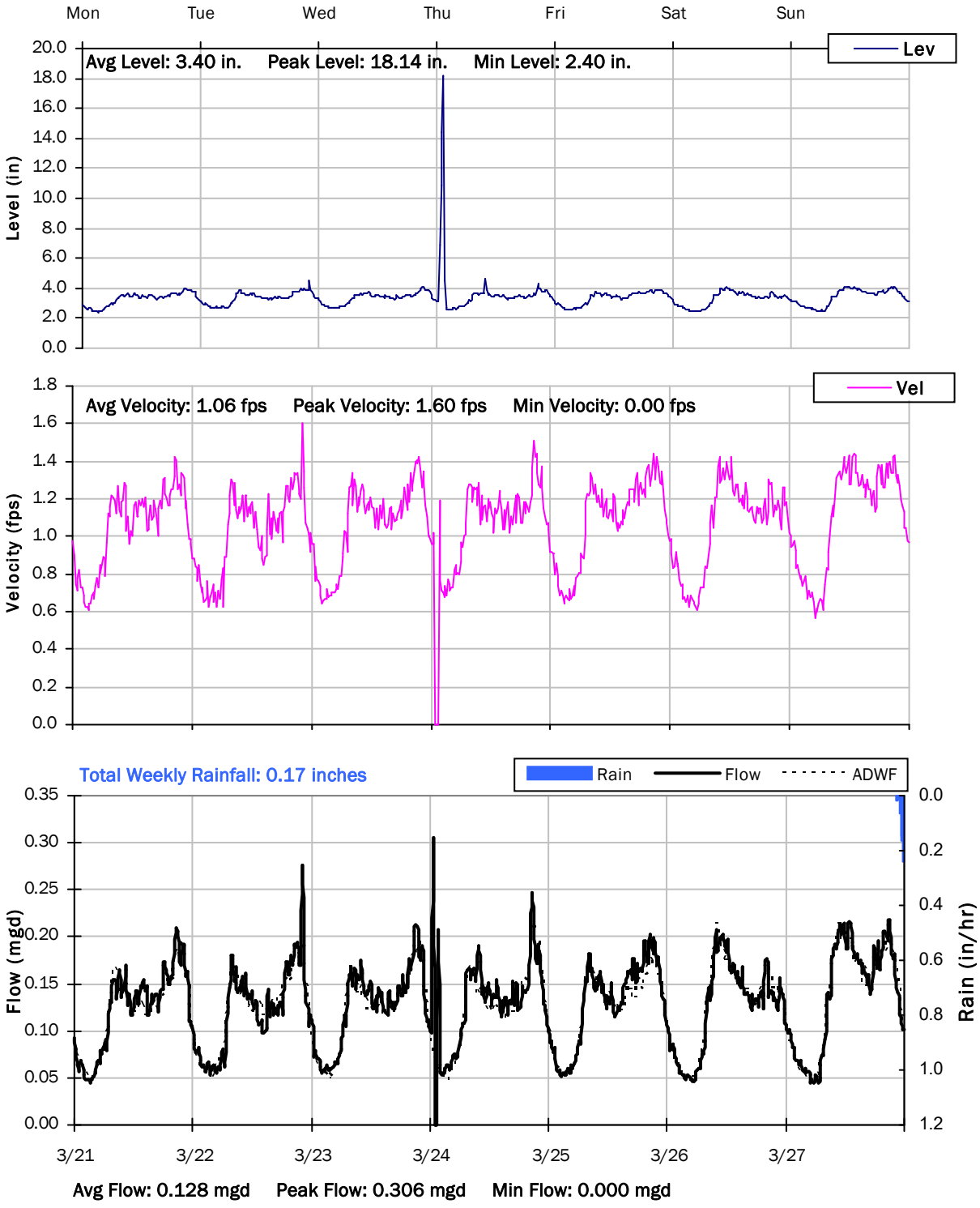
3/14/2022 to 3/21/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

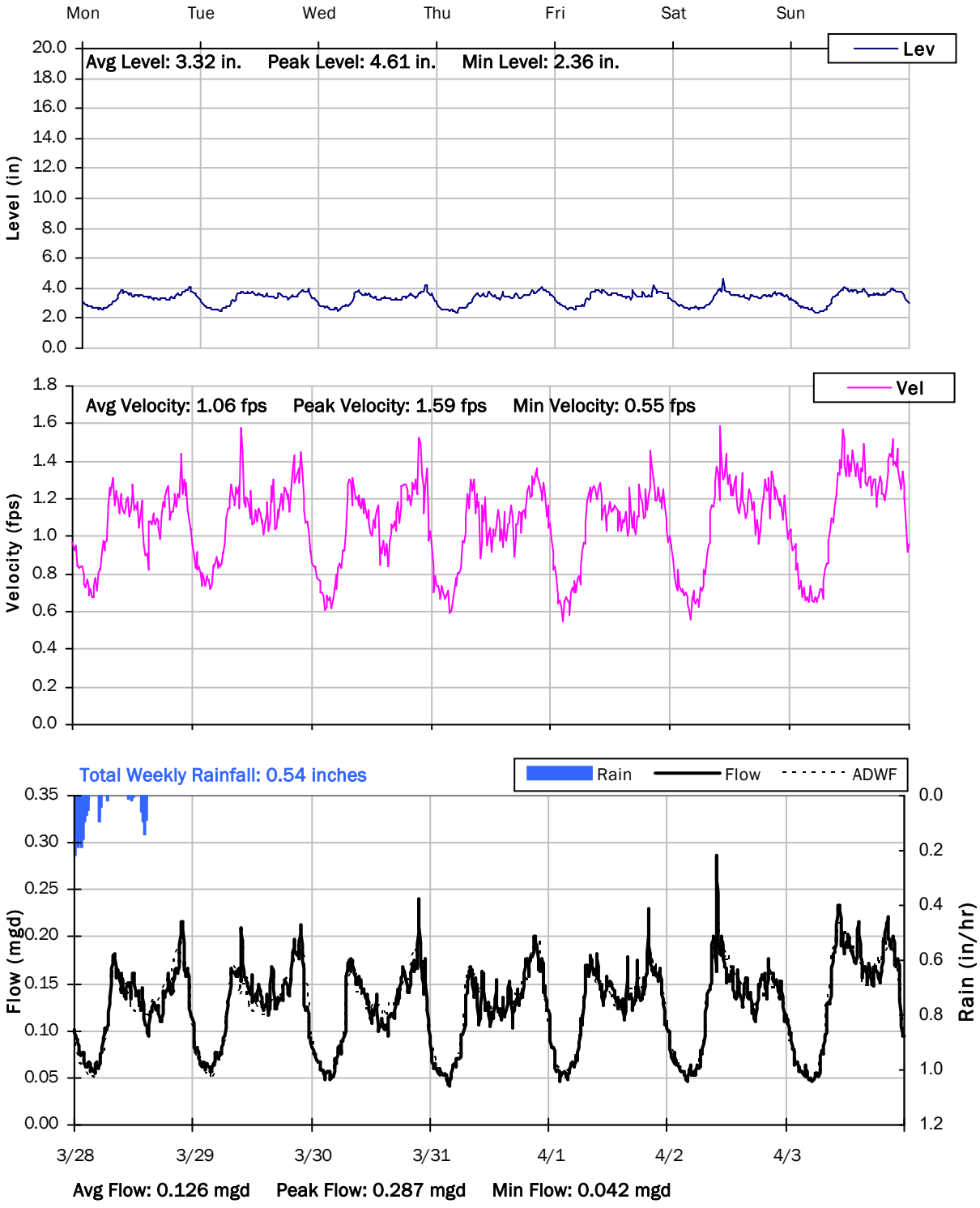
3/21/2022 to 3/28/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

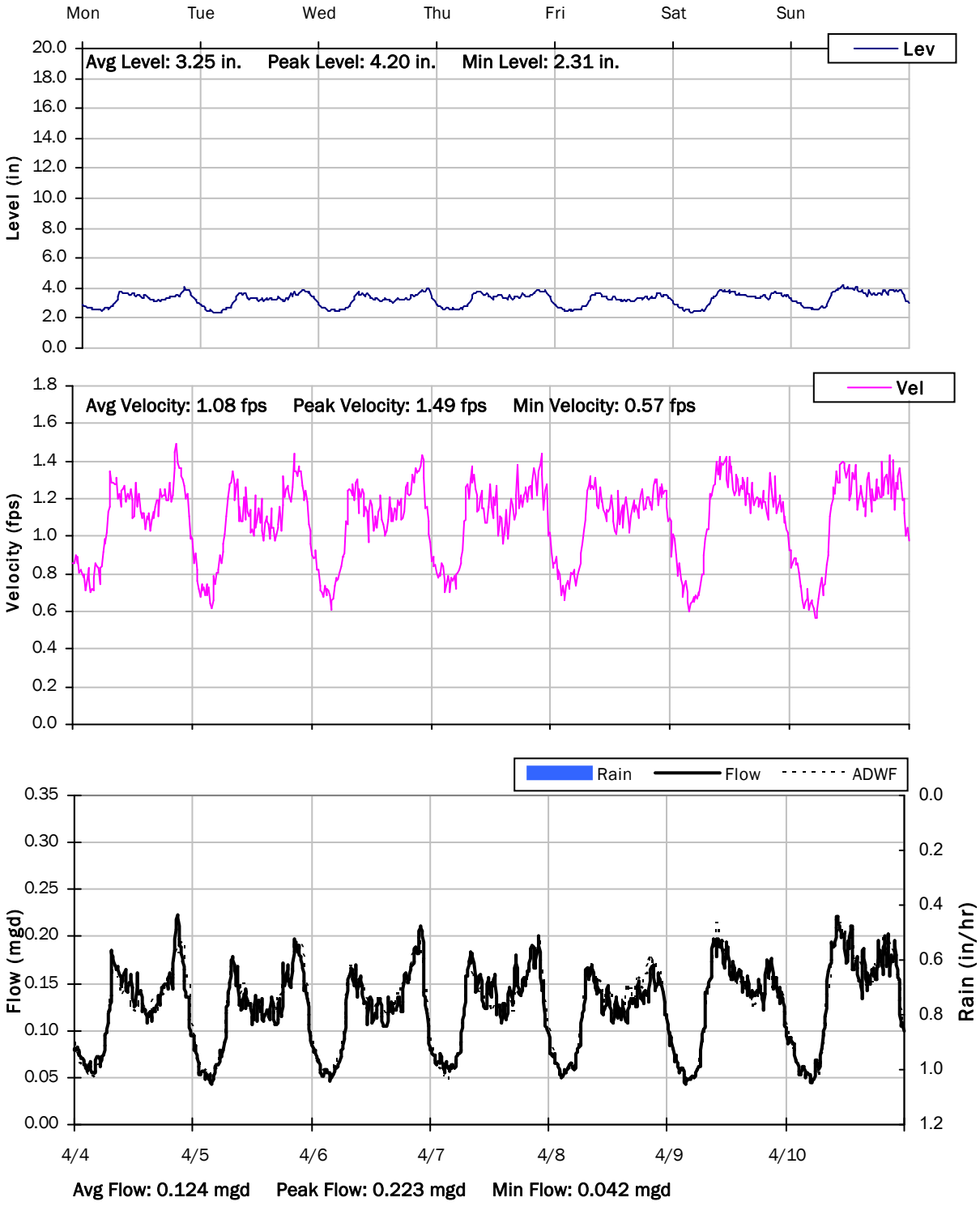
3/28/2022 to 4/4/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

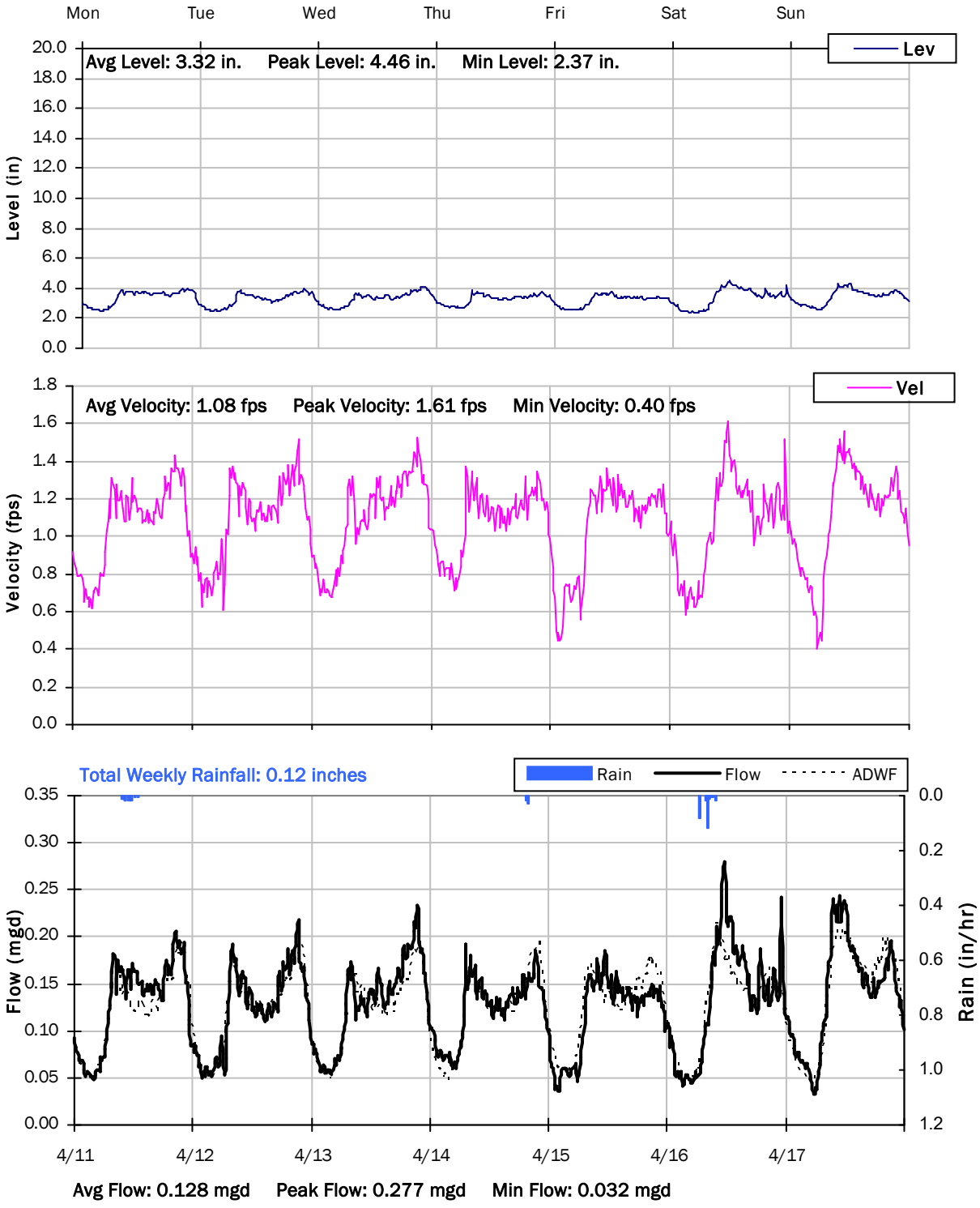
4/4/2022 to 4/11/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

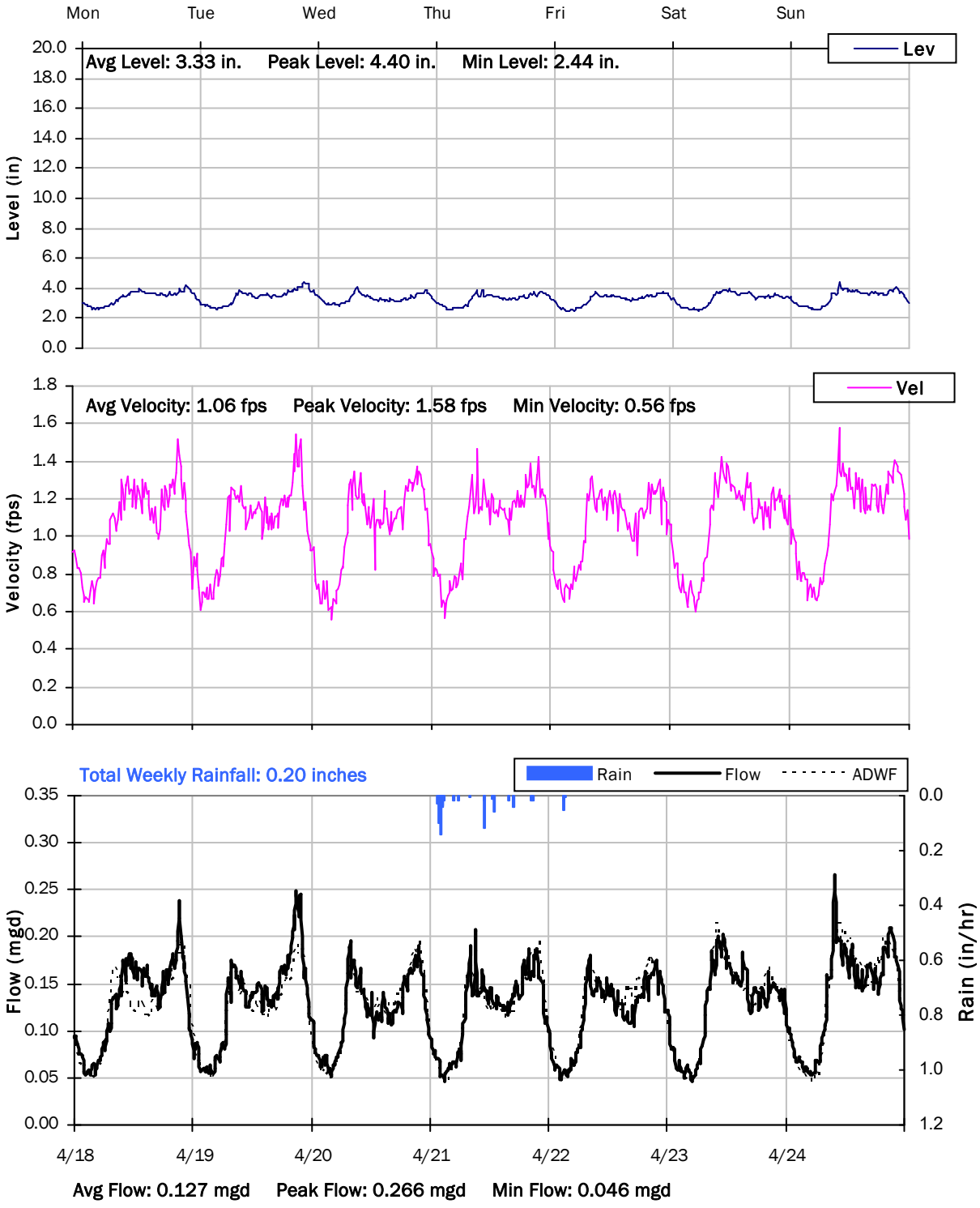
4/11/2022 to 4/18/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

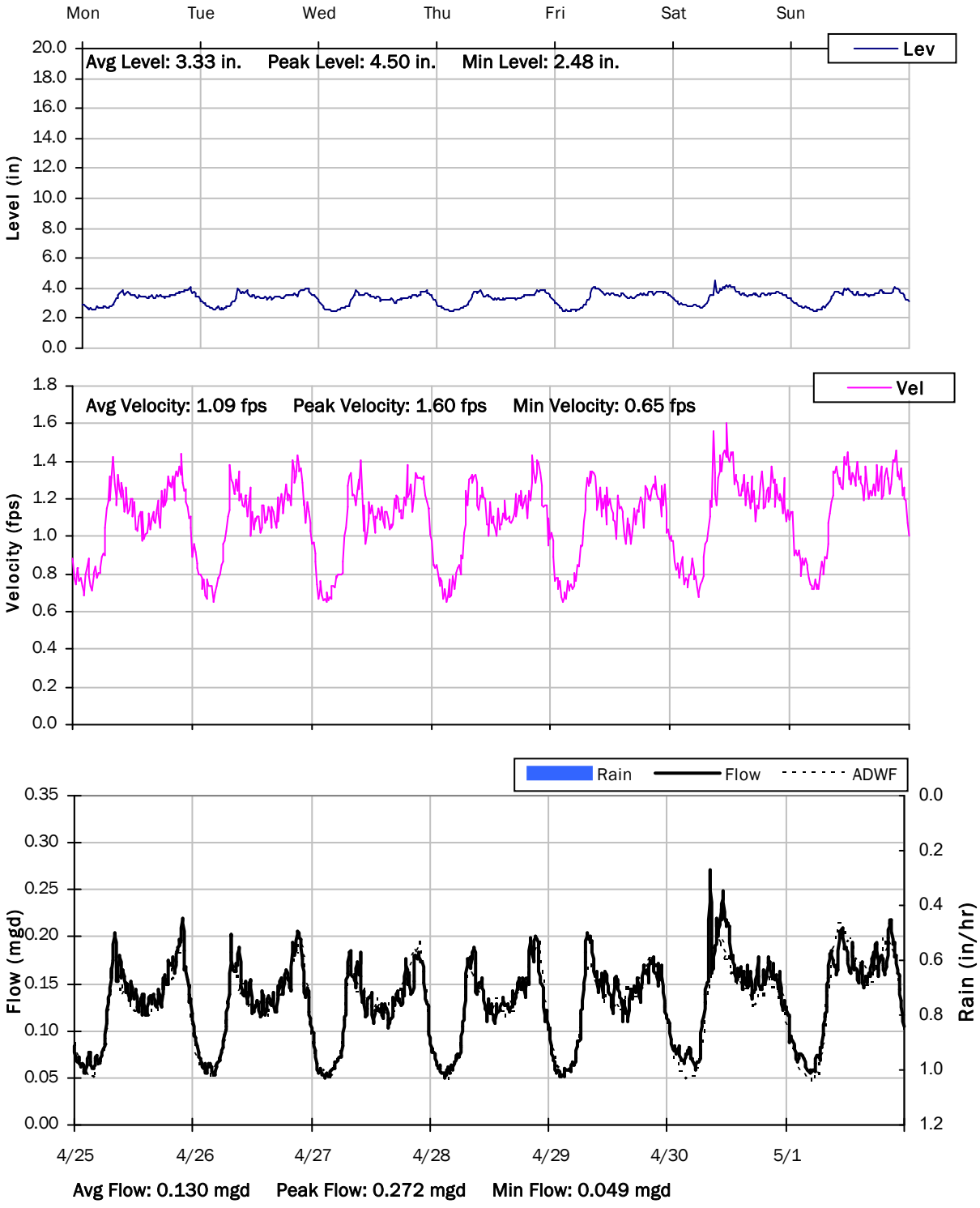
4/18/2022 to 4/25/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

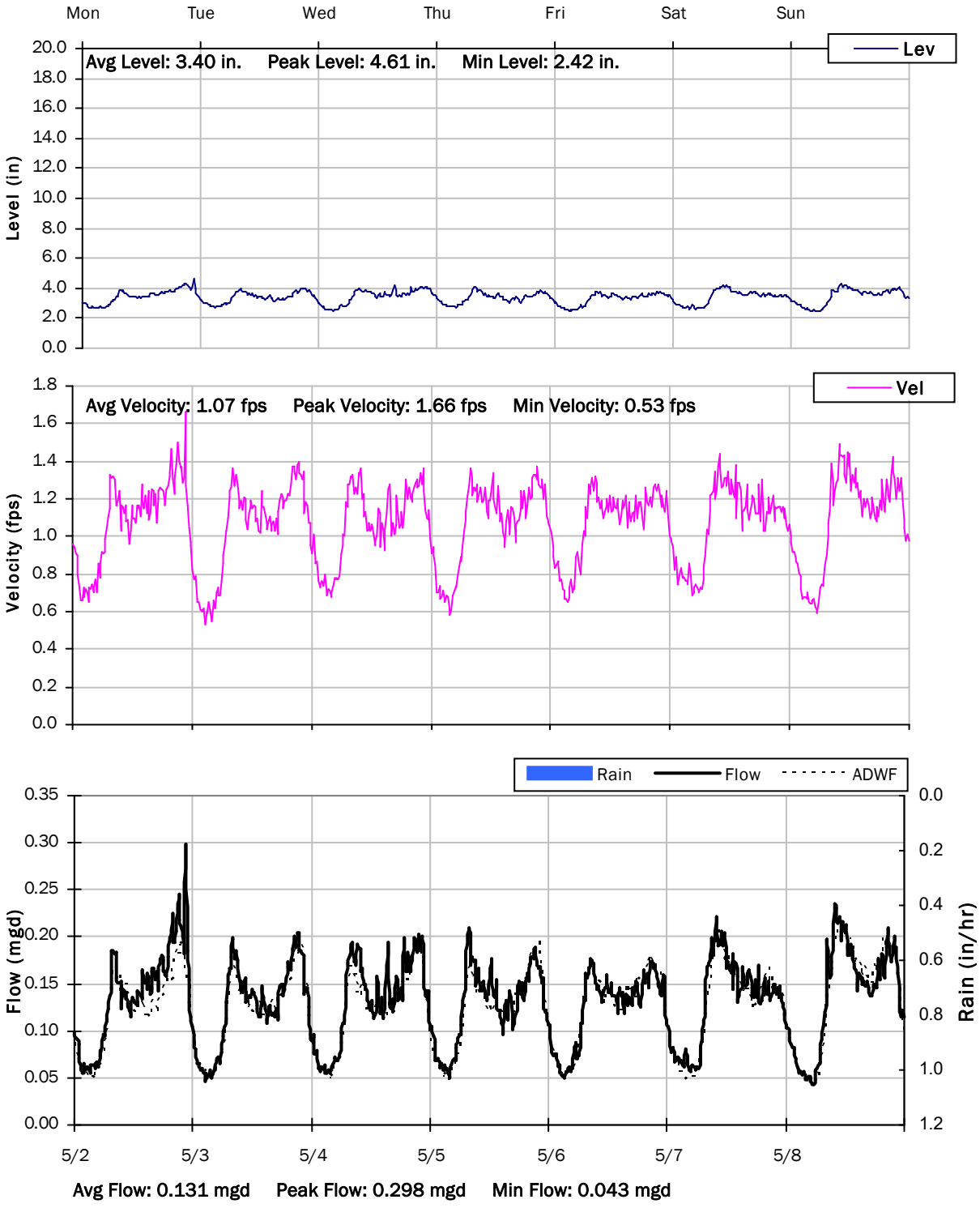
4/25/2022 to 5/2/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

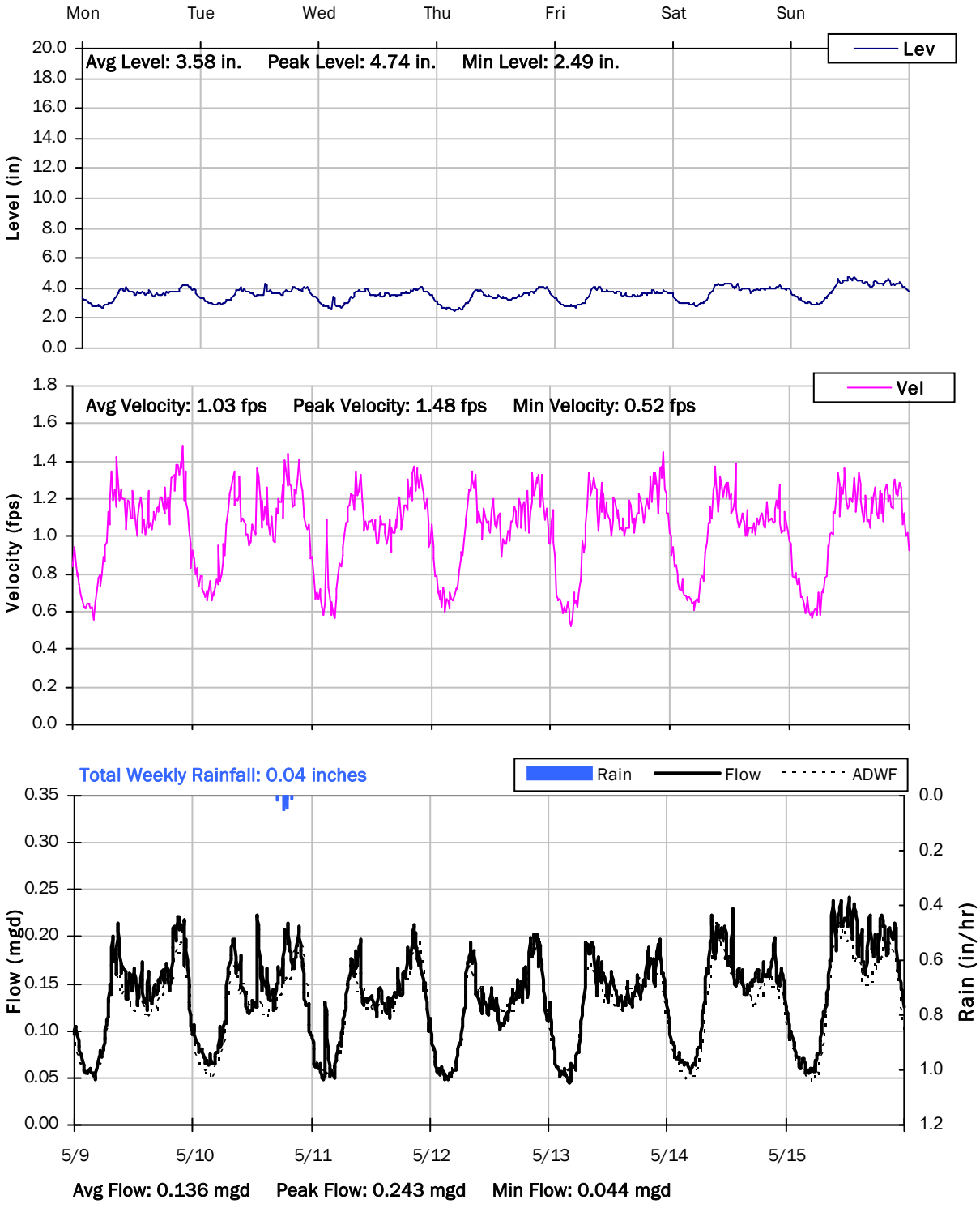
5/2/2022 to 5/9/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

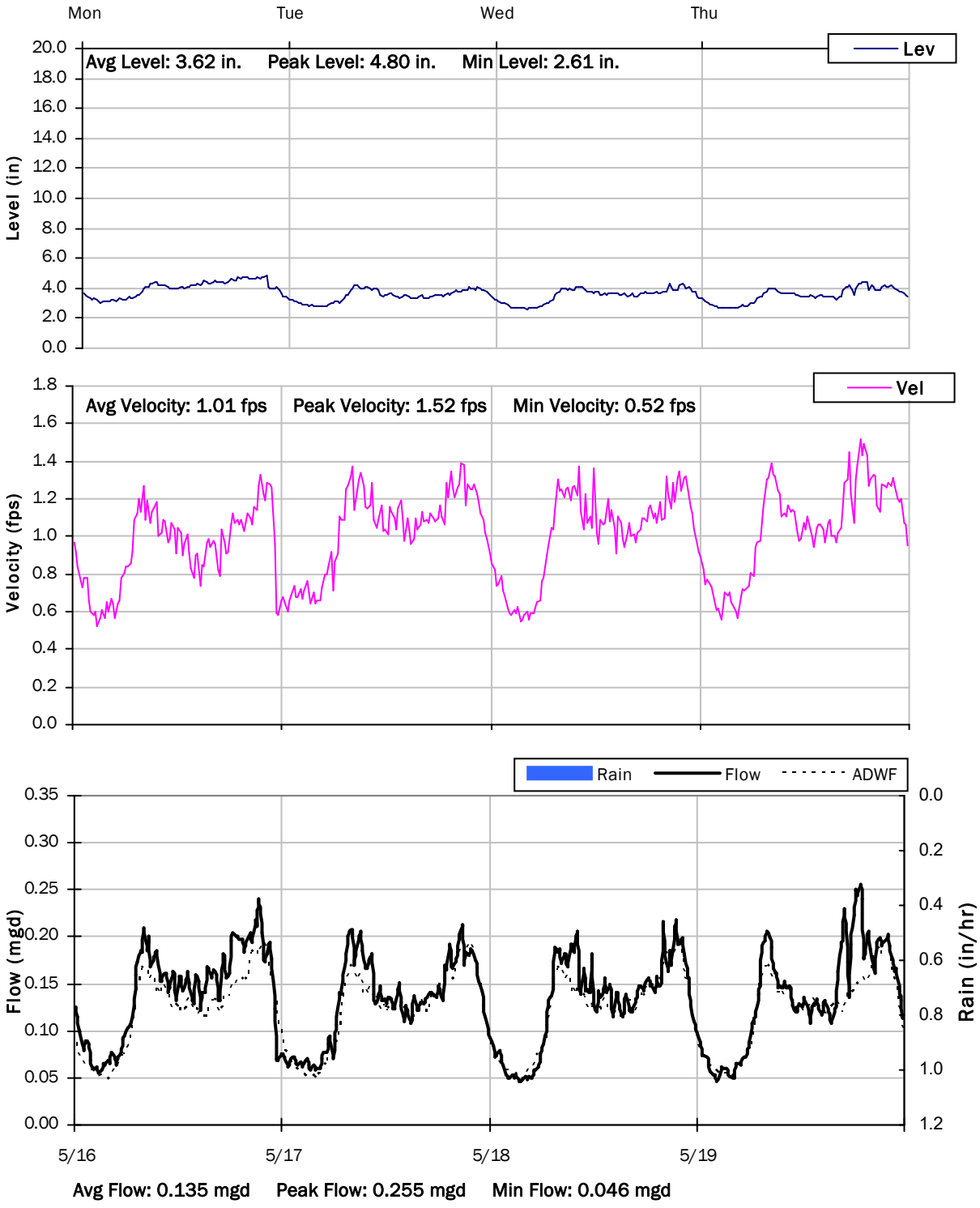
5/9/2022 to 5/16/2022



SITE 1

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 2

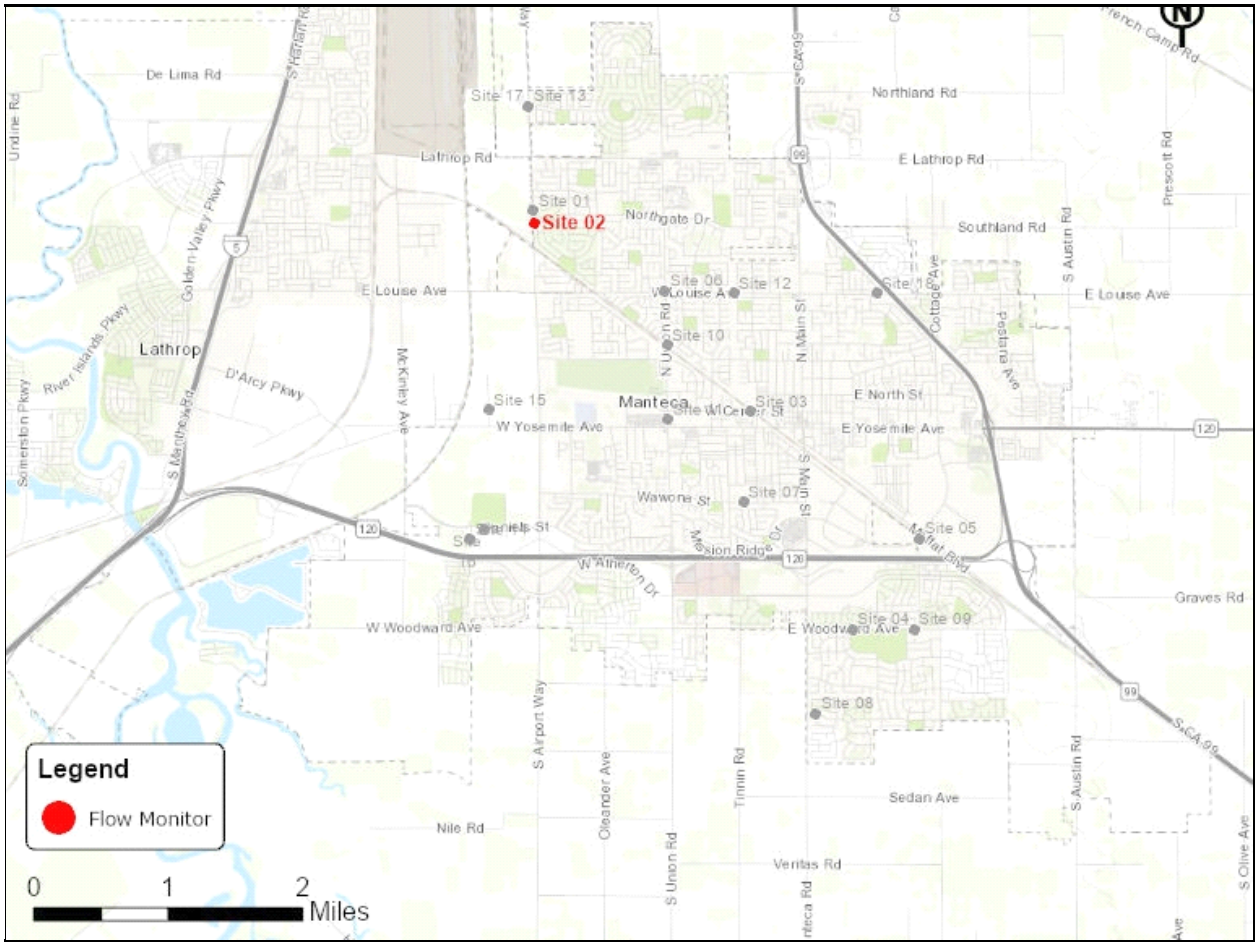
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: S. Airport Way at Northgate Drive

Data Summary Report



Vicinity Map: Site 2

SITE 2

Additional Site Photos

Effluent Pipe

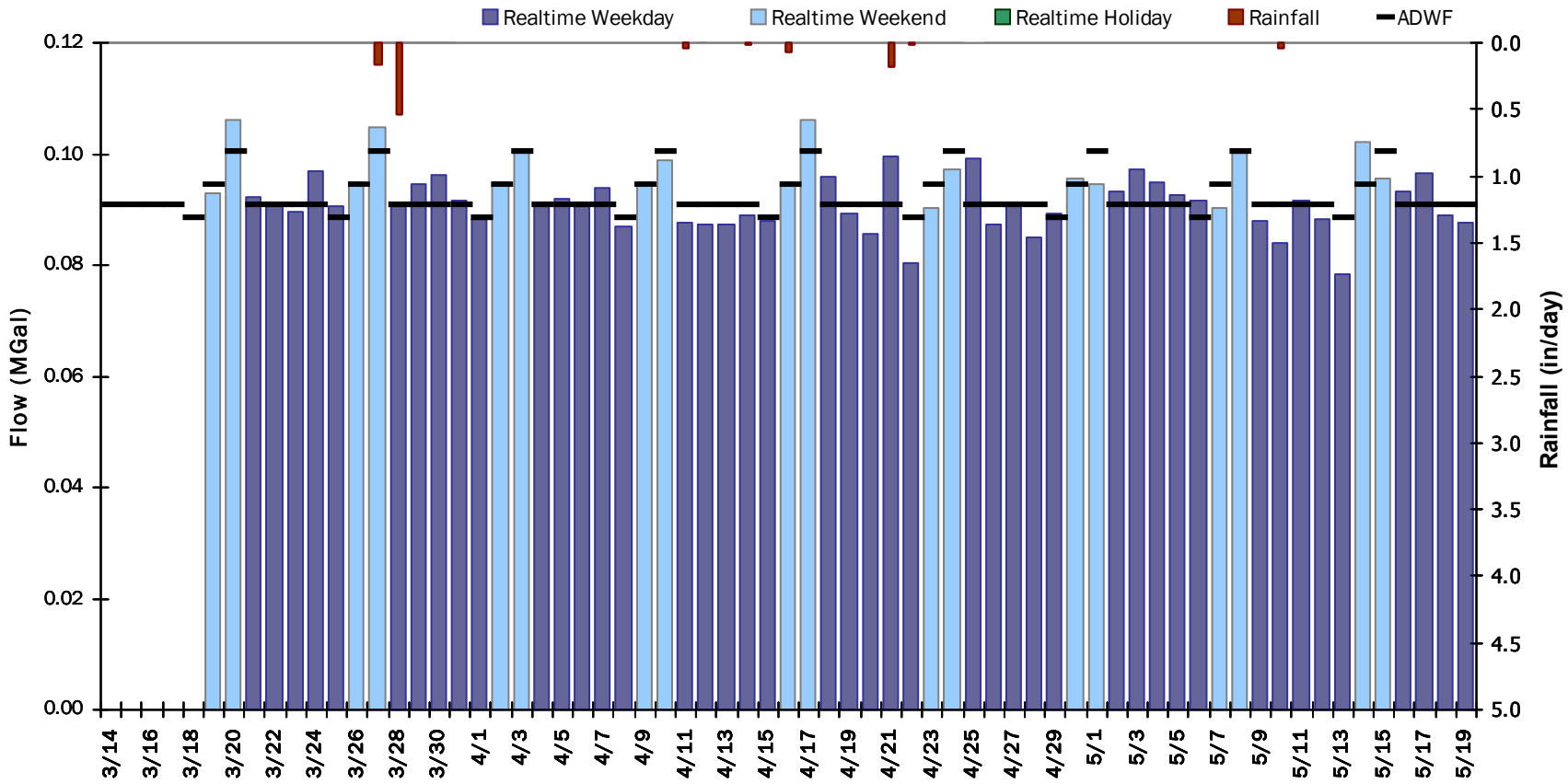
Monitored East Influent Pipe

SITE 2

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.092 MGal Peak Daily Flow: 0.106 MGal Min Daily Flow: 0.078 MGal

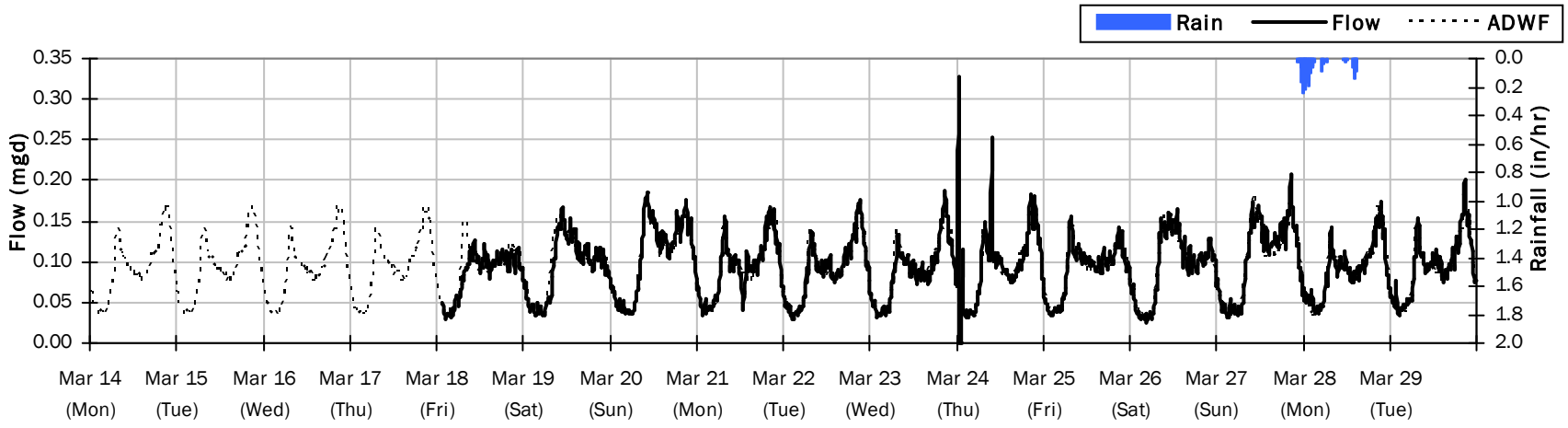
Total Rainfall: 1.07 inches

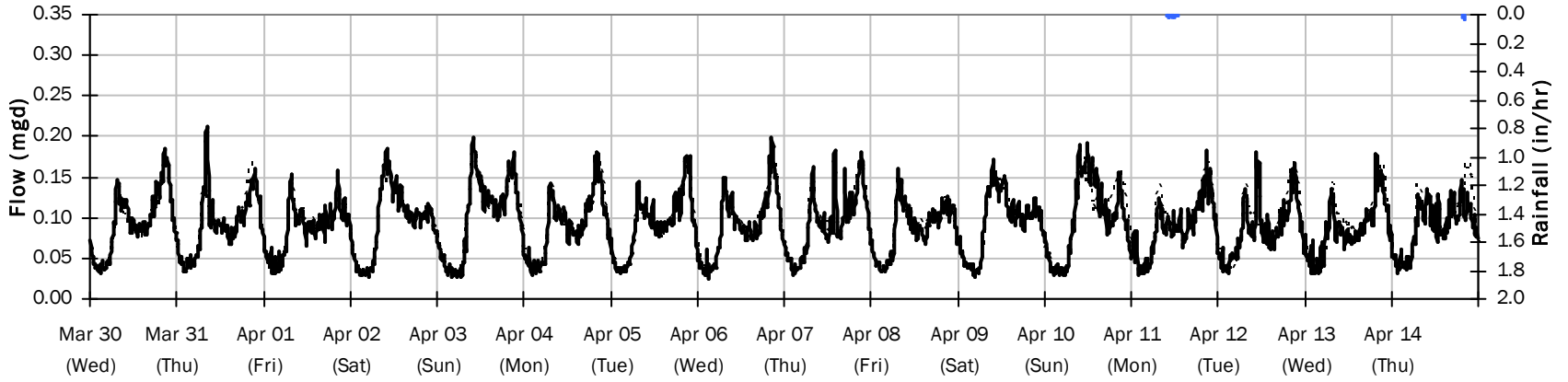


SITE 2

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.093 mgd Period Peak Flow: 0.328 mgd Period Min Flow: 0.000 mgd

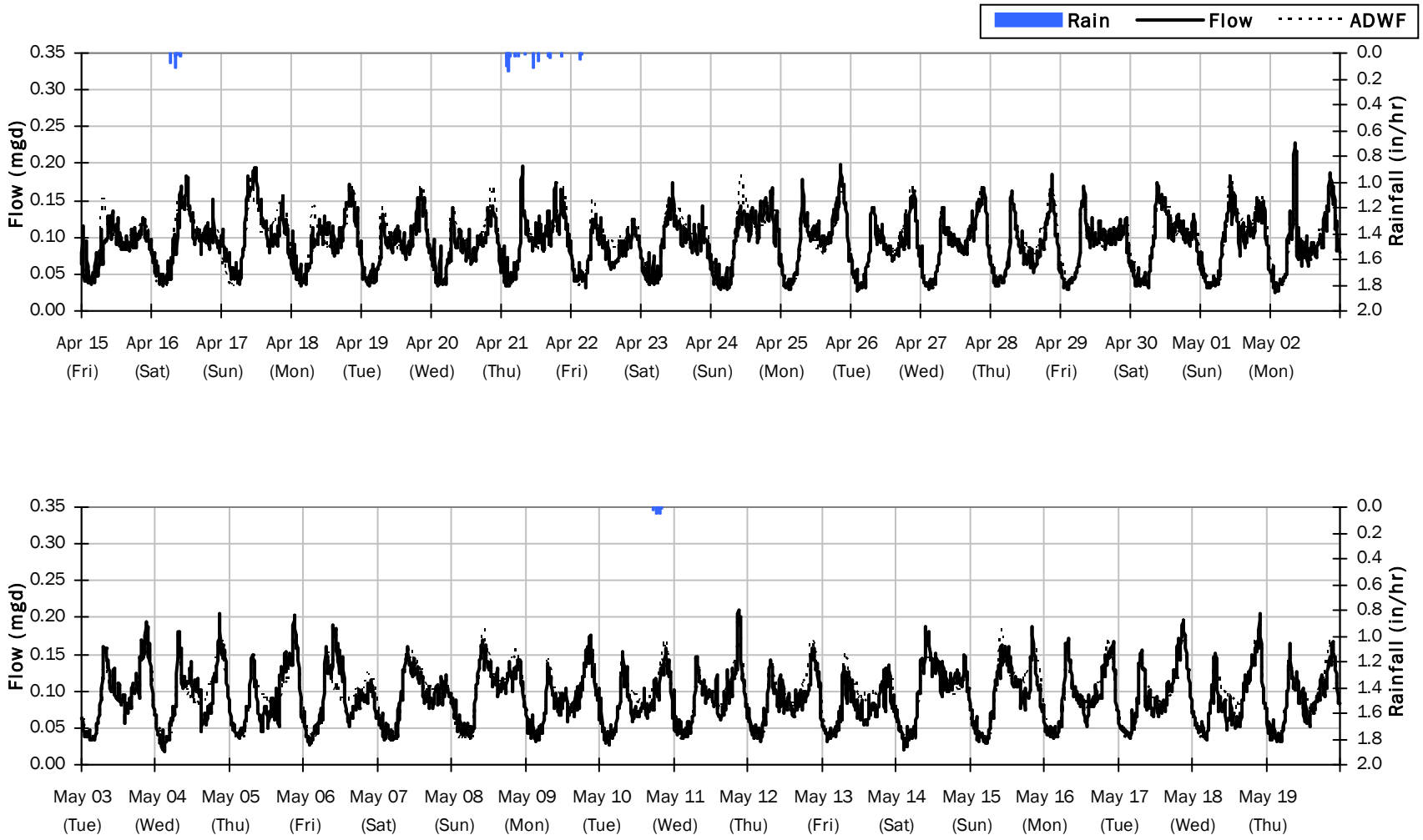




SITE 2

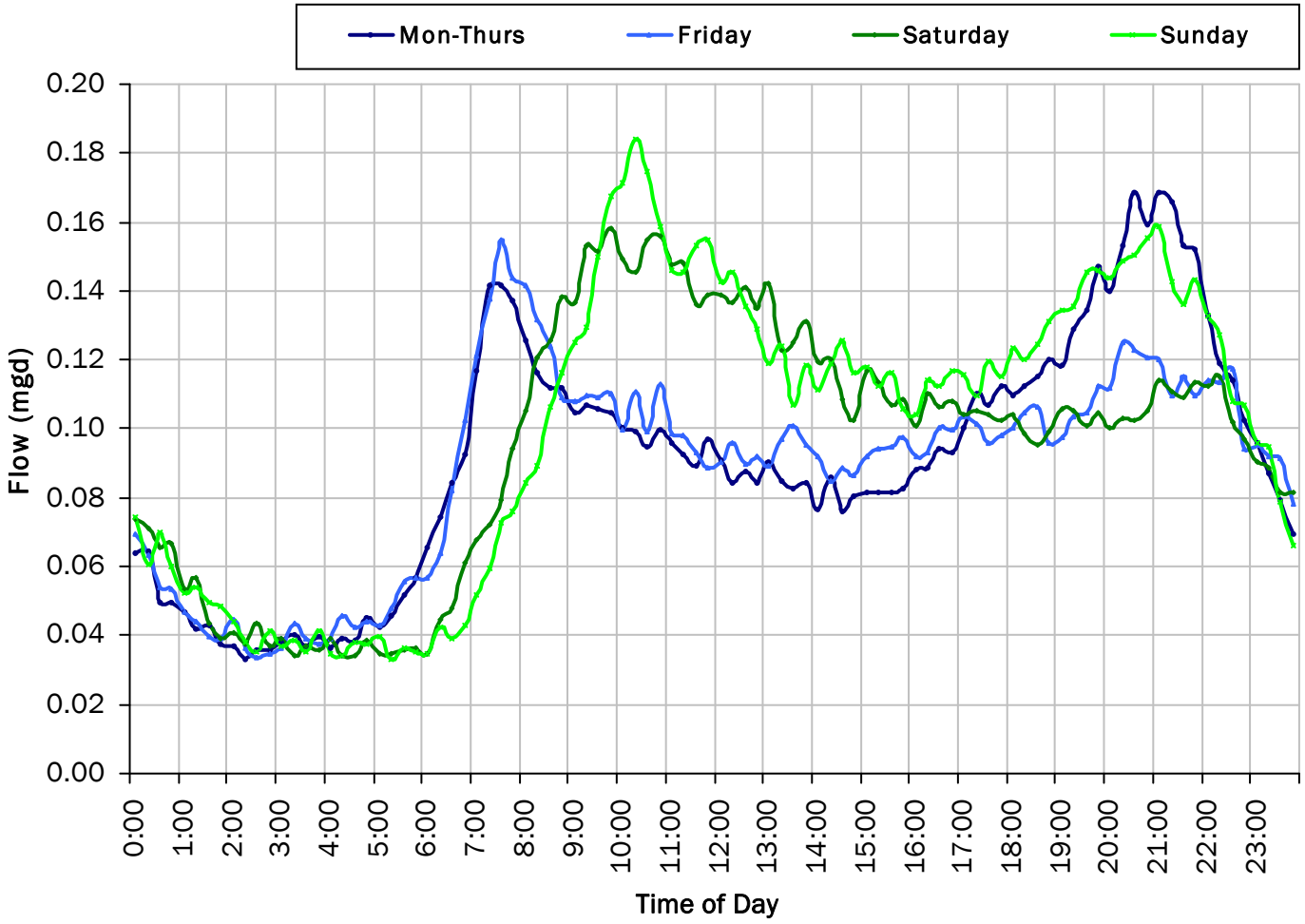
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.31 inches Period Avg Flow: 0.092 mgd Period Peak Flow: 0.228 mgd Period Min Flow: 0.018 mgd



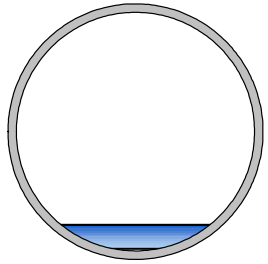
SITE 2

Average Dry Weather Flow Hydrographs



ADWF:

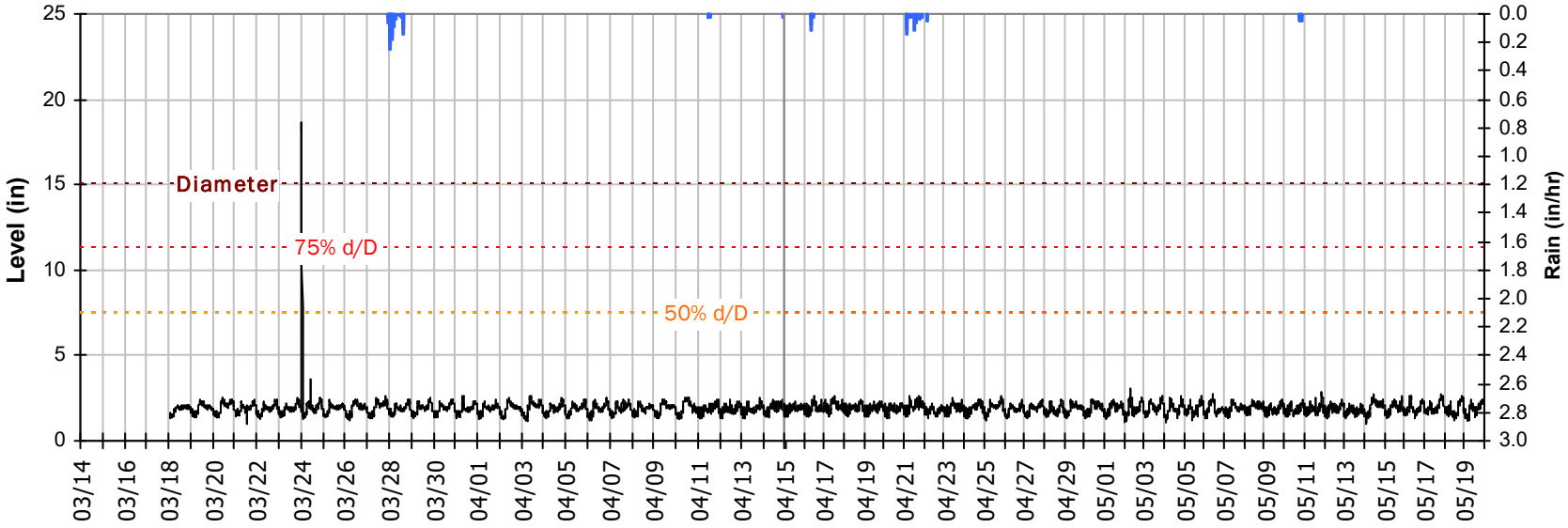
0.092 *mgd*

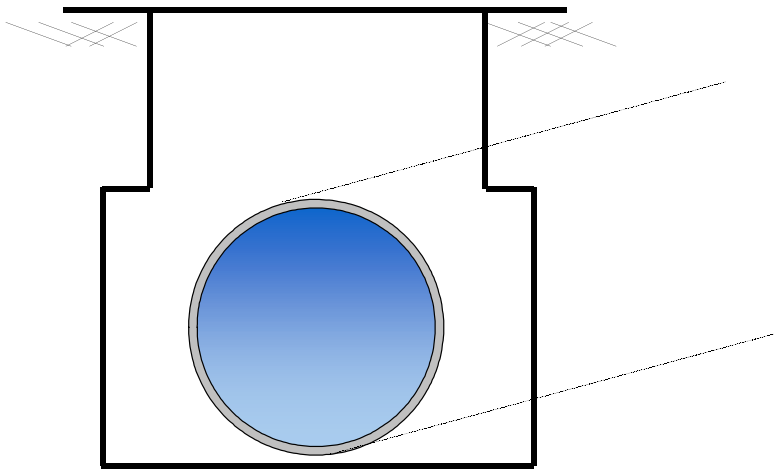


SITE 2

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



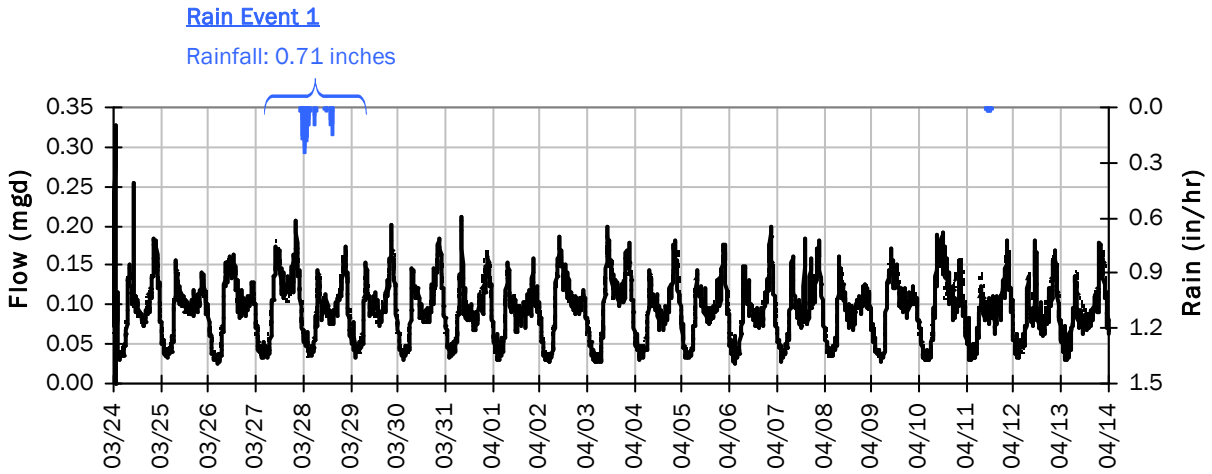


Pipe Diameter:	15	*inches*
Peak Measured Level:	18.2	*inches*
Peak d/D Ratio:	1.21	

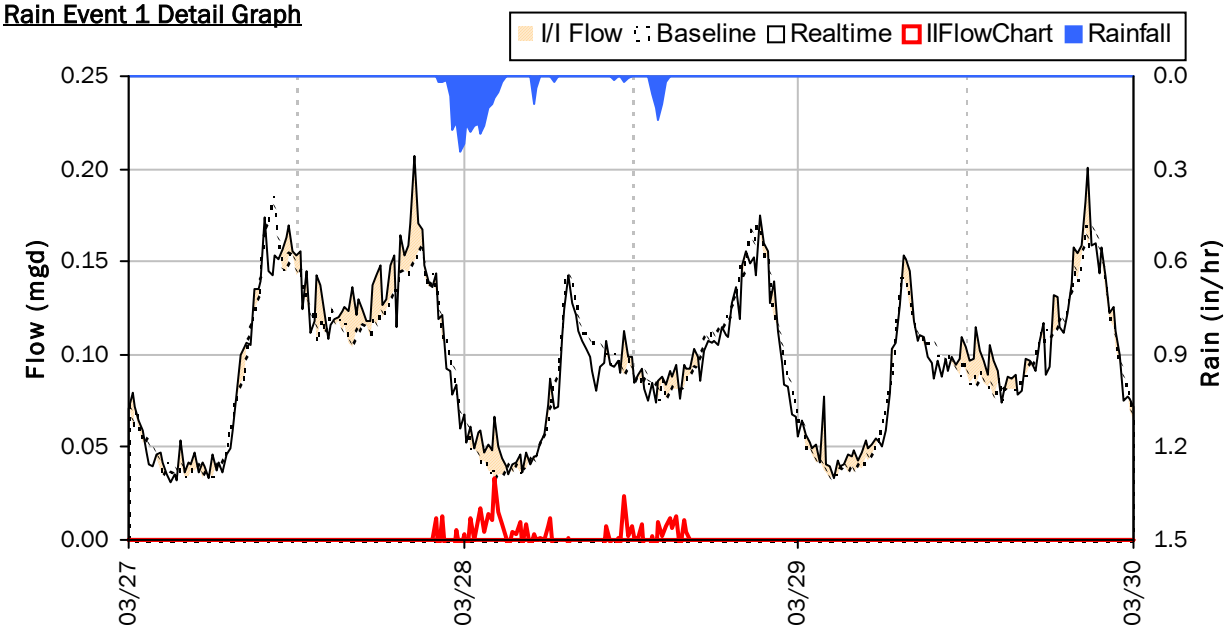
Surcharged 3.2 inches over crown

SITE 2
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



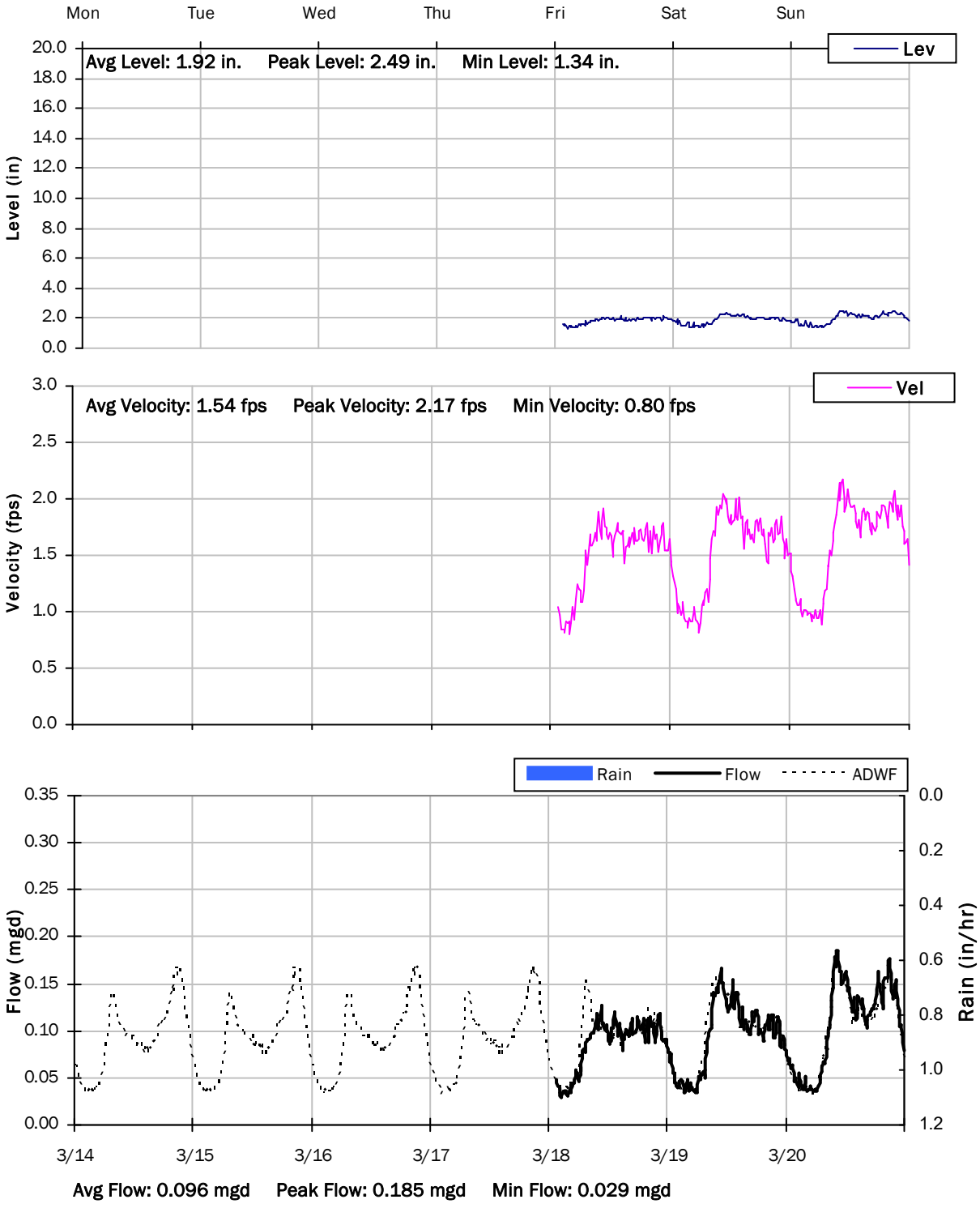
Storm Event I/I Analysis (Rain = 0.71 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.144 *mgd*	**Peak I/I Rate:**	0.033 *mgd*
PF:	1.56	**Total I/I:**	1,000 *gallons*
Peak Level:	2.28 *in*		
d/D Ratio:	0.15		

SITE 2

Weekly Level, Velocity and Flow Hydrographs

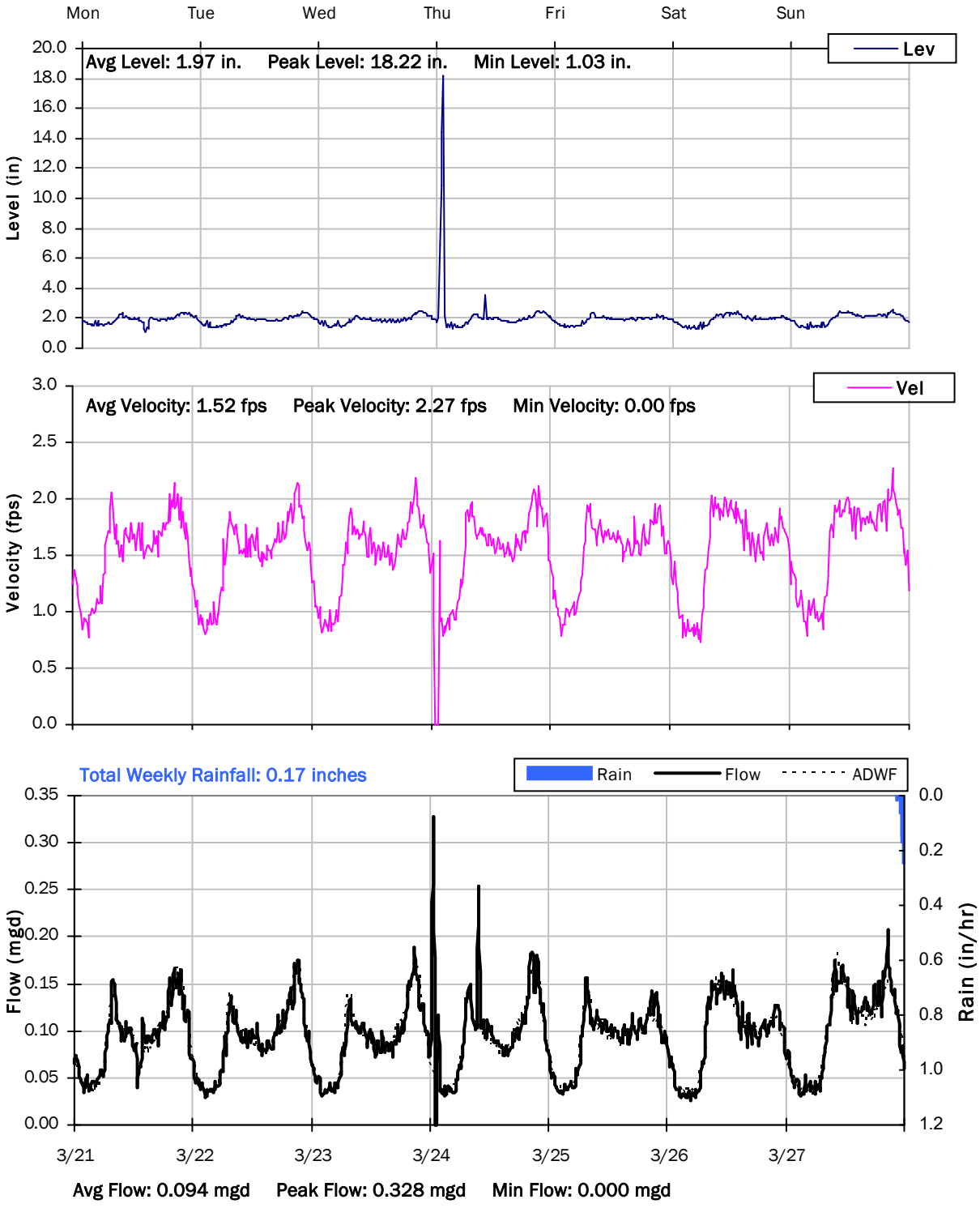
3/14/2022 to 3/21/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

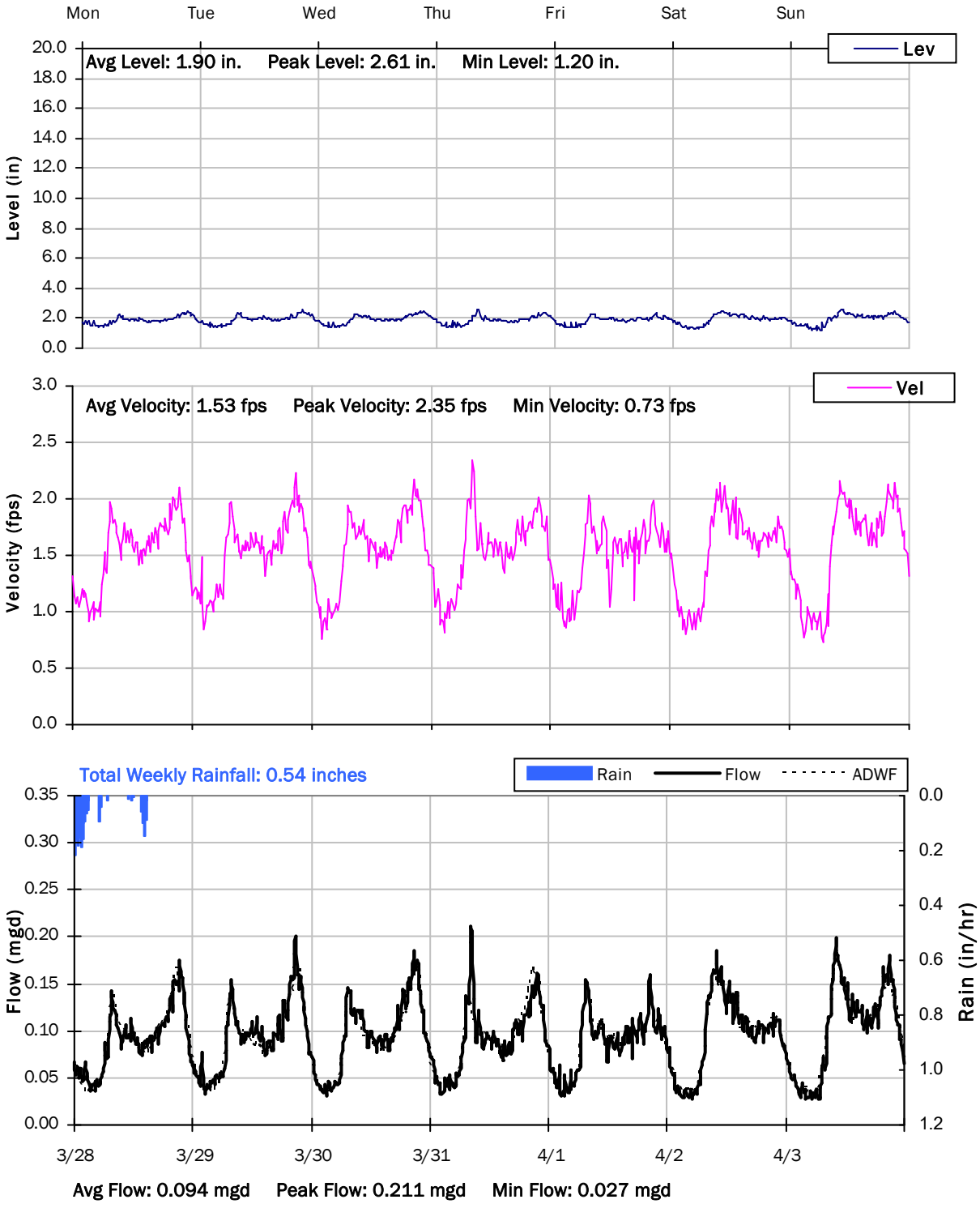
3/21/2022 to 3/28/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

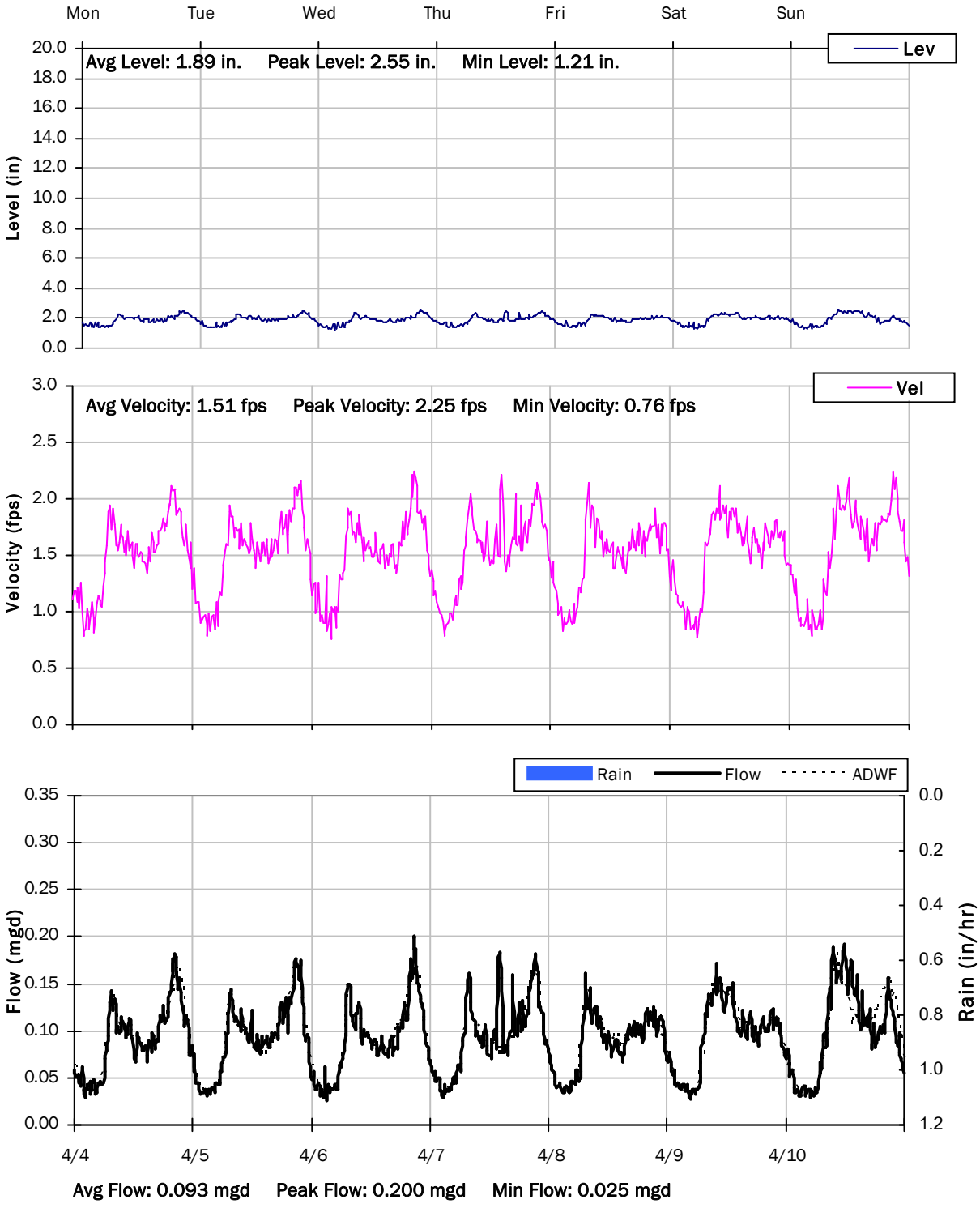
3/28/2022 to 4/4/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

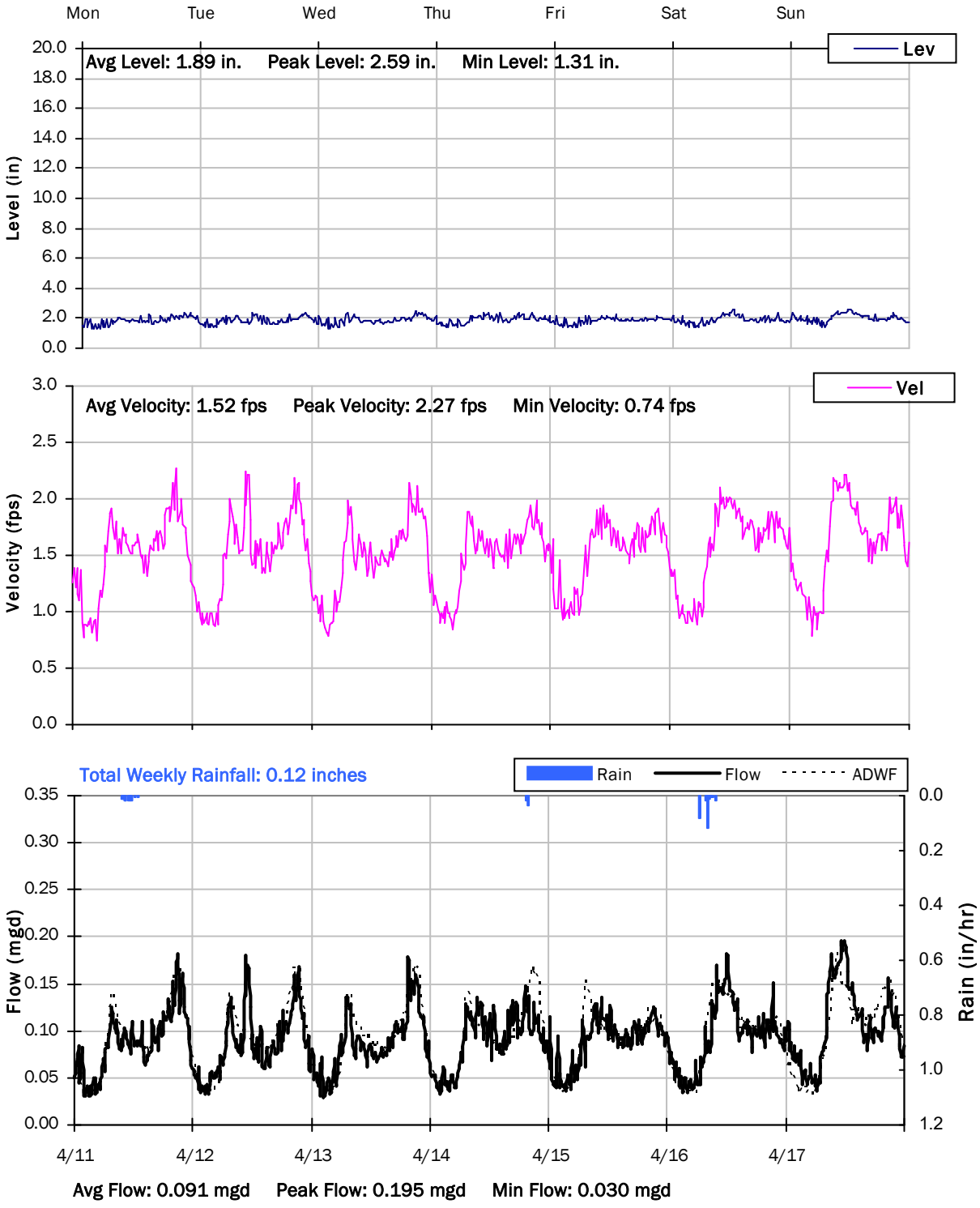
4/4/2022 to 4/11/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

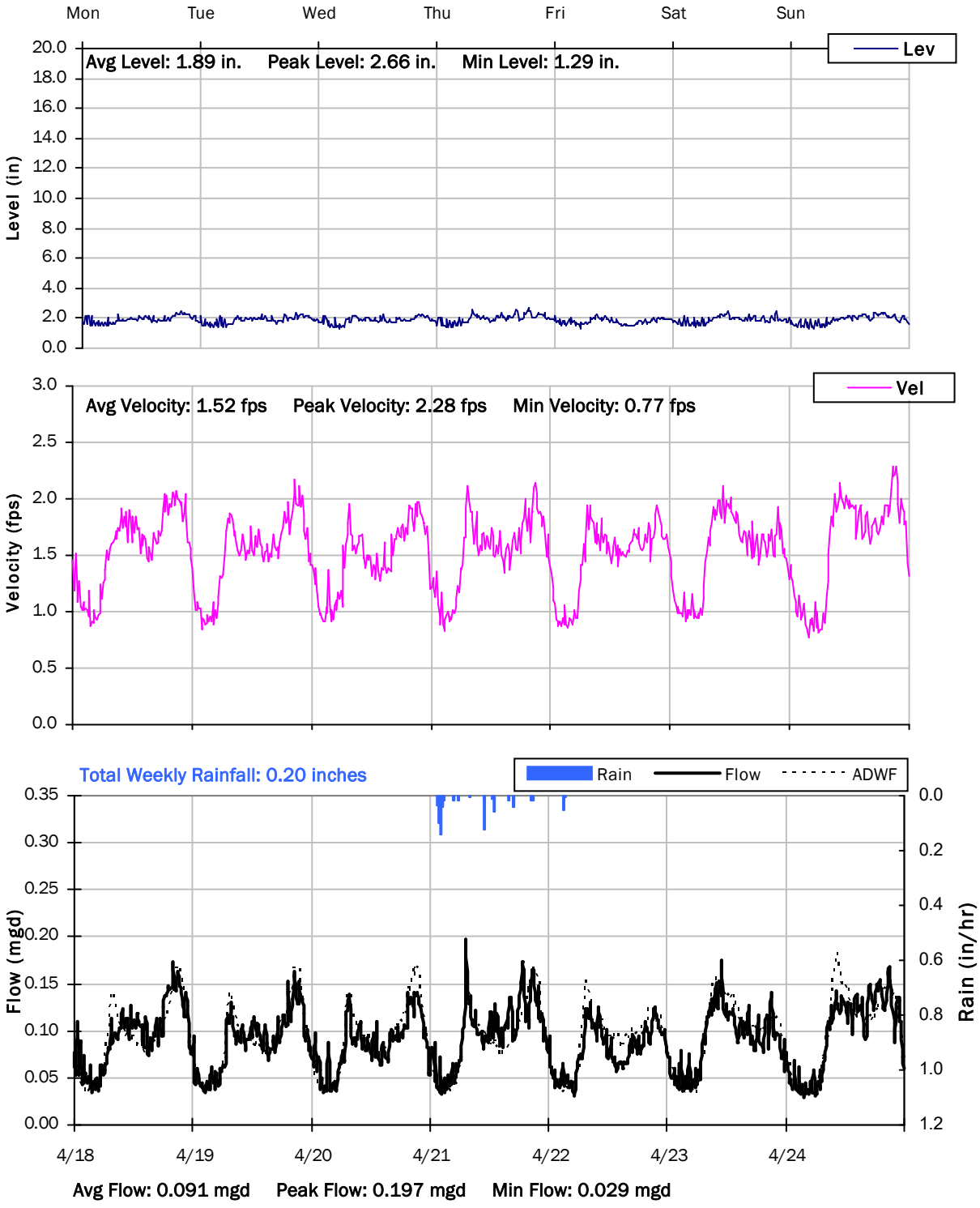
4/11/2022 to 4/18/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

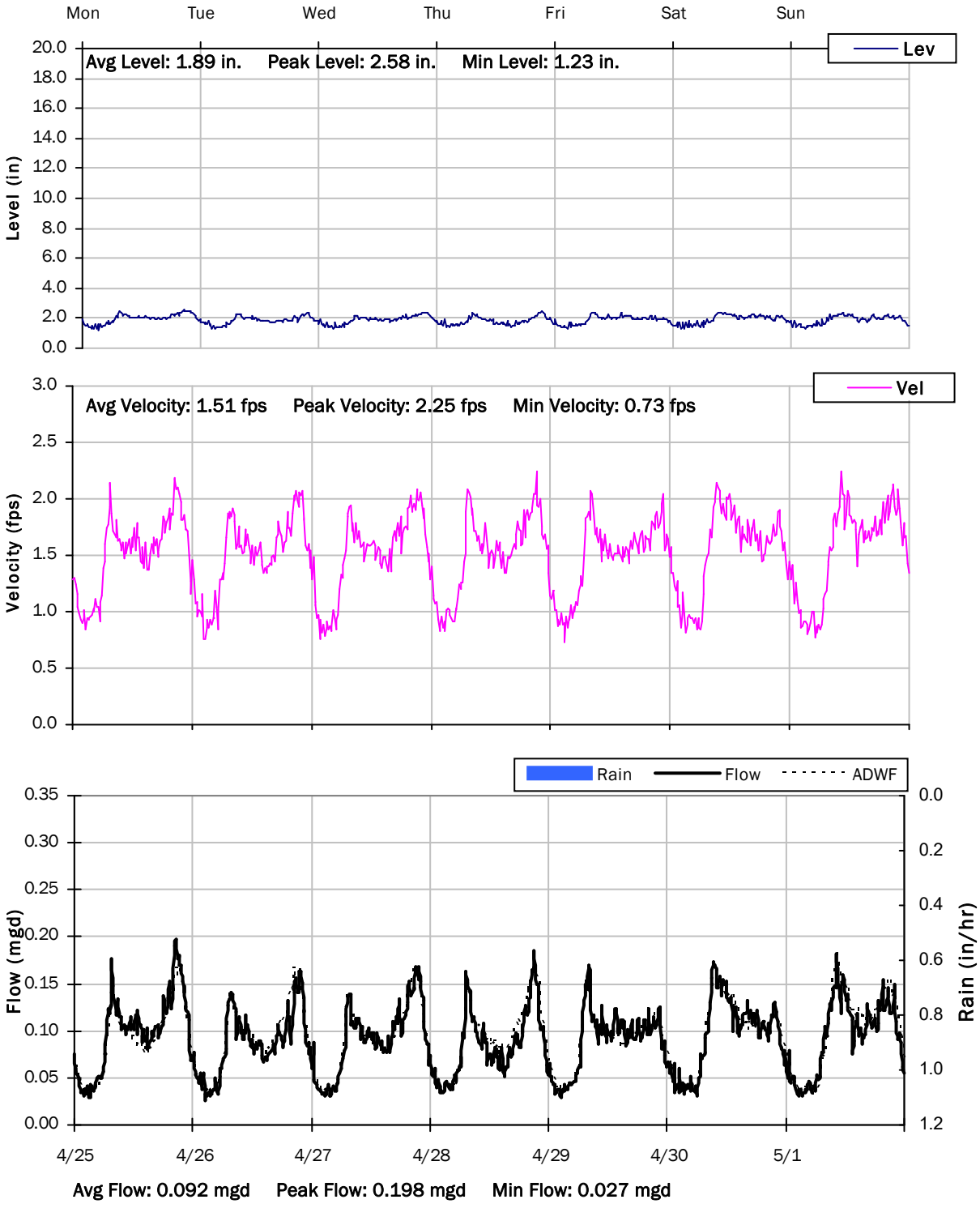
4/18/2022 to 4/25/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

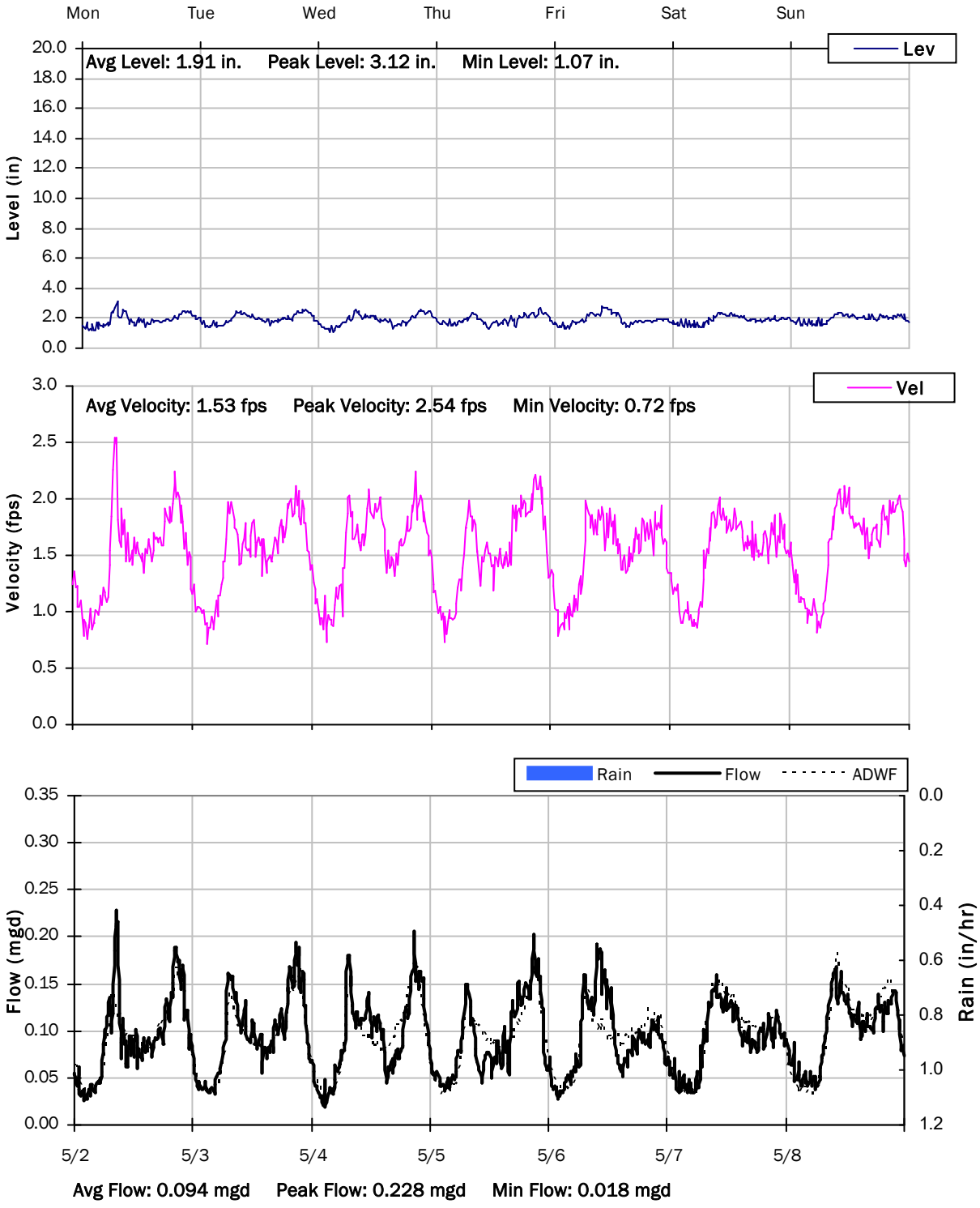
4/25/2022 to 5/2/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

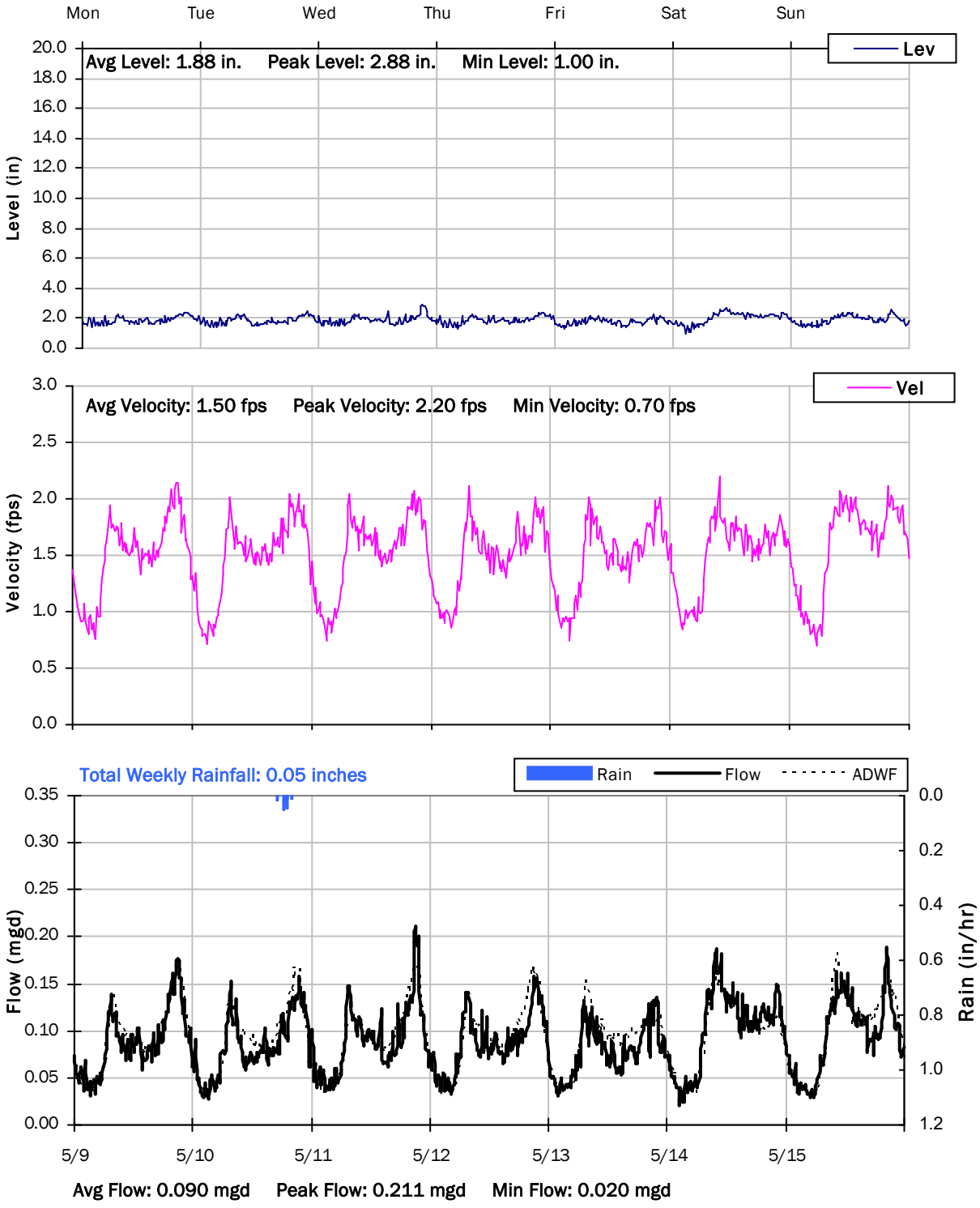
5/2/2022 to 5/9/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

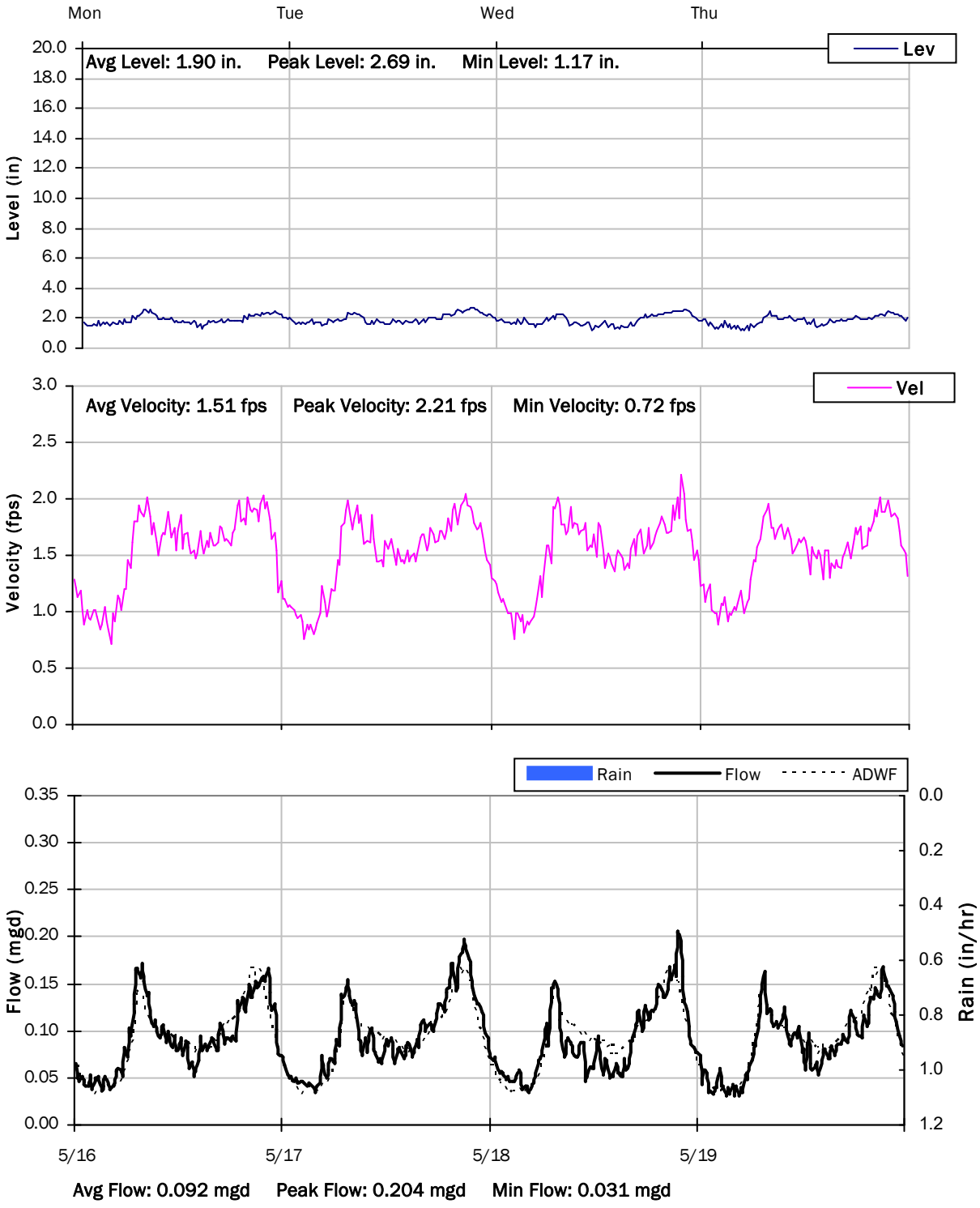
5/9/2022 to 5/16/2022



SITE 2

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 3

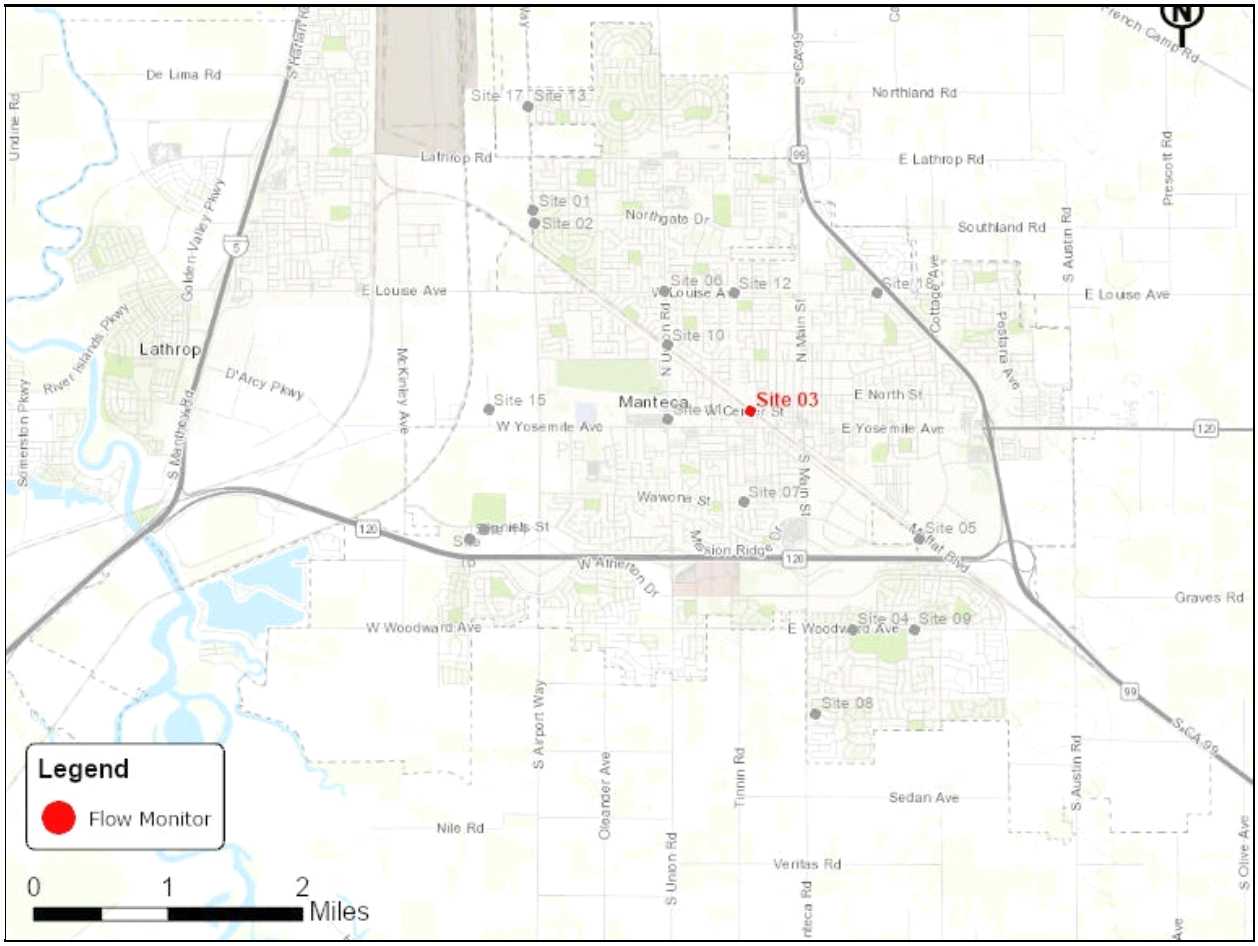
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: W. Center Street at Rose Lane

Data Summary Report



Vicinity Map: Site 3

SITE 3

Additional Site Photos

Effluent Pipe

Monitored East Influent Pipe

SITE 3

Additional Site Photos

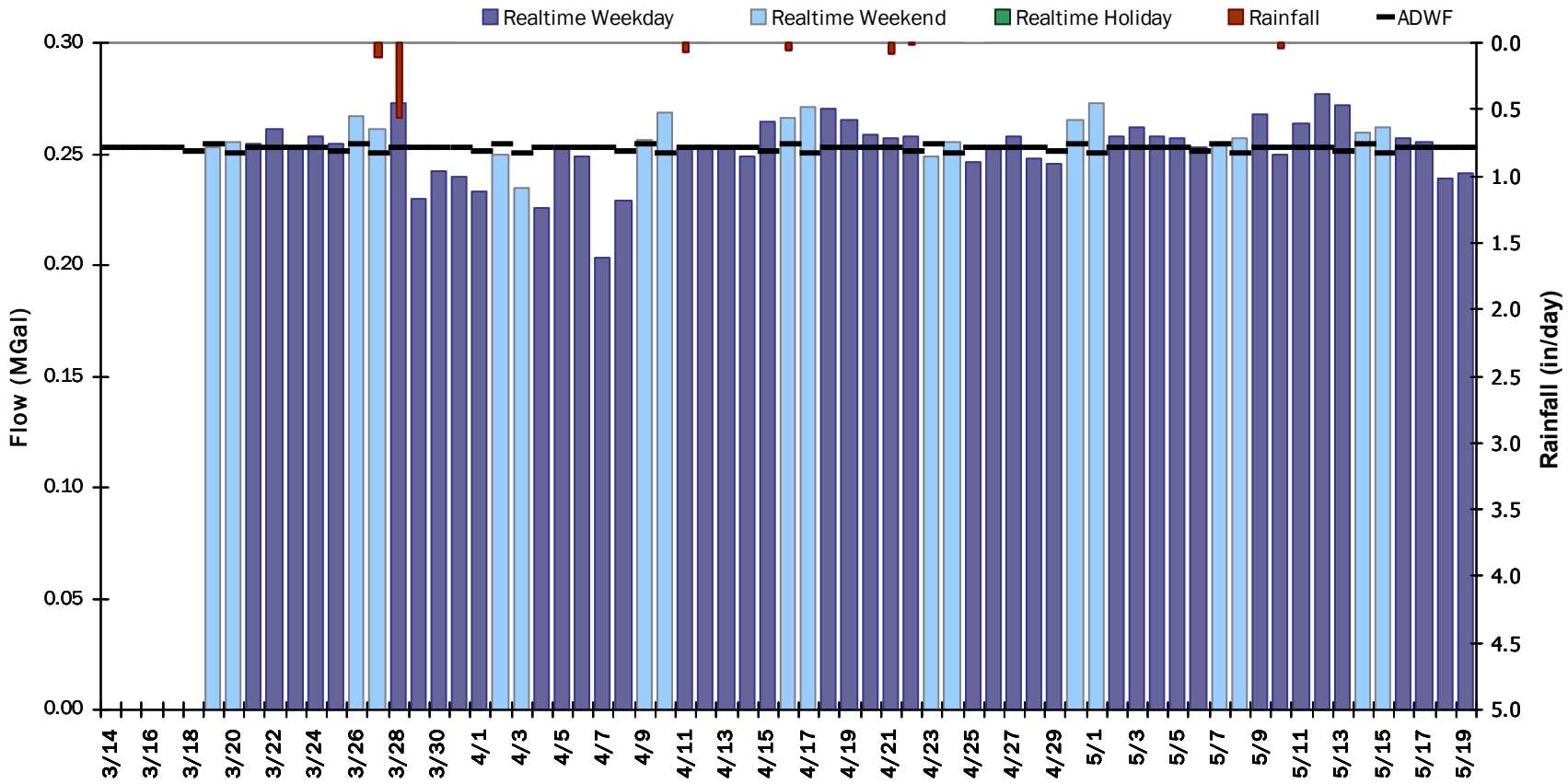
Southeast Influent Pipe

SITE 3

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.254 MGal Peak Daily Flow: 0.276 MGal Min Daily Flow: 0.203 MGal

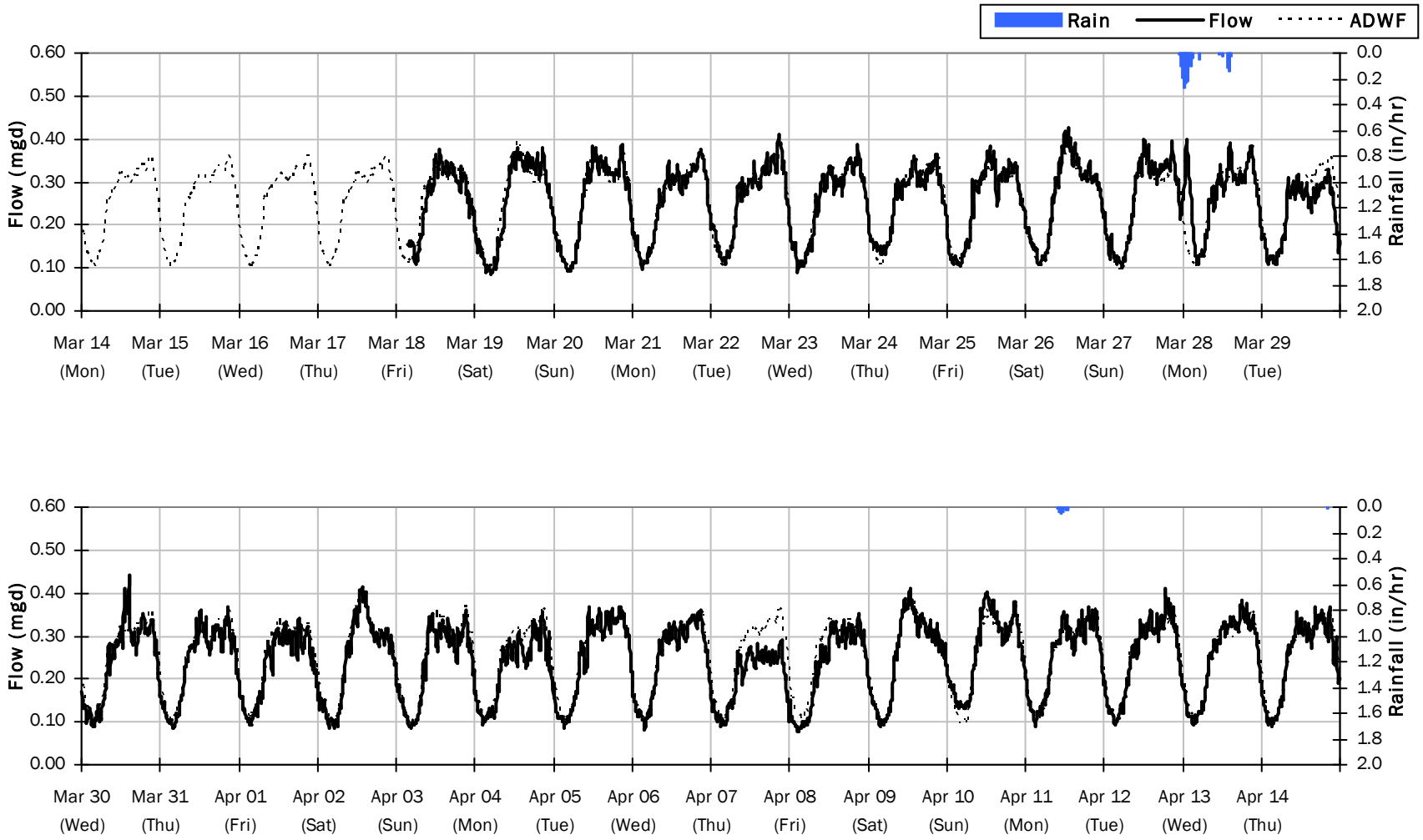
Total Rainfall: 0.93 inches



SITE 3

Flow Summary: 3/14/2022 to 4/14/2022

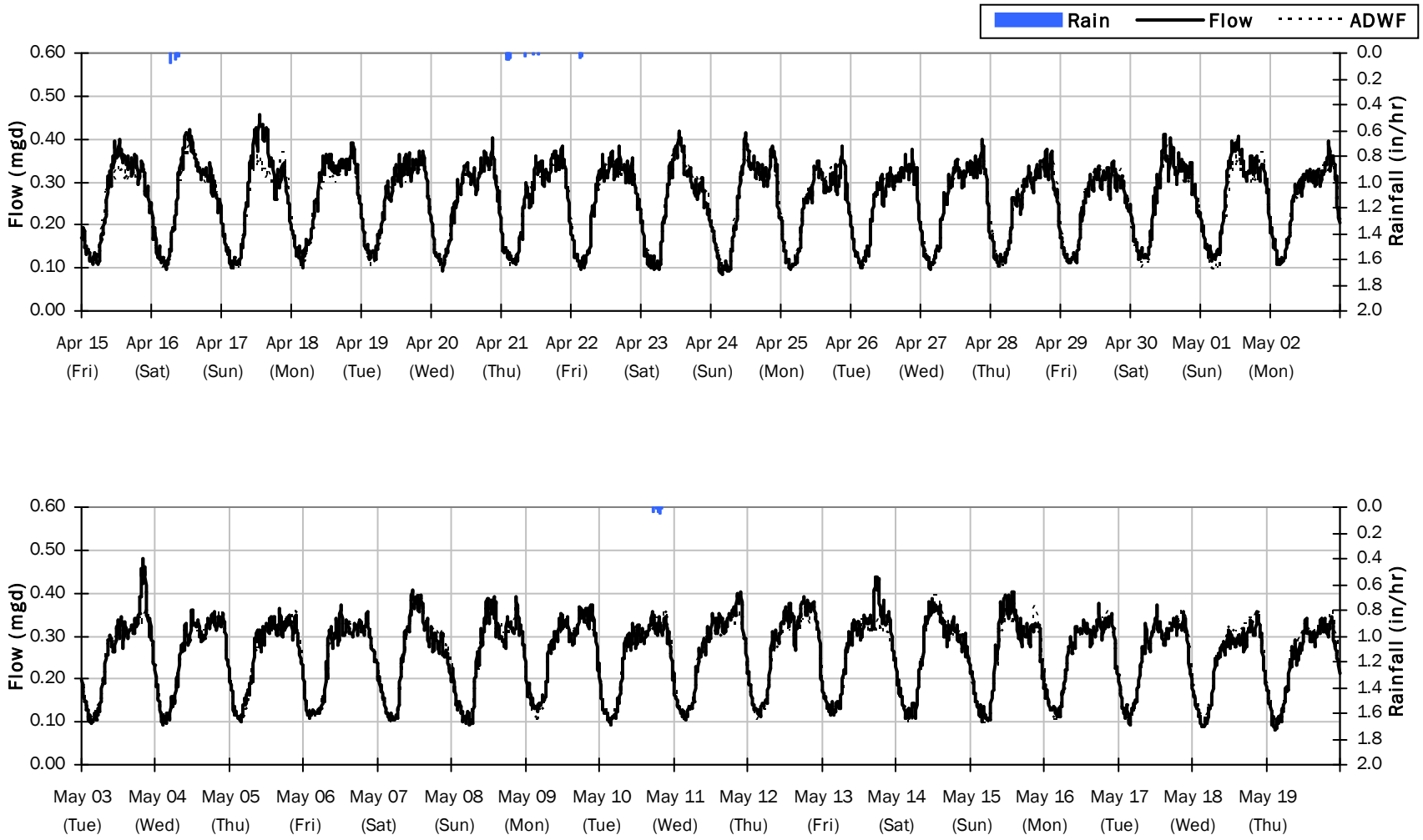
Period Rainfall: 0.74 inches Period Avg Flow: 0.249 mgd Period Peak Flow: 0.441 mgd Period Min Flow: 0.078 mgd



SITE 3

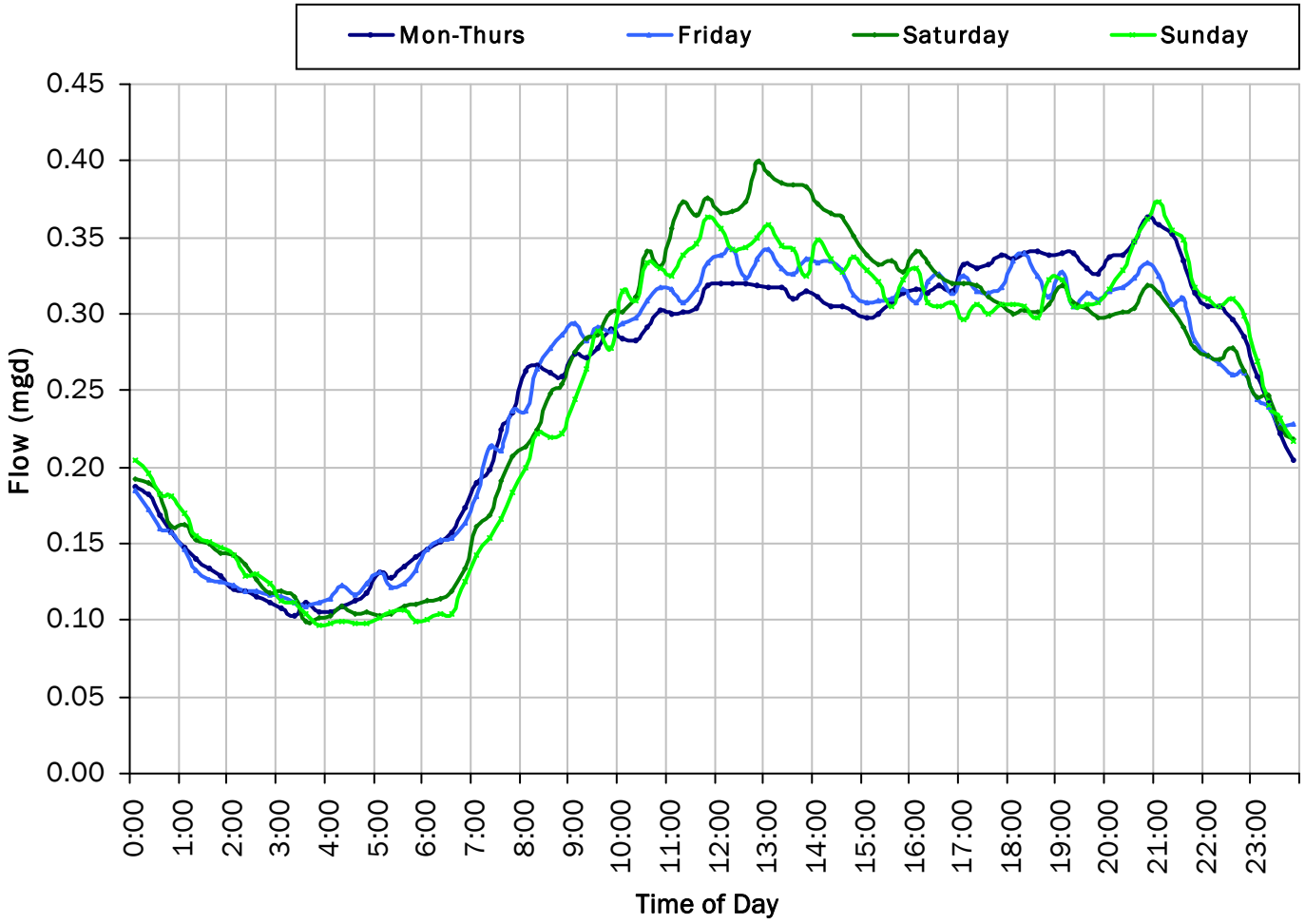
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.19 inches Period Avg Flow: 0.258 mgd Period Peak Flow: 0.481 mgd Period Min Flow: 0.082 mgd



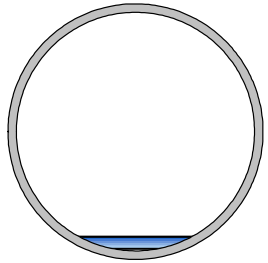
SITE 3

Average Dry Weather Flow Hydrographs



ADWF:

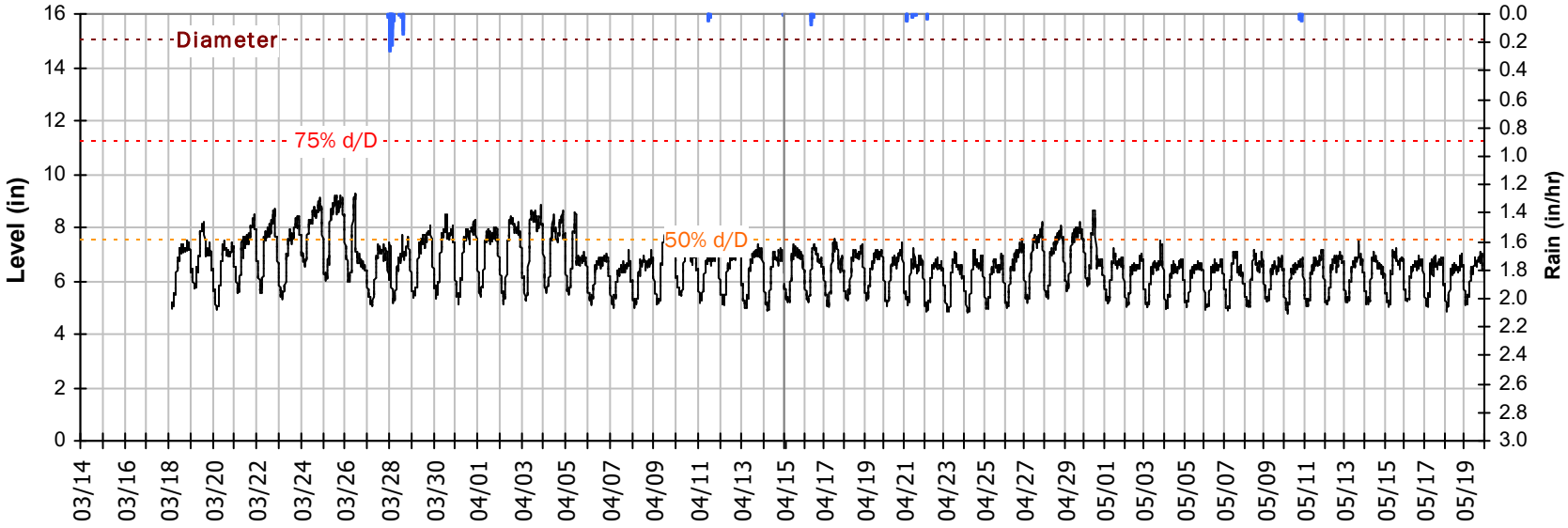
0.253 *mgd*

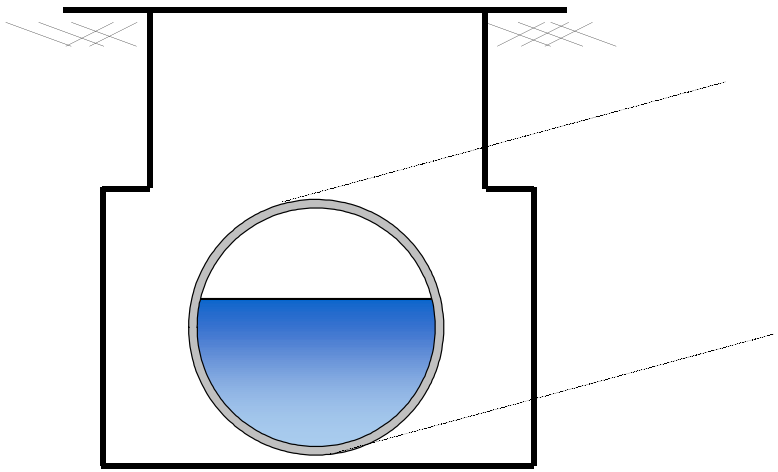


SITE 3

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





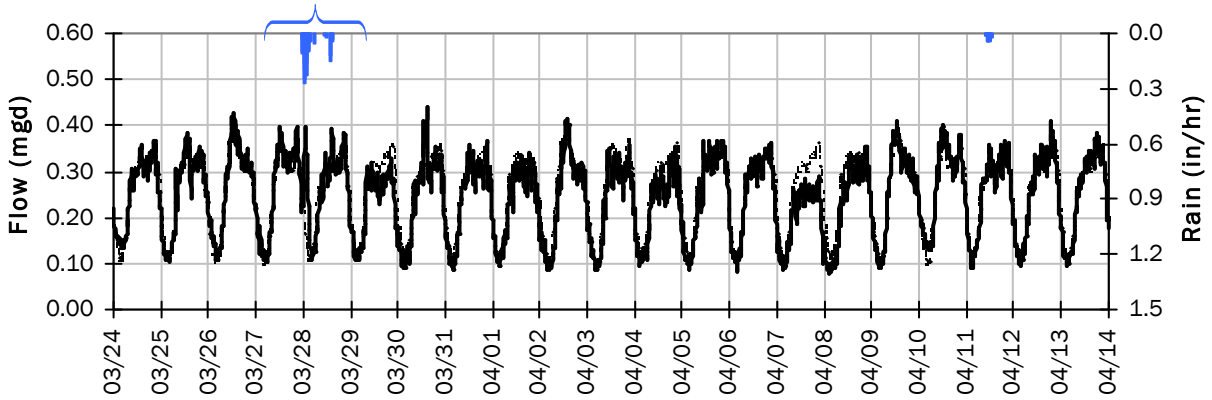
Pipe Diameter:	15	*inches*
Peak Measured Level:	9.24	*inches*
Peak d/D Ratio:	0.62	

SITE 3
I/I Summary: Rain Event 1

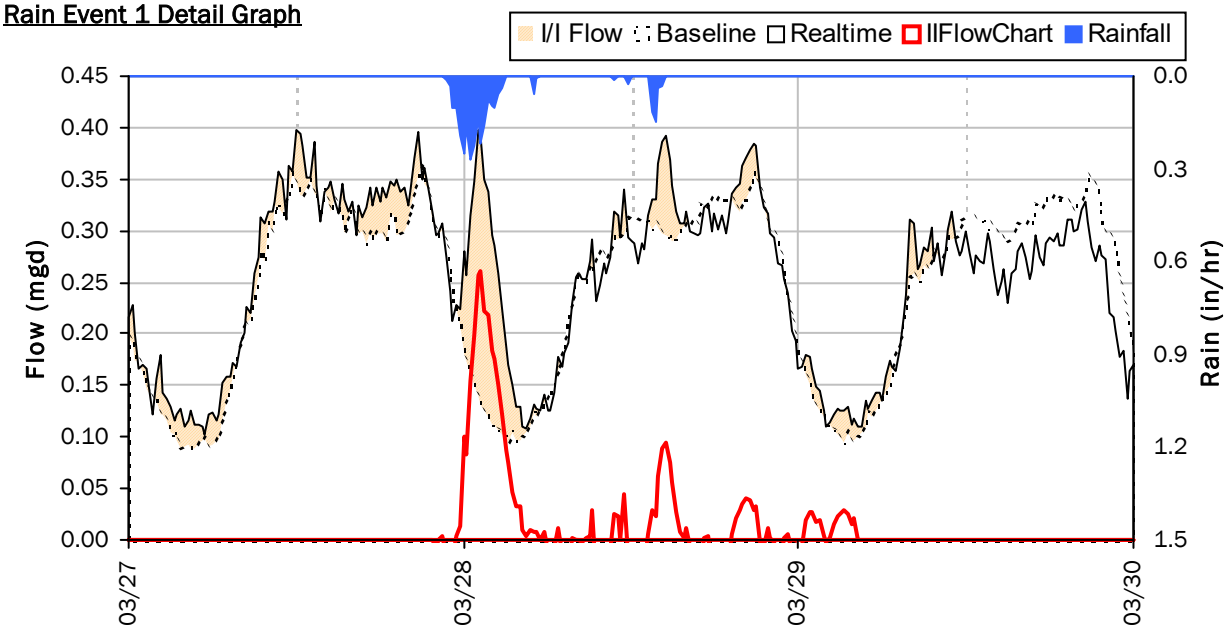
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Rain Event 1

Rainfall: 0.67 inches



Rain Event 1 Detail Graph



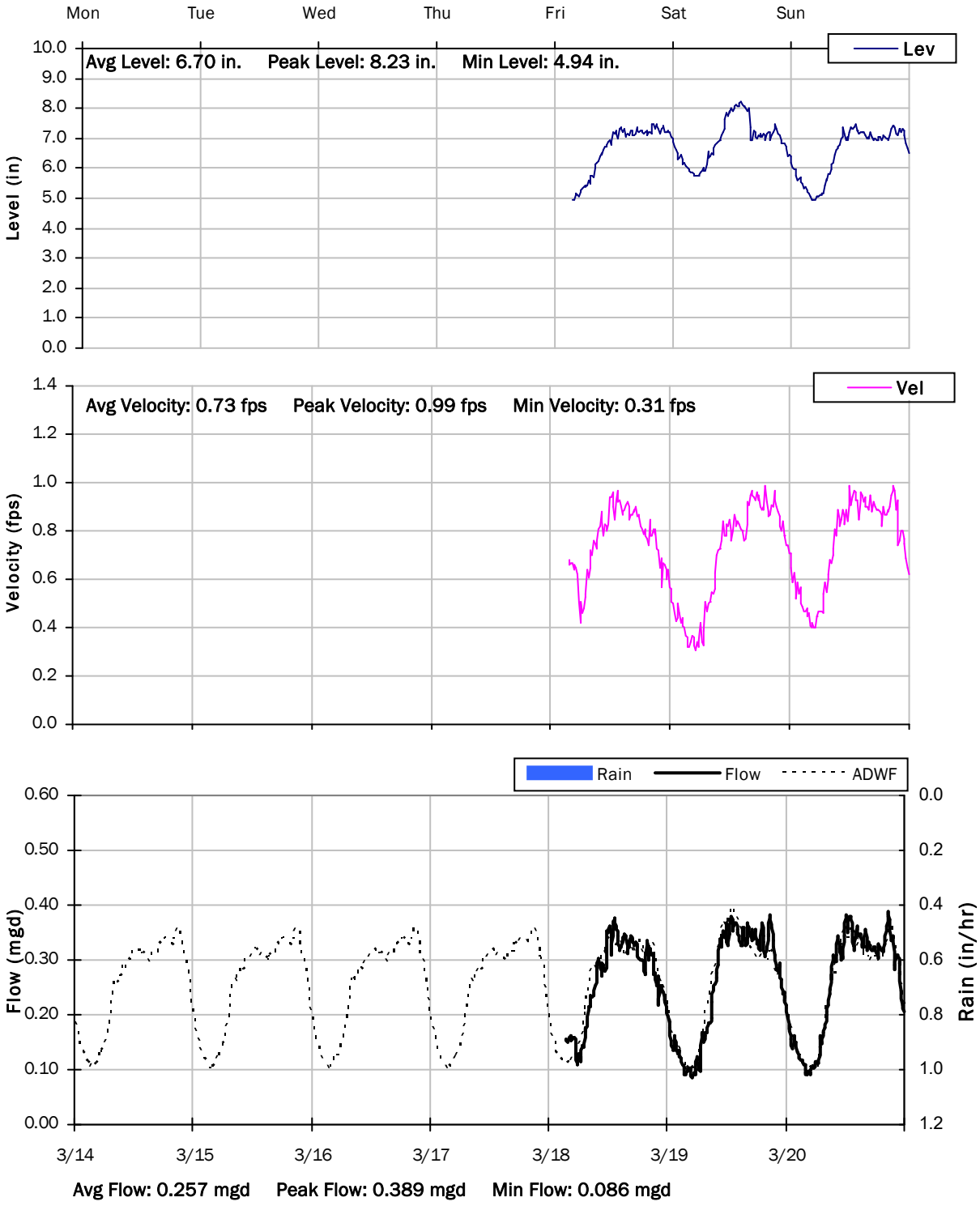
Storm Event I/I Analysis (Rain = 0.67 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.397 *mgd*	**Peak I/I Rate:**	0.262 *mgd*
PF:	1.57	**Total I/I:**	31,000 *gallons*
Peak Level:	7.74 *in*		
d/D Ratio:	0.52		

SITE 3

Weekly Level, Velocity and Flow Hydrographs

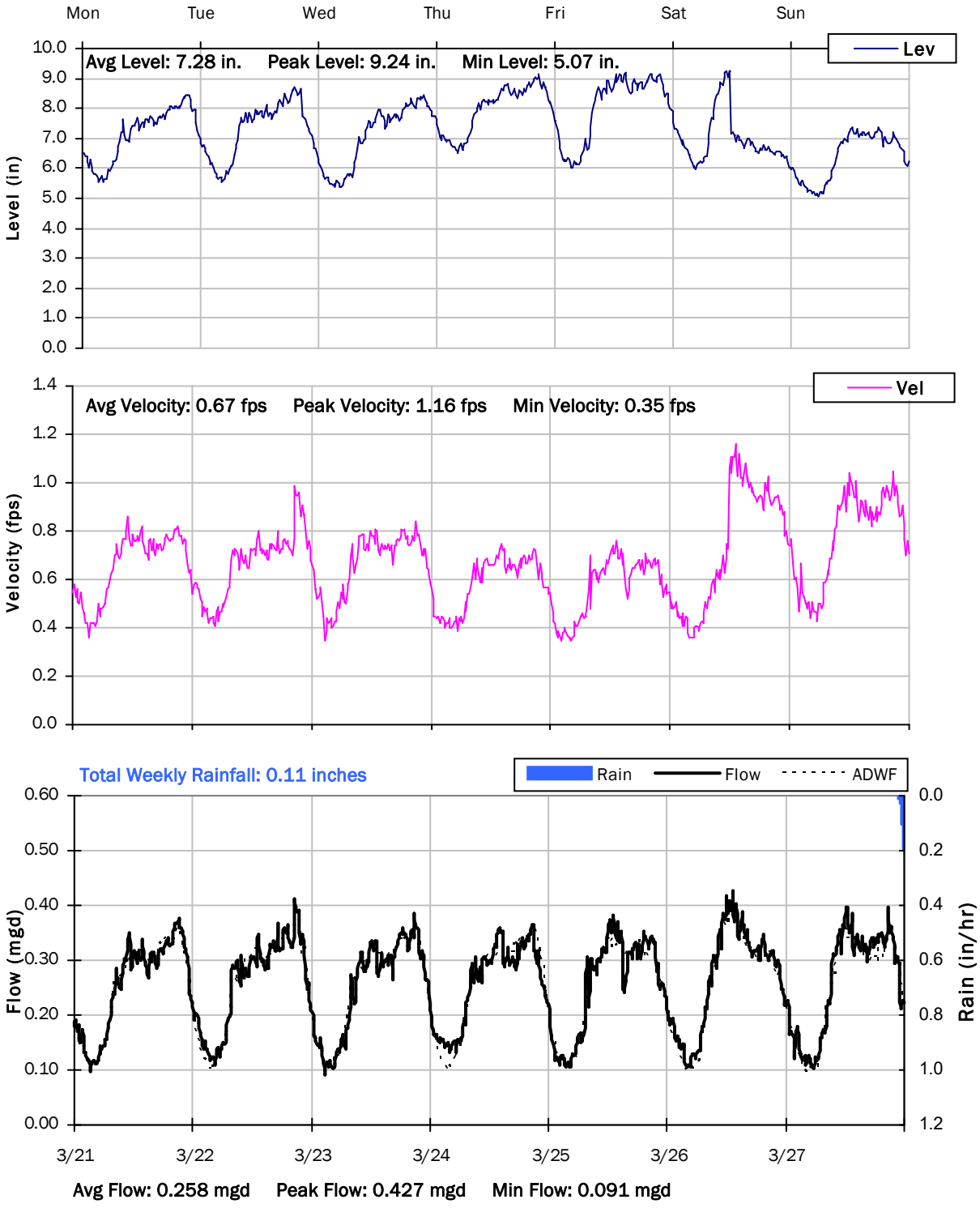
3/14/2022 to 3/21/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

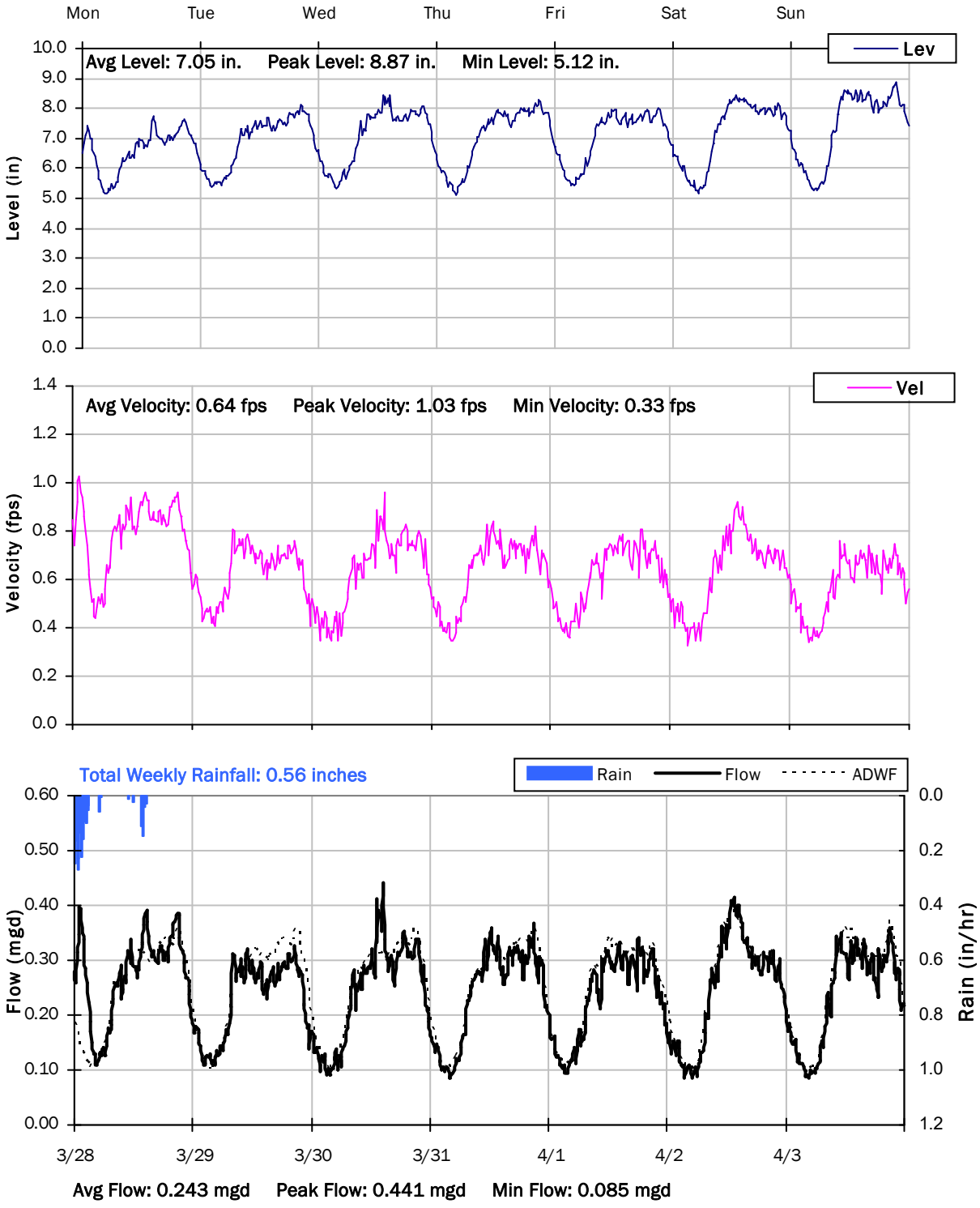
3/21/2022 to 3/28/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

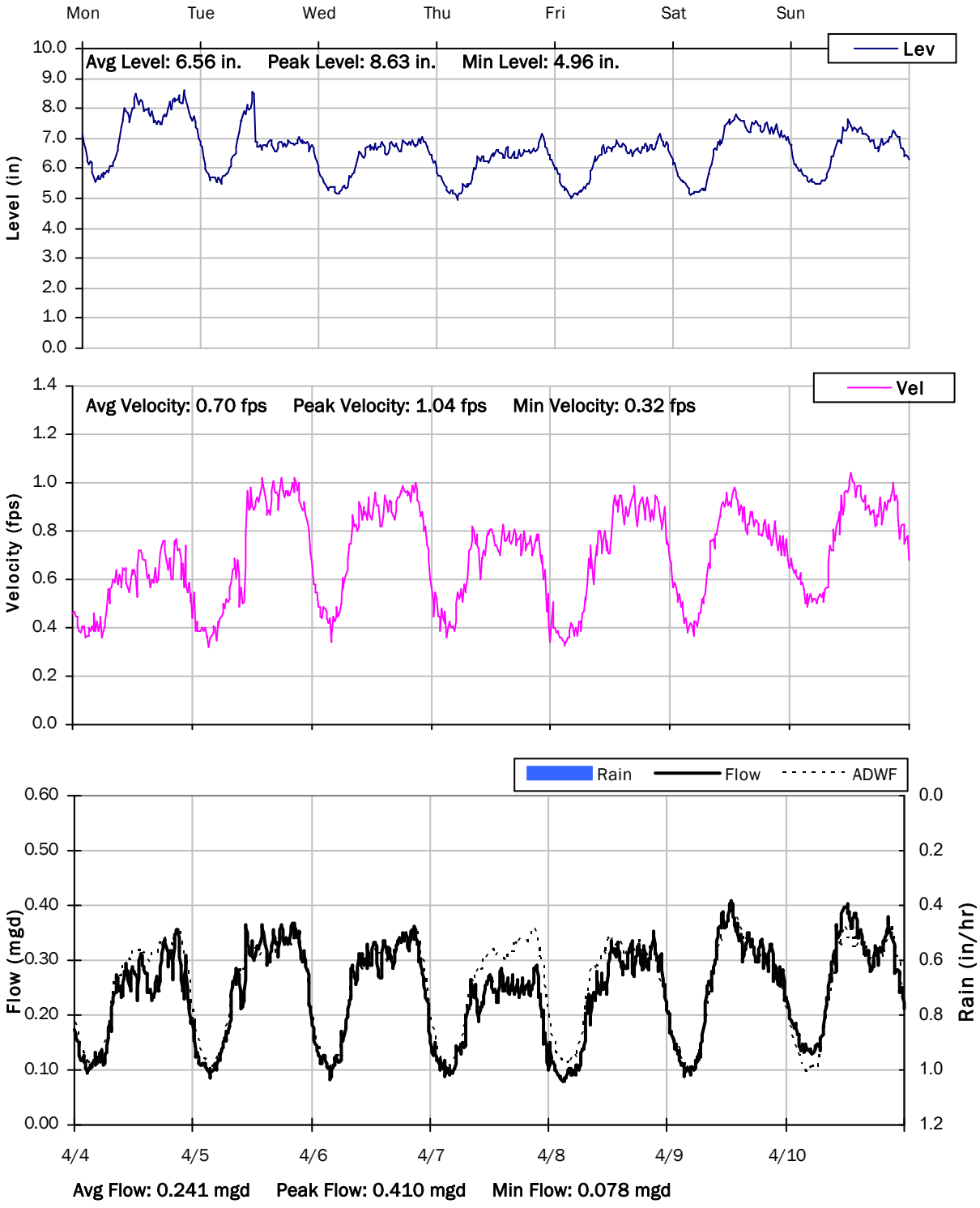
3/28/2022 to 4/4/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

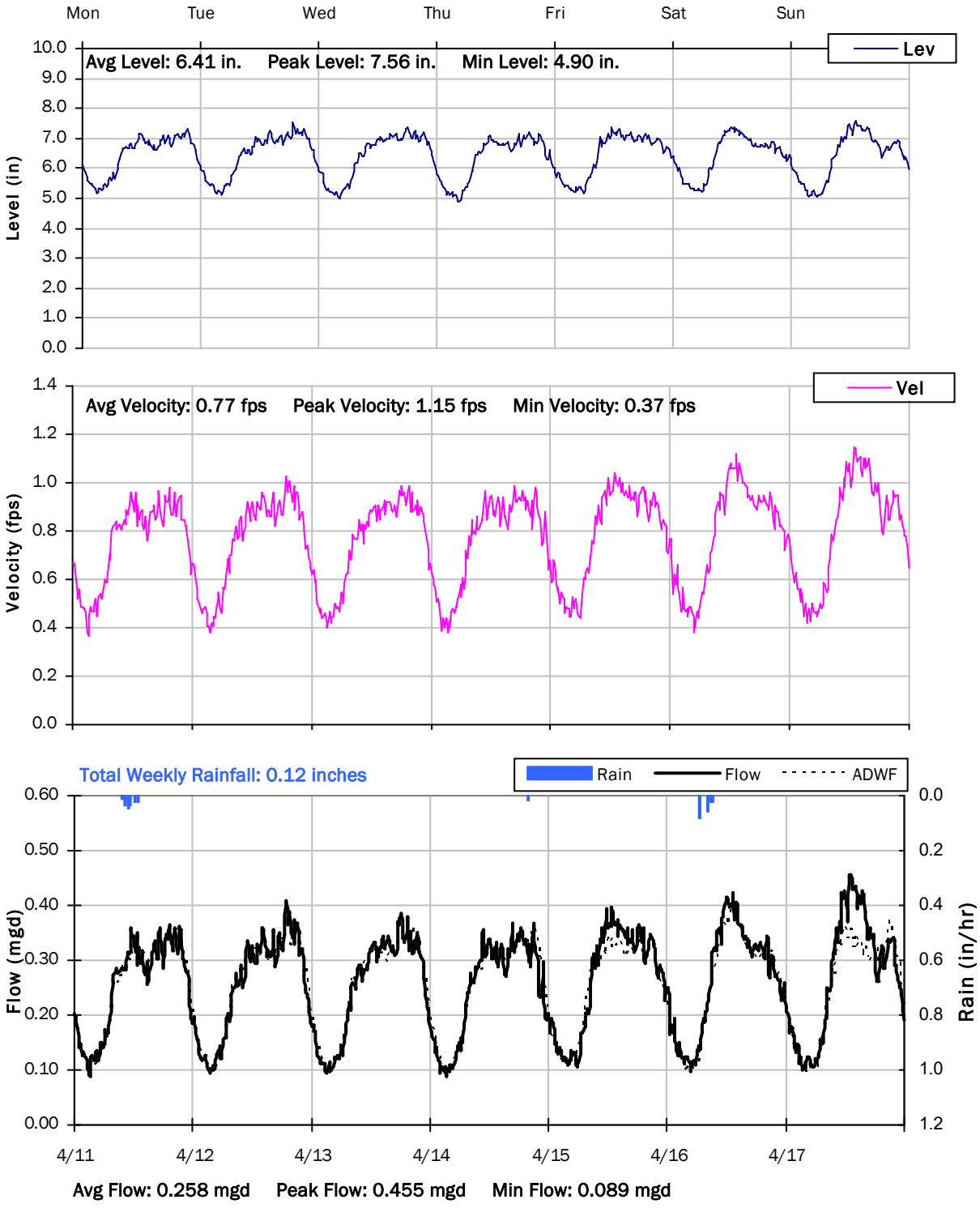
4/4/2022 to 4/11/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

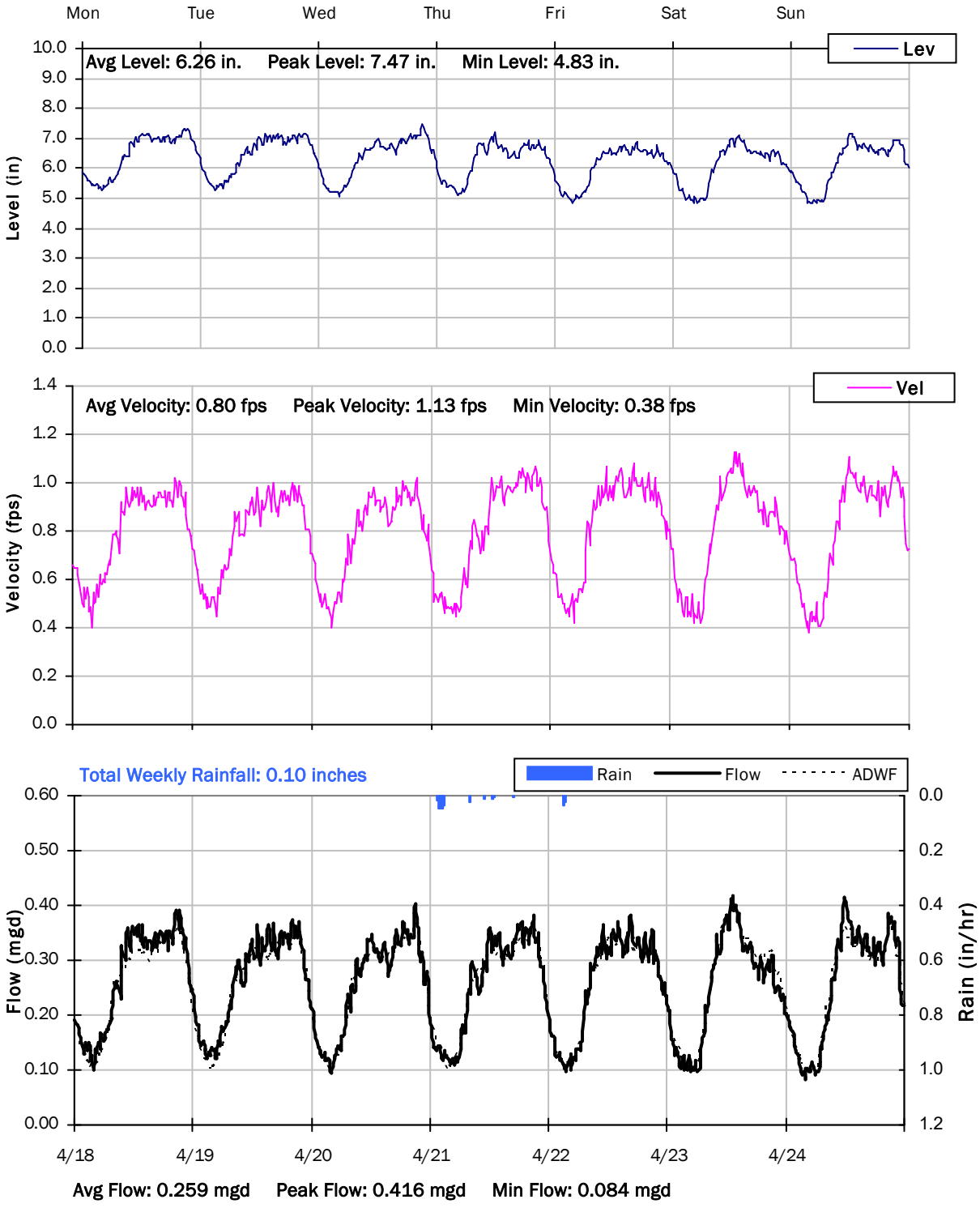
4/11/2022 to 4/18/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

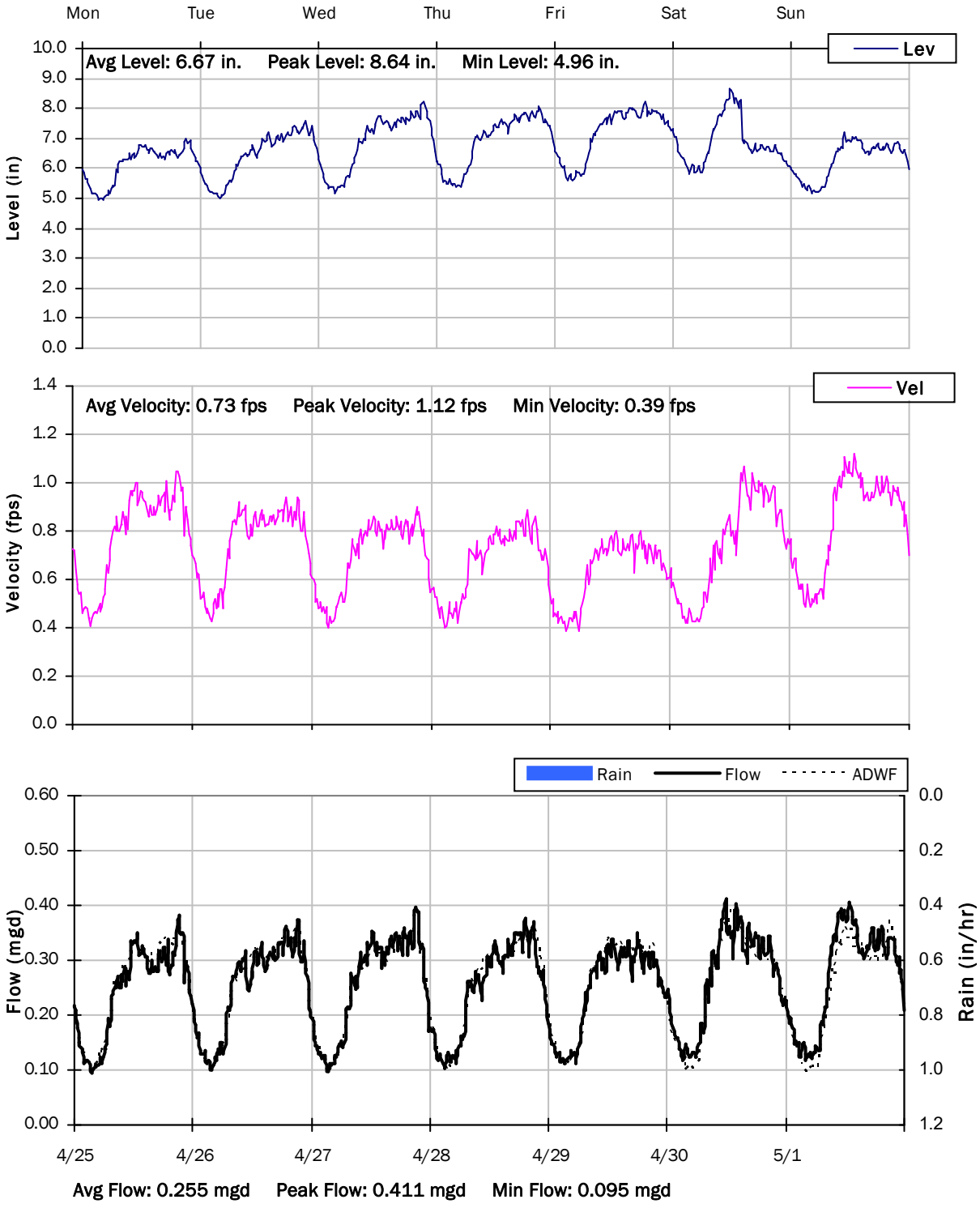
4/18/2022 to 4/25/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

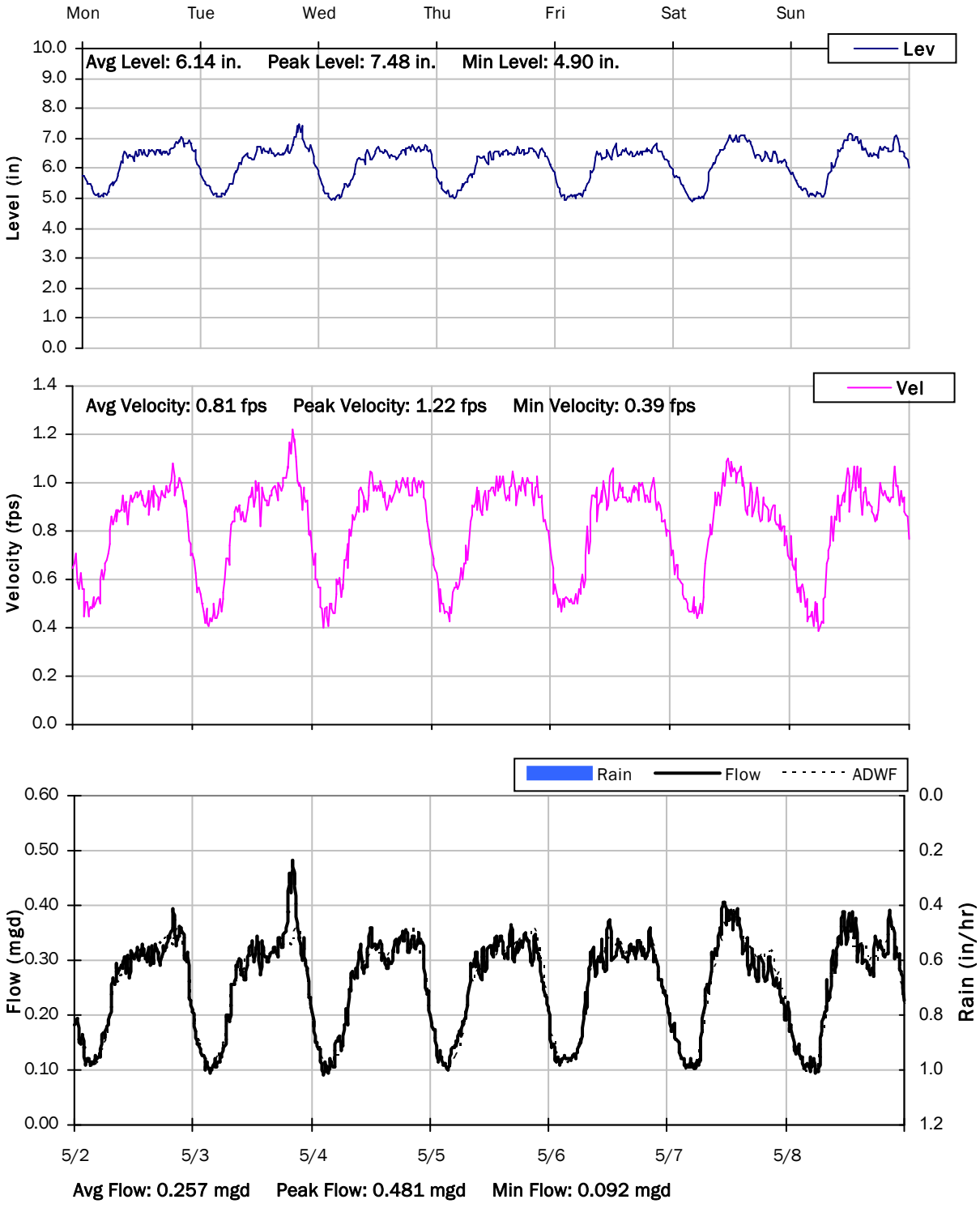
4/25/2022 to 5/2/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

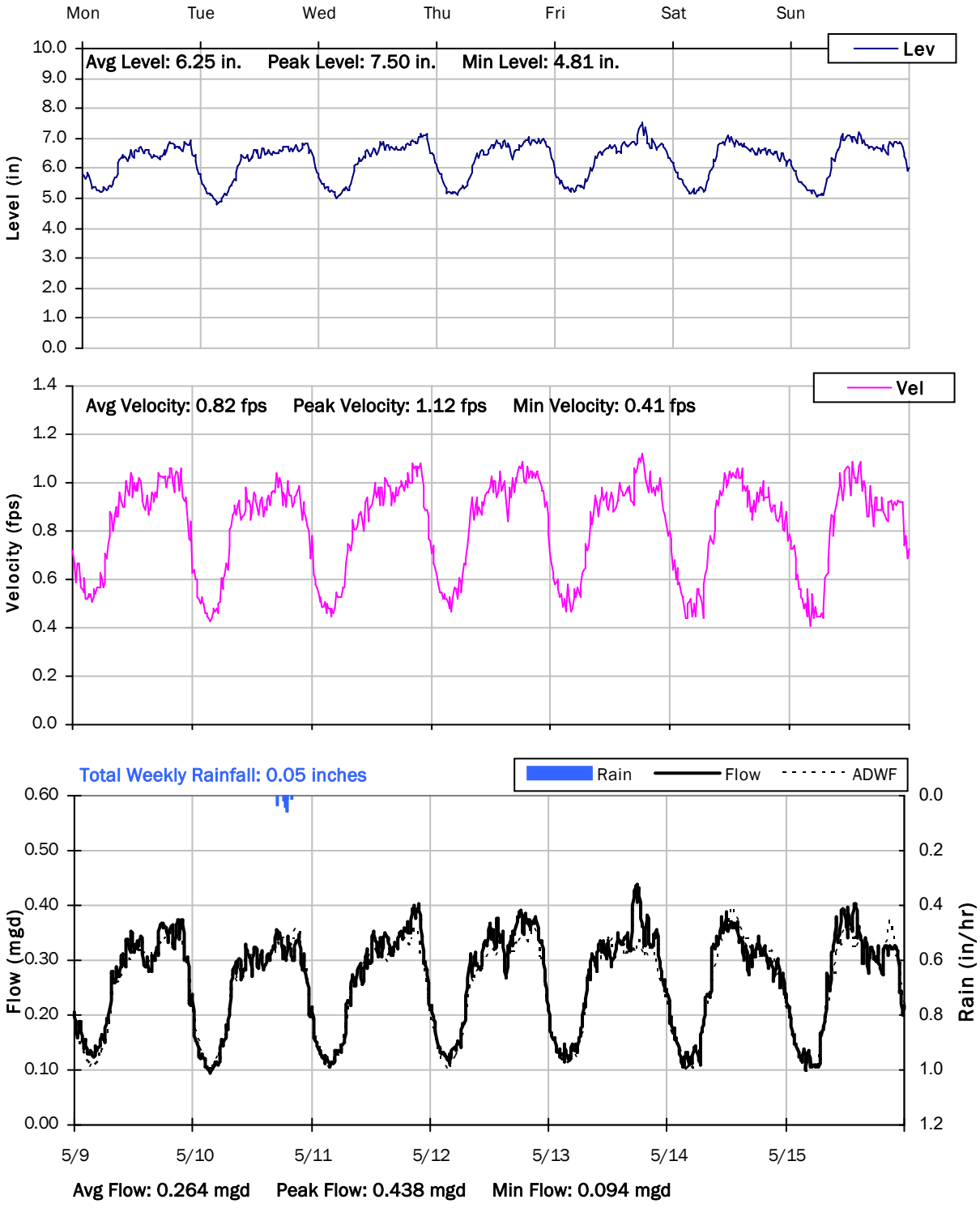
5/2/2022 to 5/9/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

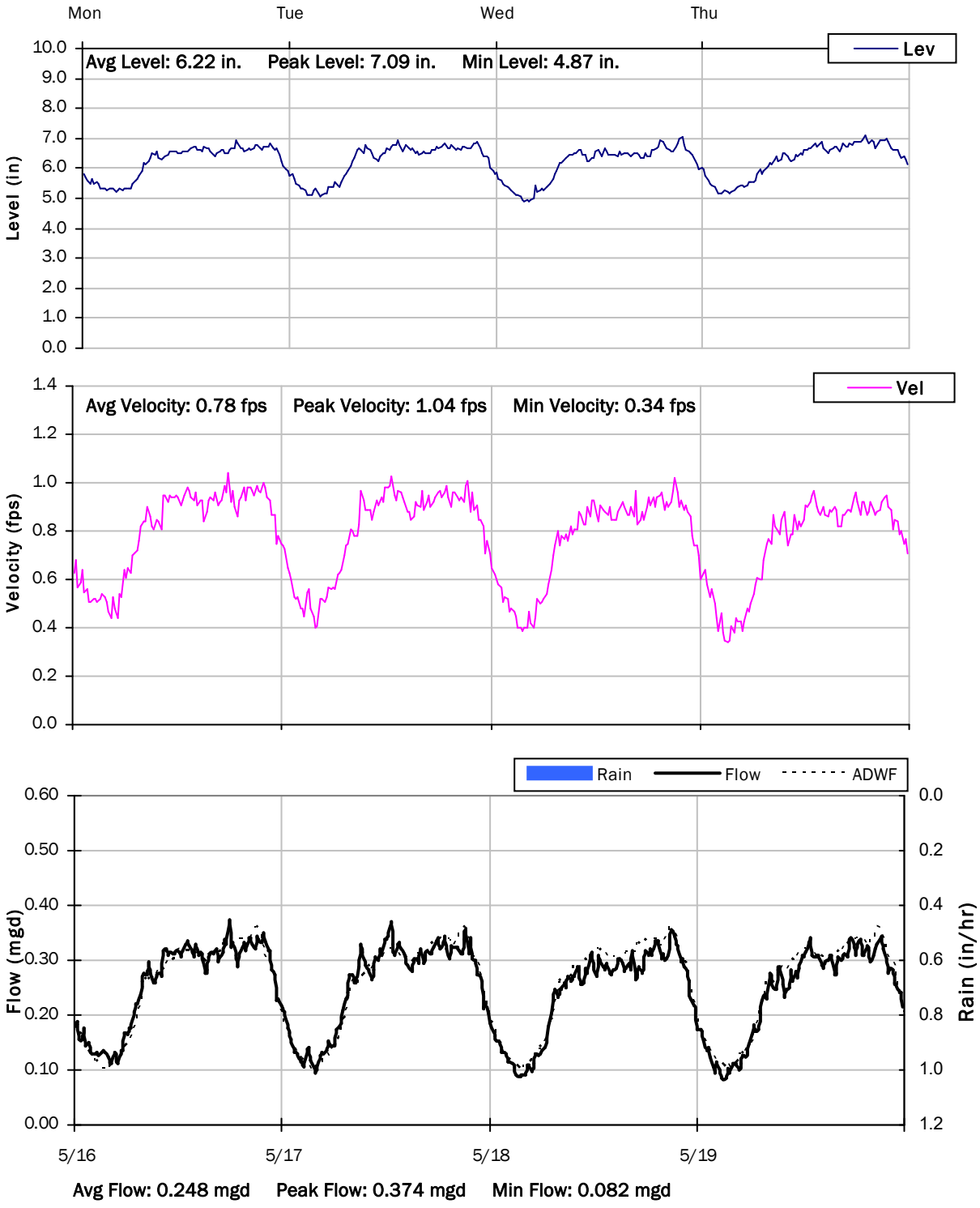
5/9/2022 to 5/16/2022



SITE 3

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 4

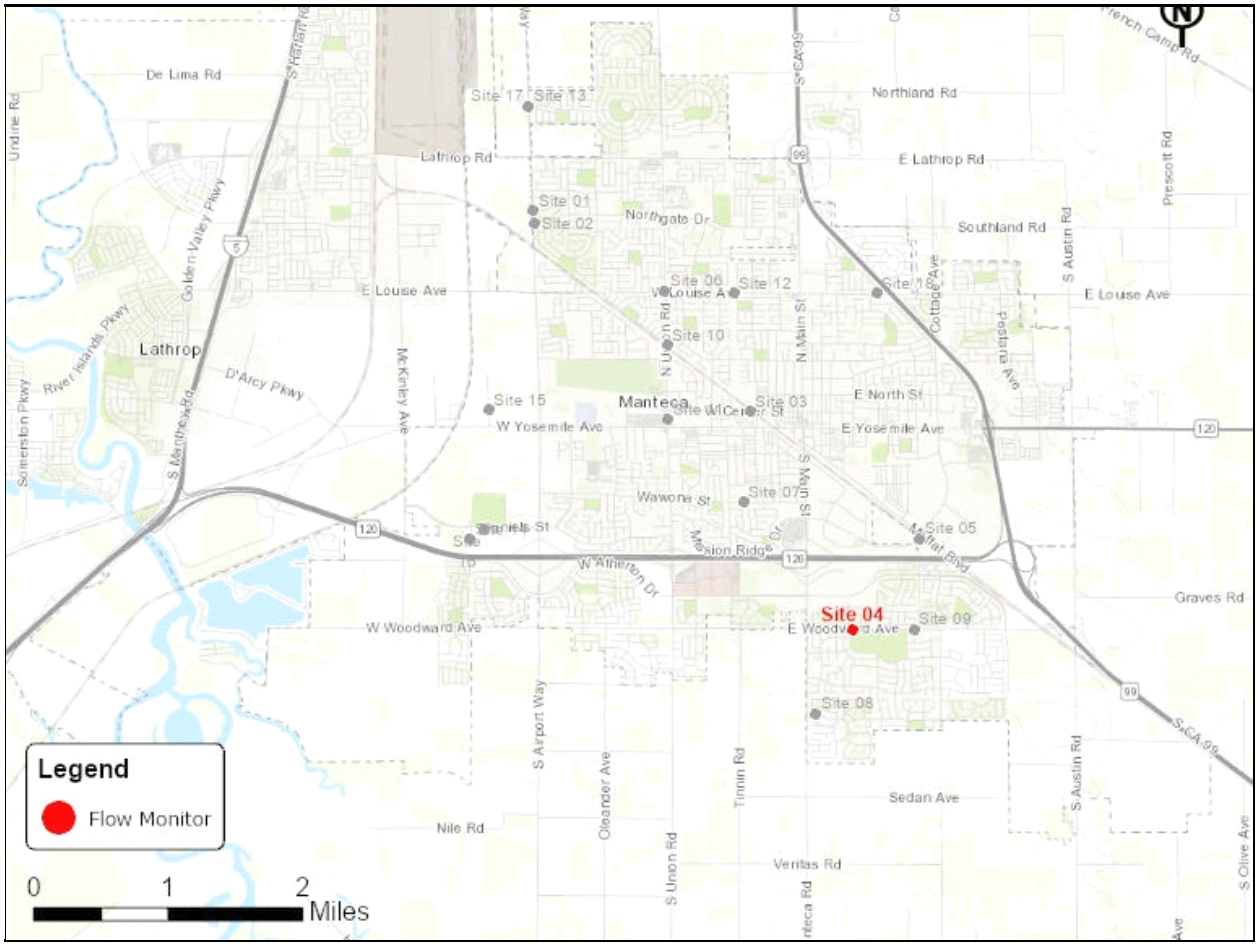
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Woodward Avenue East of Buena Vista Drive

Data Summary Report



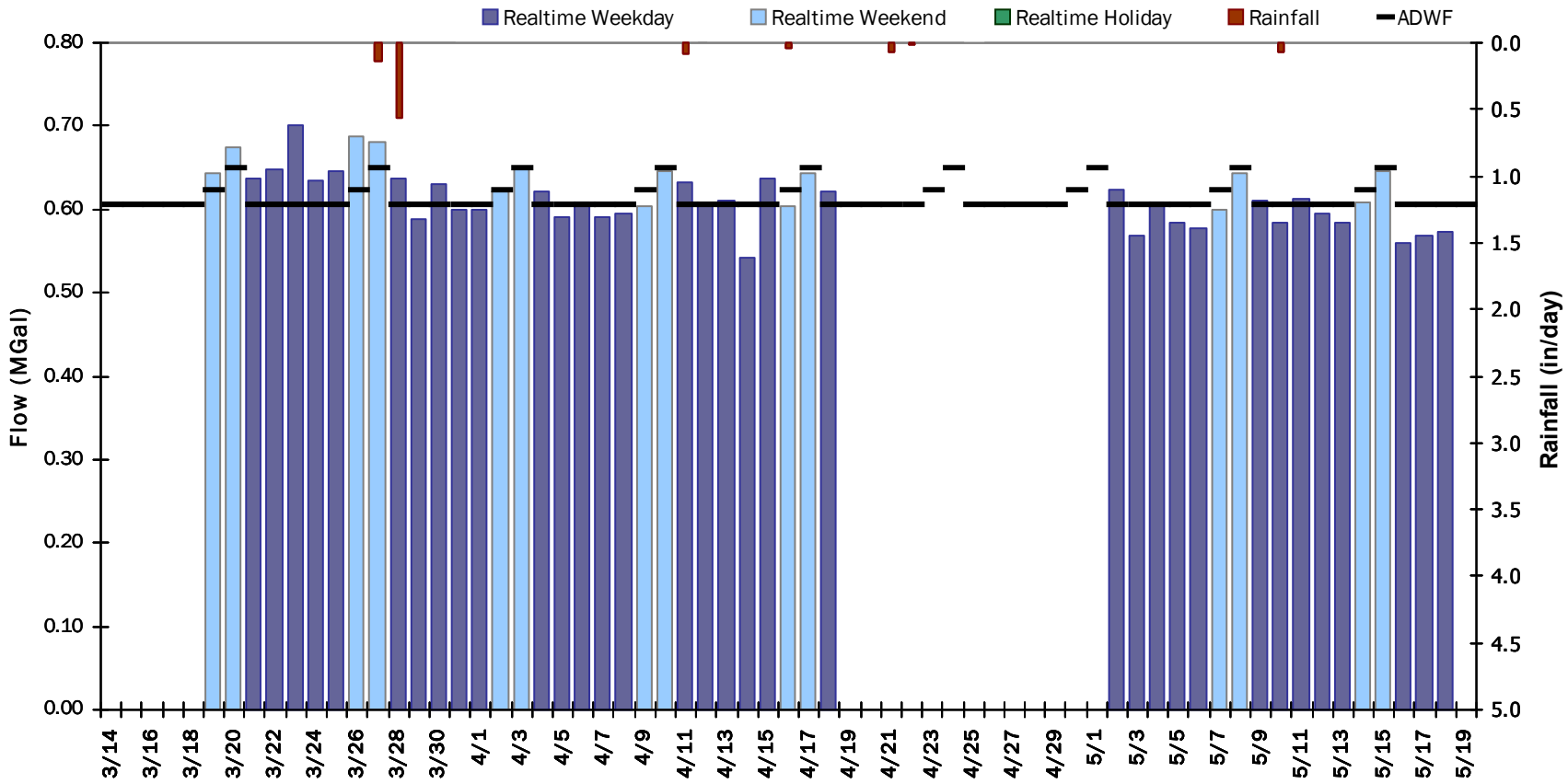
Vicinity Map: Site 4

SITE 4

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.620 MGal Peak Daily Flow: 0.840 MGal Min Daily Flow: 0.542 MGal

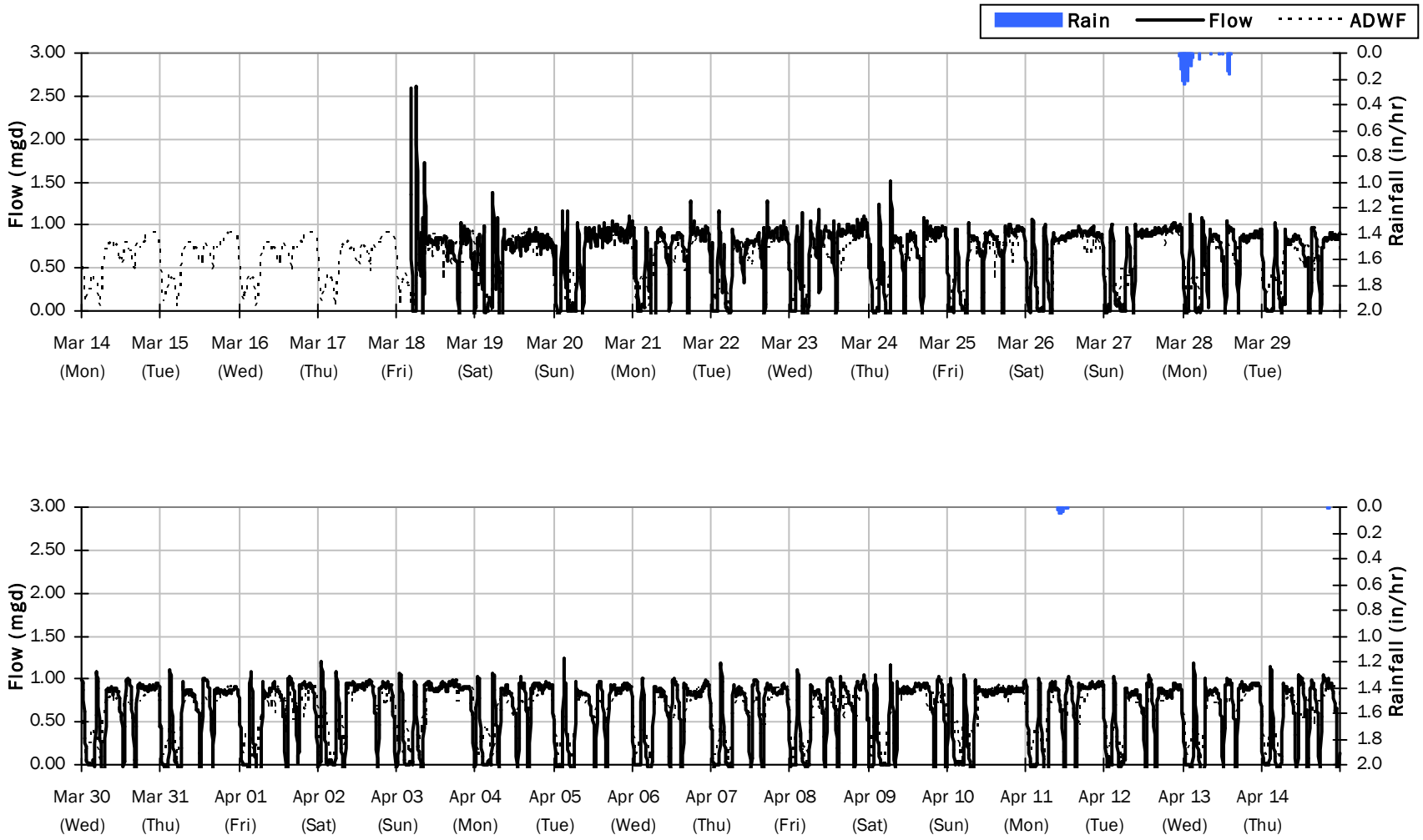
Total Rainfall: 0.90 inches



SITE 4

Flow Summary: 3/14/2022 to 4/14/2022

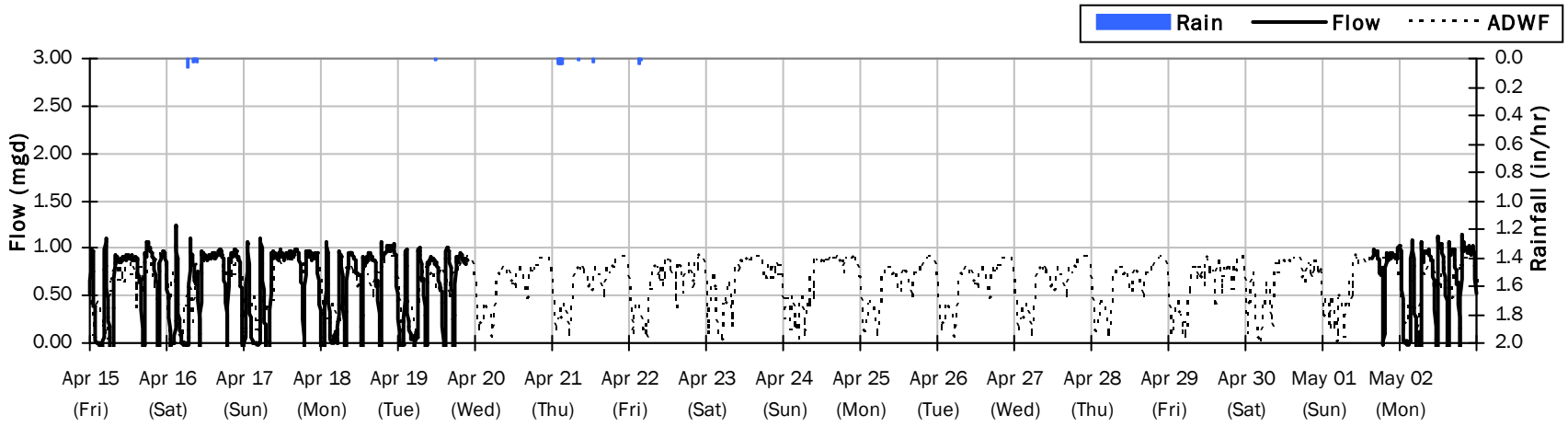
Period Rainfall: 0.79 inches Period Avg Flow: 0.630 mgd Period Peak Flow: 2.598 mgd Period Min Flow: -0.266 mgd

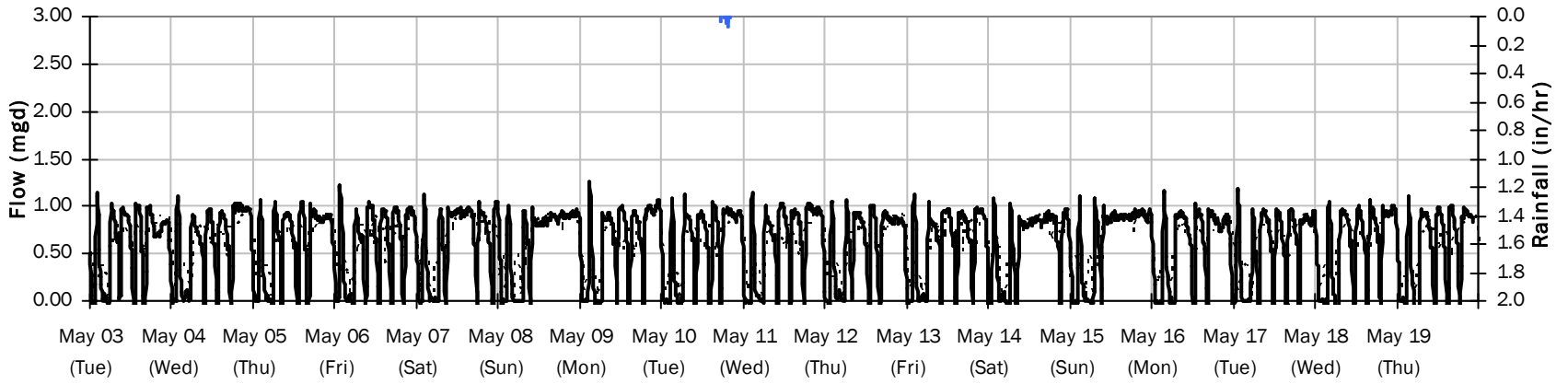


SITE 4

Flow Summary: 4/15/2022 to 5/19/2022

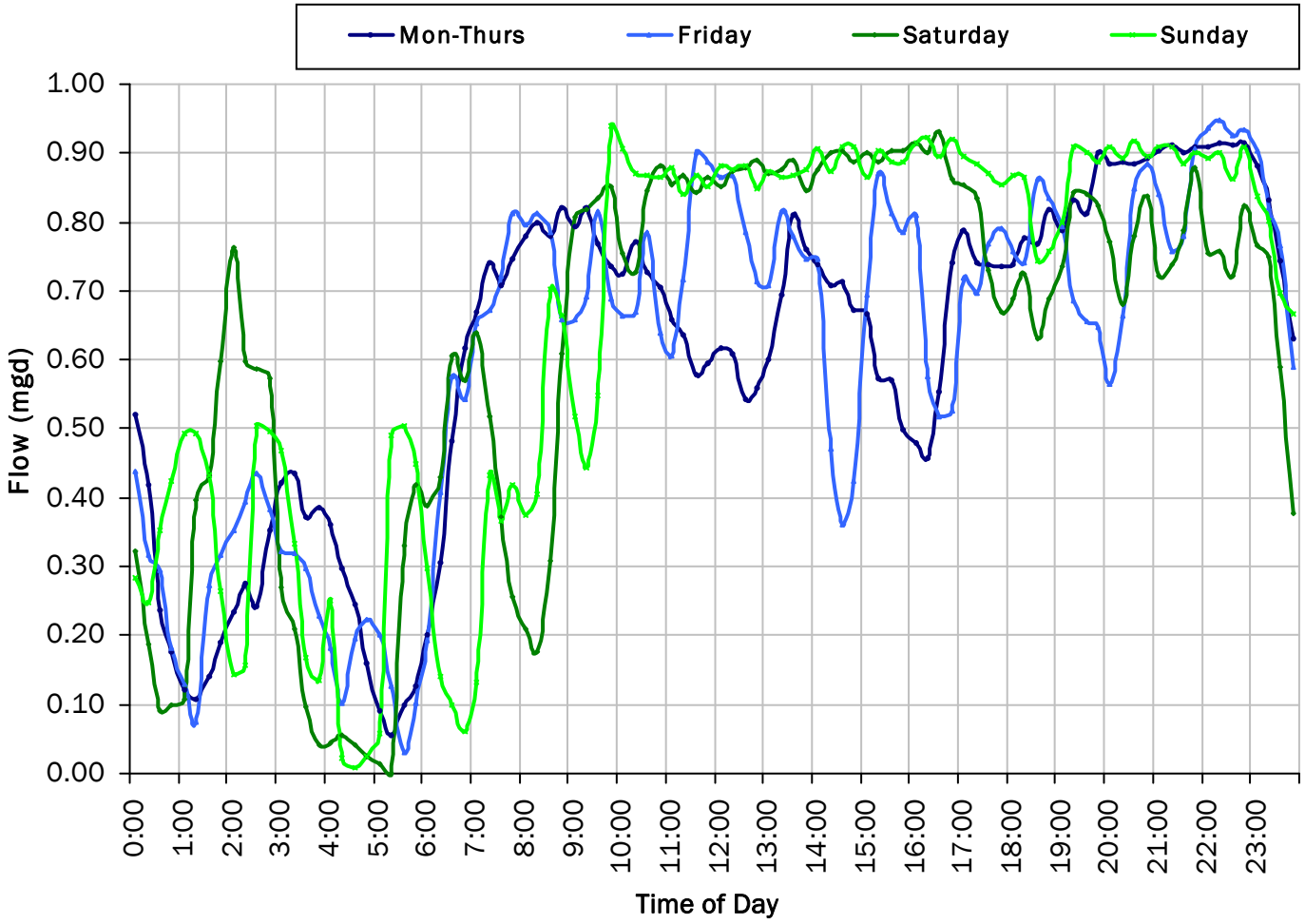
Period Rainfall: 0.19 inches Period Avg Flow: 0.602 mgd Period Peak Flow: 1.237 mgd Period Min Flow: -0.304 mgd





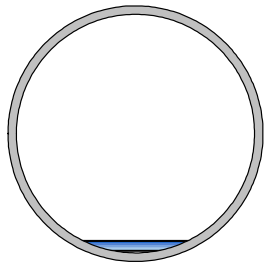
SITE 4

Average Dry Weather Flow Hydrographs



ADWF:

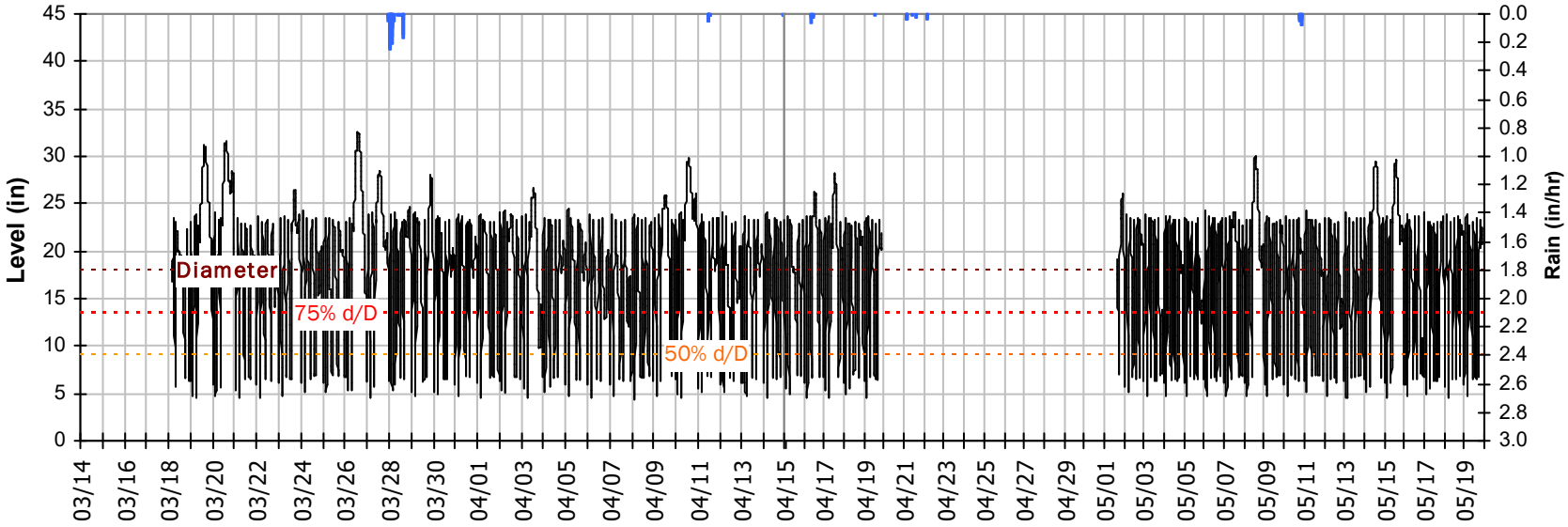
0.614 *mgd*

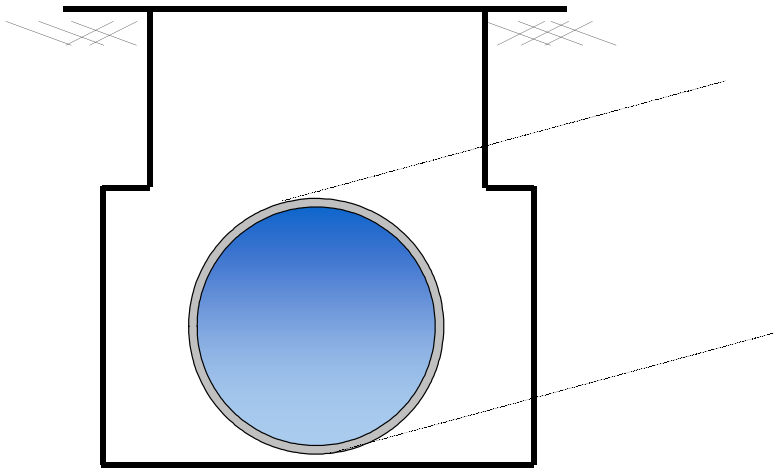


SITE 4

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





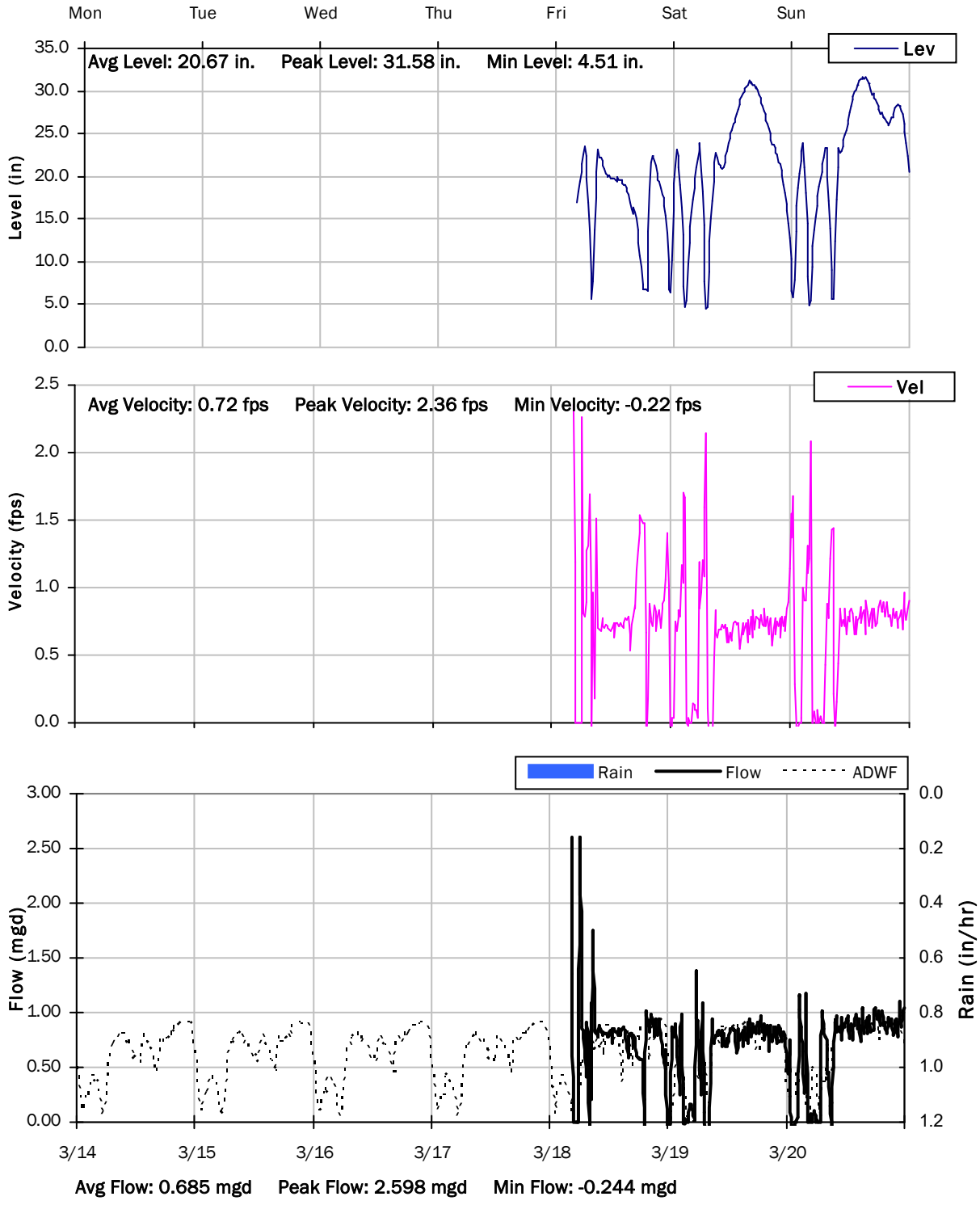
Pipe Diameter:	18	*inches*
Peak Measured Level:	32.6	*inches*
Peak d/D Ratio:	1.81	

Surcharged 14.6 inches over crown

SITE 4

Weekly Level, Velocity and Flow Hydrographs

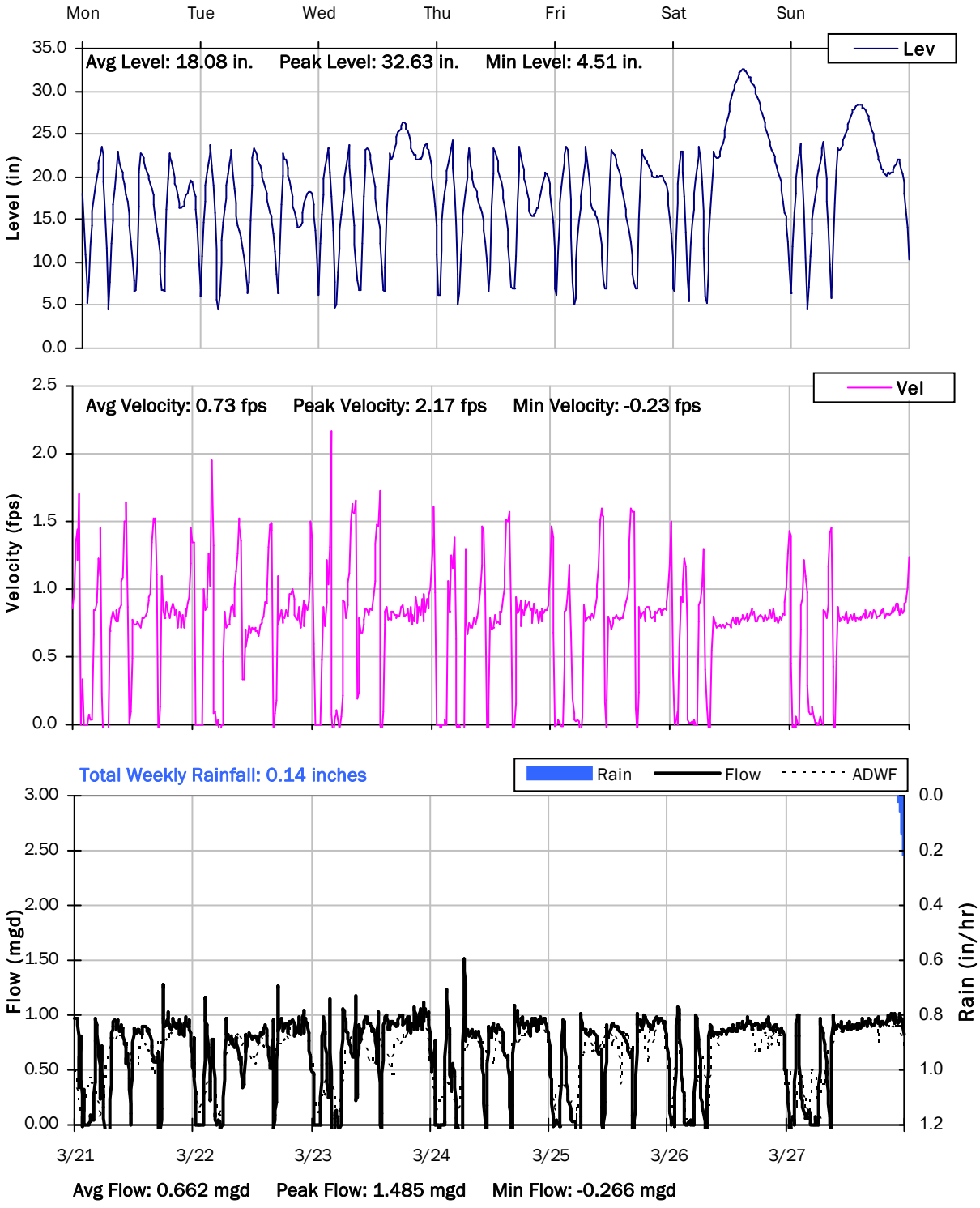
3/14/2022 to 3/21/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

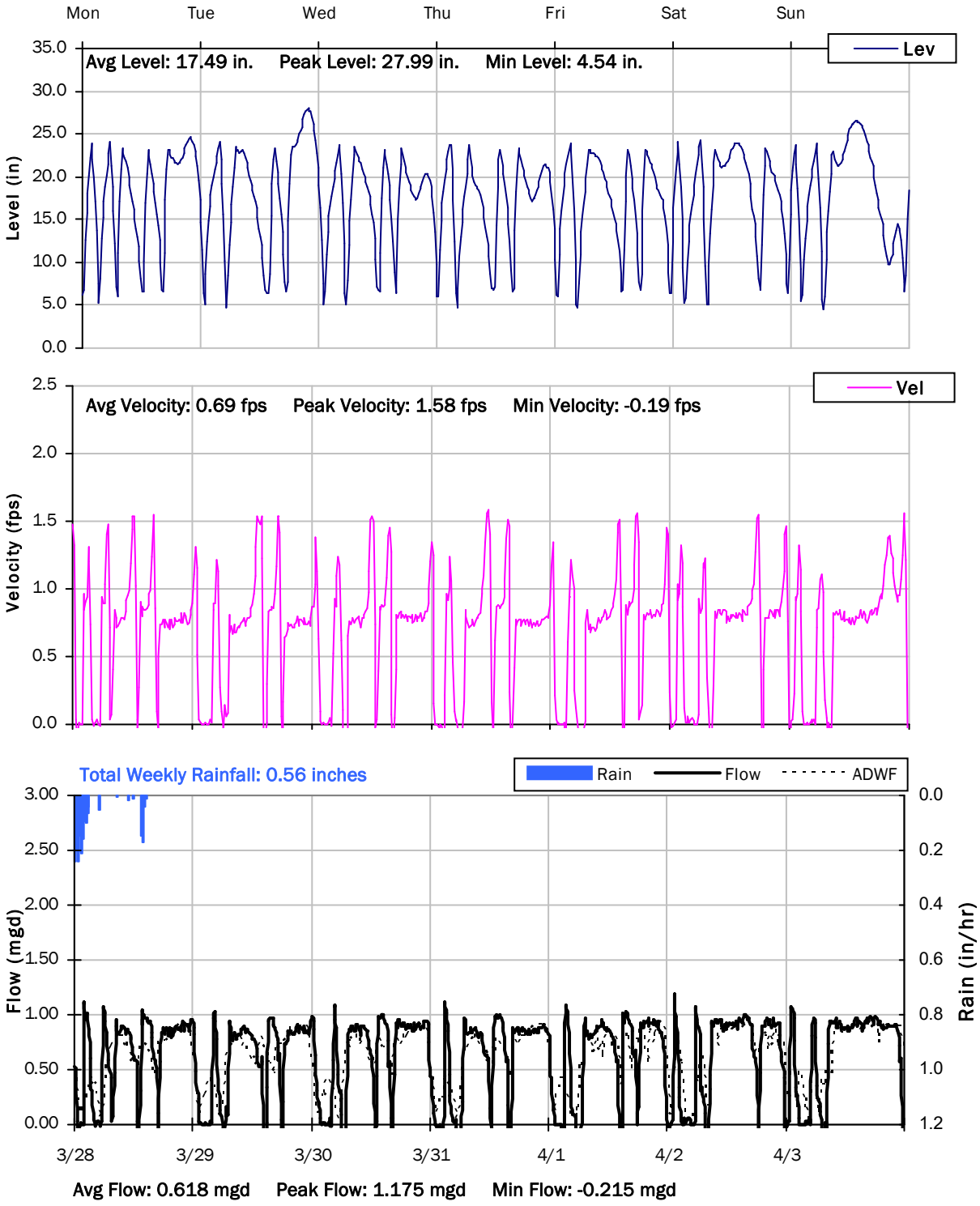
3/21/2022 to 3/28/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

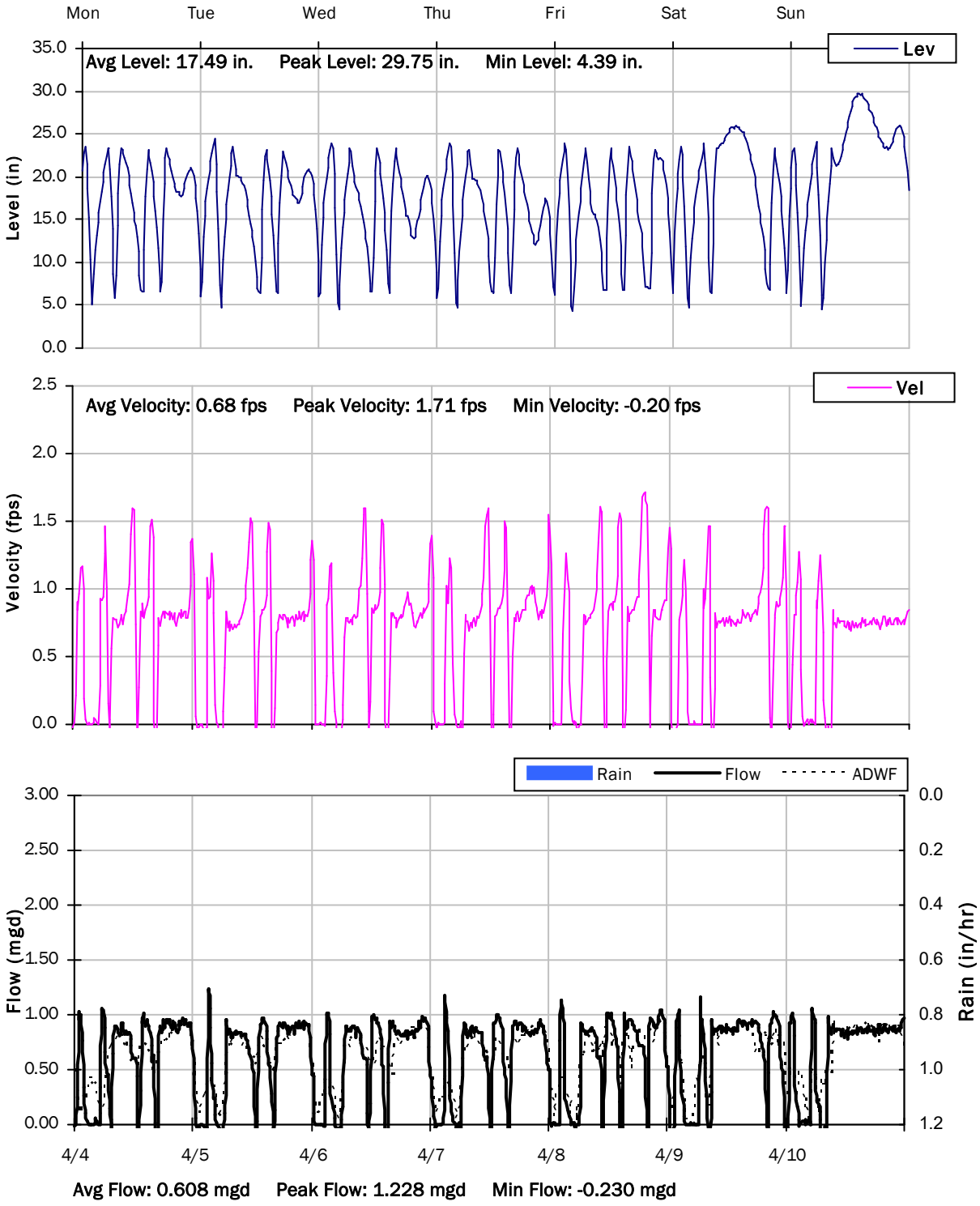
3/28/2022 to 4/4/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

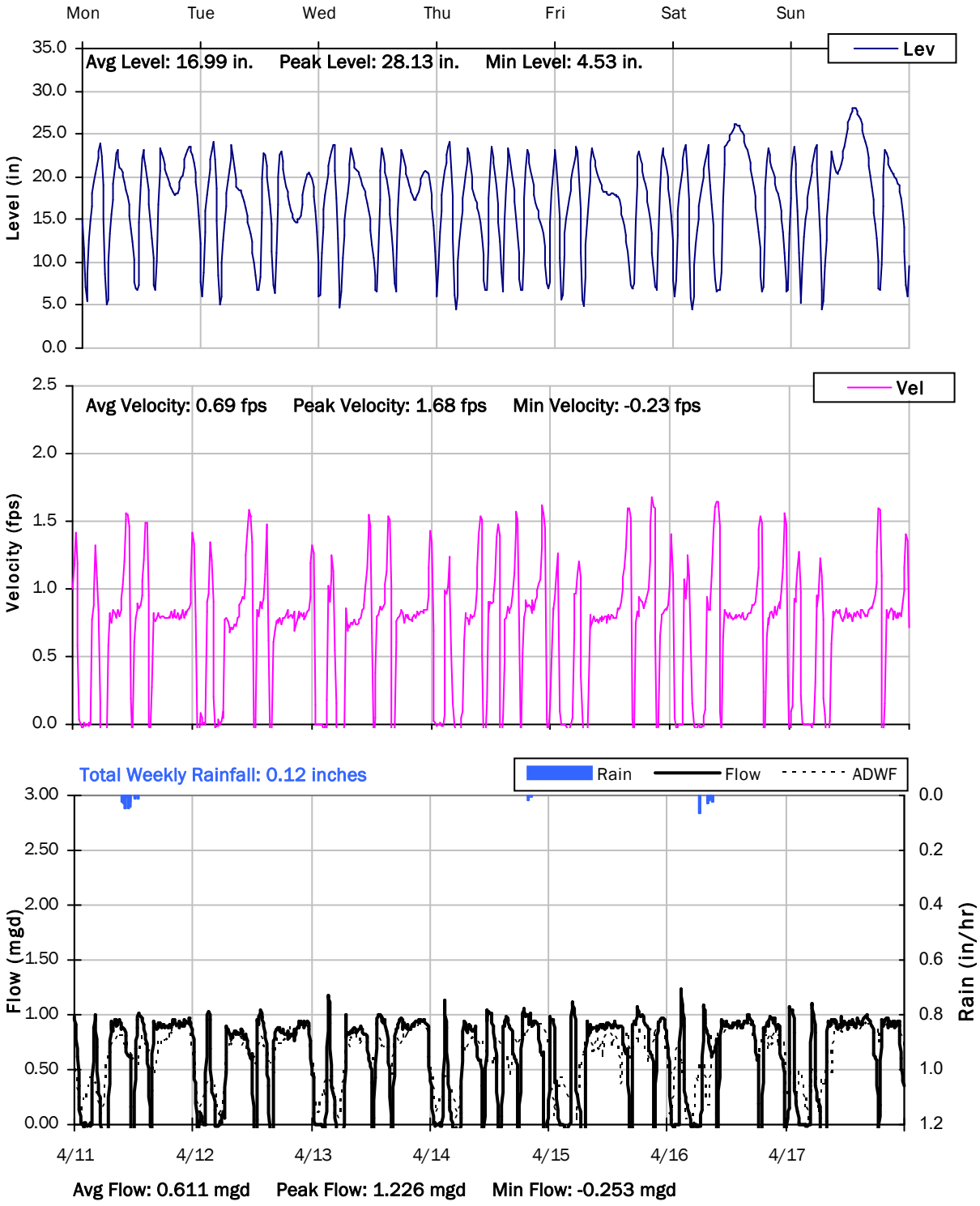
4/4/2022 to 4/11/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

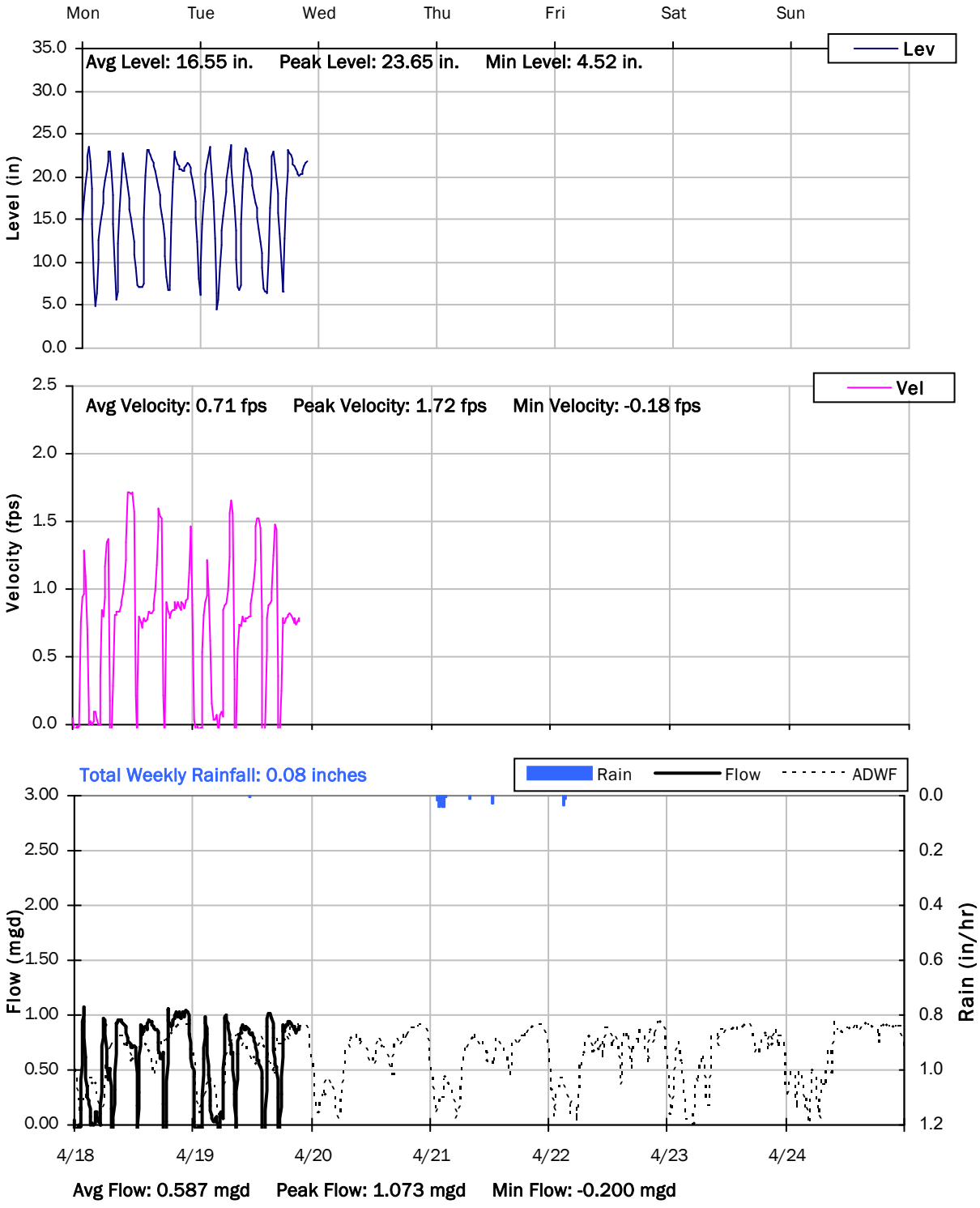
4/11/2022 to 4/18/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

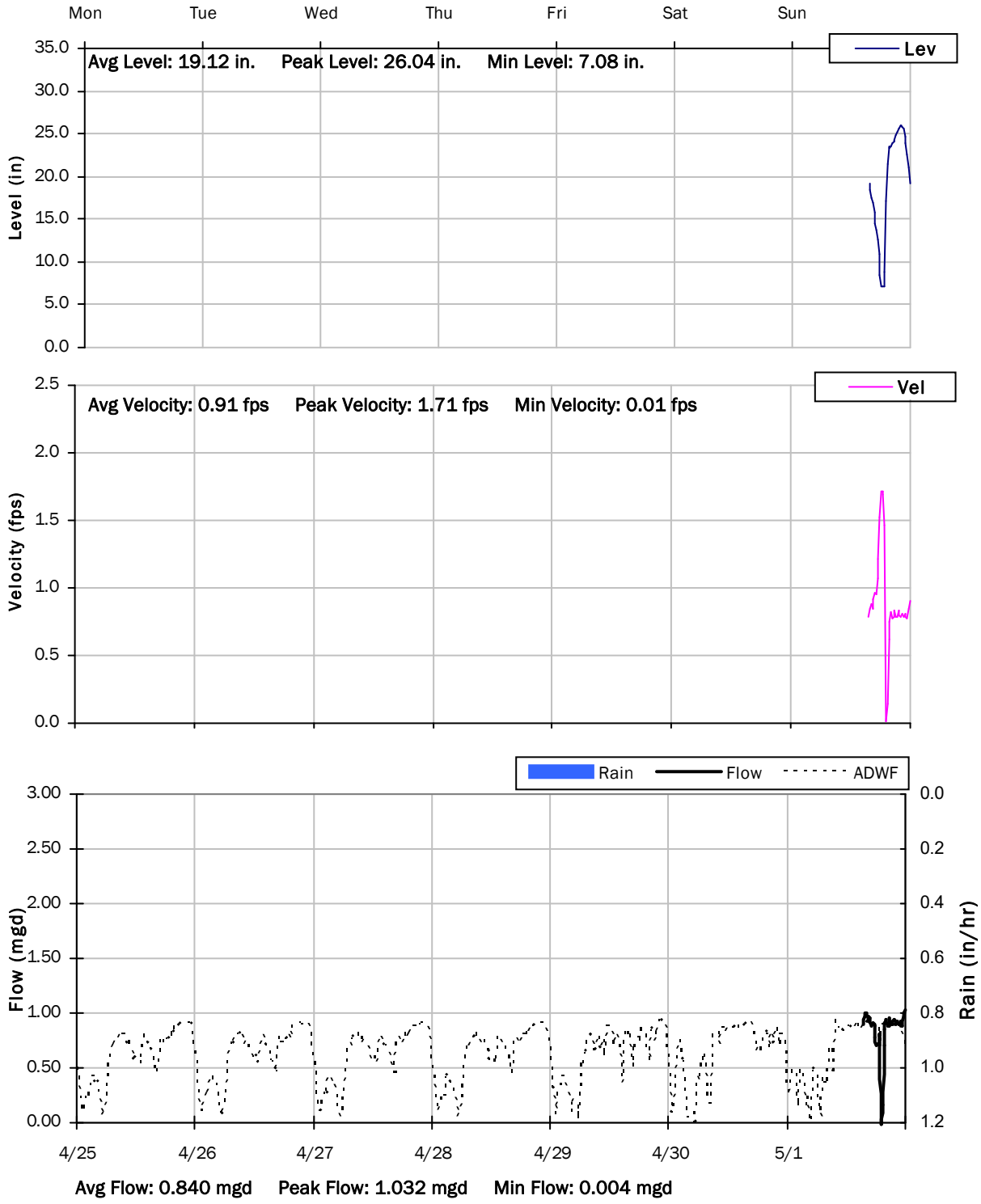
4/18/2022 to 4/25/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

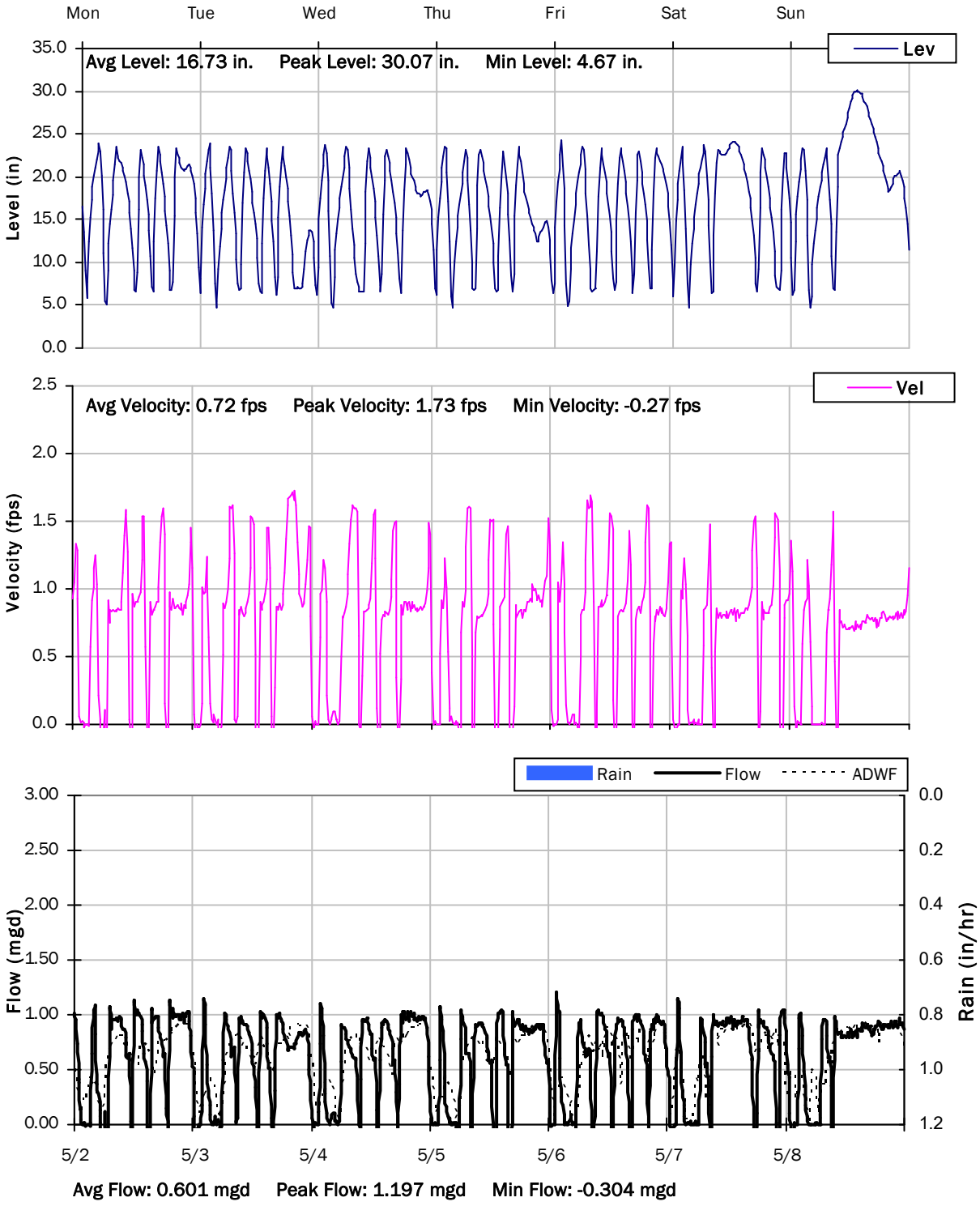
4/25/2022 to 5/2/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

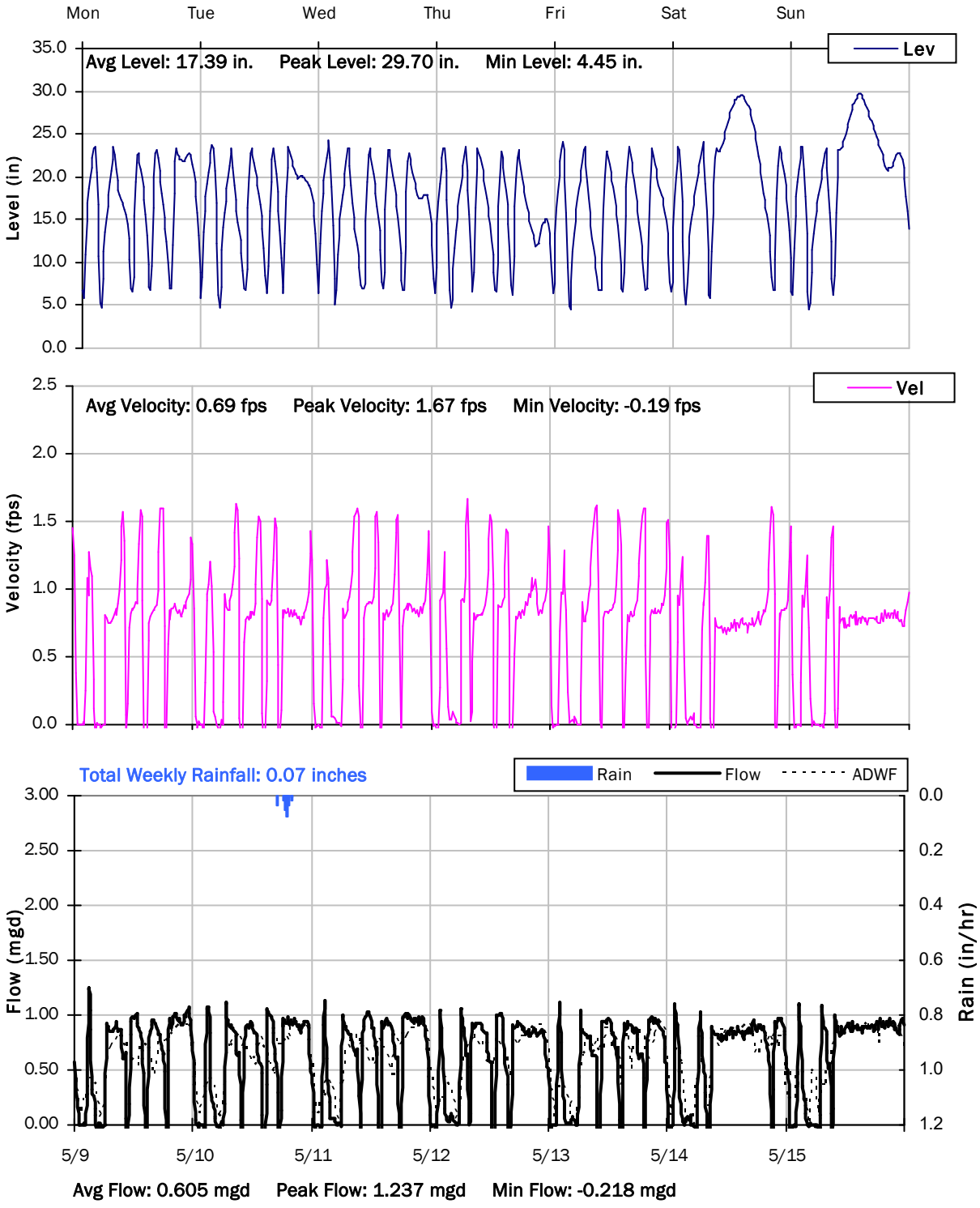
5/2/2022 to 5/9/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

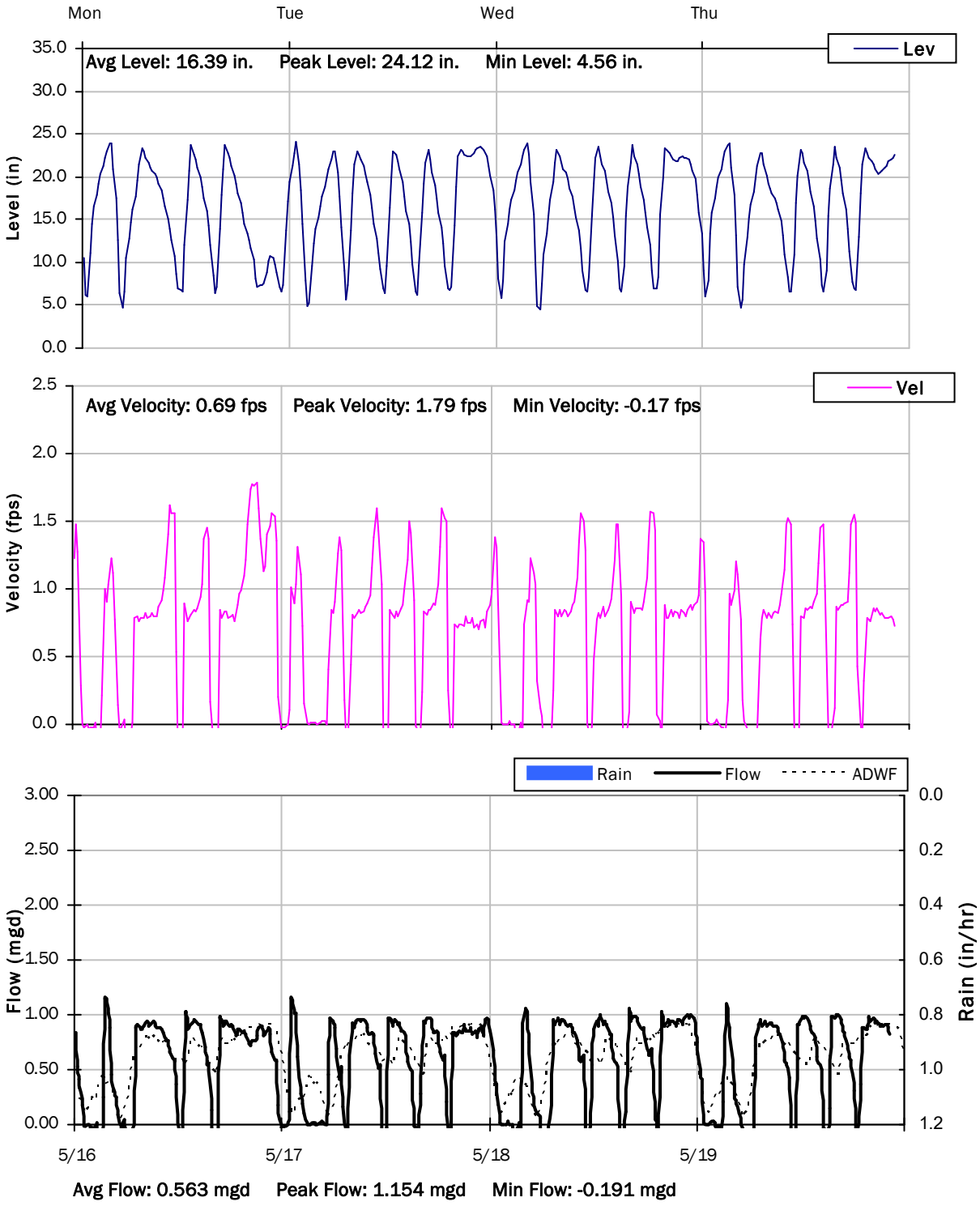
5/9/2022 to 5/16/2022



SITE 4

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 5

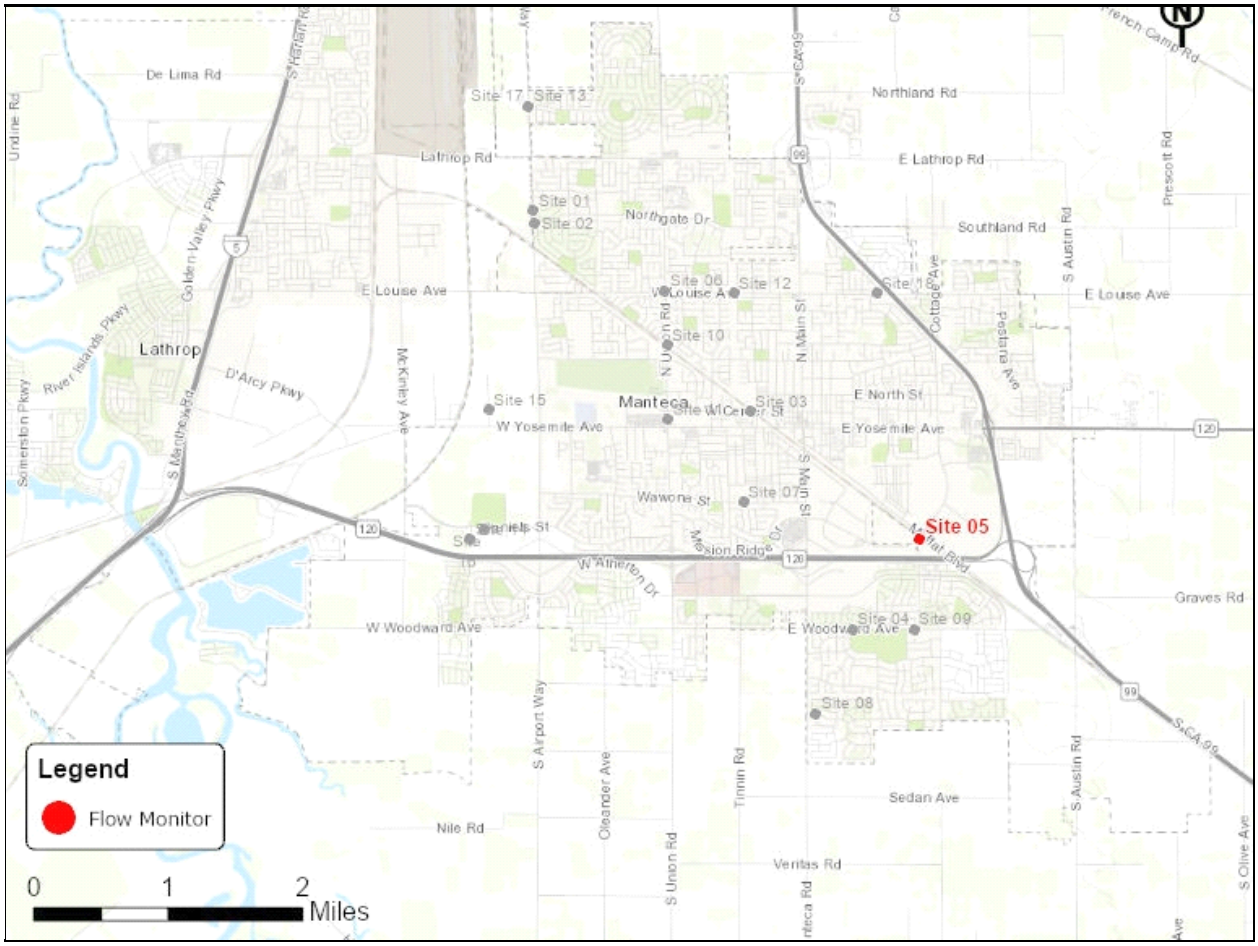
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Industrial Park Drive South of Moffat Boulevard

Data Summary Report



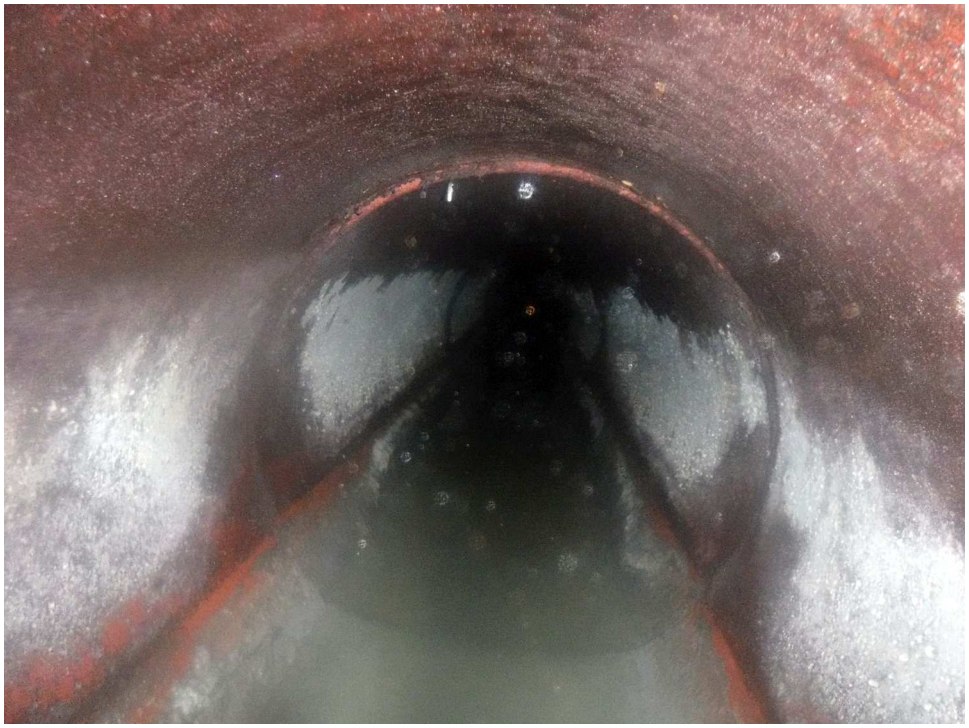
Vicinity Map: Site 5

SITE 5

Additional Site Photos

Effluent Pipe

Monitored Northeast Influent Pipe

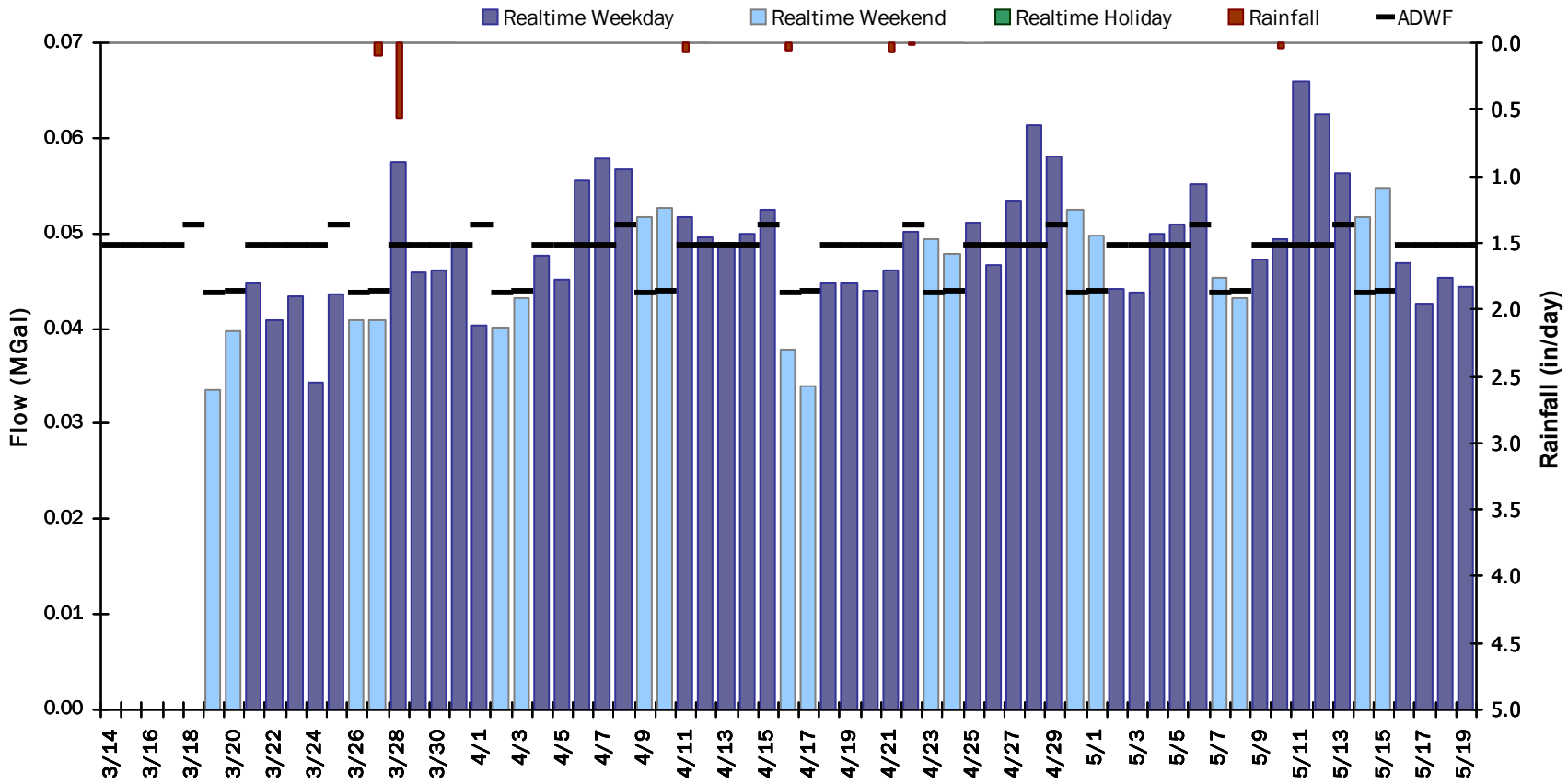


SITE 5

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.048 MGal Peak Daily Flow: 0.066 MGal Min Daily Flow: 0.034 MGal

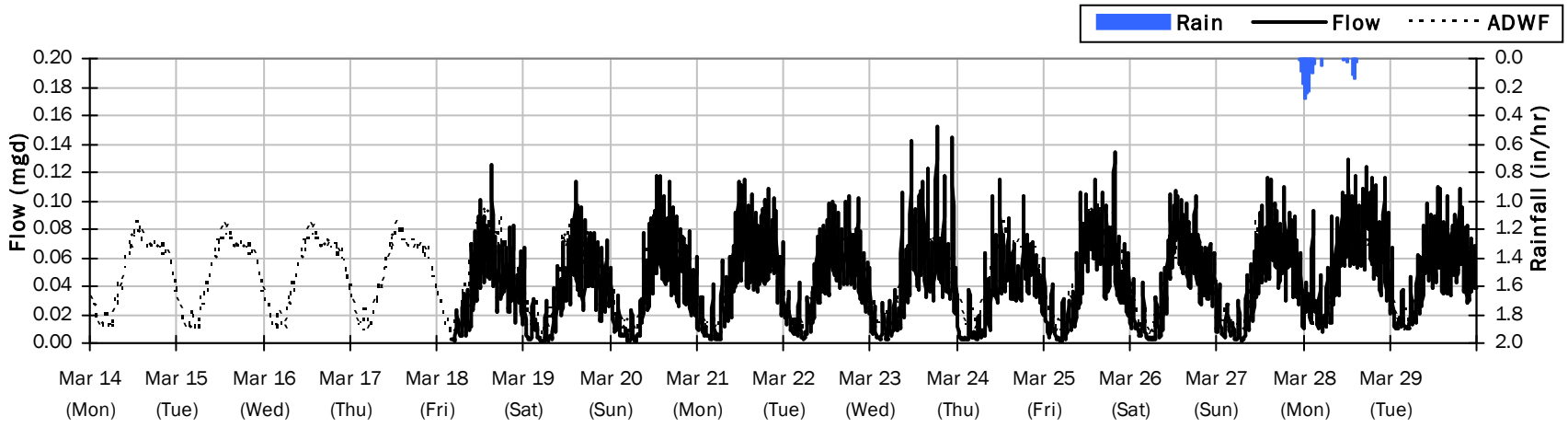
Total Rainfall: 0.91 inches

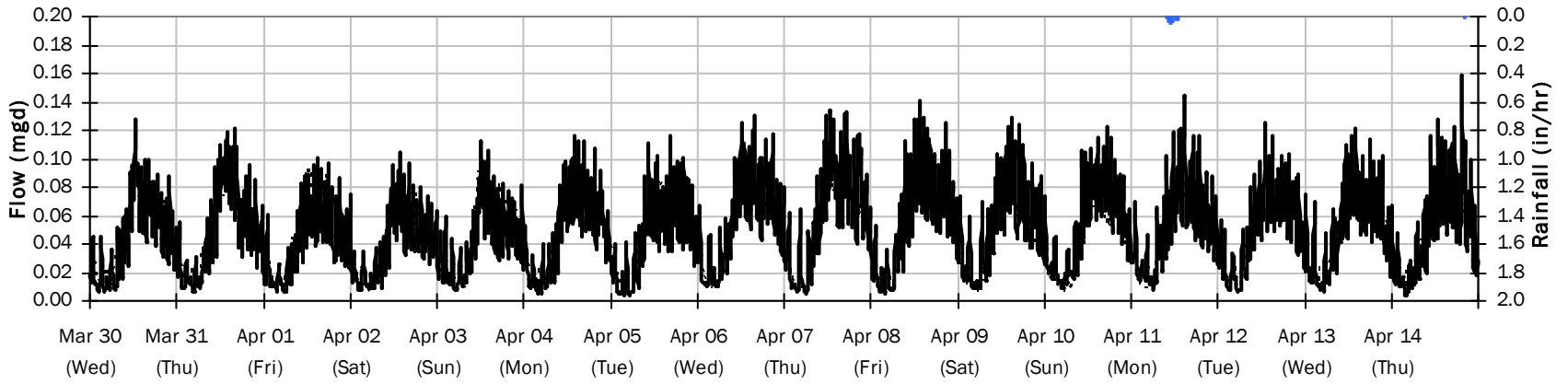


SITE 5

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.73 inches Period Avg Flow: 0.046 mgd Period Peak Flow: 0.159 mgd Period Min Flow: 0.001 mgd

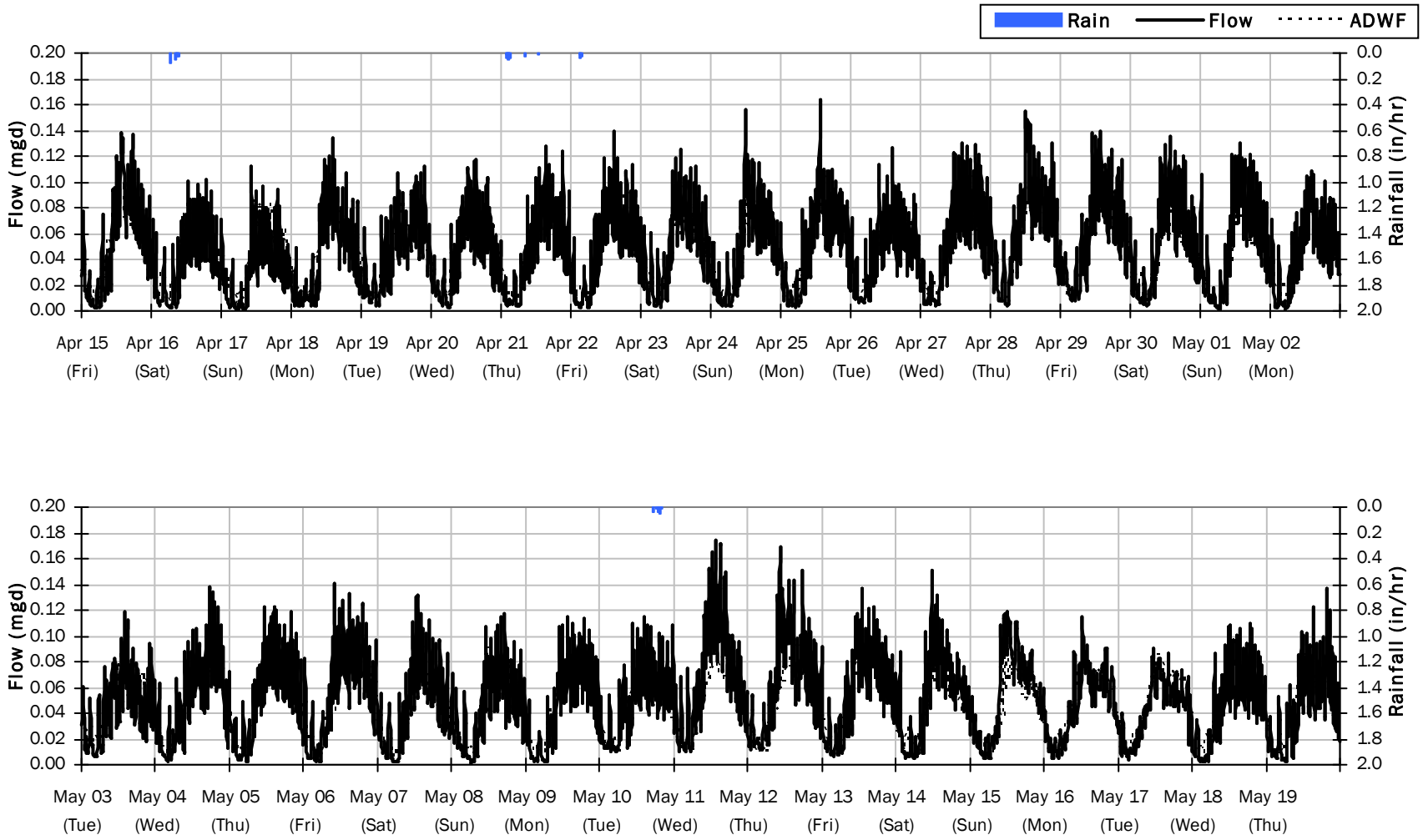




SITE 5

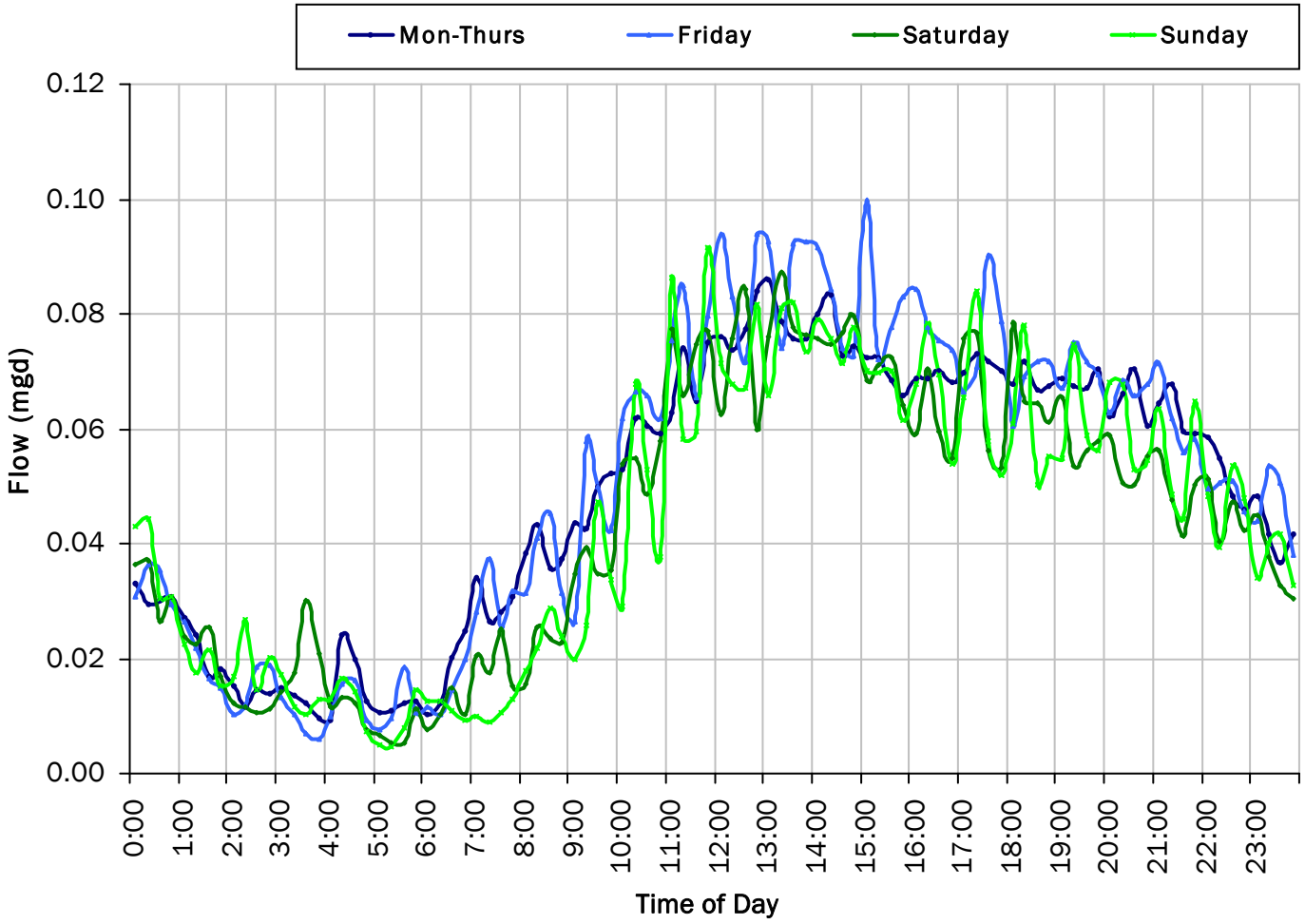
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.18 inches Period Avg Flow: 0.049 mgd Period Peak Flow: 0.174 mgd Period Min Flow: 0.001 mgd



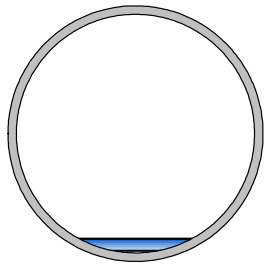
SITE 5

Average Dry Weather Flow Hydrographs



ADWF:

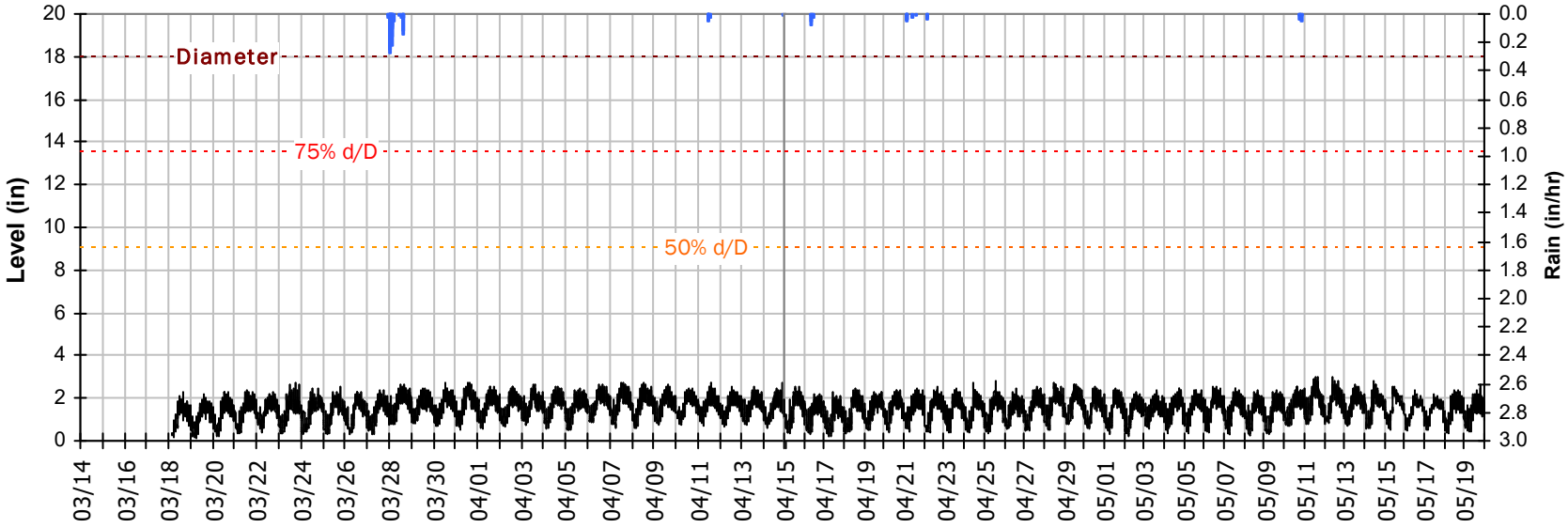
0.048 *mgd*

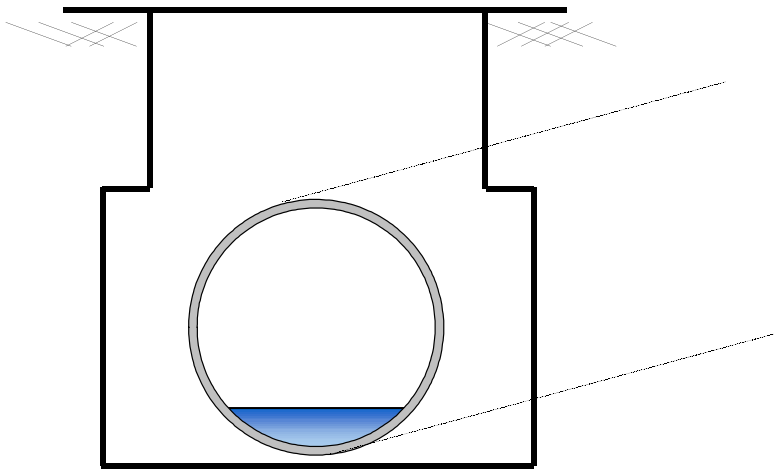


SITE 5

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



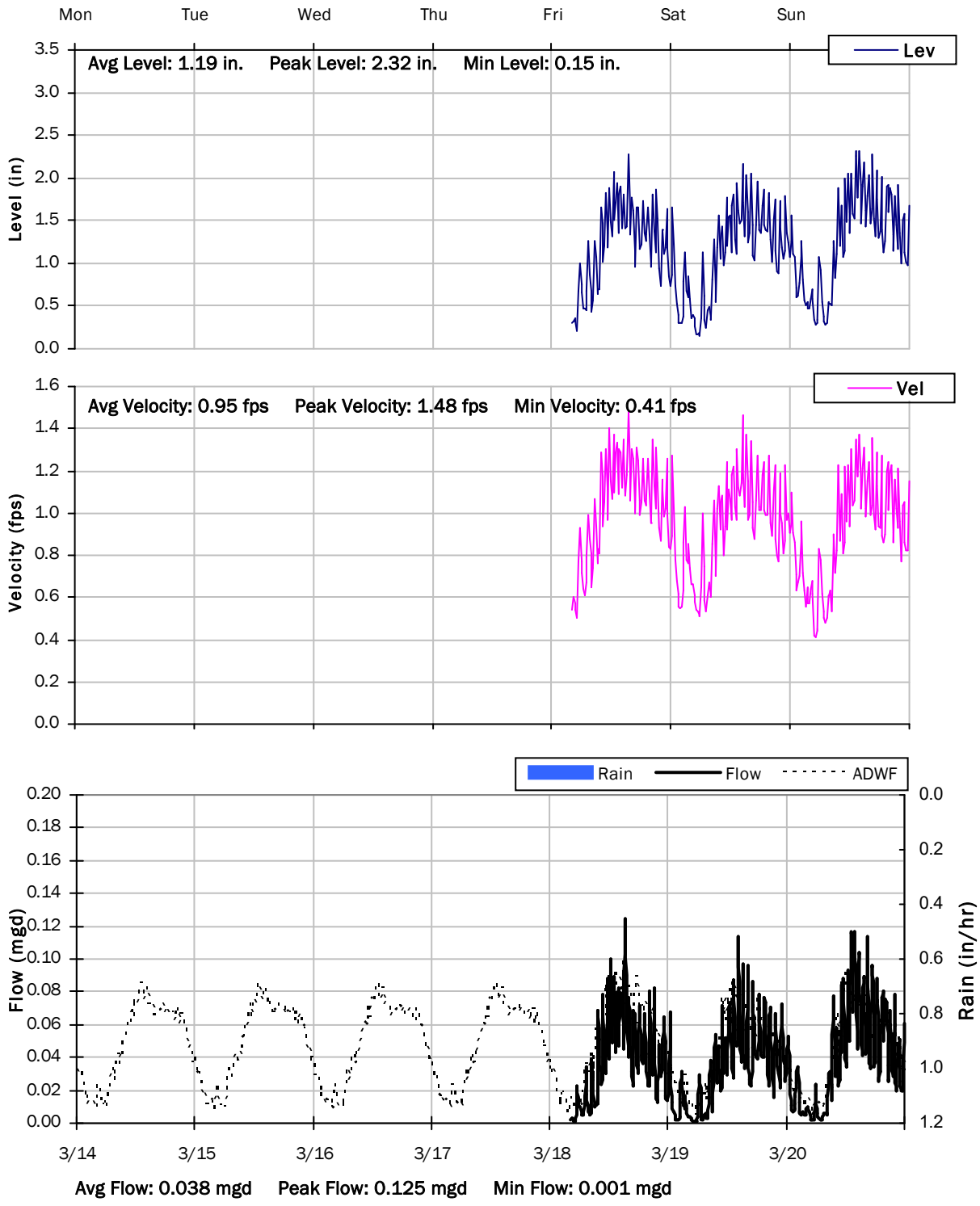


Pipe Diameter:	18	*inches*
Peak Measured Level:	3.01	*inches*
Peak d/D Ratio:	0.17	

SITE 5

Weekly Level, Velocity and Flow Hydrographs

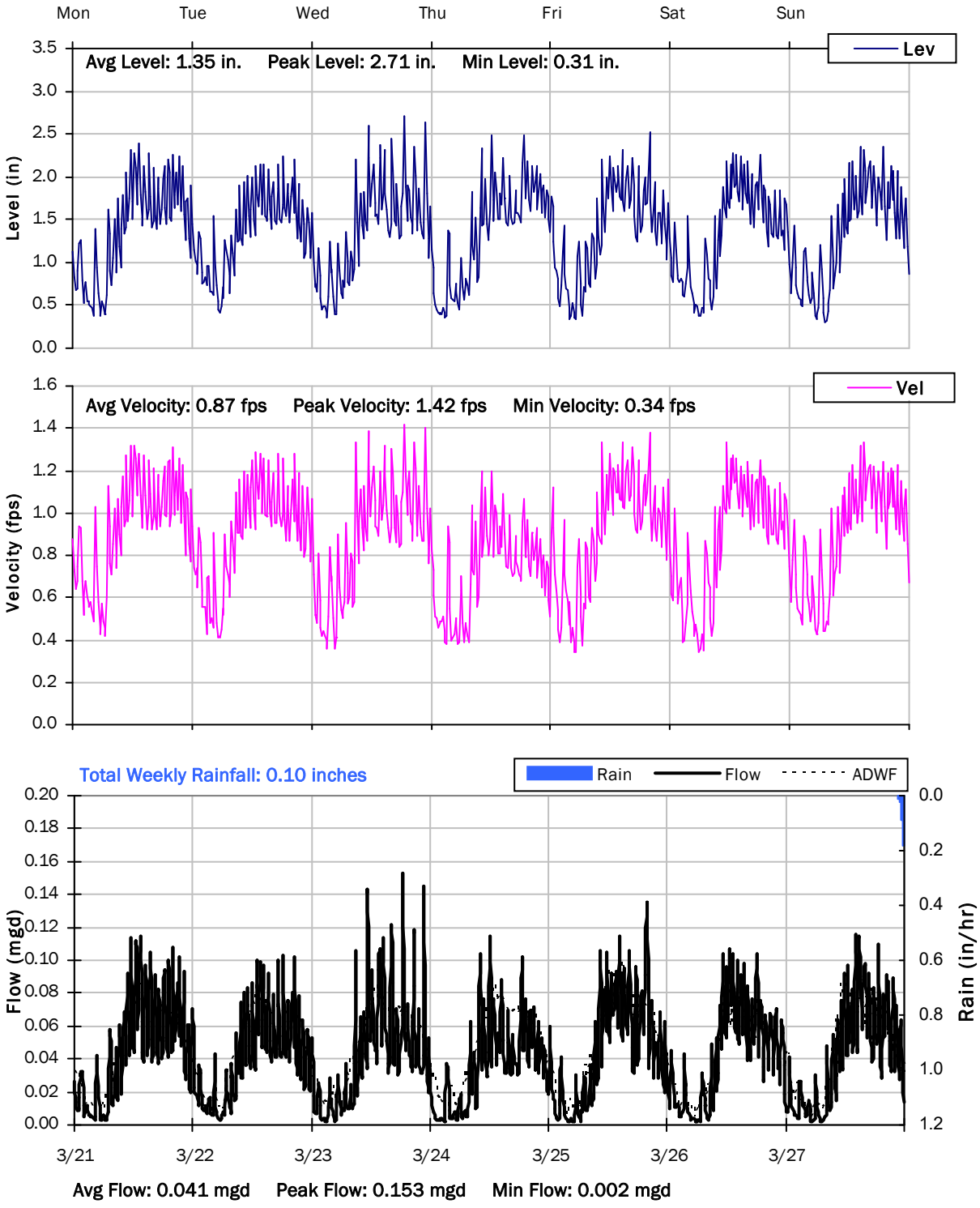
3/14/2022 to 3/21/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

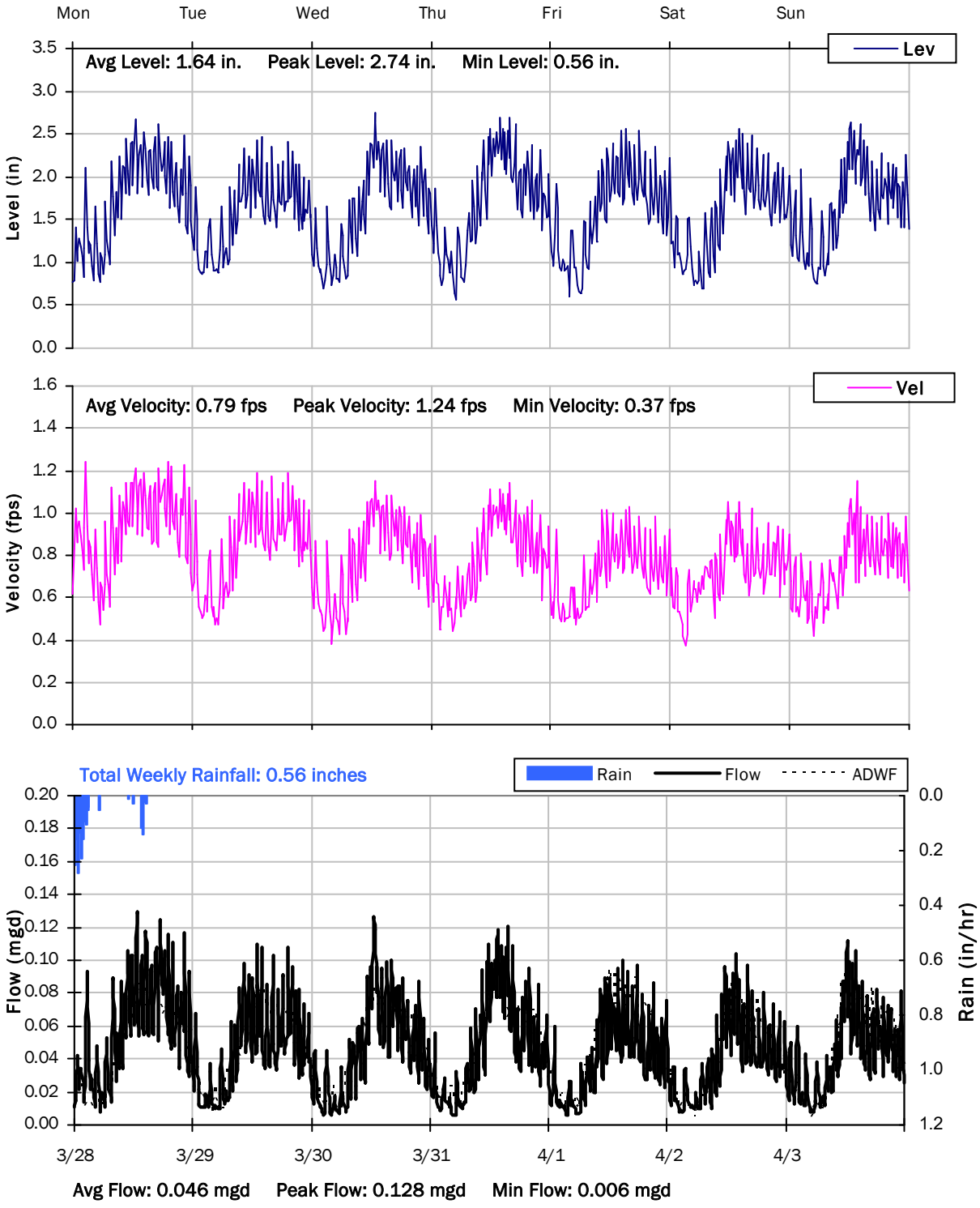
3/21/2022 to 3/28/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

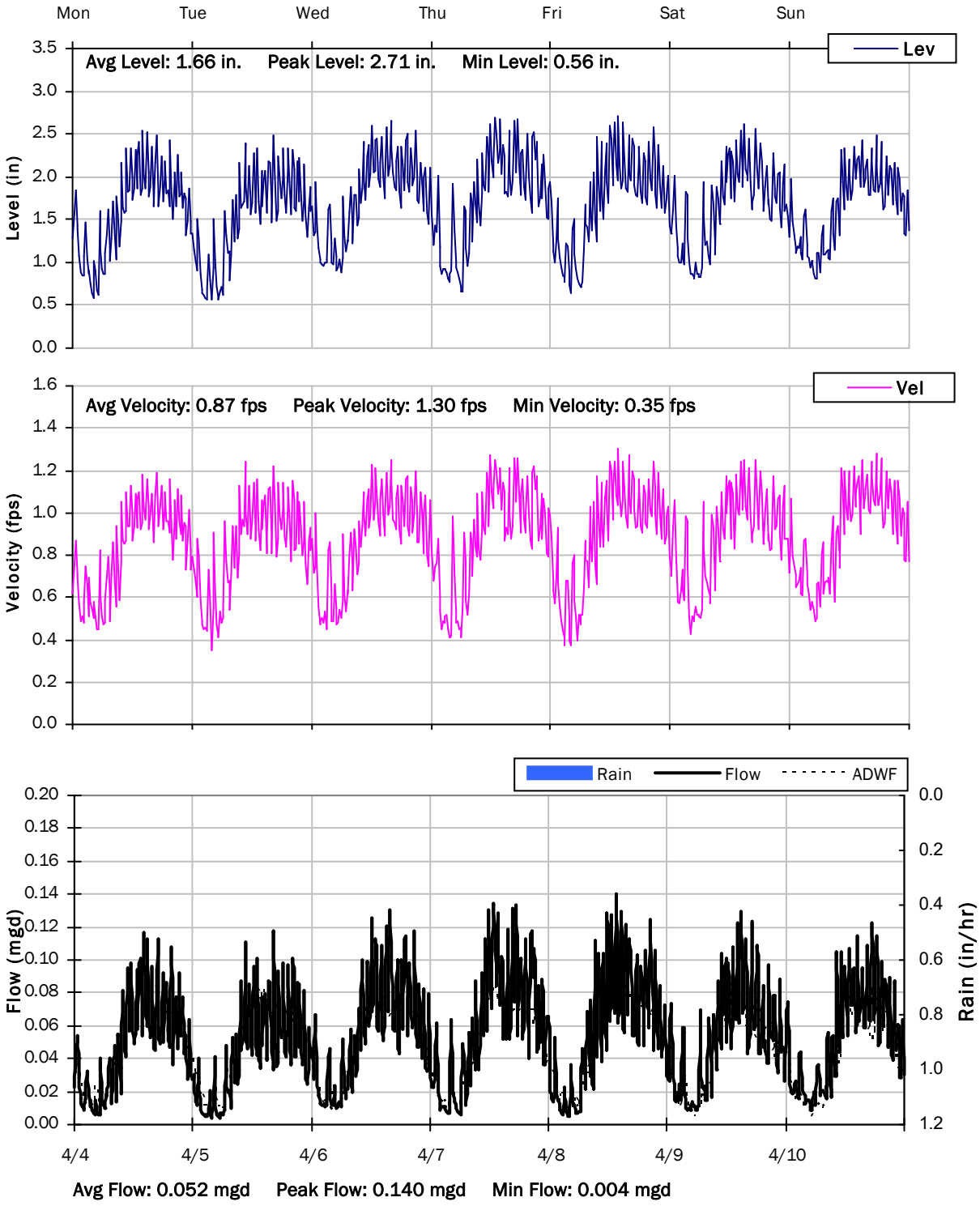
3/28/2022 to 4/4/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

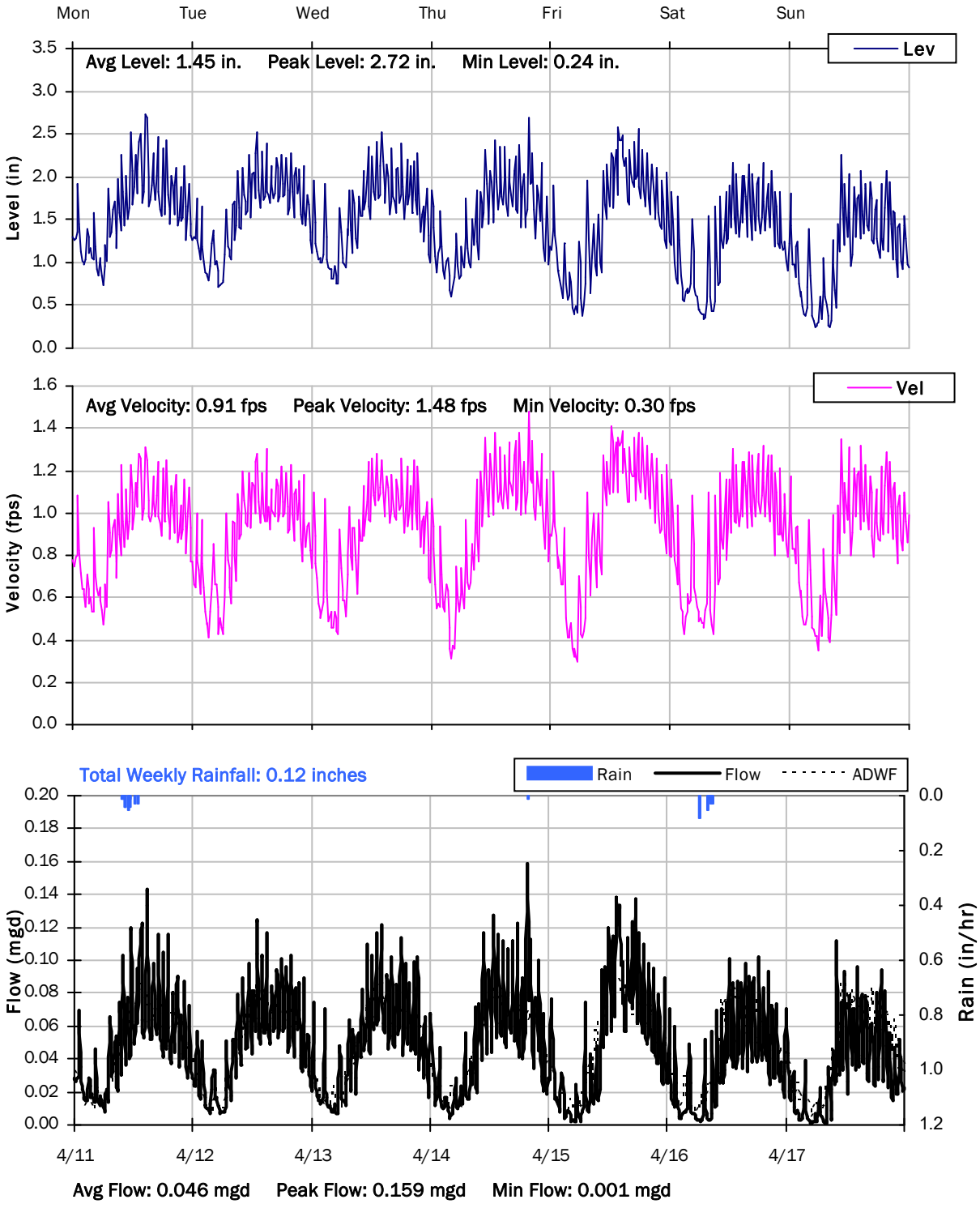
4/4/2022 to 4/11/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

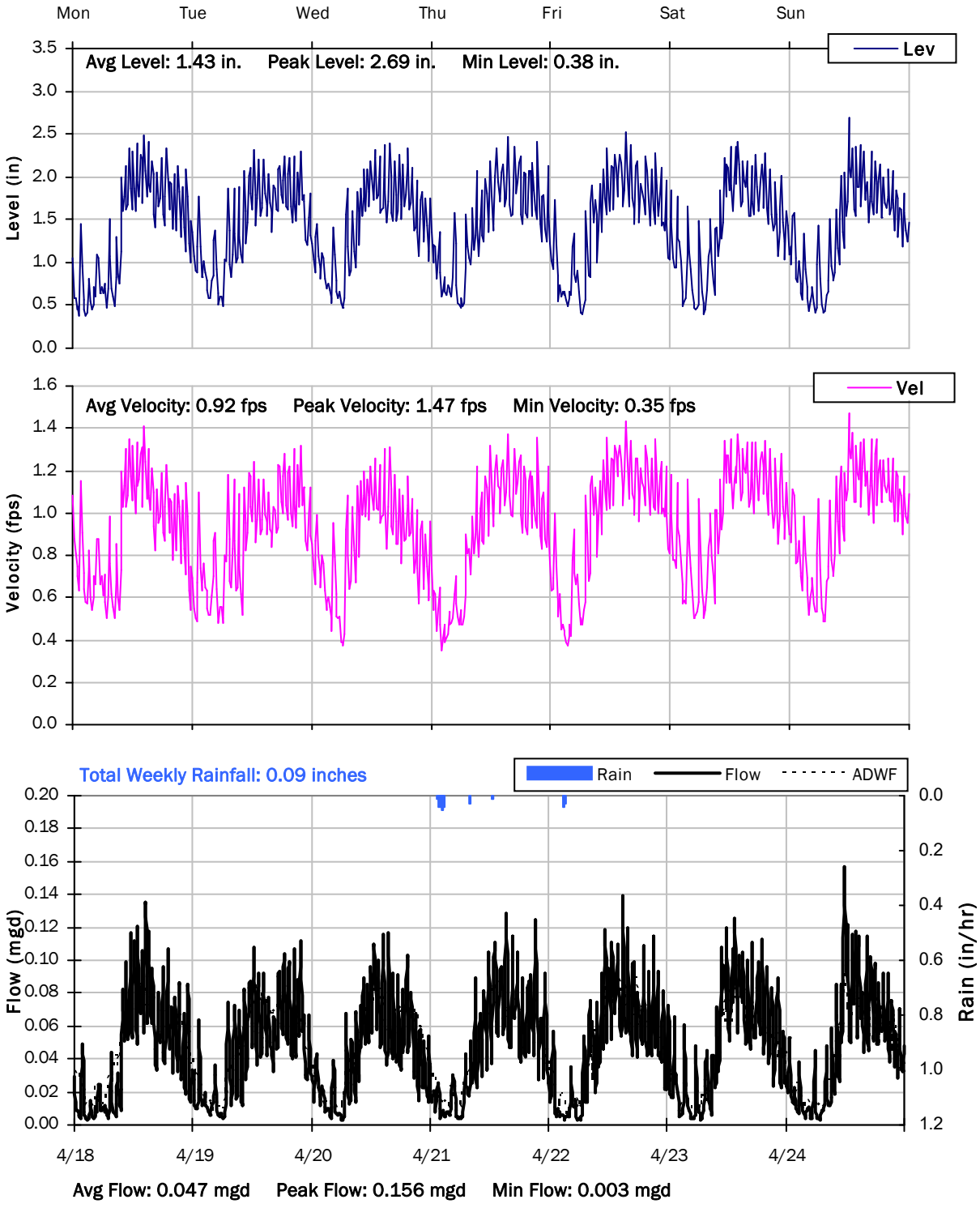
4/11/2022 to 4/18/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

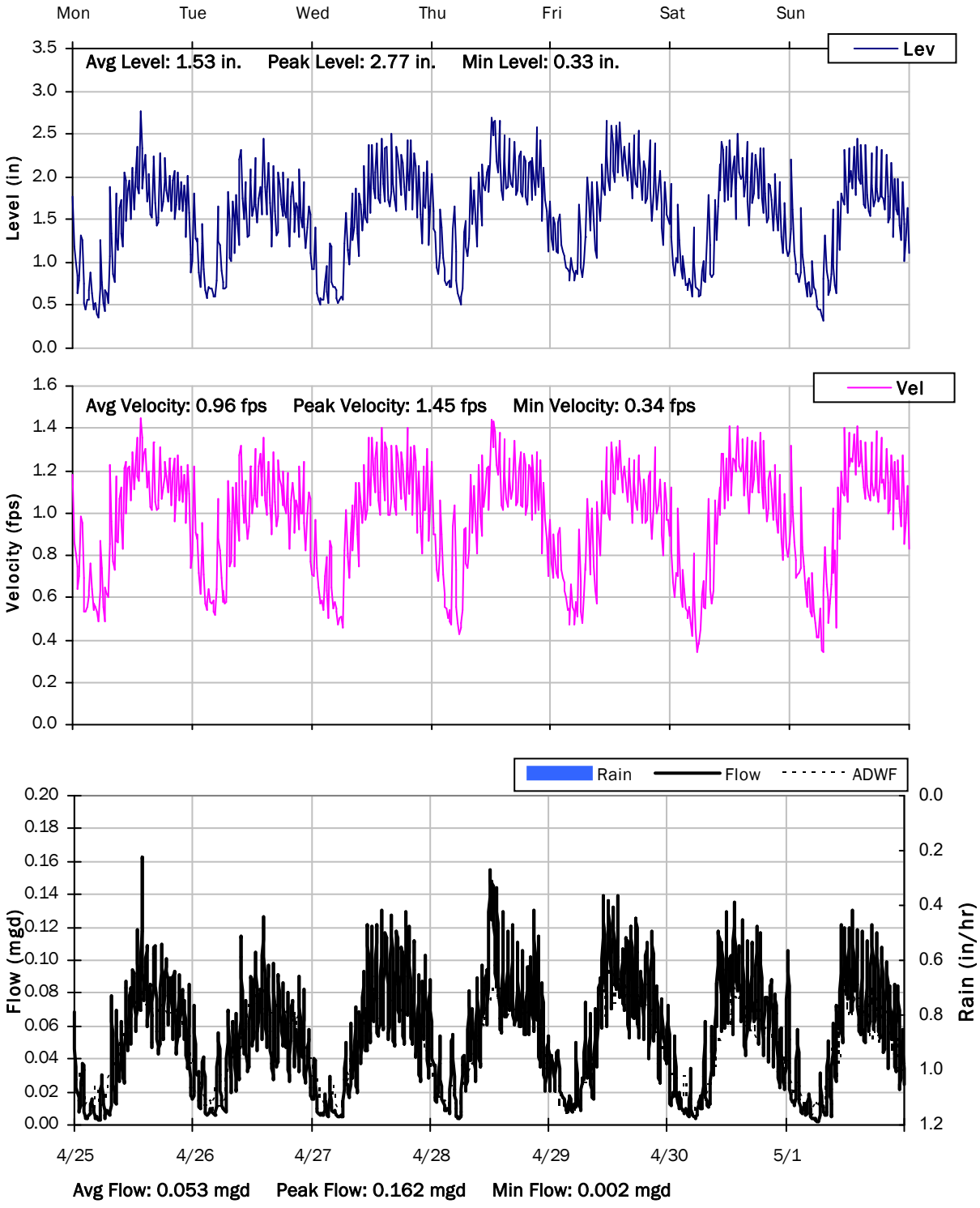
4/18/2022 to 4/25/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

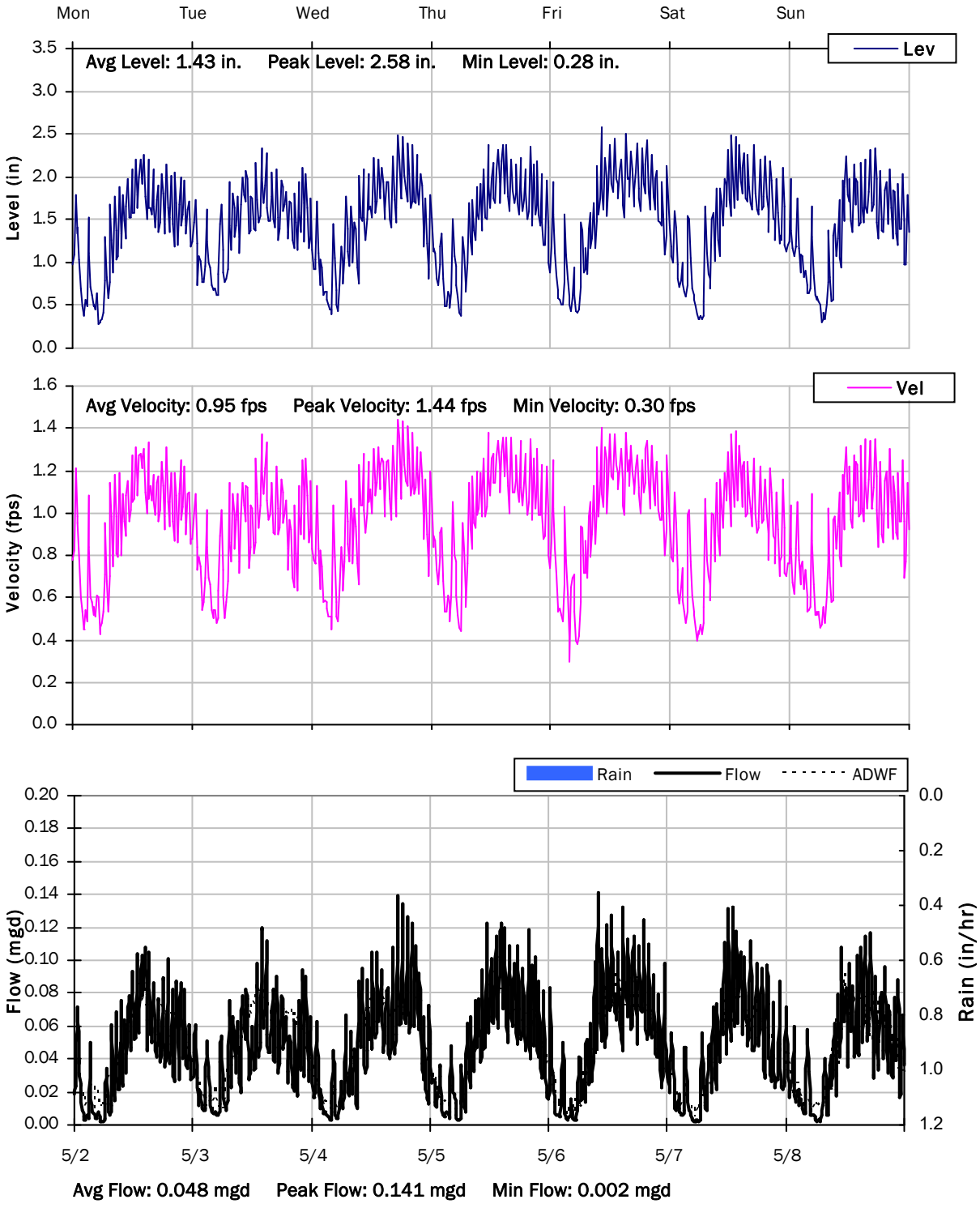
4/25/2022 to 5/2/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

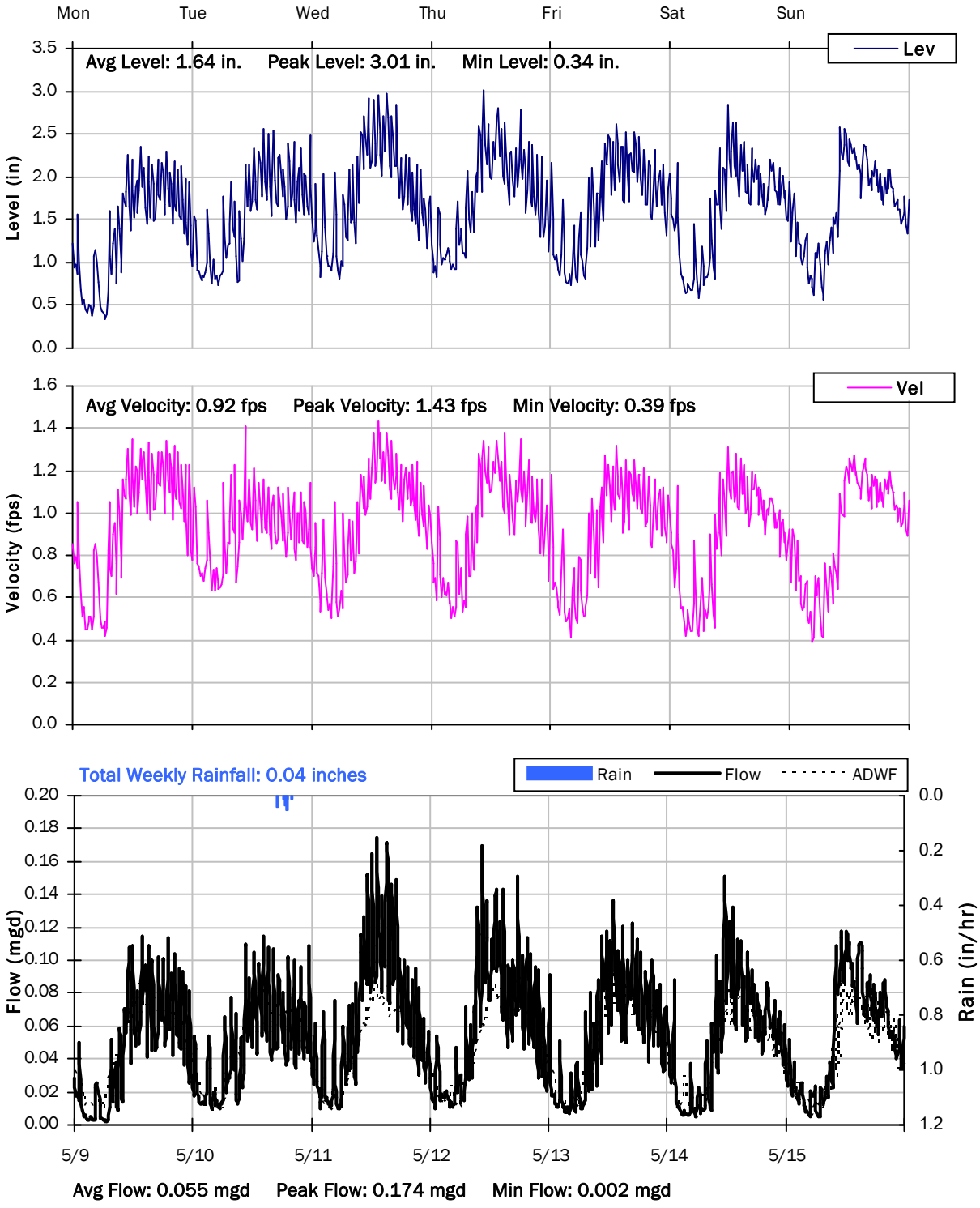
5/2/2022 to 5/9/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

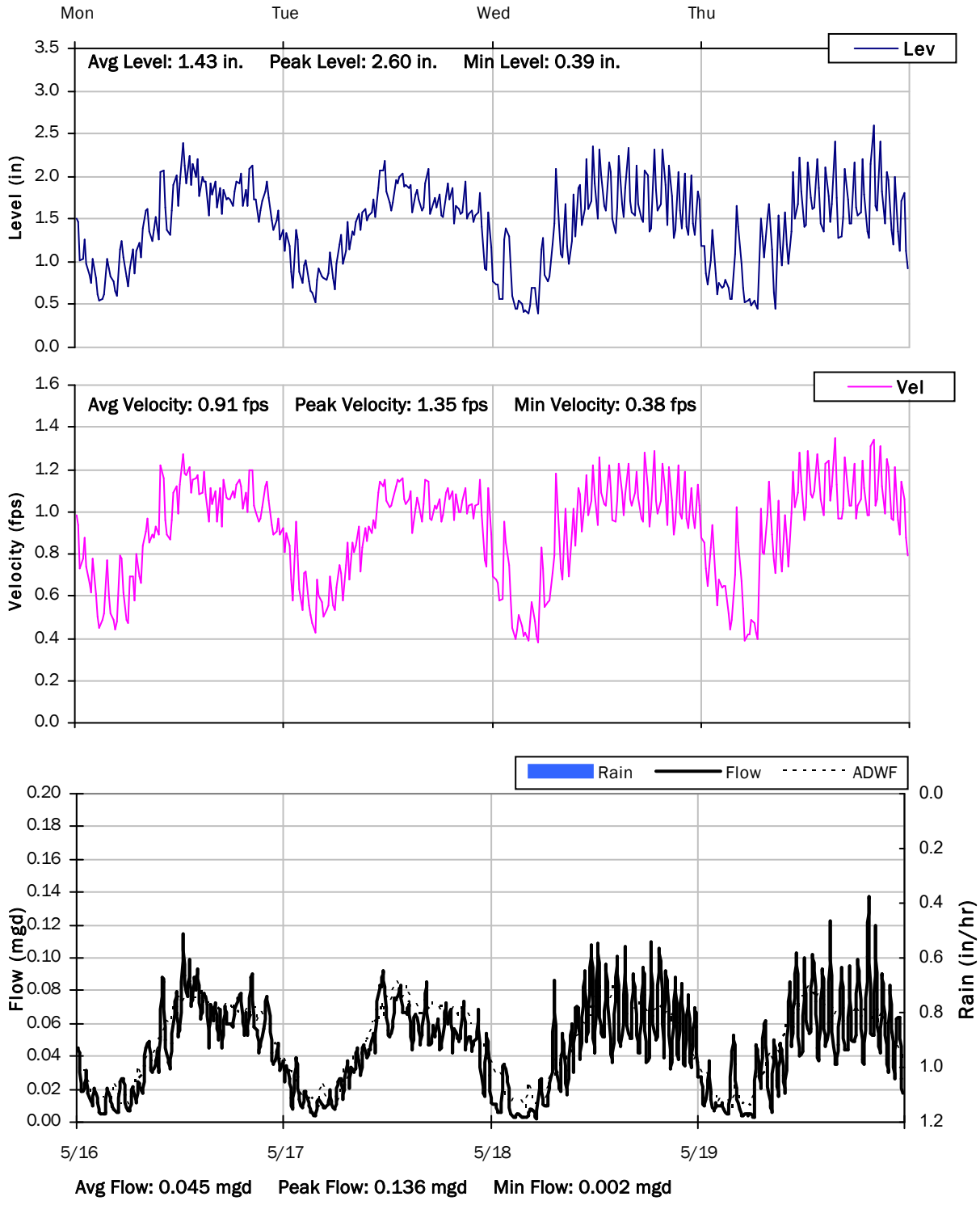
5/9/2022 to 5/16/2022



SITE 5

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 6

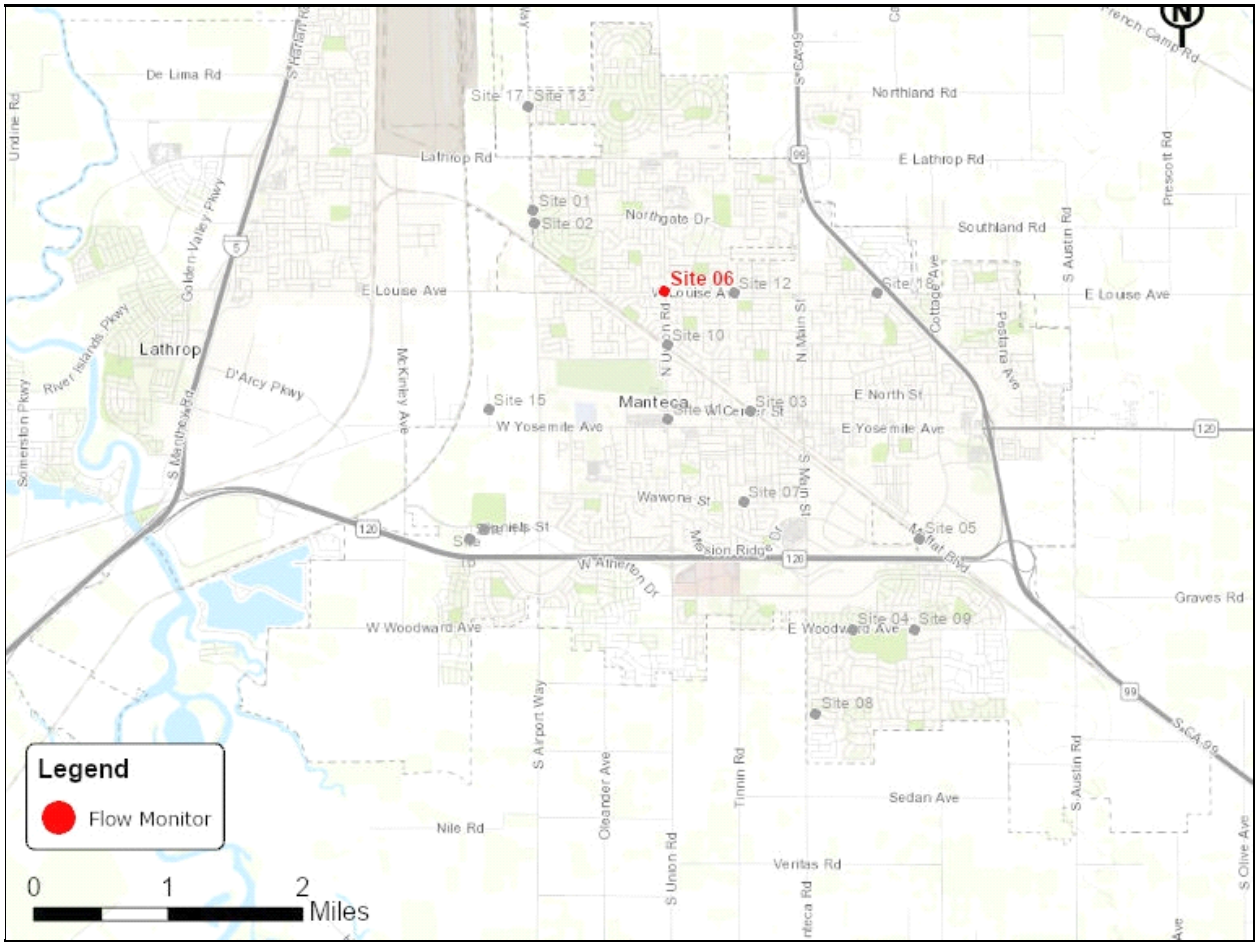
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: W. Louise Avenue at N. Union Road

Data Summary Report



Vicinity Map: Site 6

SITE 6

Additional Site Photos

Effluent Pipe

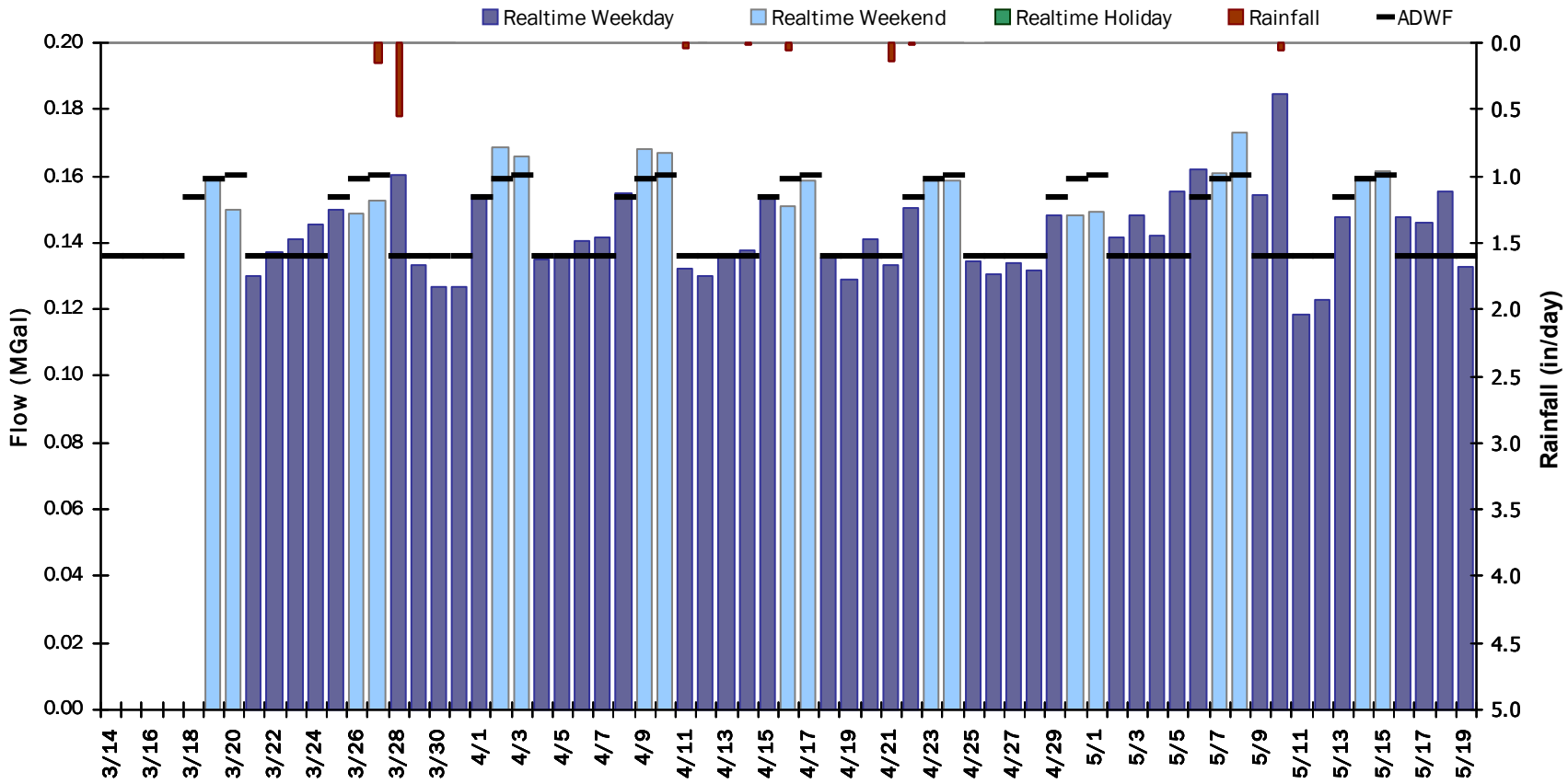
Monitored Northwest Influent Pipe

SITE 6

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.147 MGal Peak Daily Flow: 0.185 MGal Min Daily Flow: 0.118 MGal

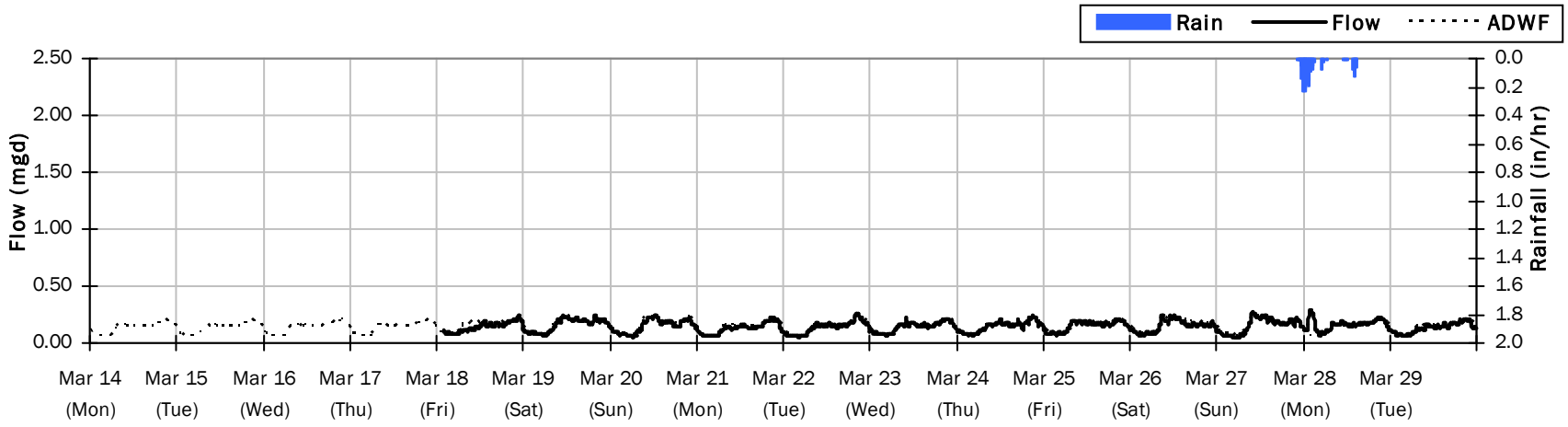
Total Rainfall: 1.02 inches

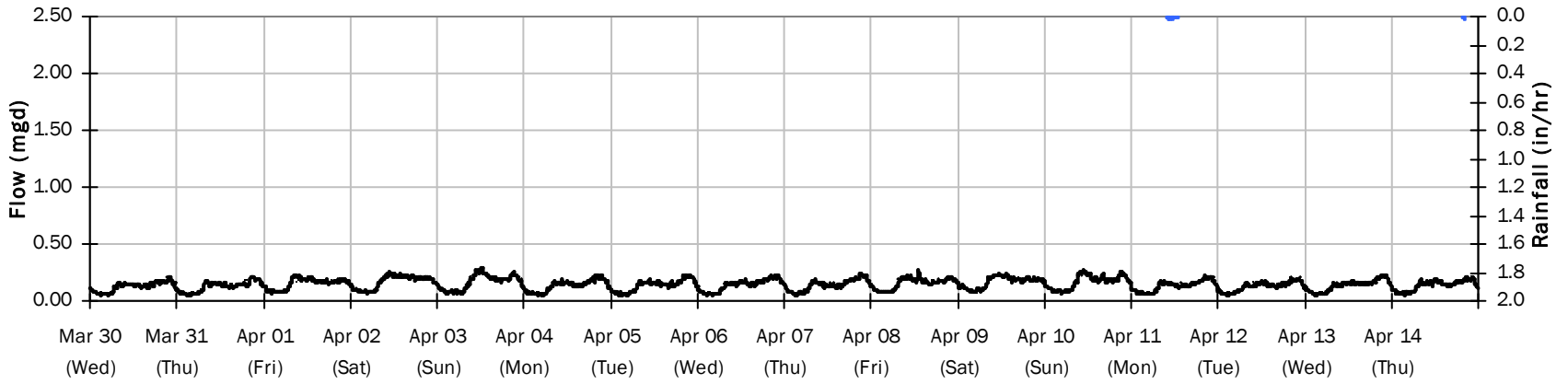


SITE 6

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.146 mgd Period Peak Flow: 0.296 mgd Period Min Flow: 0.049 mgd

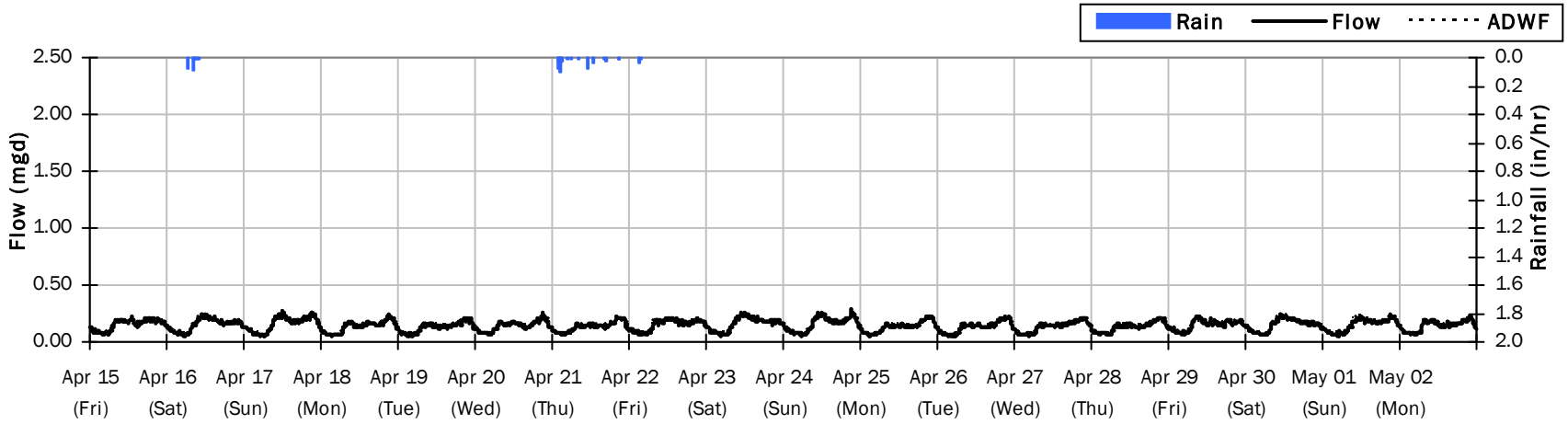


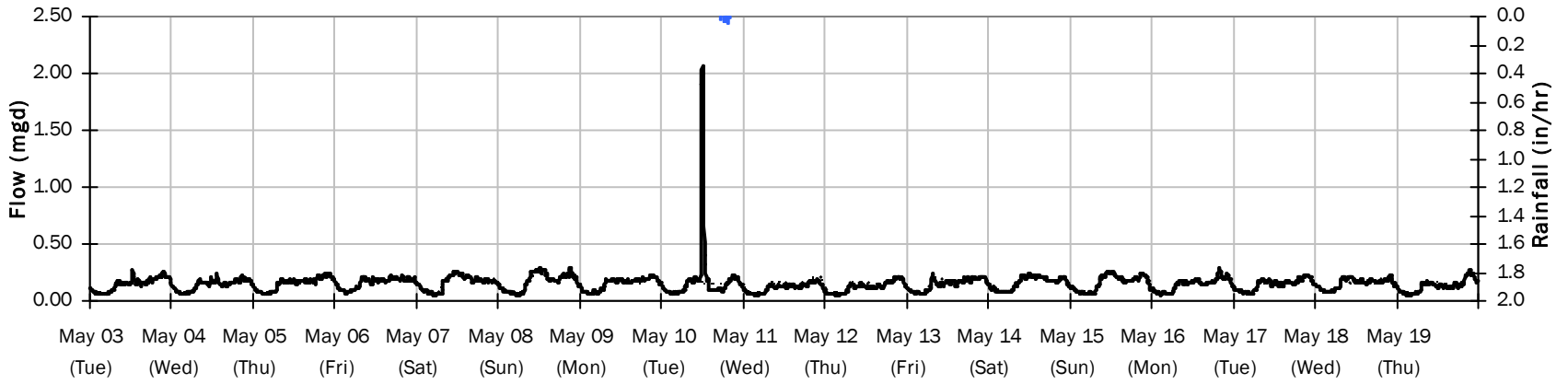


SITE 6

Flow Summary: 4/15/2022 to 5/19/2022

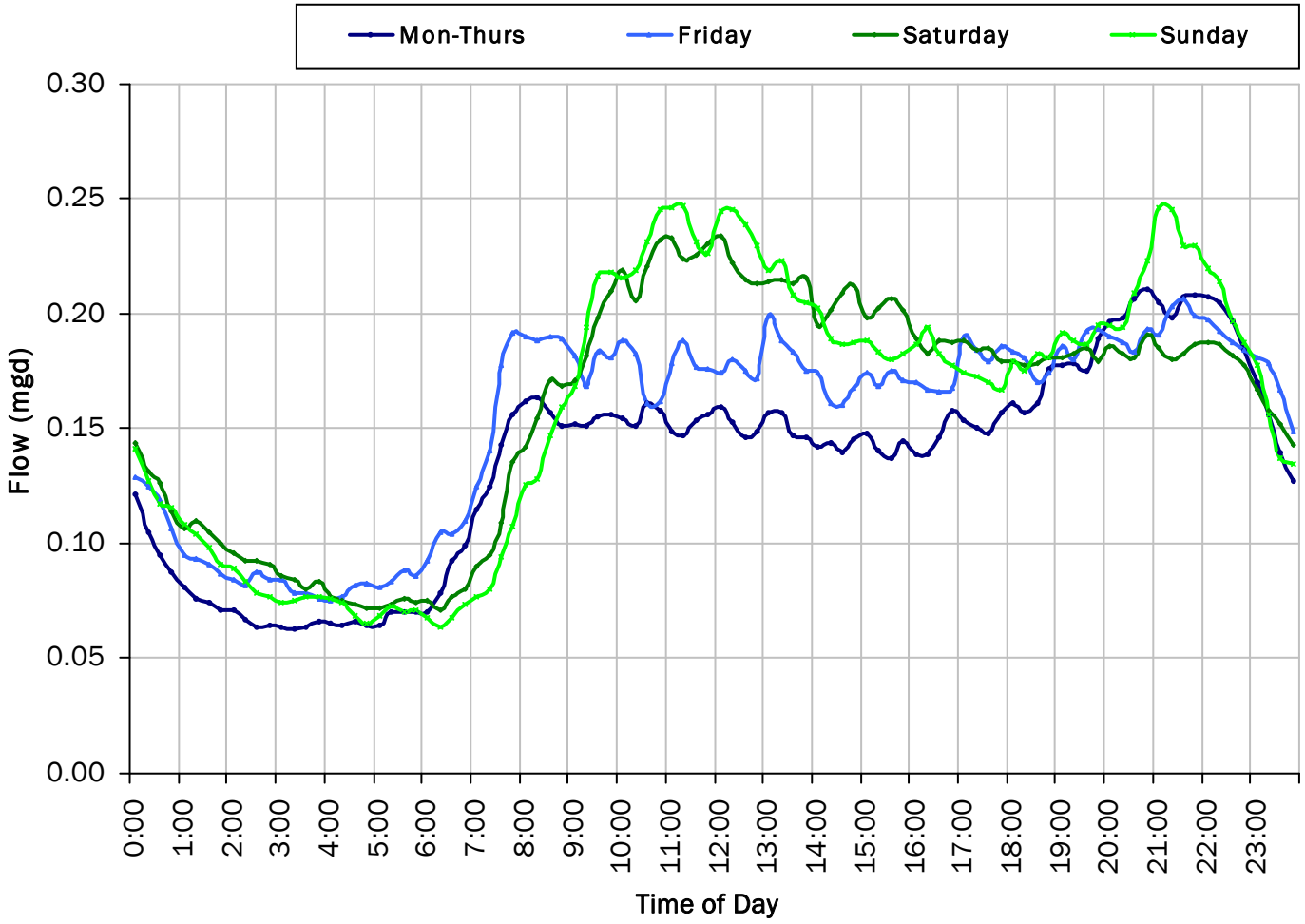
Period Rainfall: 0.27 inches Period Avg Flow: 0.147 mgd Period Peak Flow: 2.060 mgd Period Min Flow: 0.047 mgd





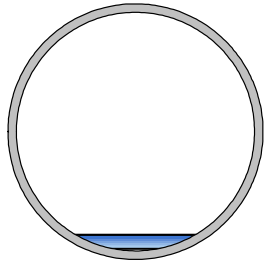
SITE 6

Average Dry Weather Flow Hydrographs



ADWF:

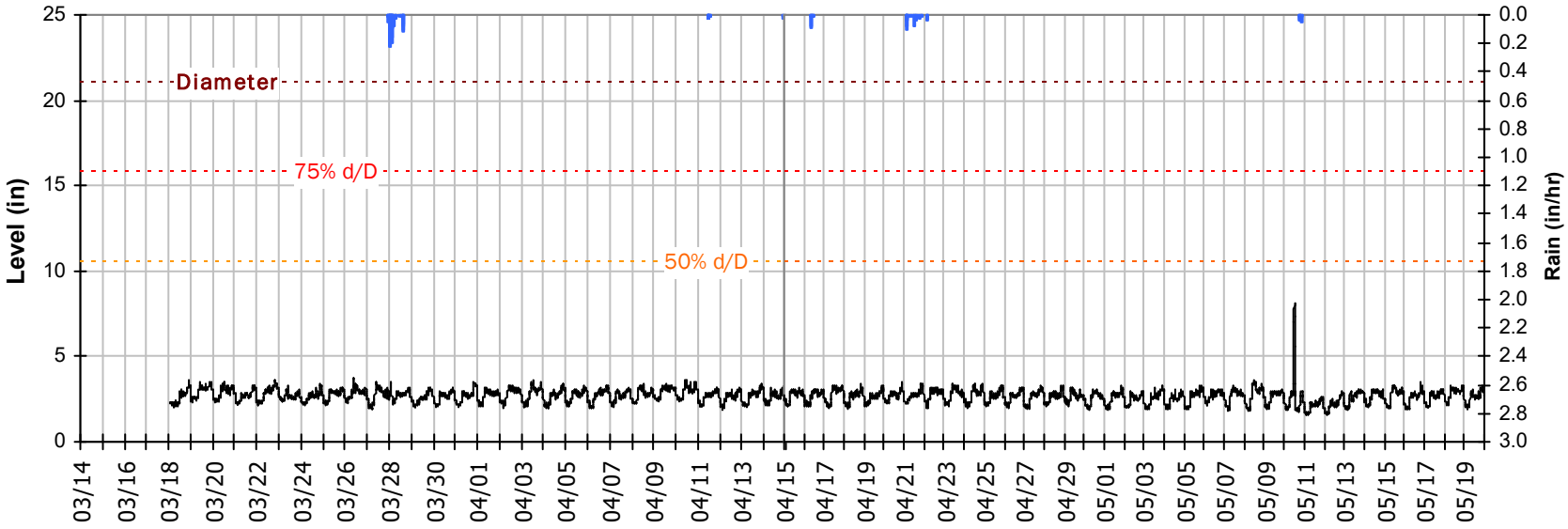
0.145 *mgd*

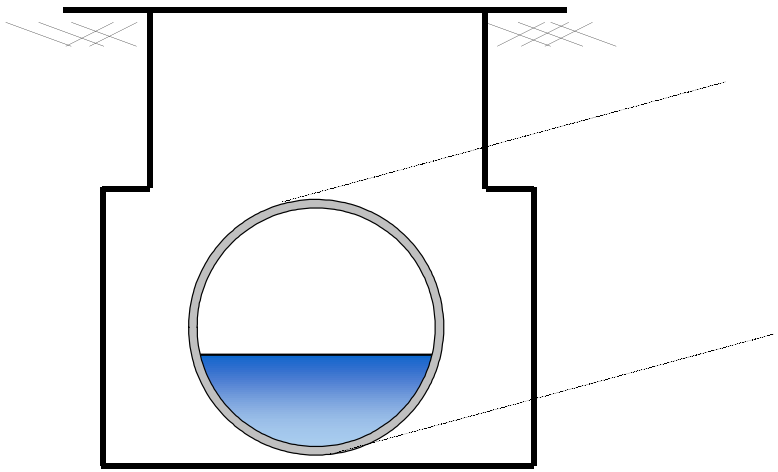


SITE 6

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



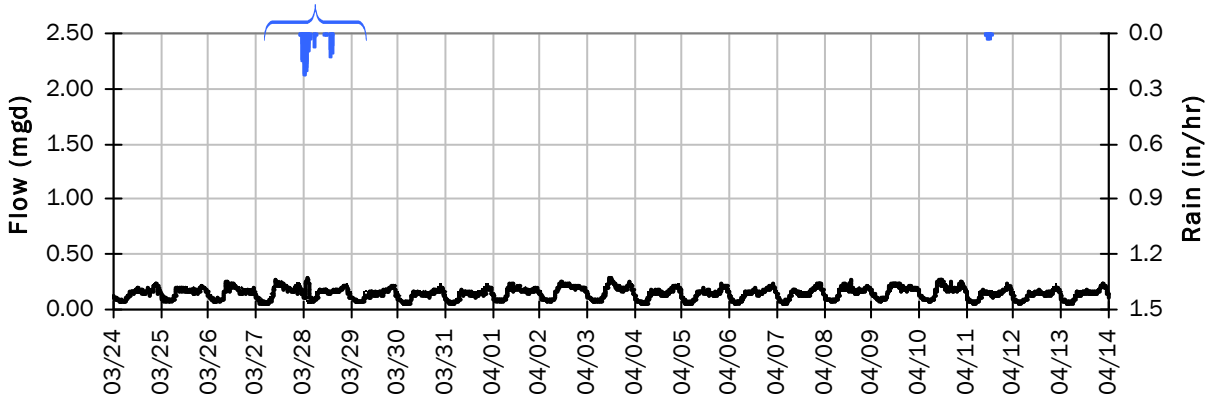


Pipe Diameter:	21	*inches*
Peak Measured Level:	8.11	*inches*
Peak d/D Ratio:	0.39	

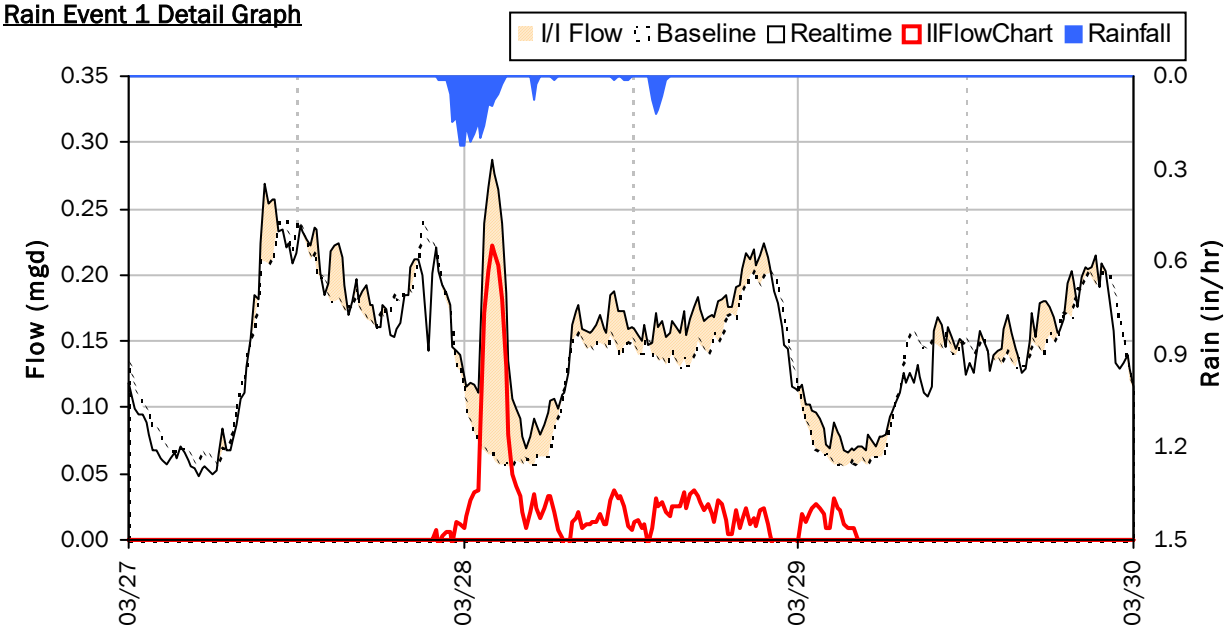
SITE 6
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Rain Event 1
Rainfall: 0.7 inches



Rain Event 1 Detail Graph



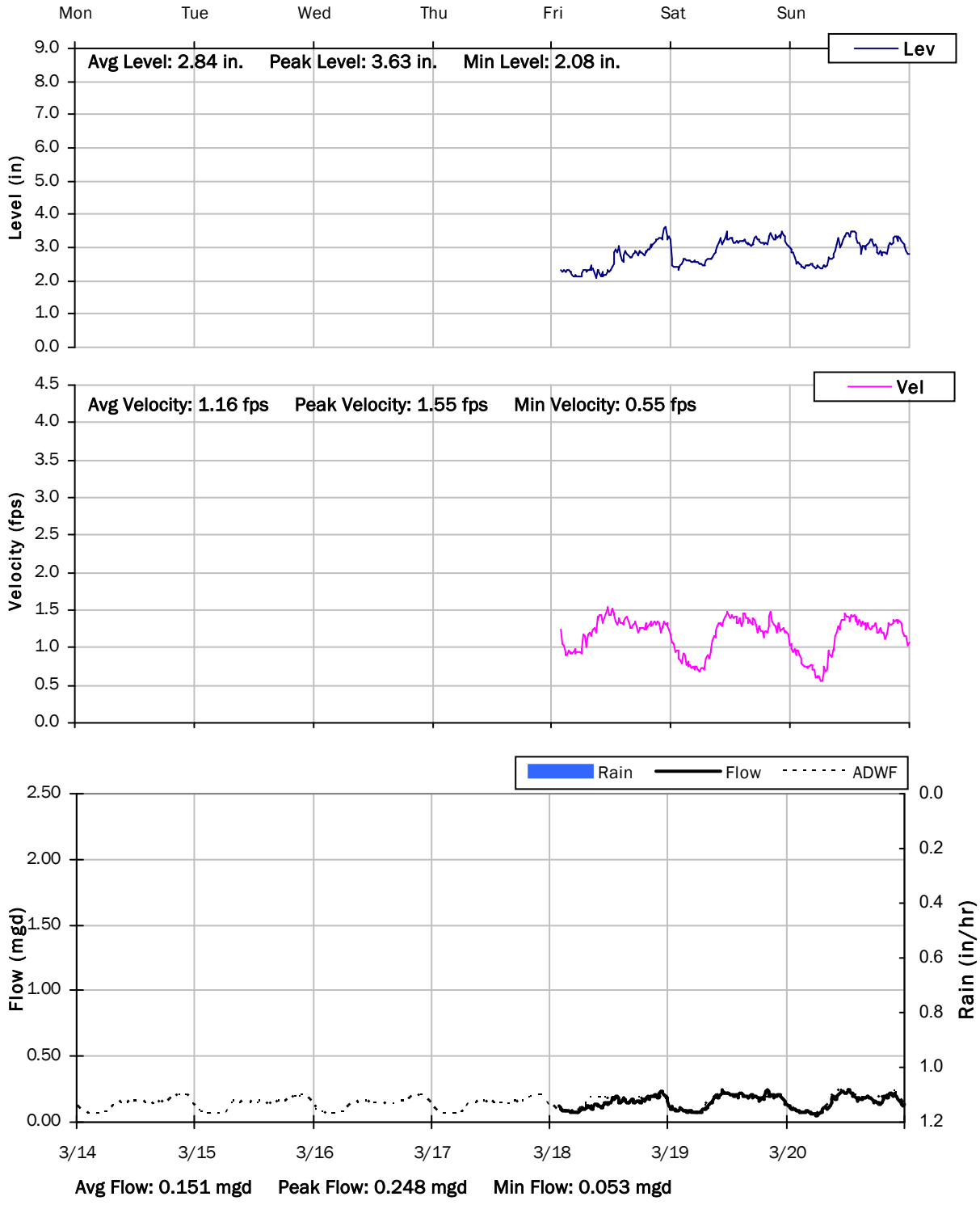
Storm Event I/I Analysis (Rain = 0.70 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.287 *mgd*	**Peak I/I Rate:**	0.223 *mgd*
PF:	1.98	**Total I/I:**	35,000 *gallons*
Peak Level:	3.50 *in*		
d/D Ratio:	0.17		

SITE 6

Weekly Level, Velocity and Flow Hydrographs

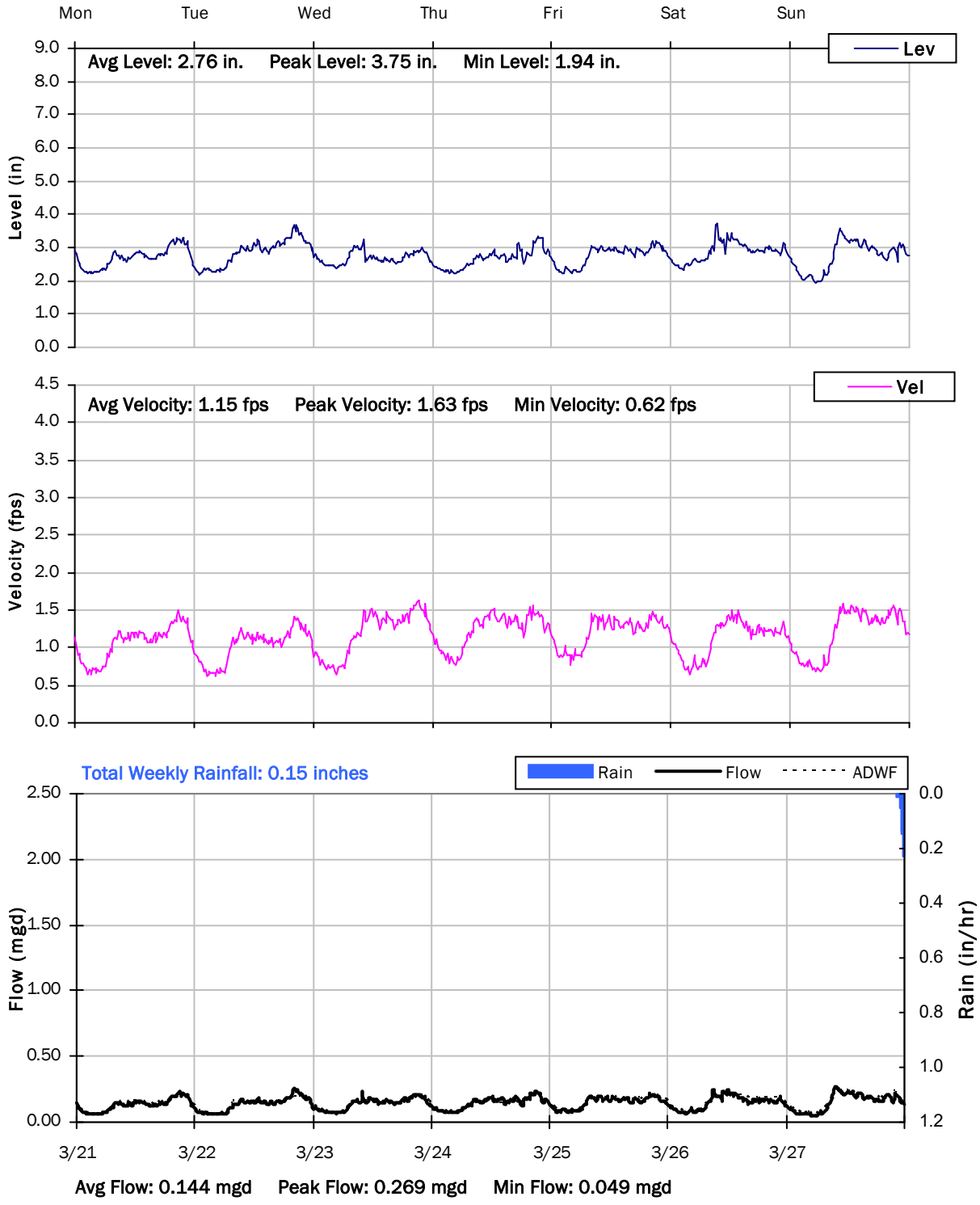
3/14/2022 to 3/21/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

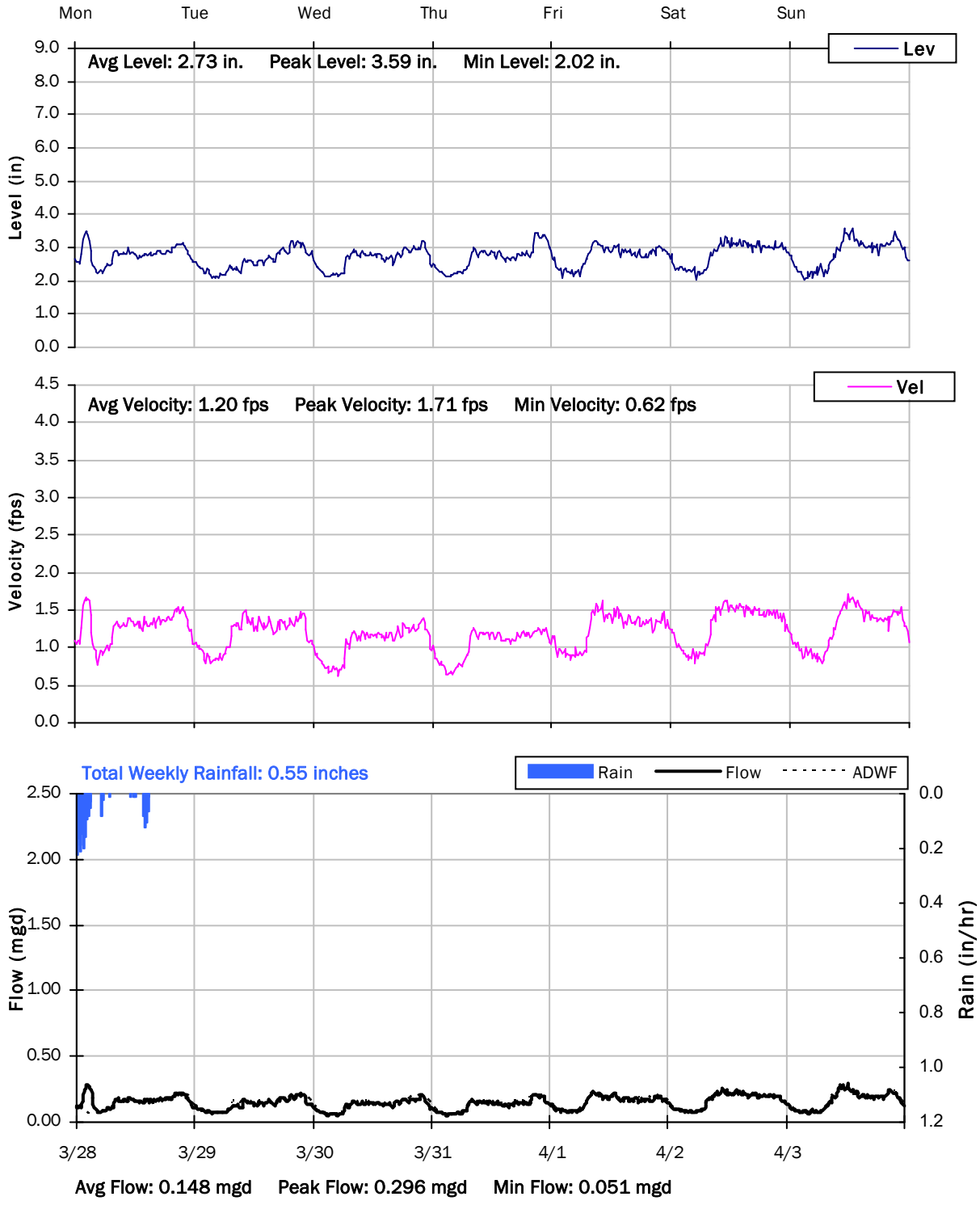
3/21/2022 to 3/28/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

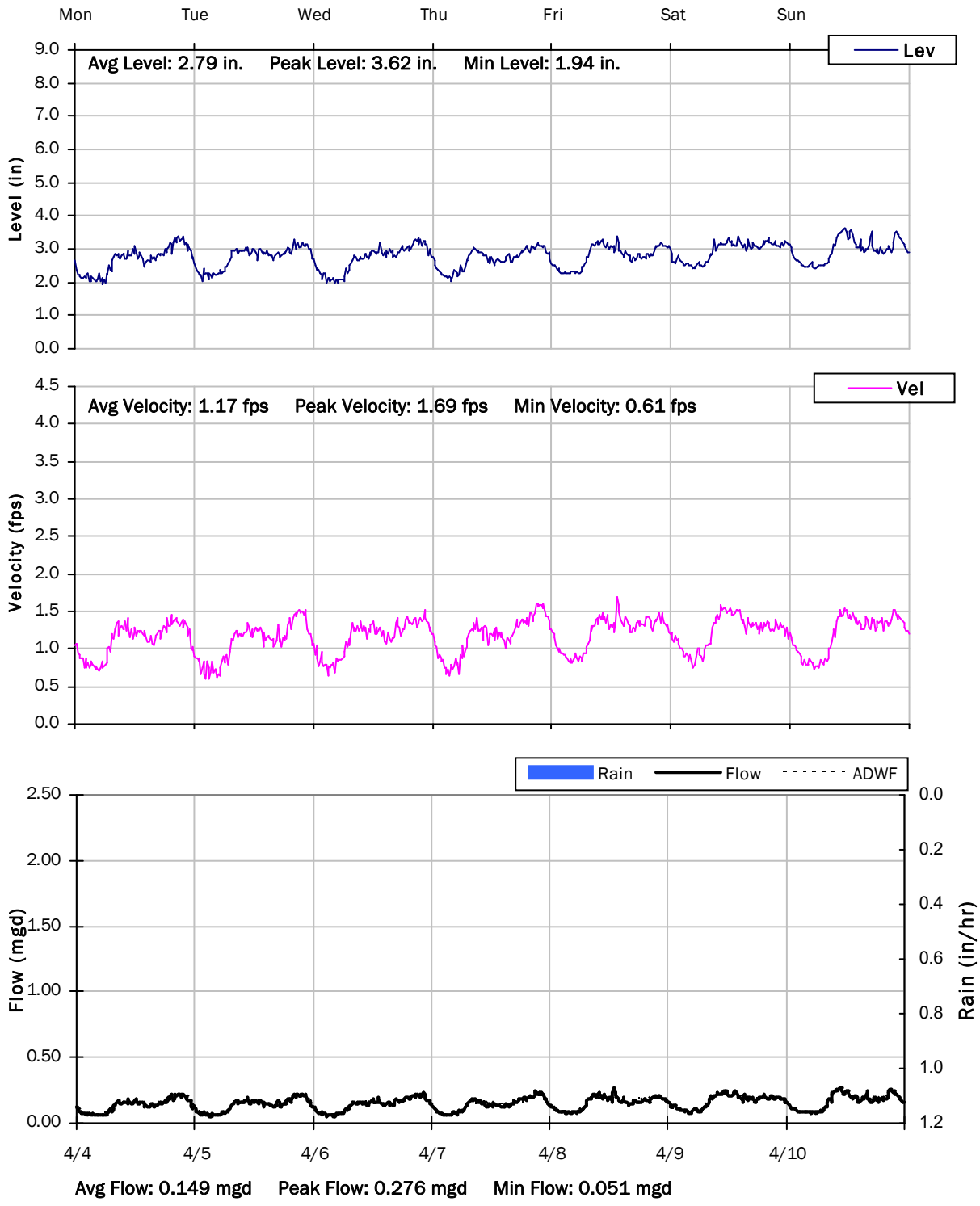
3/28/2022 to 4/4/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

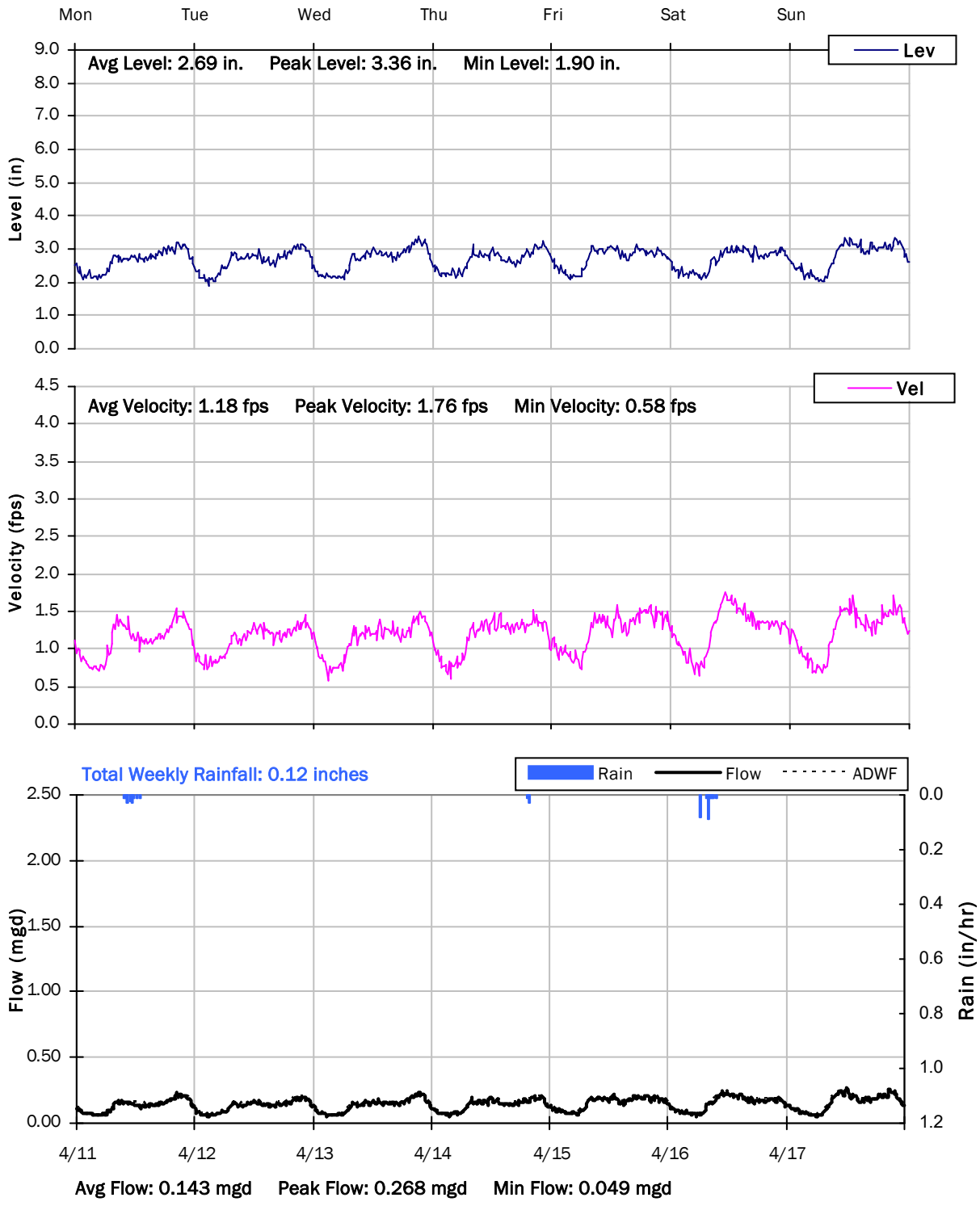
4/4/2022 to 4/11/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

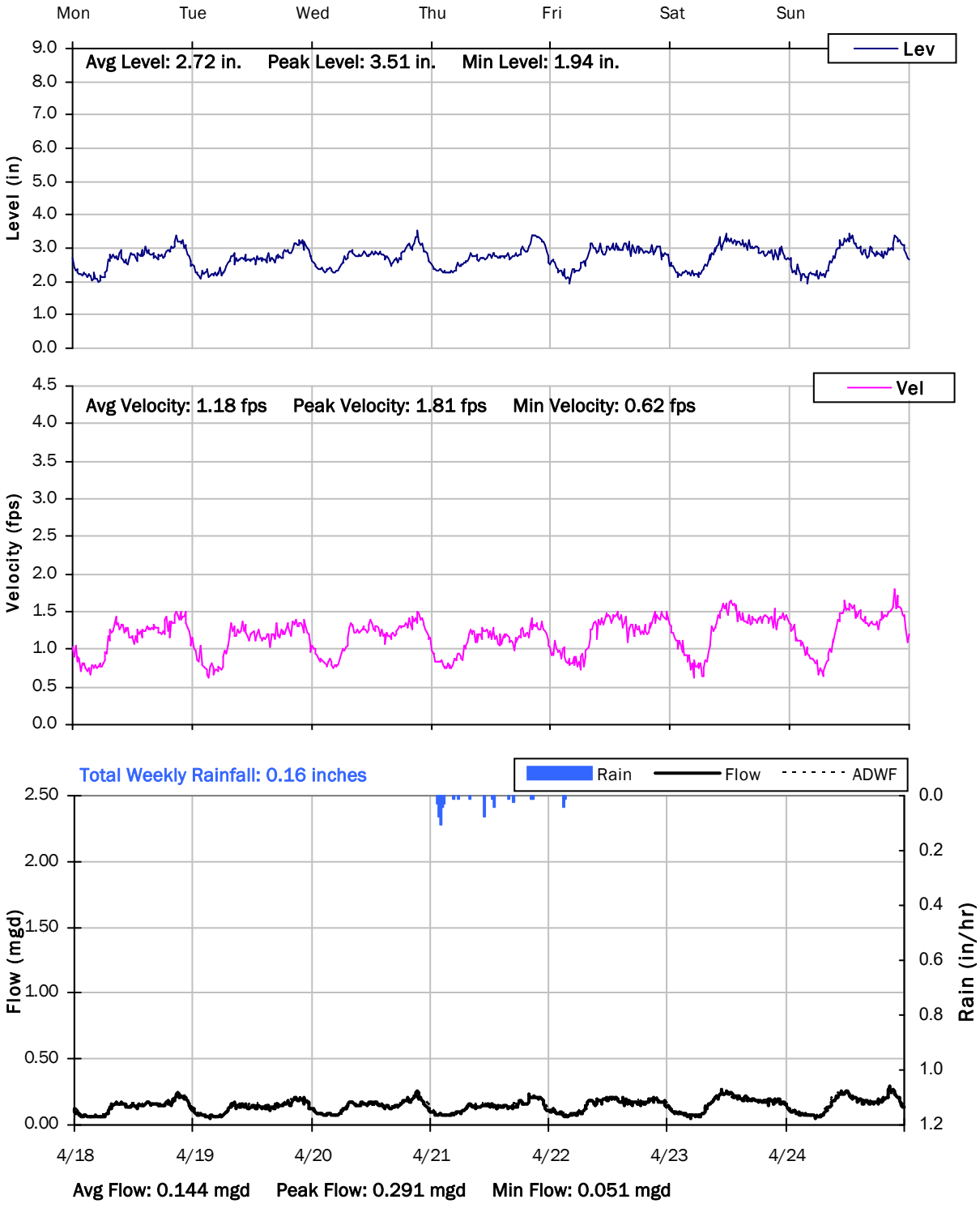
4/11/2022 to 4/18/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

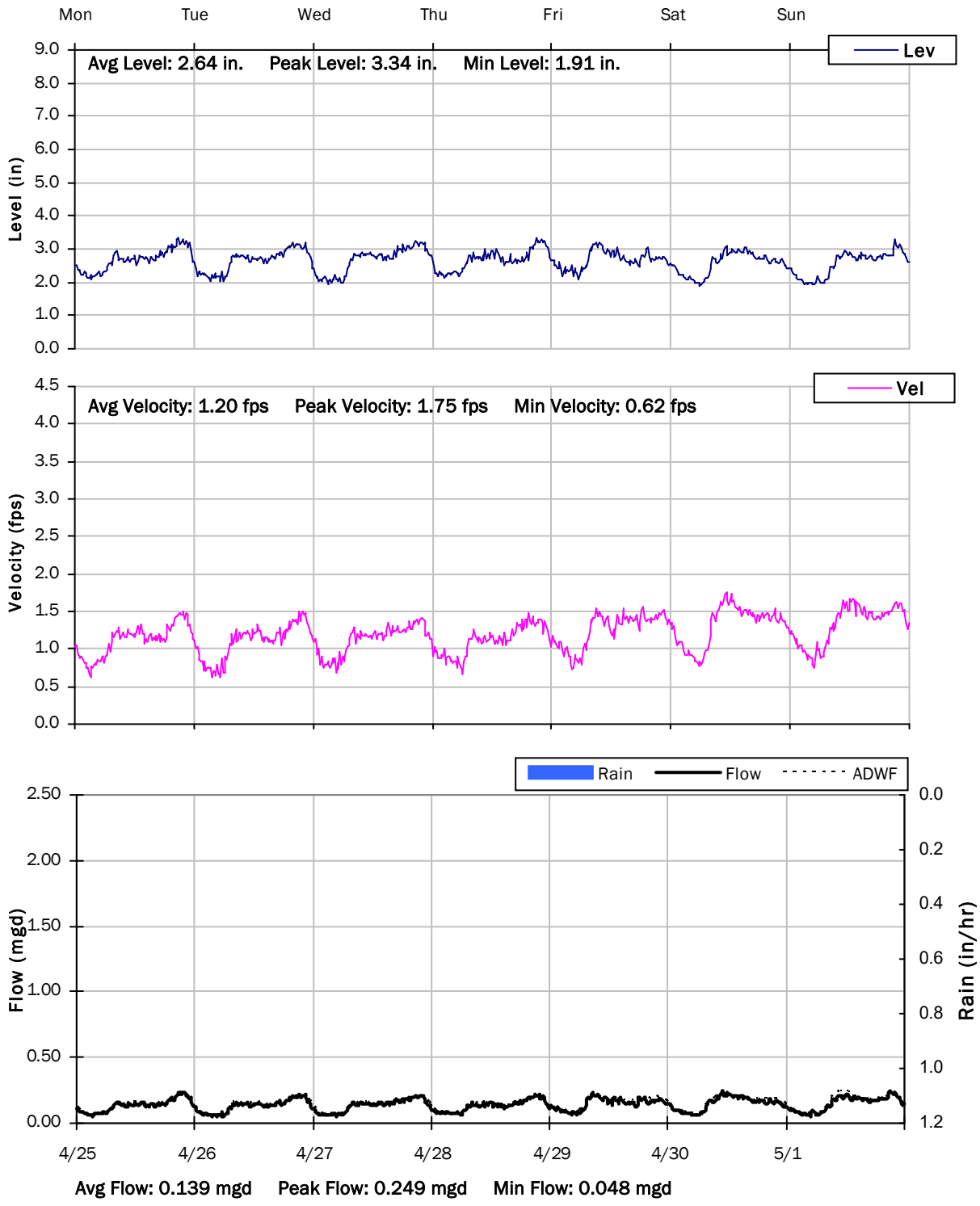
4/18/2022 to 4/25/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

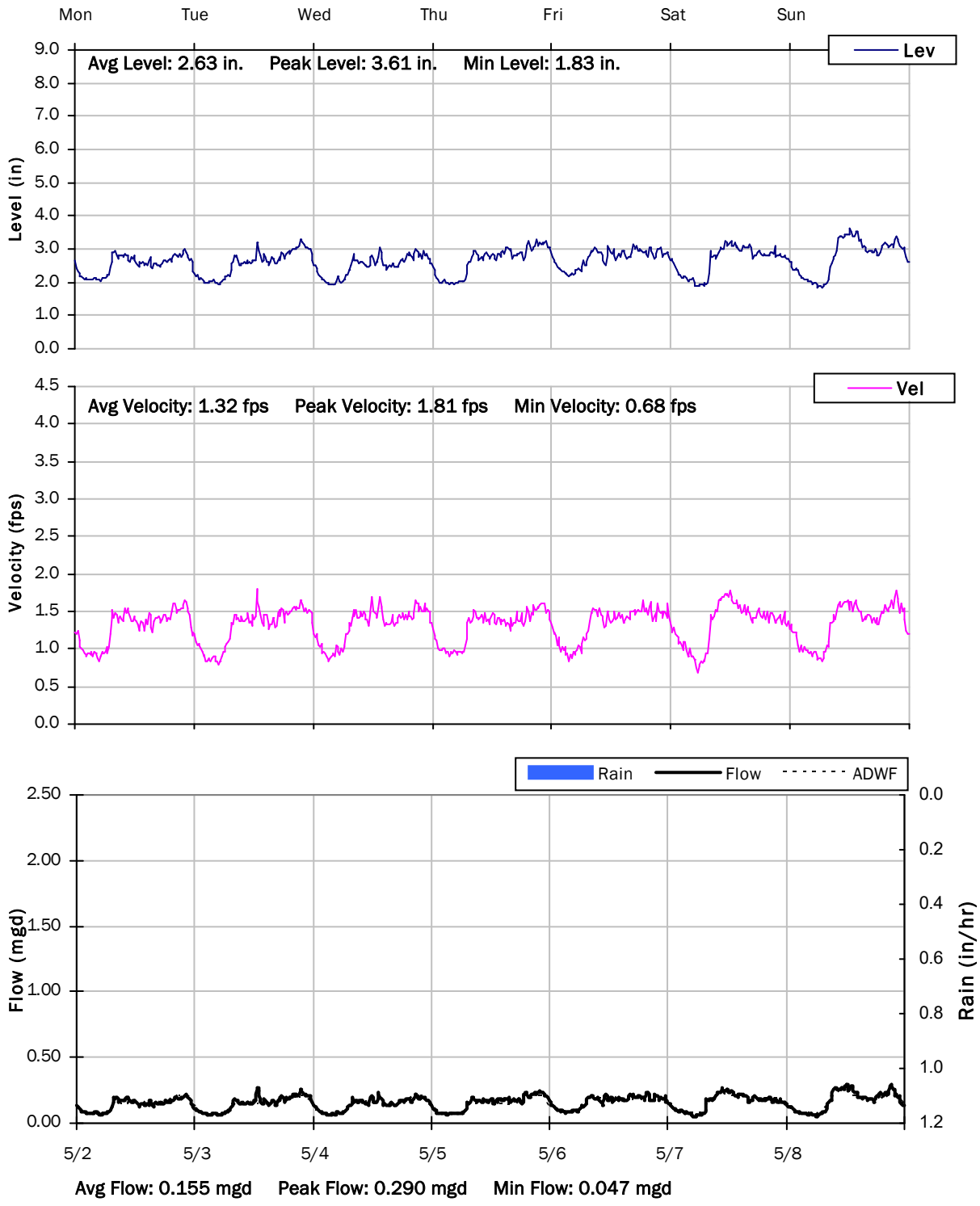
4/25/2022 to 5/2/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

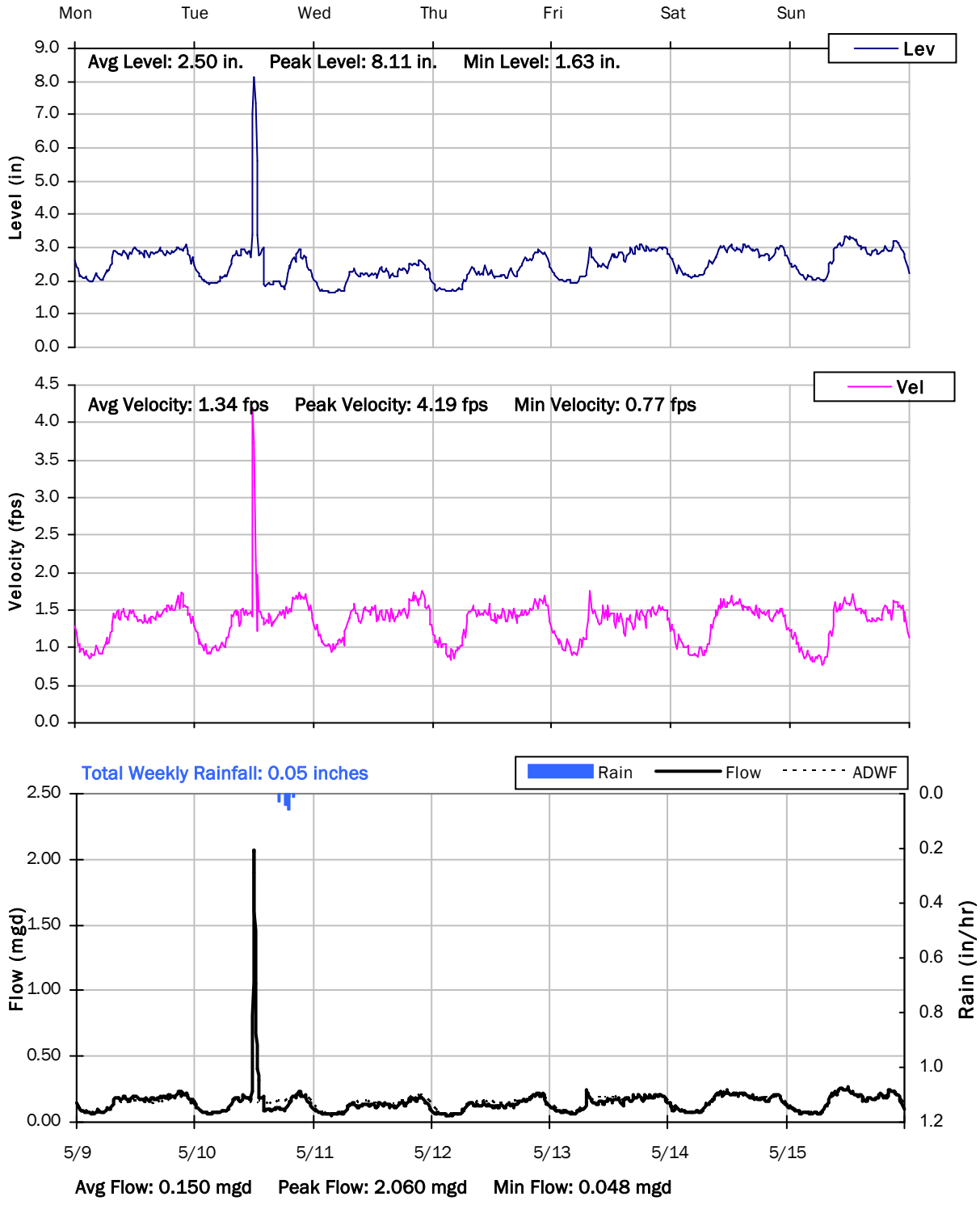
5/2/2022 to 5/9/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

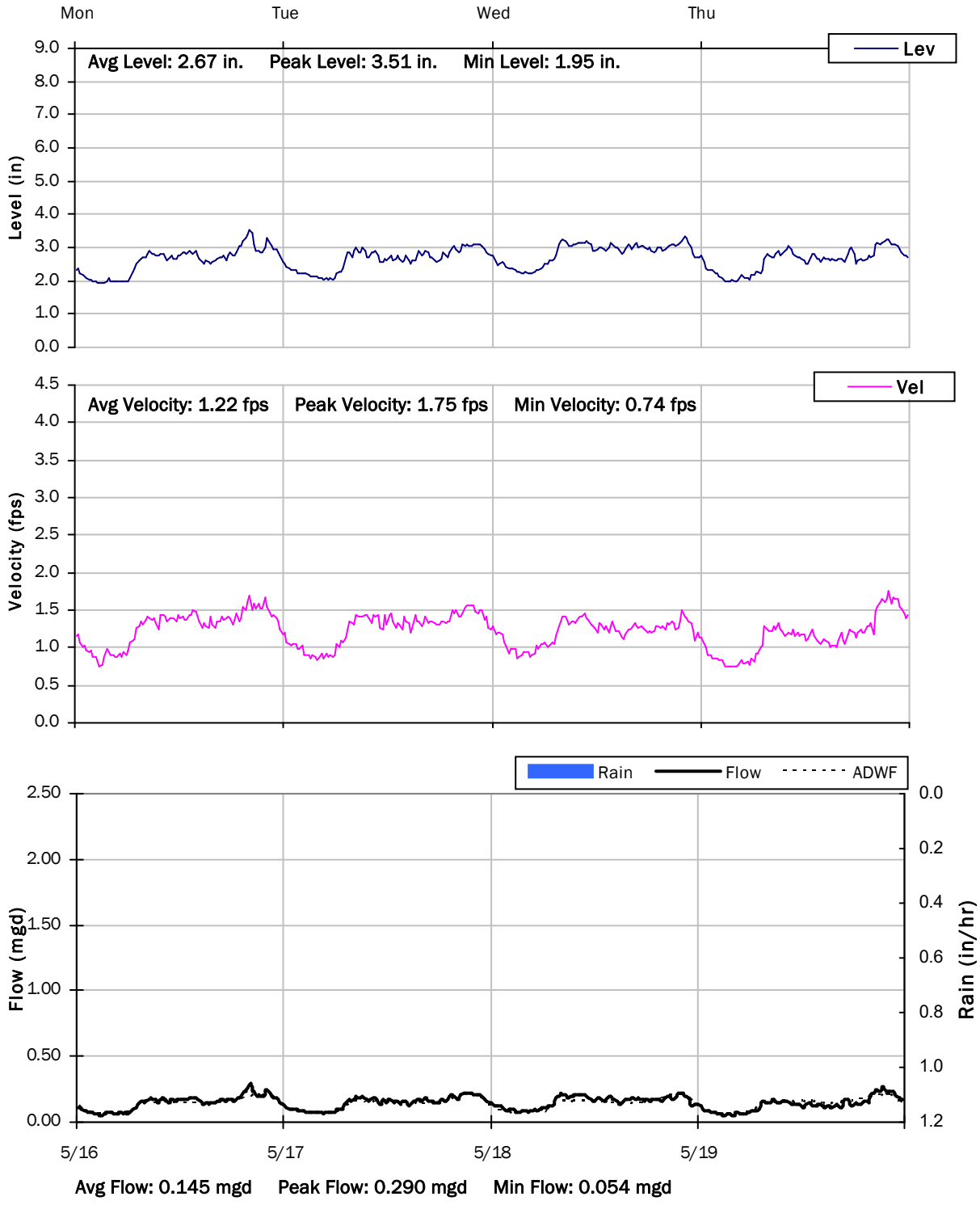
5/9/2022 to 5/16/2022



SITE 6

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 7

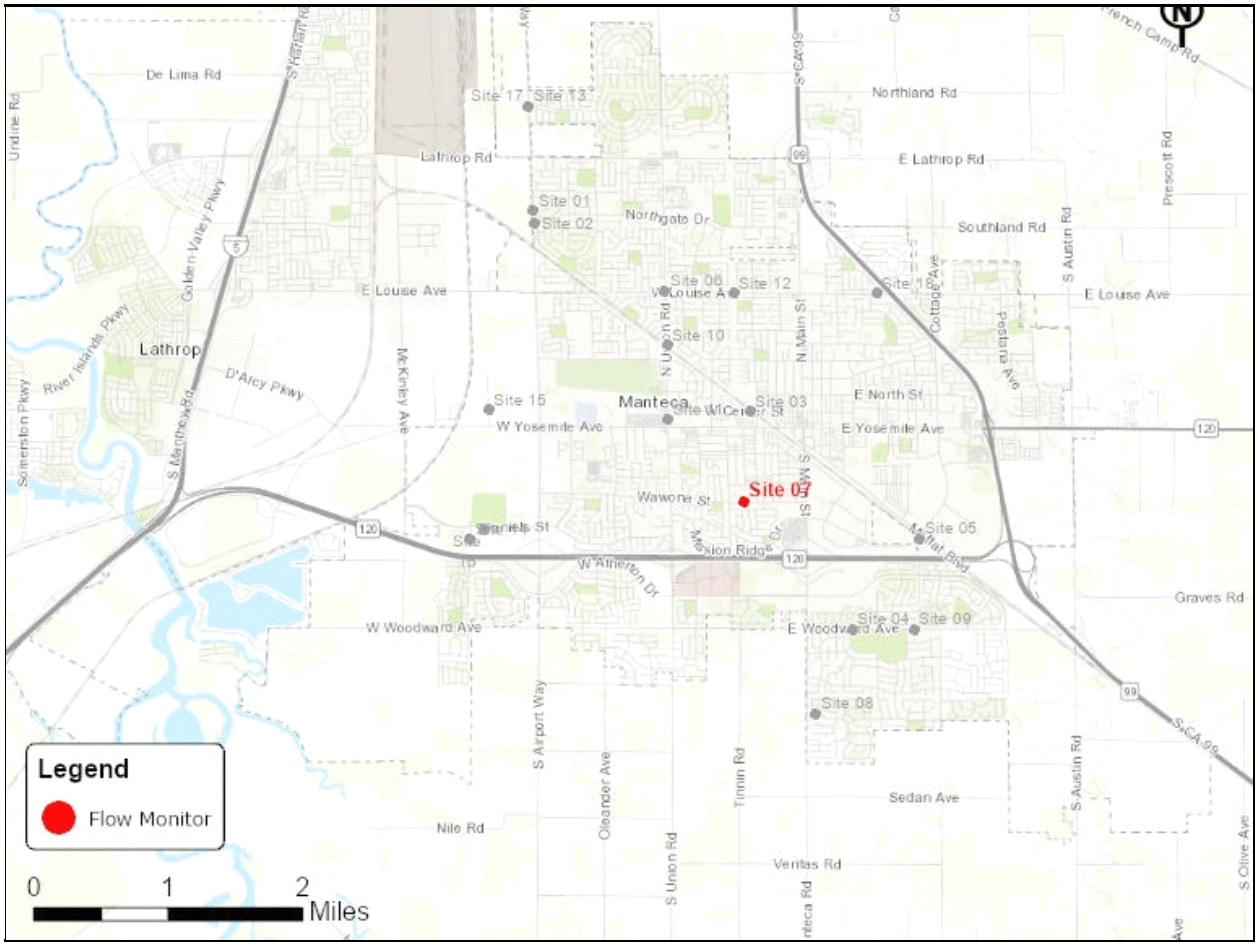
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Wawona Street West of Sequoia Avenue

Data Summary Report

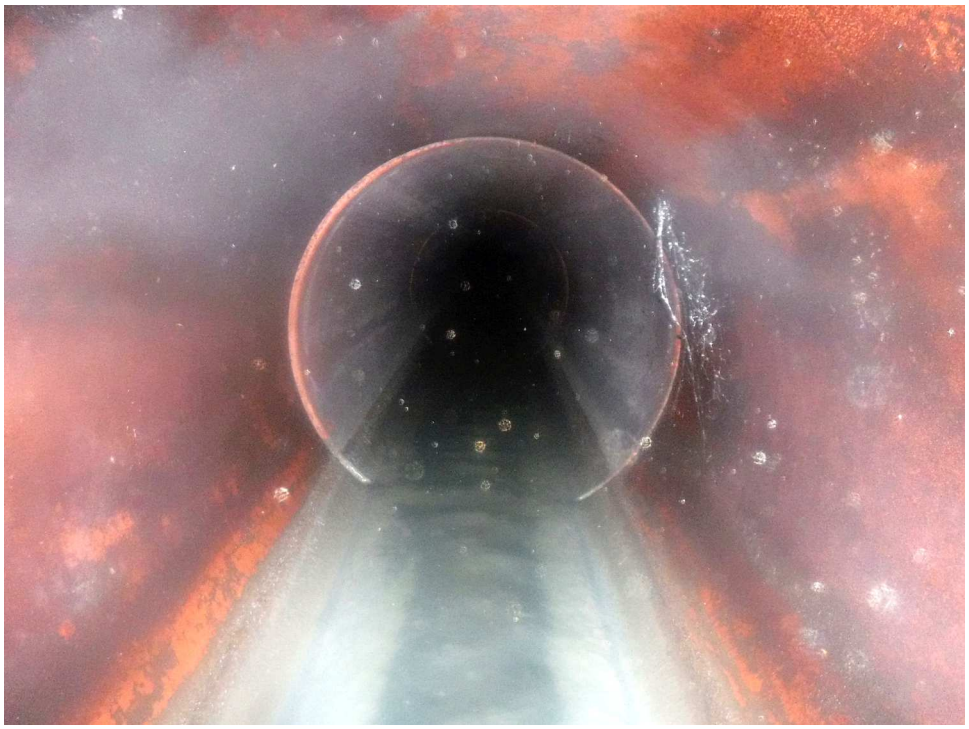


Vicinity Map: Site 7

SITE 7

Additional Site Photos

Effluent Pipe



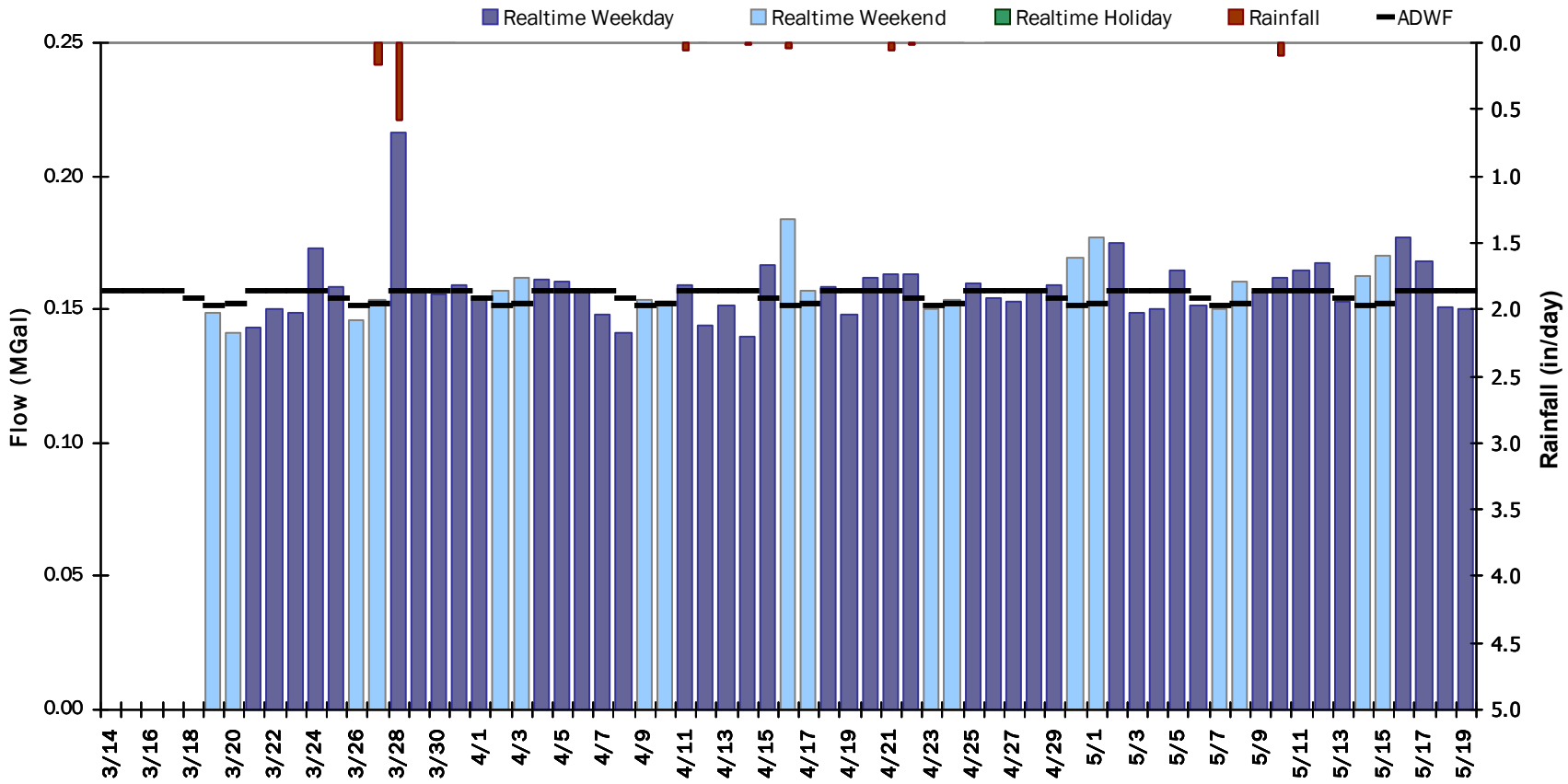
Monitored East Influent Pipe

SITE 7

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.159 MGal Peak Daily Flow: 0.216 MGal Min Daily Flow: 0.140 MGal

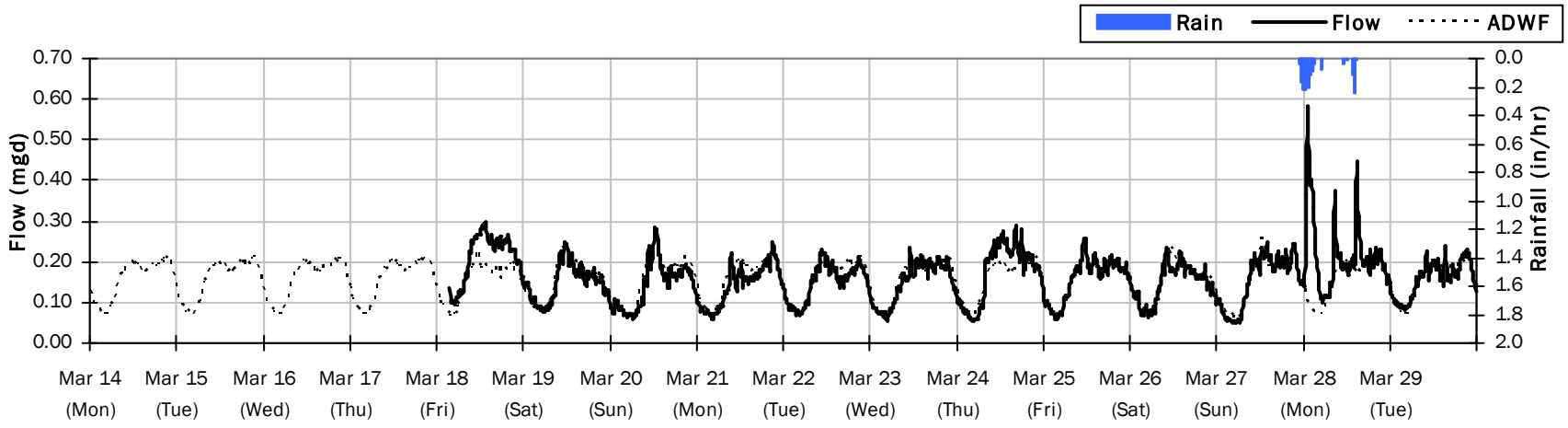
Total Rainfall: 1.02 inches

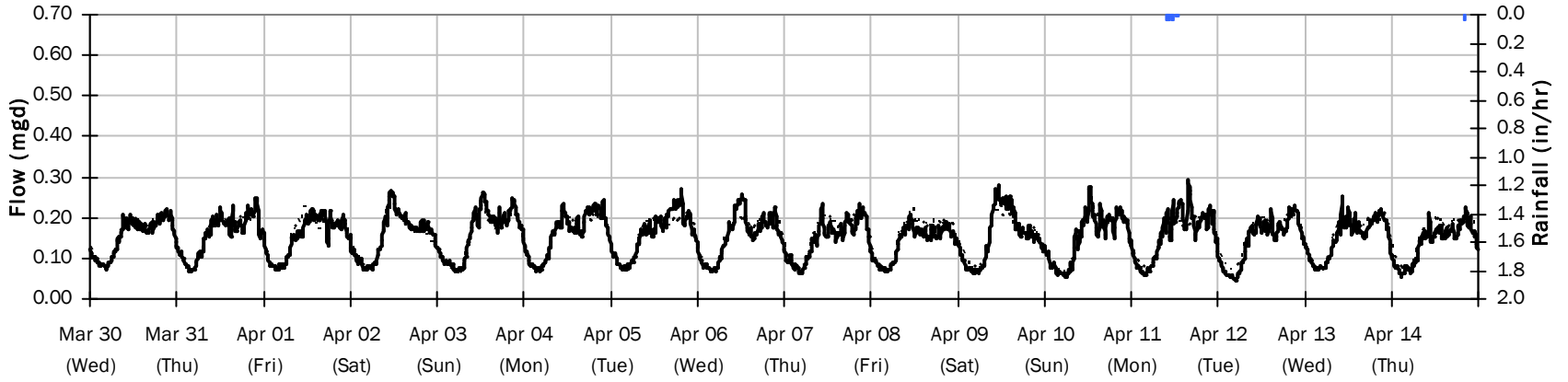


SITE 7

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.81 inches Period Avg Flow: 0.157 mgd Period Peak Flow: 0.576 mgd Period Min Flow: 0.046 mgd

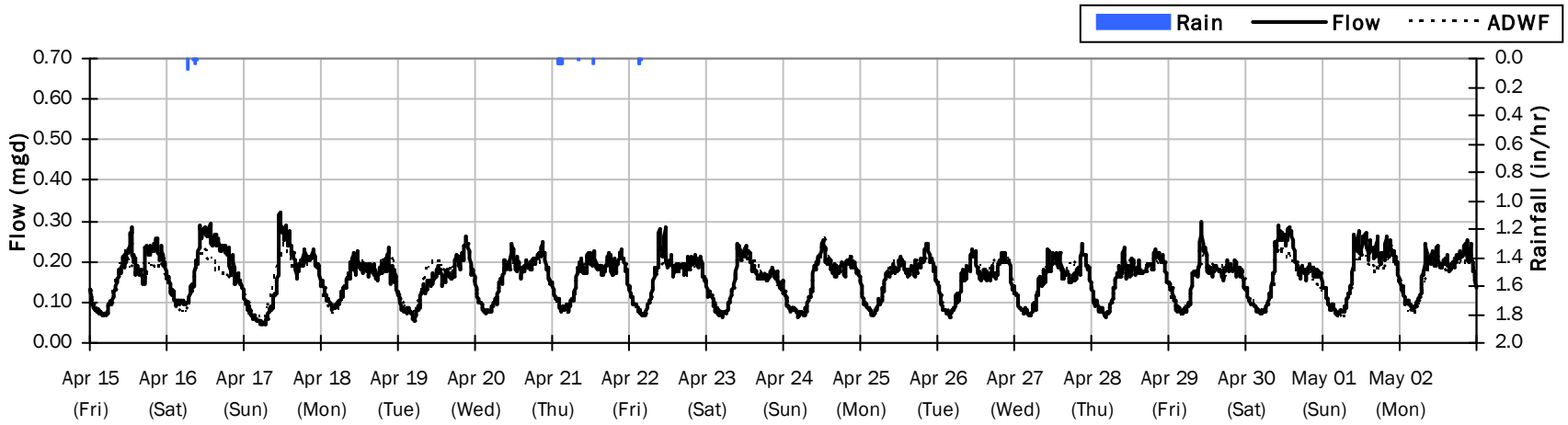


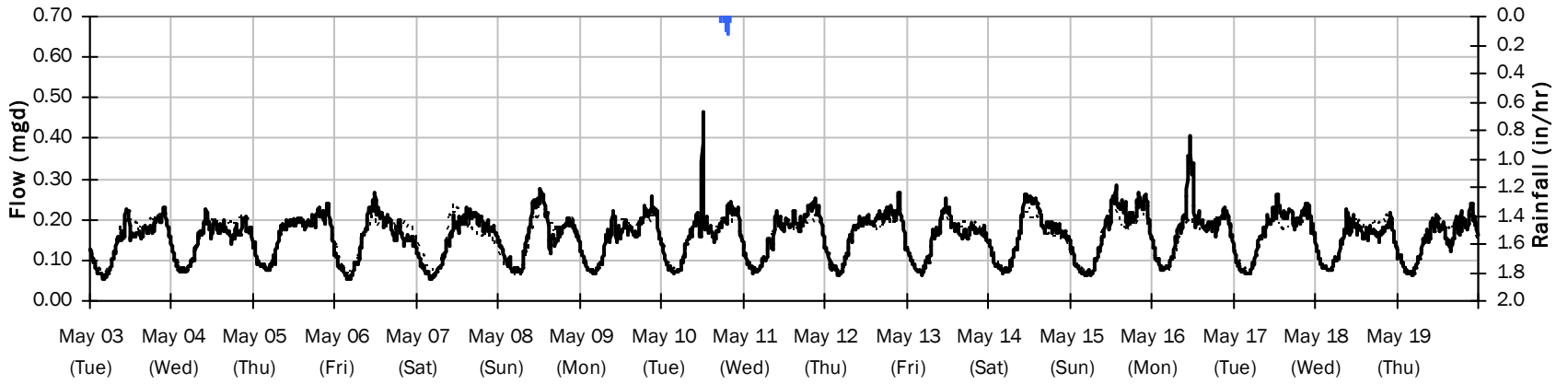


SITE 7

Flow Summary: 4/15/2022 to 5/19/2022

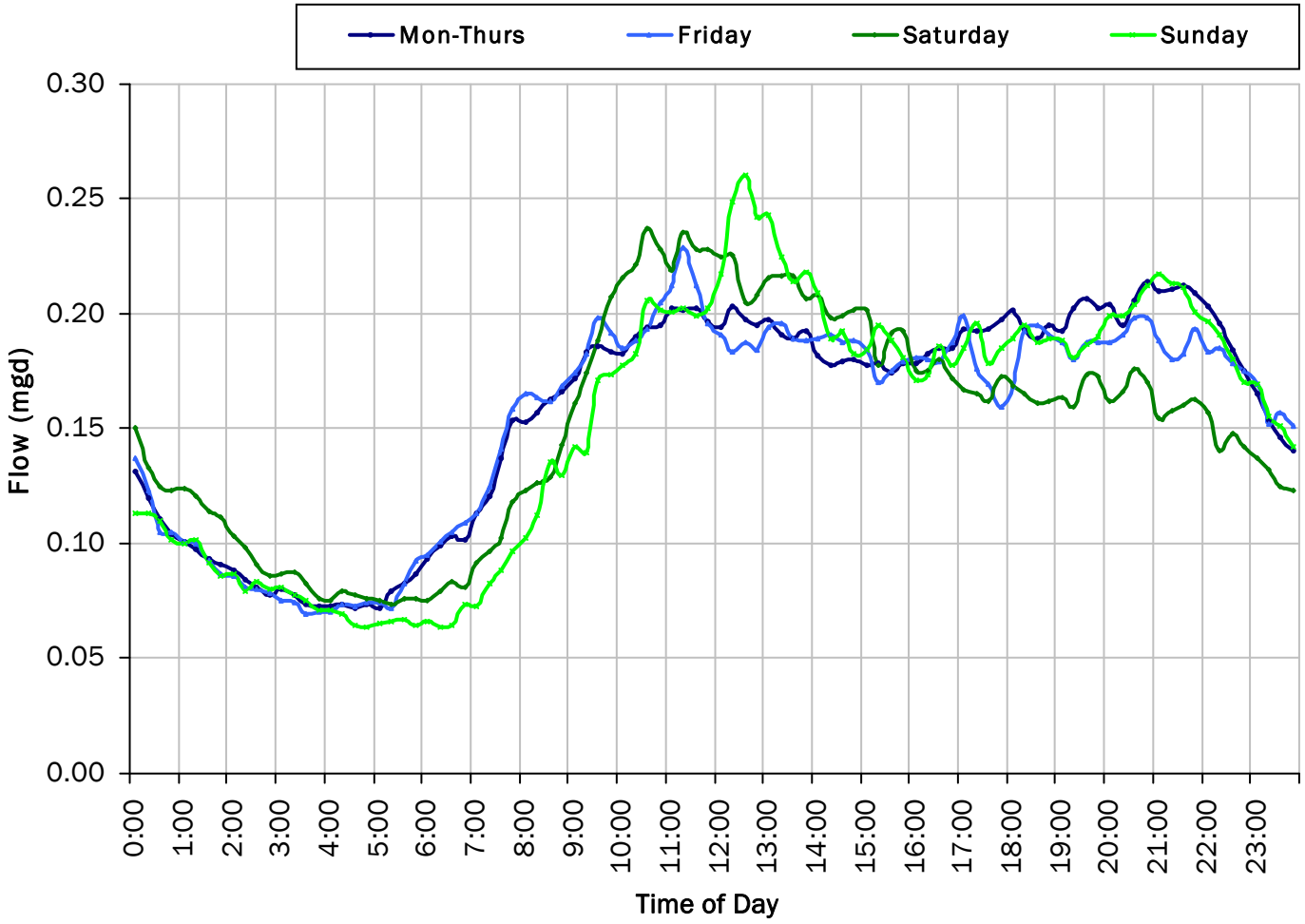
Period Rainfall: 0.21 inches Period Avg Flow: 0.160 mgd Period Peak Flow: 0.467 mgd Period Min Flow: 0.044 mgd





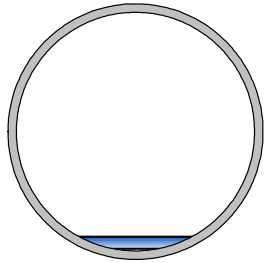
SITE 7

Average Dry Weather Flow Hydrographs



ADWF:

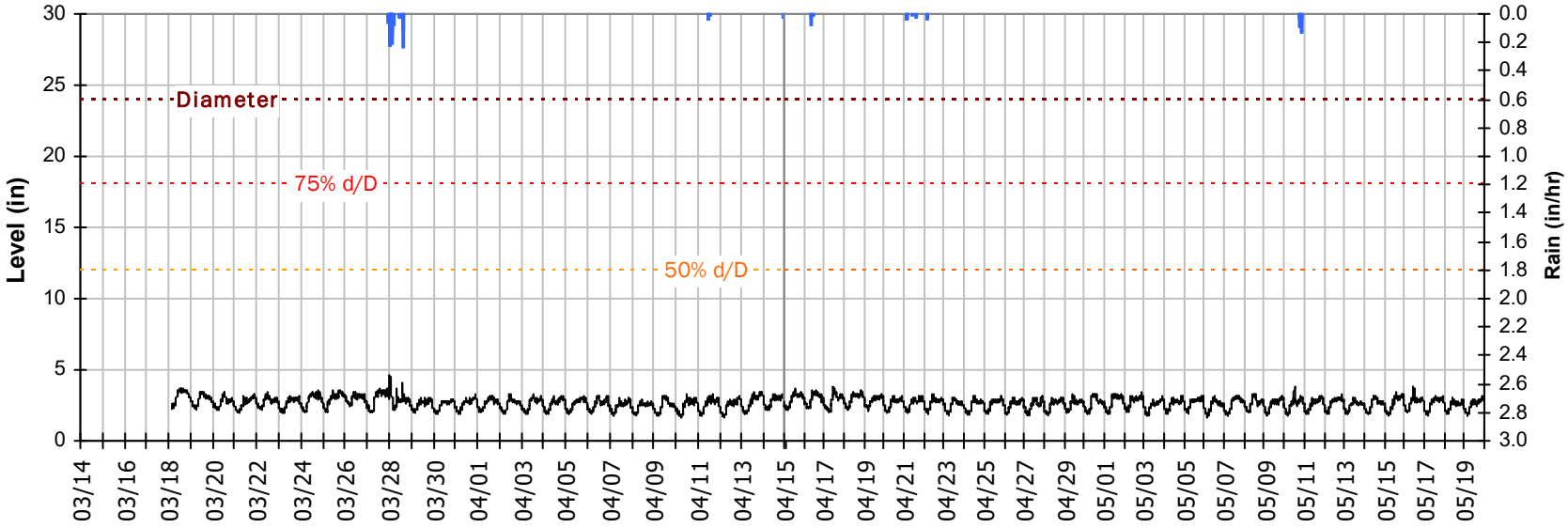
0.155 *mgd*

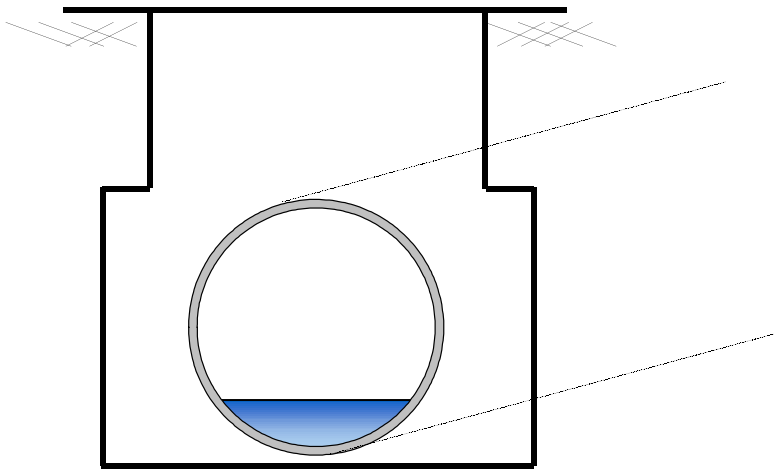


SITE 7

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

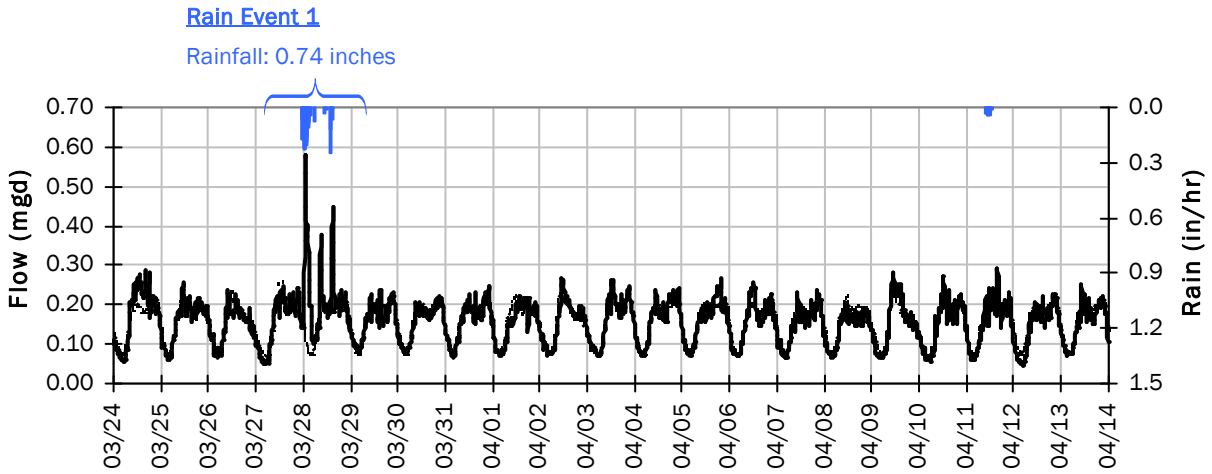




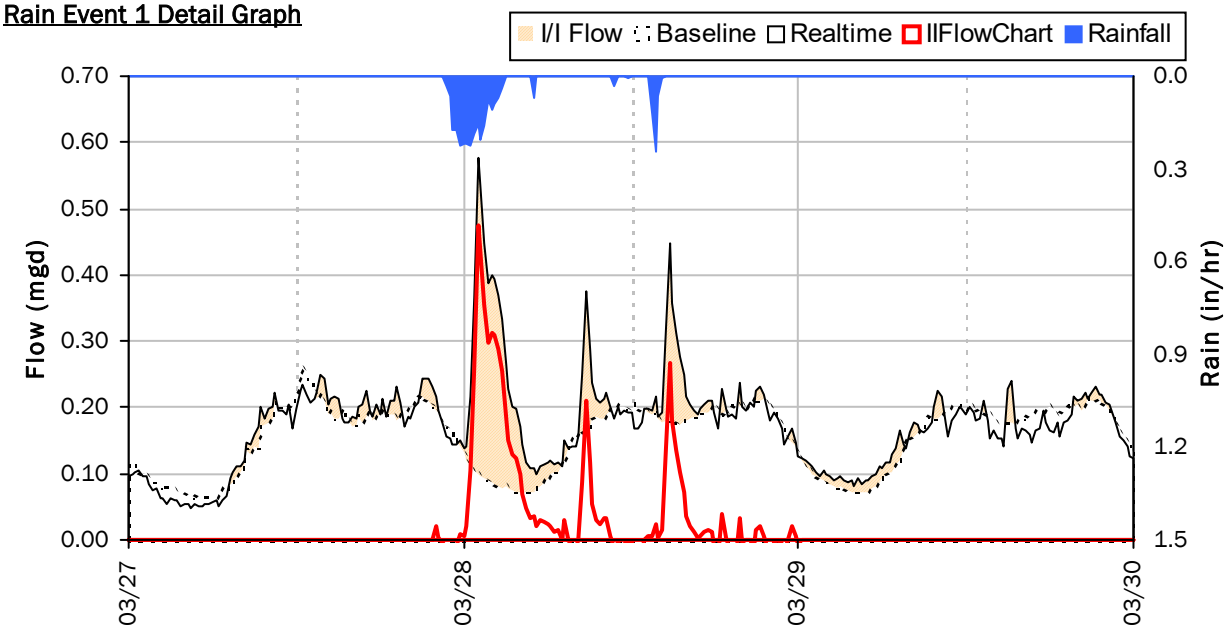
Pipe Diameter:	24	*inches*
Peak Measured Level:	4.64	*inches*
Peak d/D Ratio:	0.19	

SITE 7
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



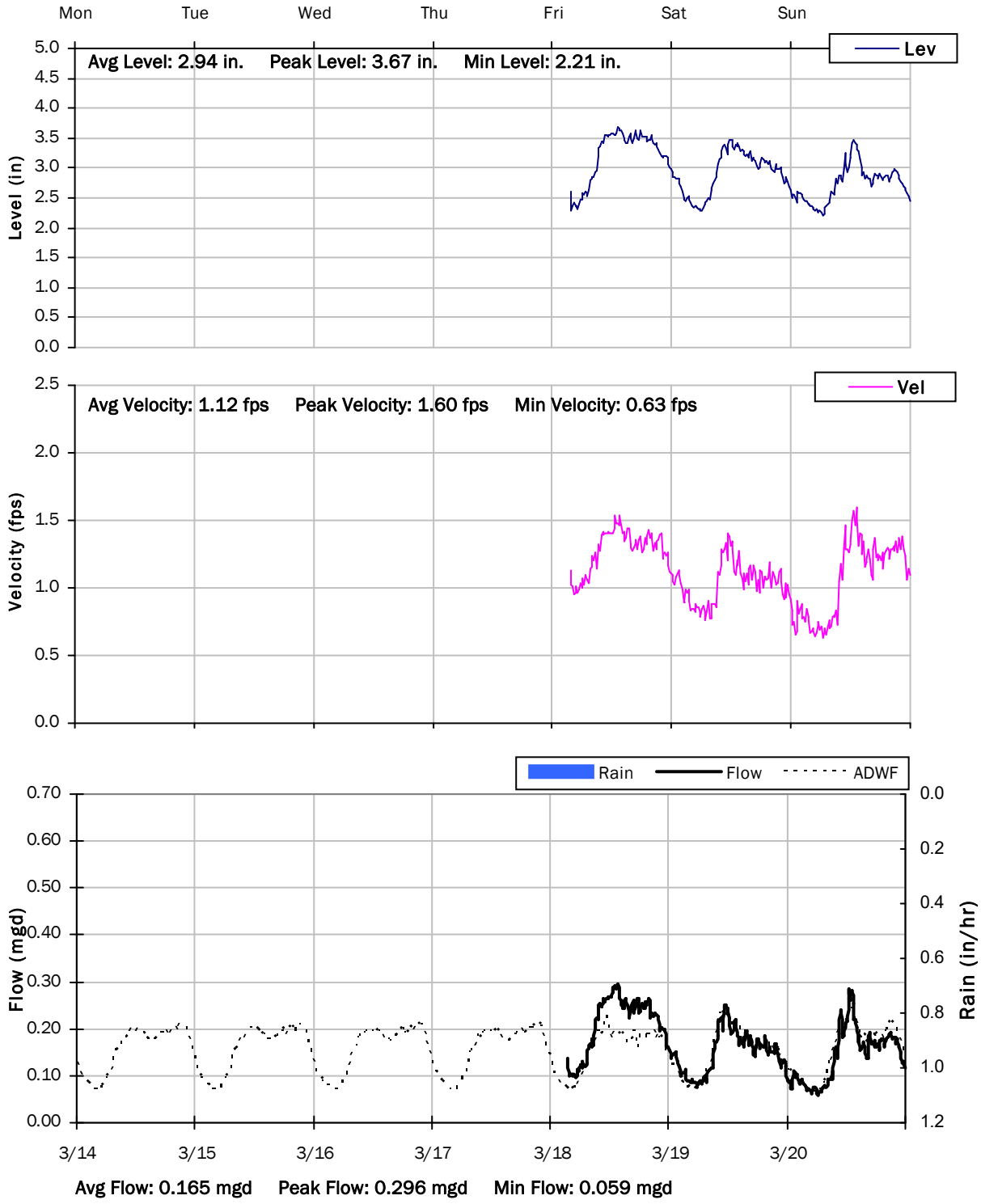
Storm Event I/I Analysis (Rain = 0.74 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.576 *mgd*	**Peak I/I Rate:**	0.476 *mgd*
PF:	3.72	**Total I/I:**	59,000 *gallons*
Peak Level:	4.64 *in*		
d/D Ratio:	0.19		

SITE 7

Weekly Level, Velocity and Flow Hydrographs

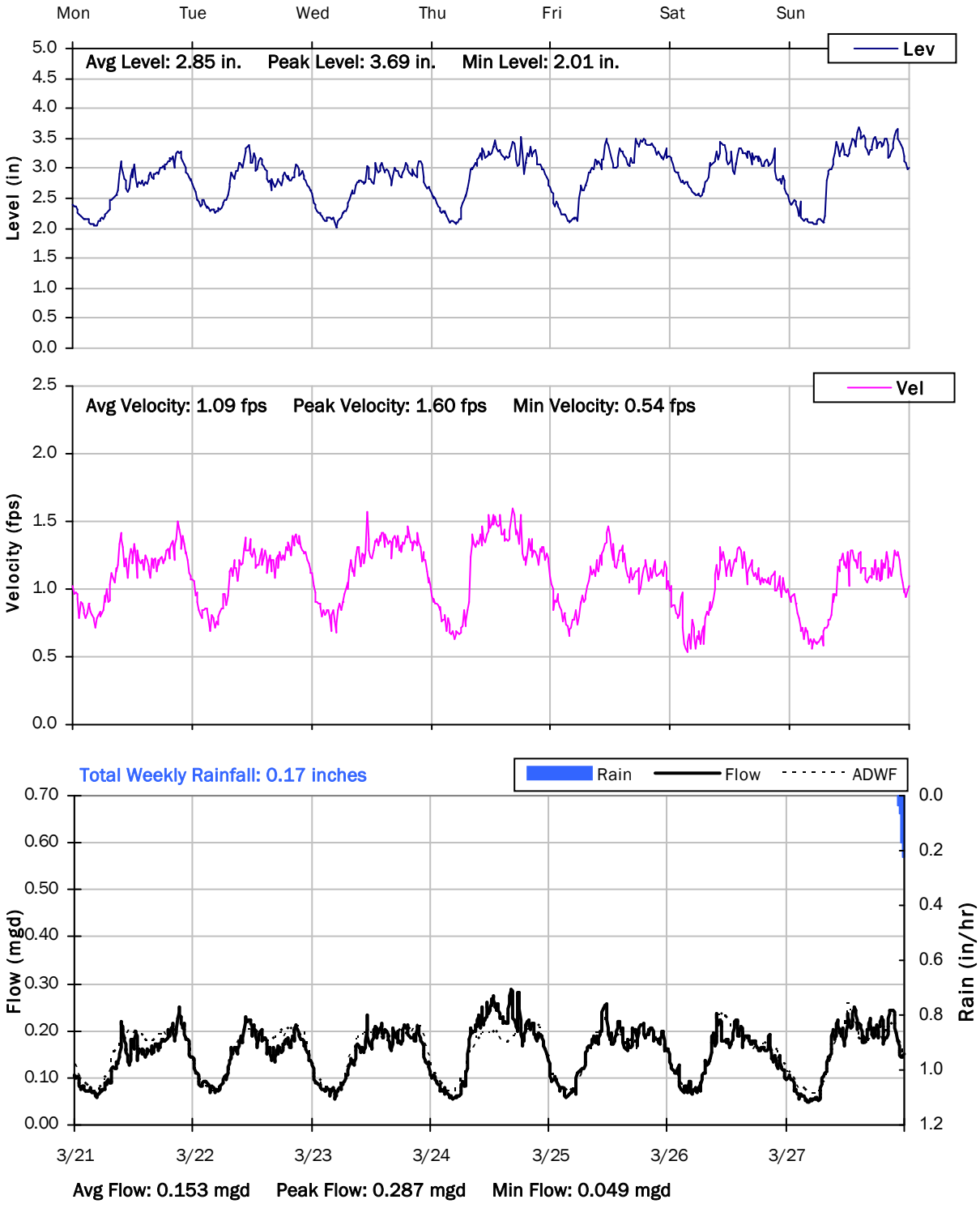
3/14/2022 to 3/21/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

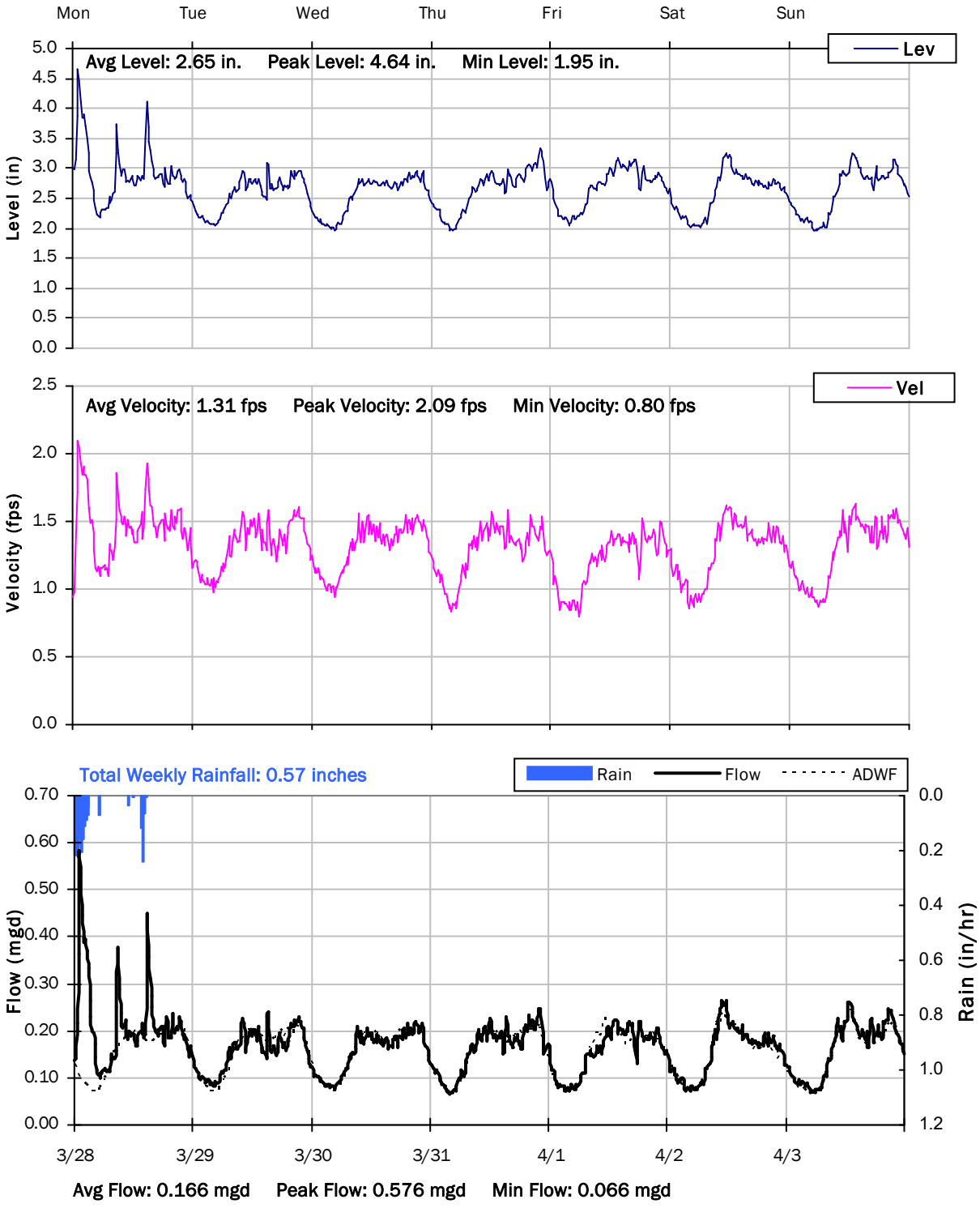
3/21/2022 to 3/28/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

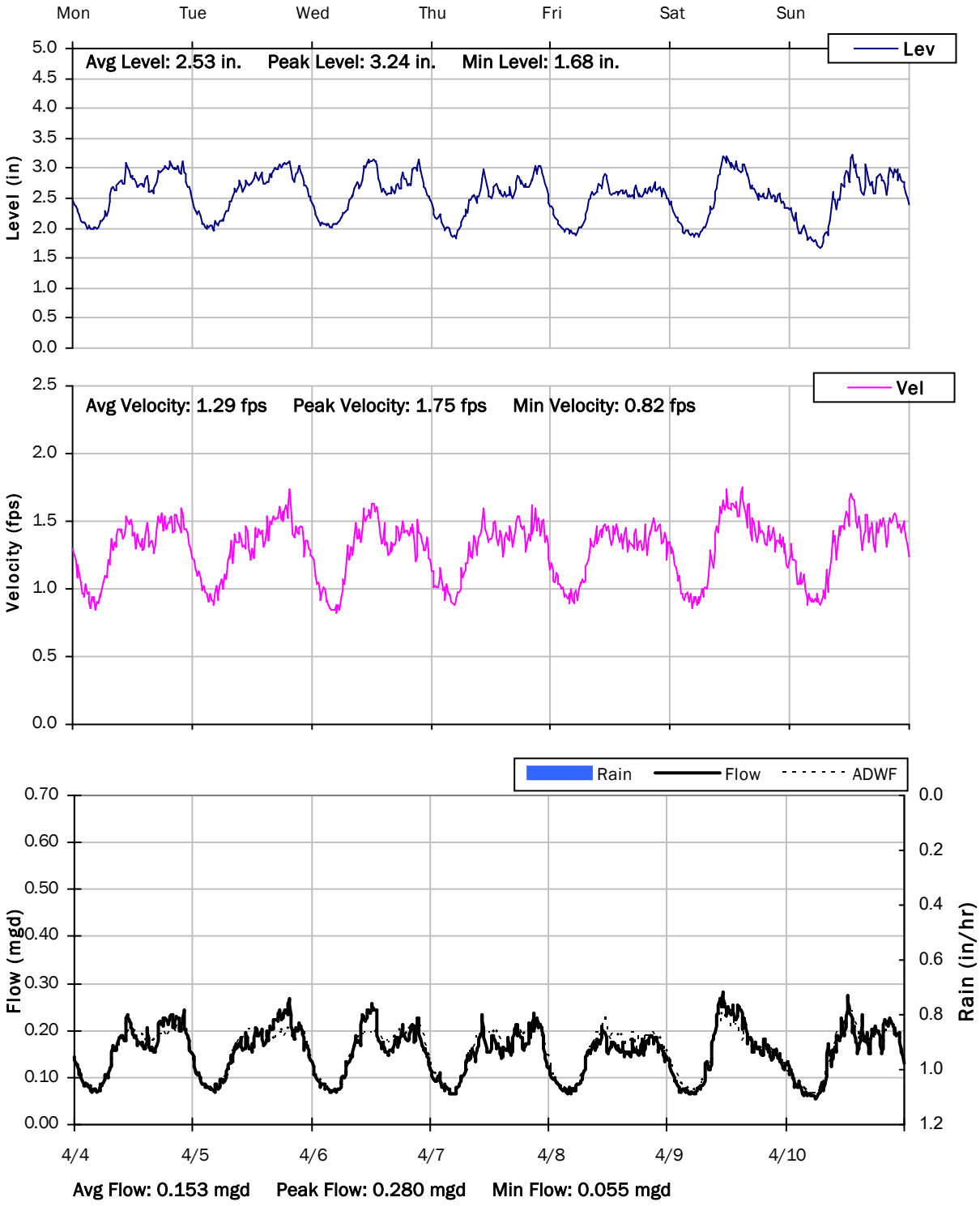
3/28/2022 to 4/4/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

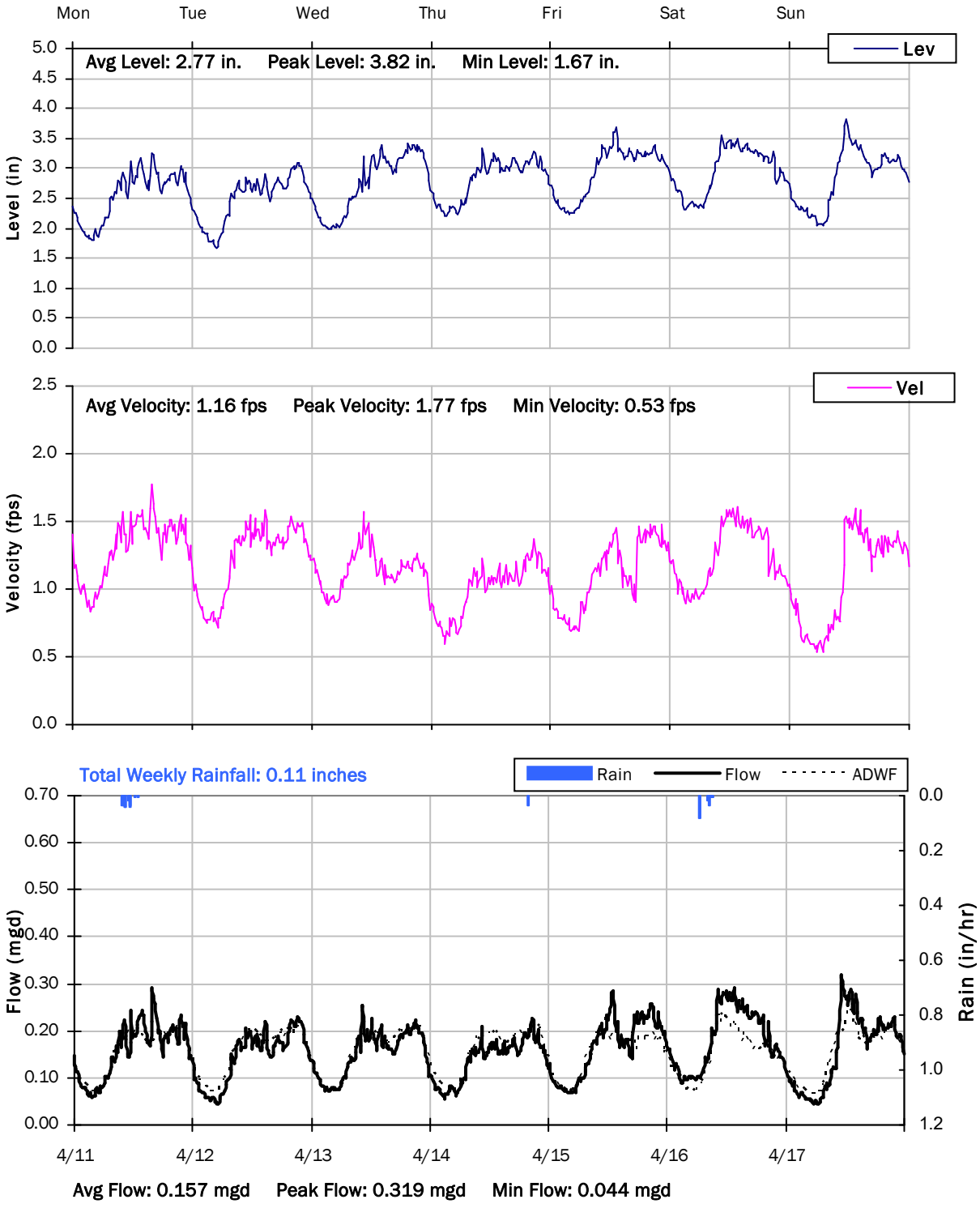
4/4/2022 to 4/11/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

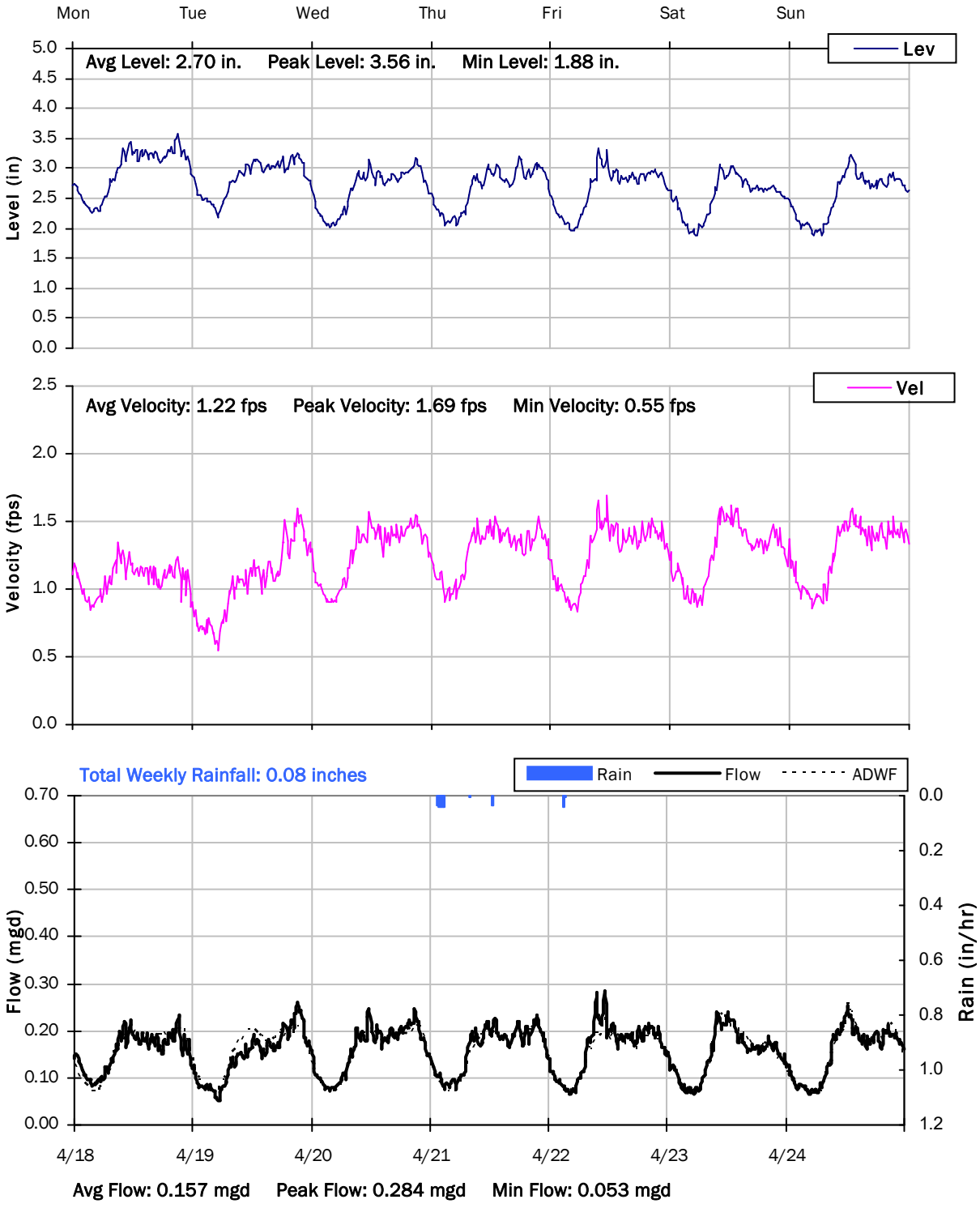
4/11/2022 to 4/18/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

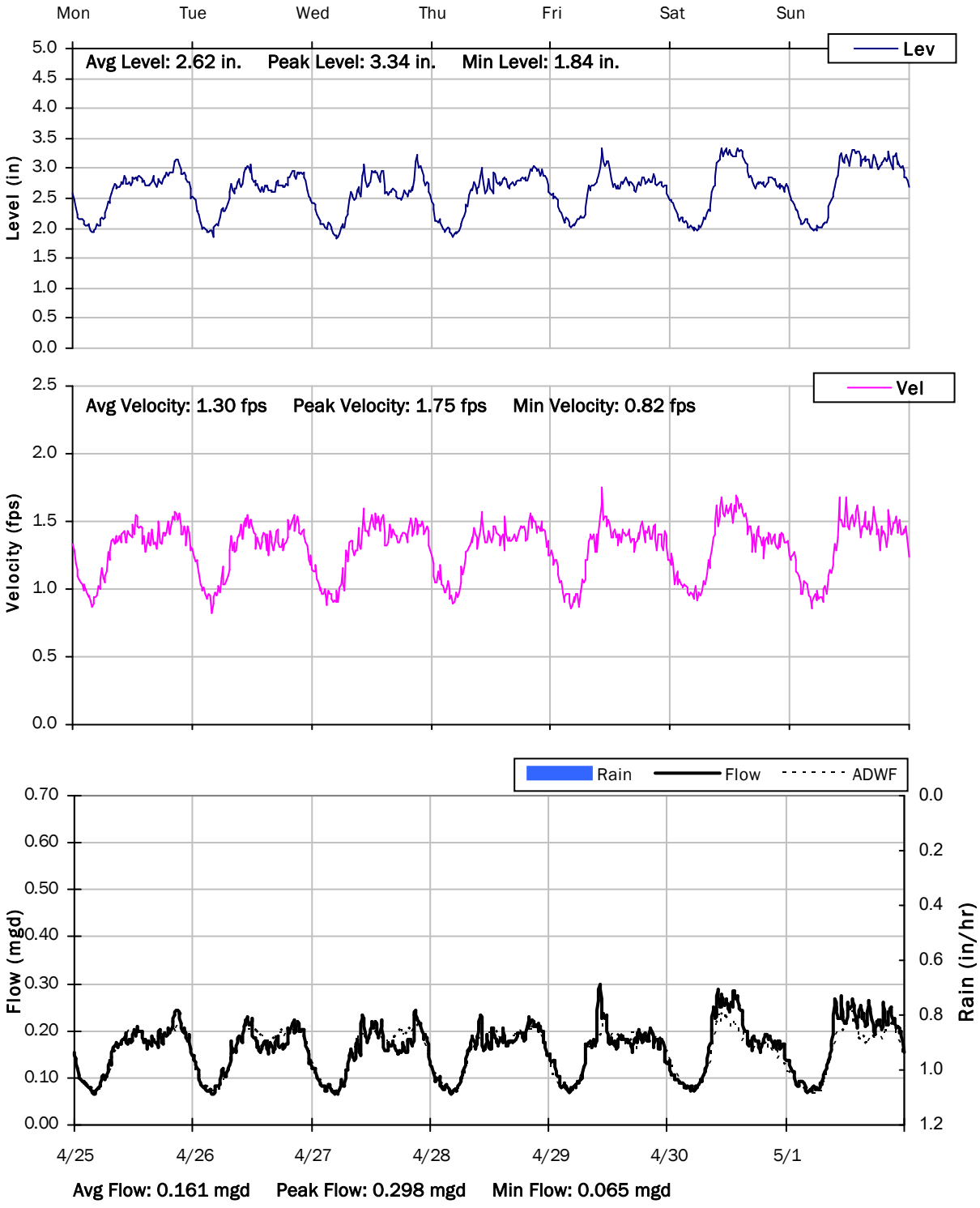
4/18/2022 to 4/25/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

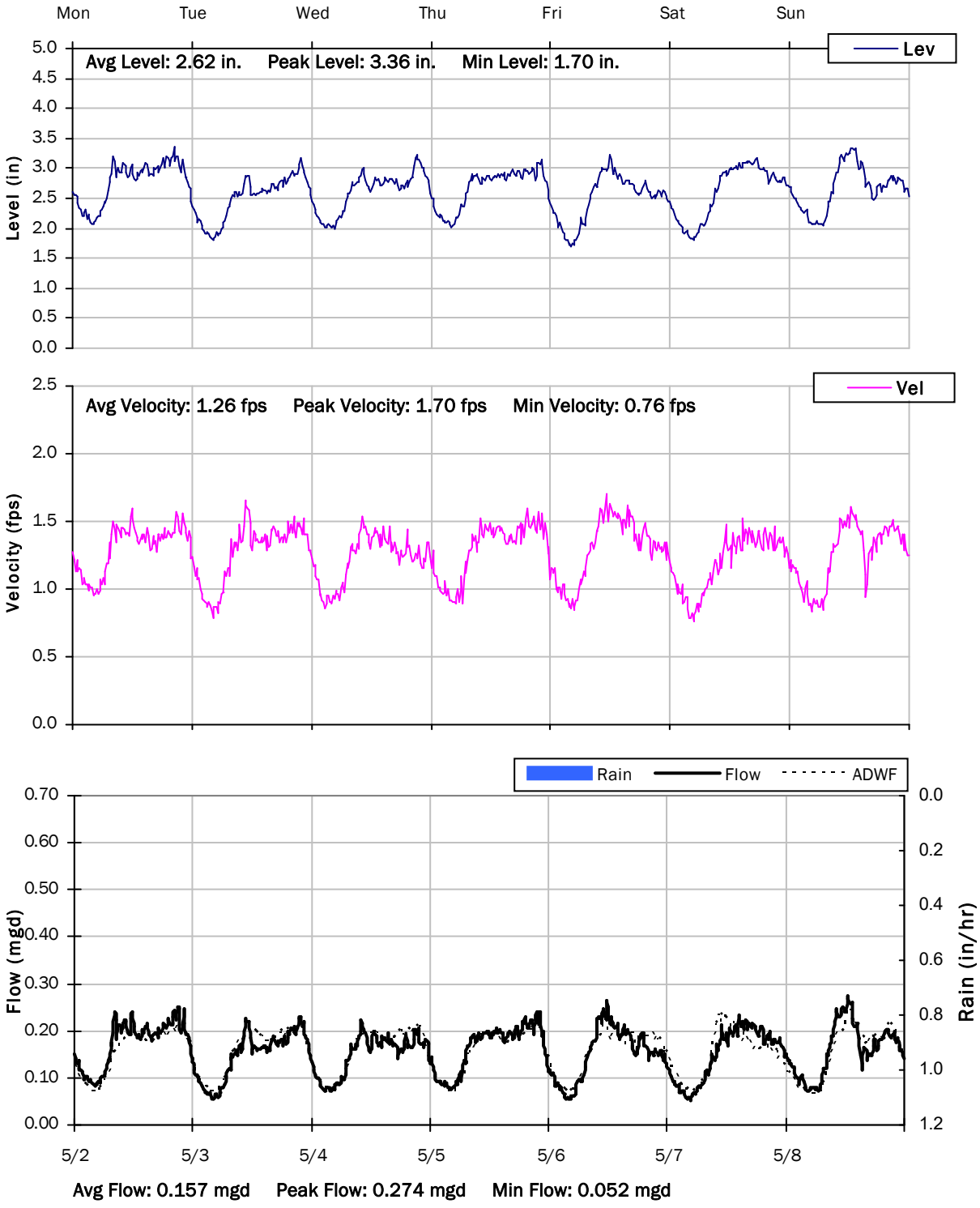
4/25/2022 to 5/2/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

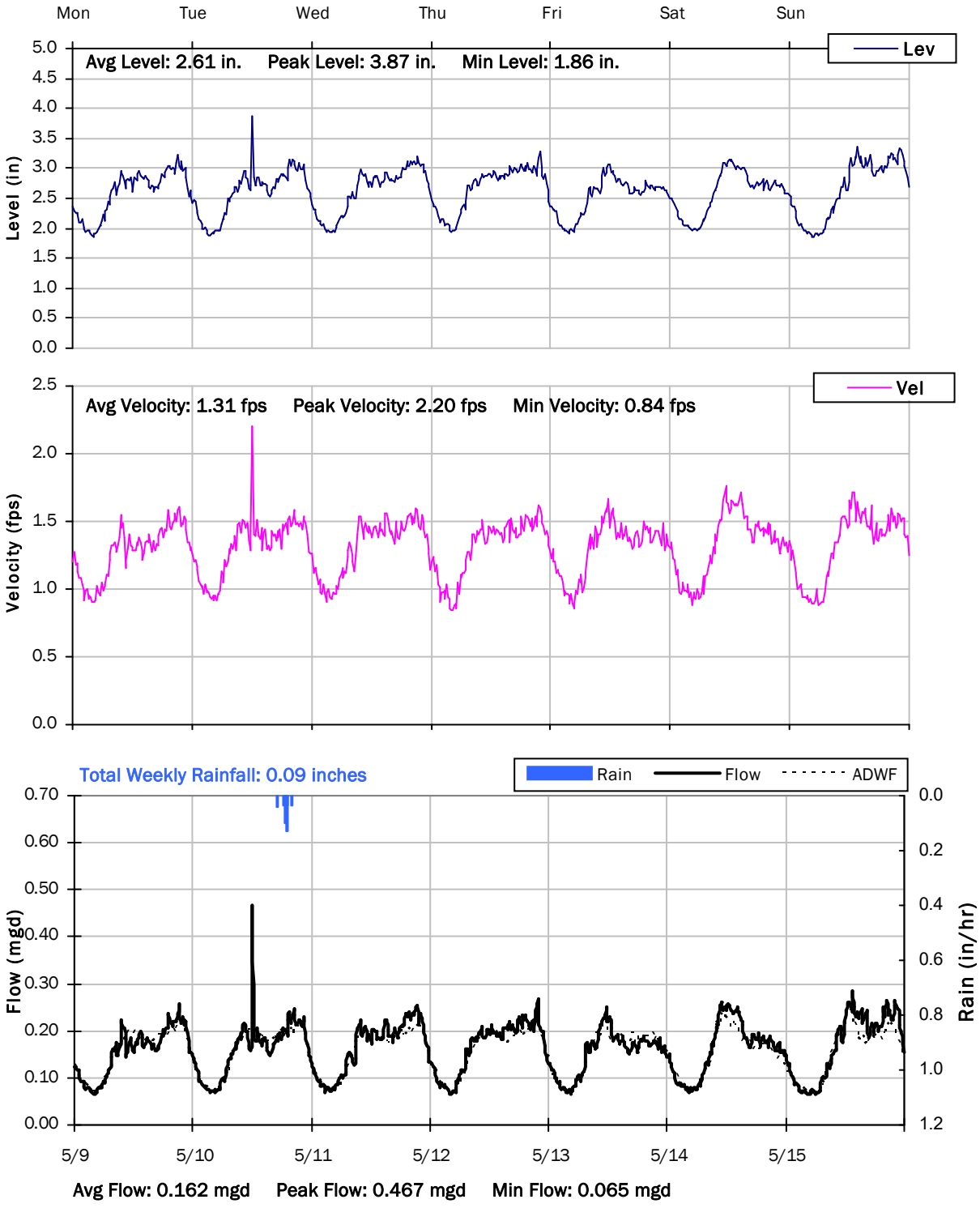
5/2/2022 to 5/9/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

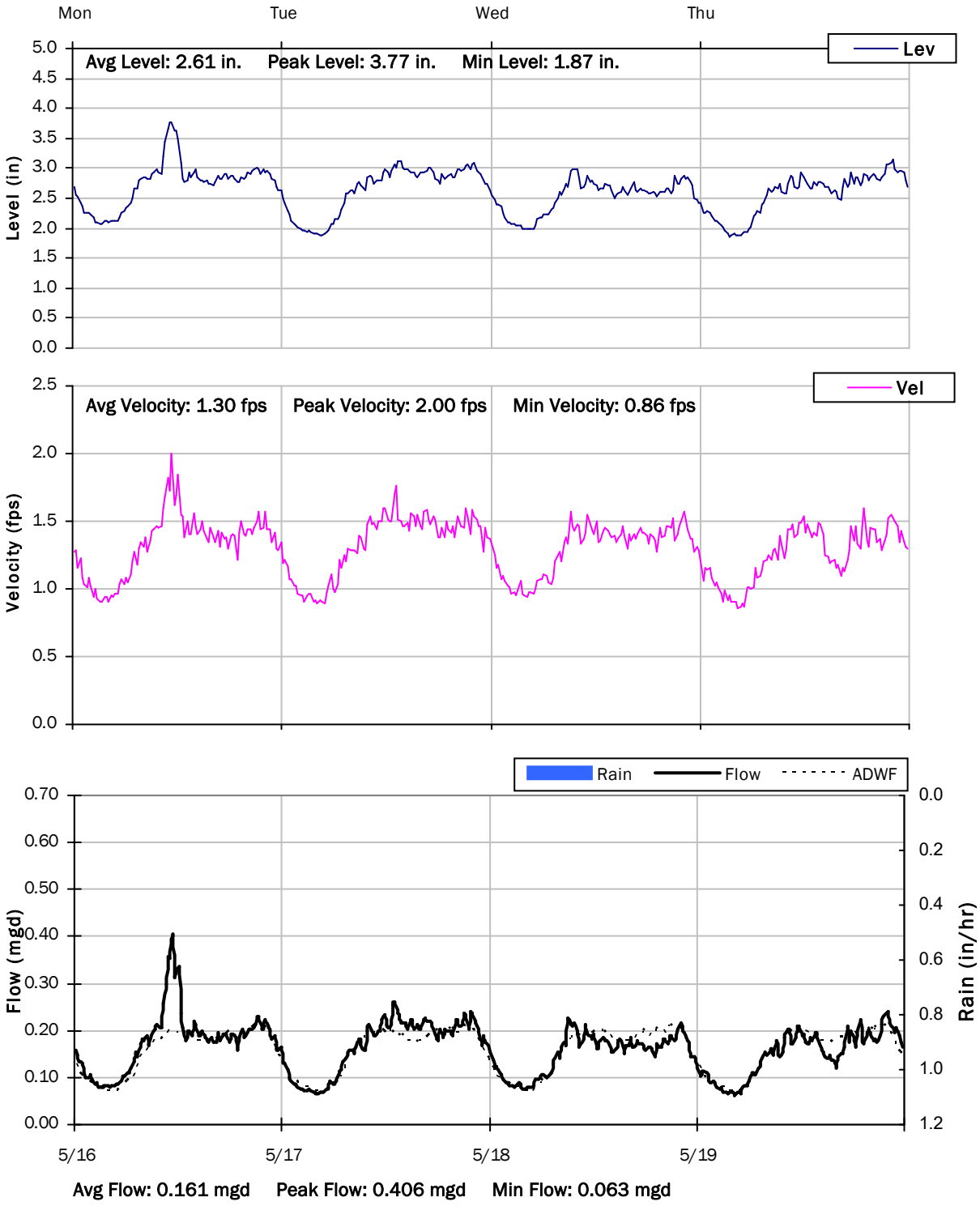
5/9/2022 to 5/16/2022



SITE 7

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 8

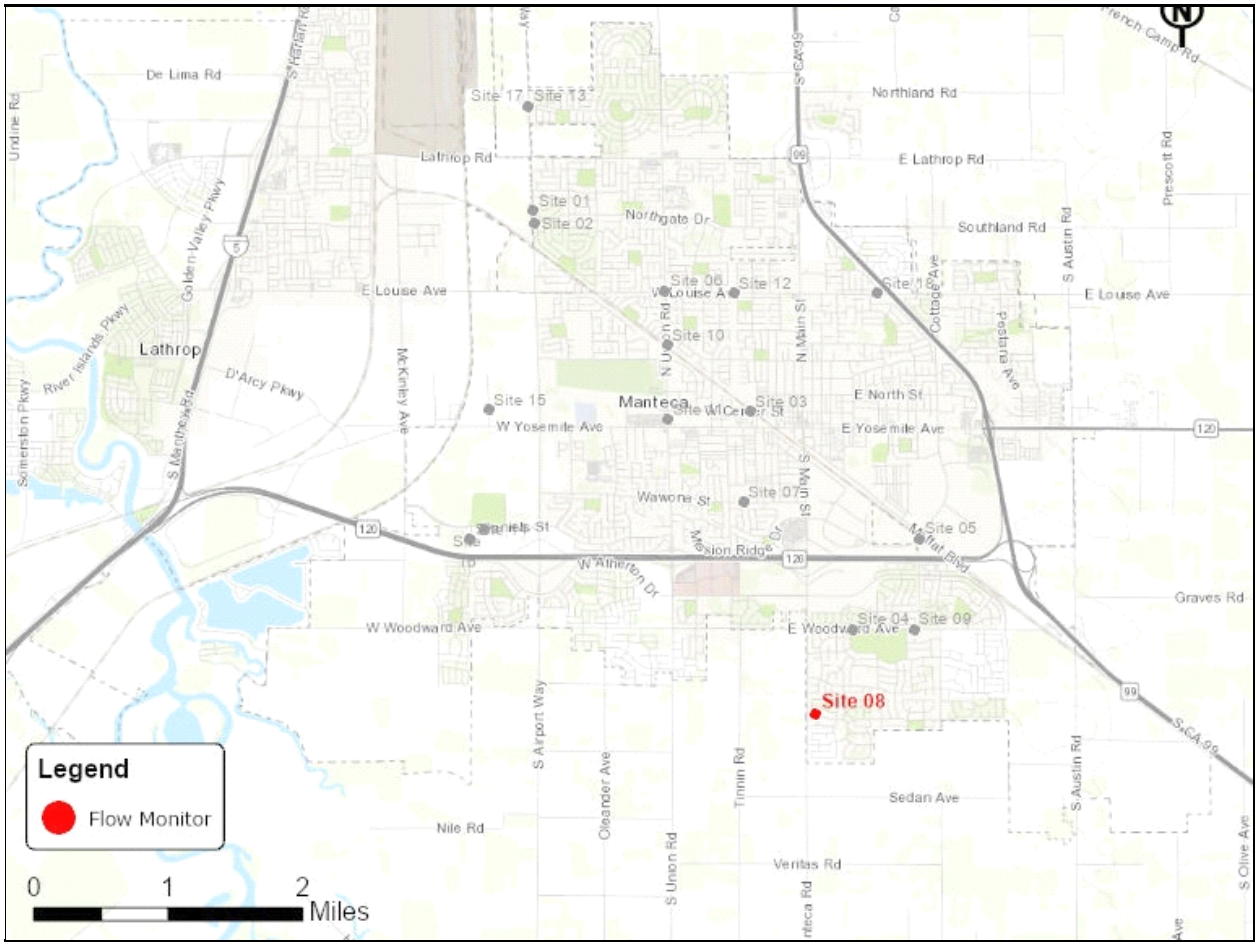
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Lion Drive at Columbus Drive

Data Summary Report



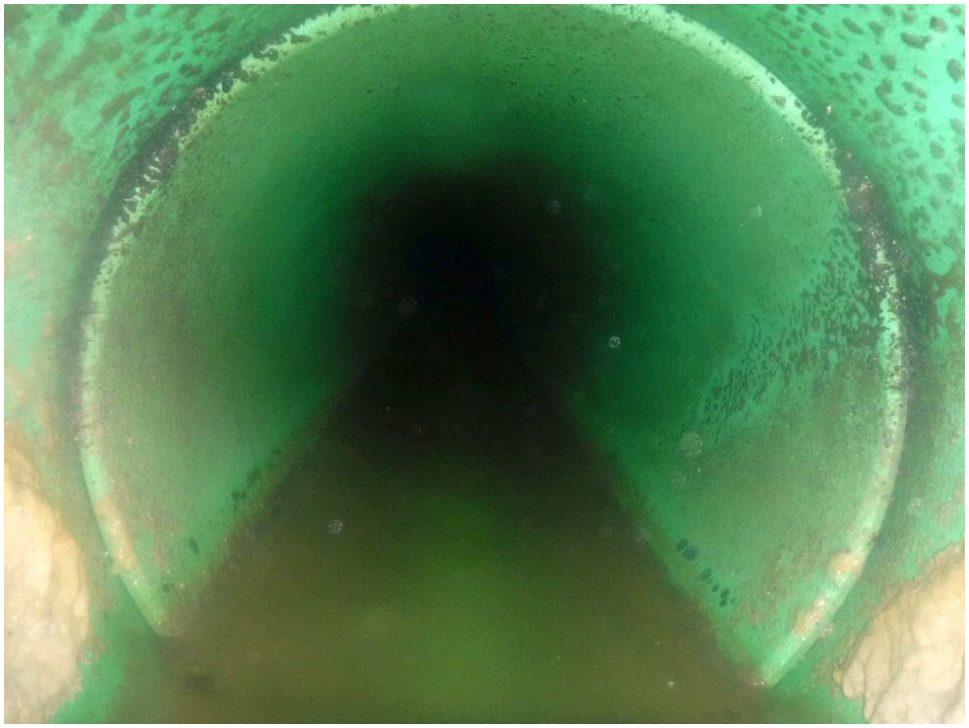
Vicinity Map: Site 8

SITE 8

Additional Site Photos

Effluent Pipe

Monitored East Influent Pipe



SITE 8

Additional Site Photos

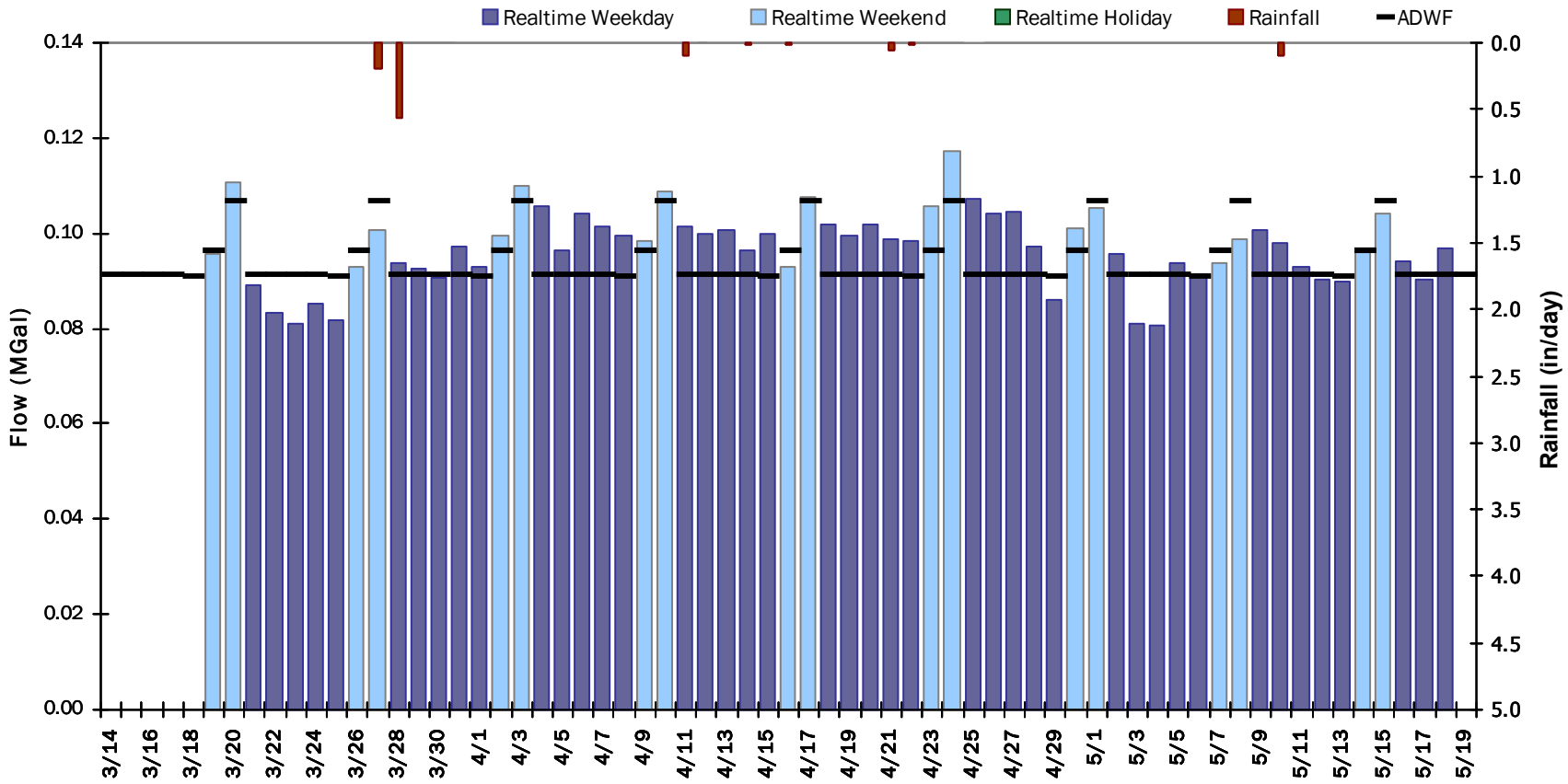
Infiltration

SITE 8

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.097 MGal Peak Daily Flow: 0.117 MGal Min Daily Flow: 0.081 MGal

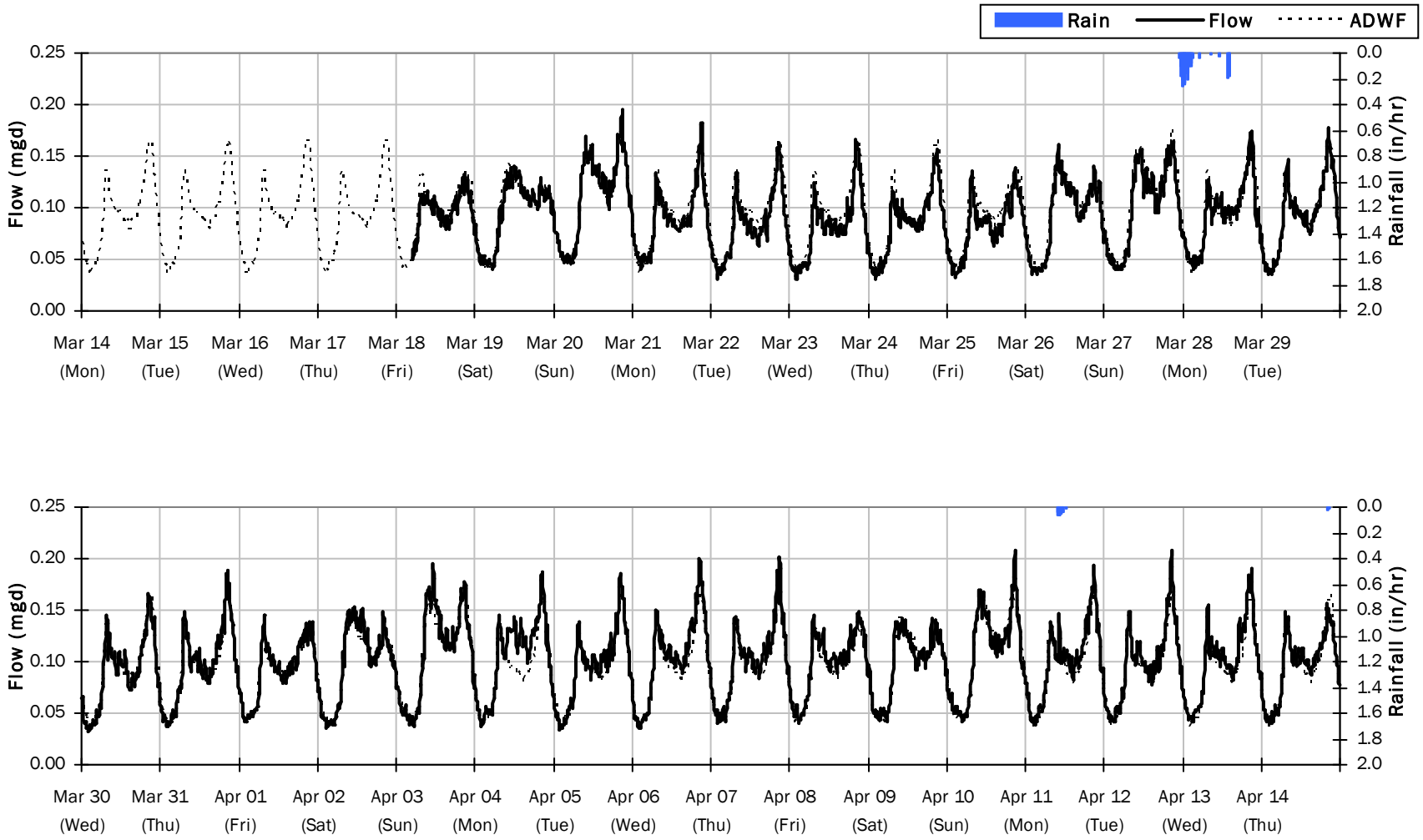
Total Rainfall: 1.06 inches



SITE 8

Flow Summary: 3/14/2022 to 4/14/2022

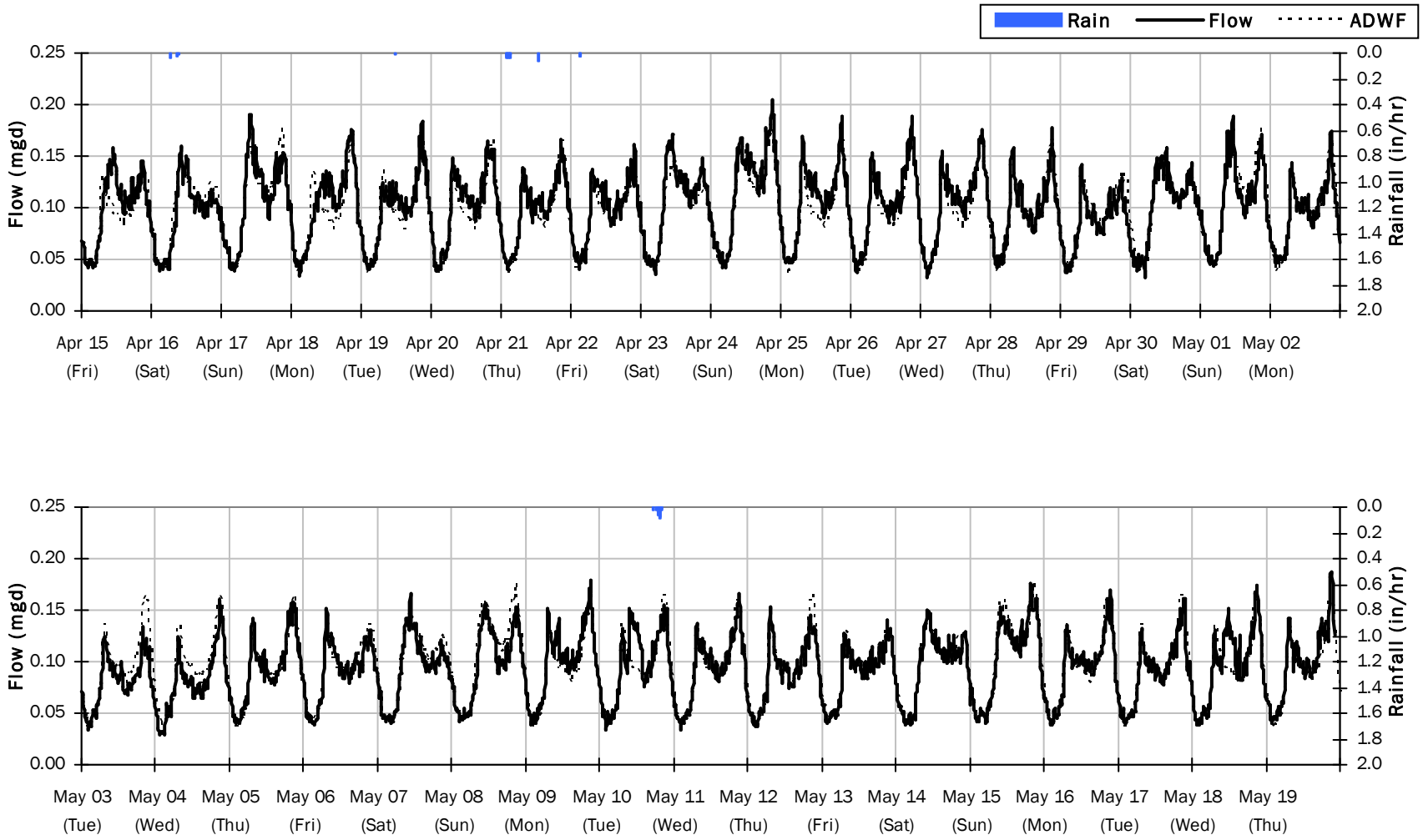
Period Rainfall: 0.87 inches Period Avg Flow: 0.097 mgd Period Peak Flow: 0.209 mgd Period Min Flow: 0.030 mgd



SITE 8

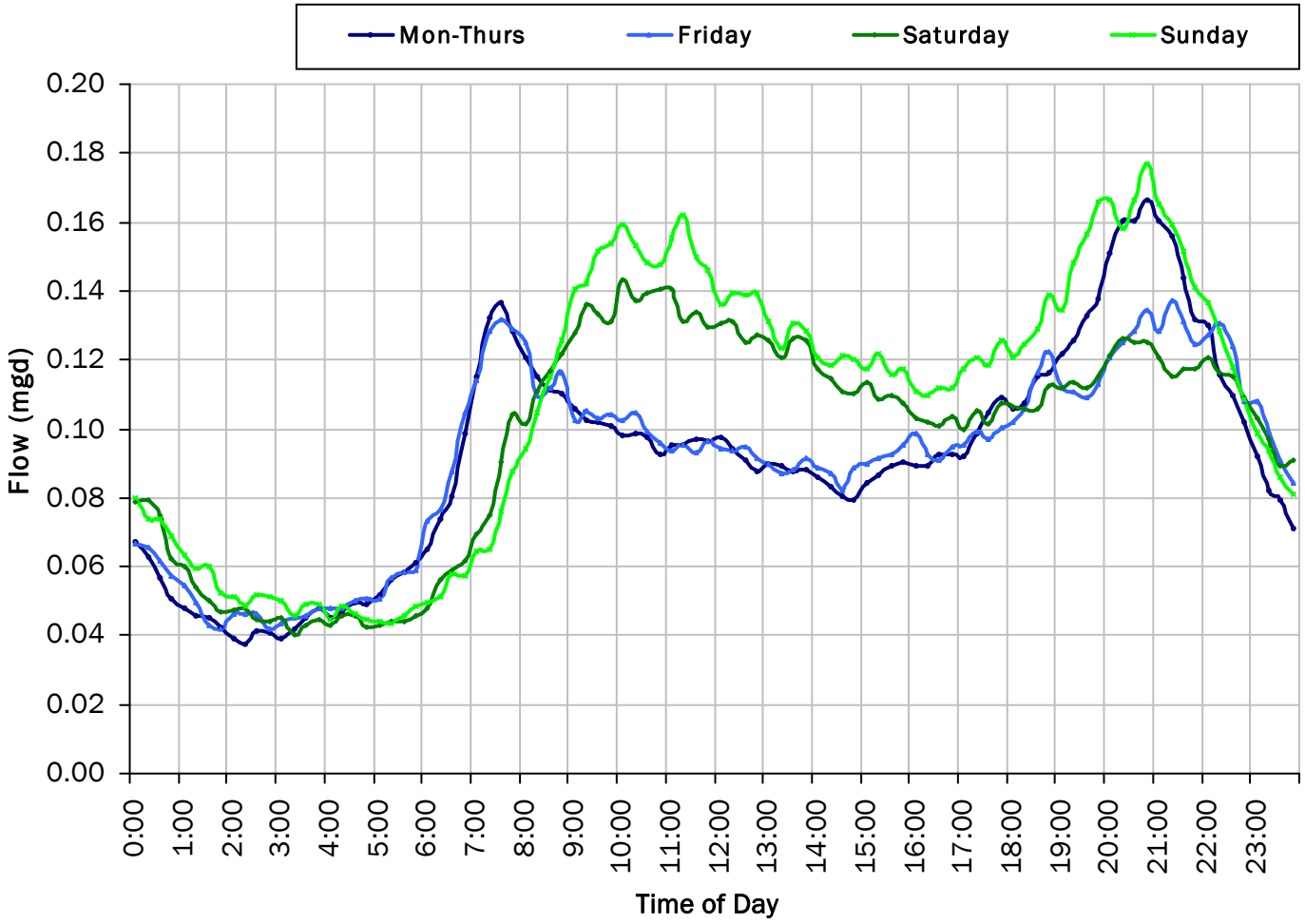
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.19 inches Period Avg Flow: 0.098 mgd Period Peak Flow: 0.204 mgd Period Min Flow: 0.029 mgd



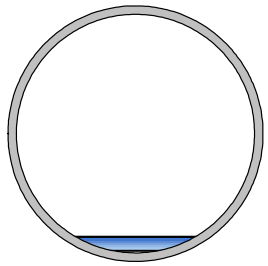
SITE 8

Average Dry Weather Flow Hydrographs



ADWF:

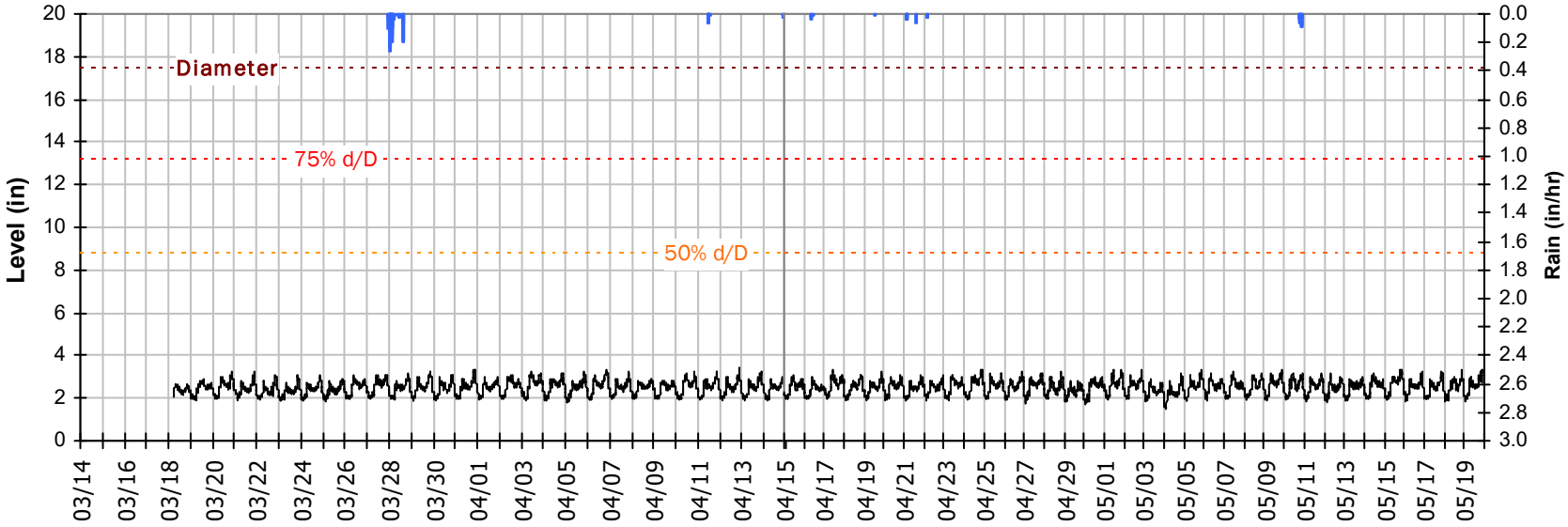
0.094 *mgd*

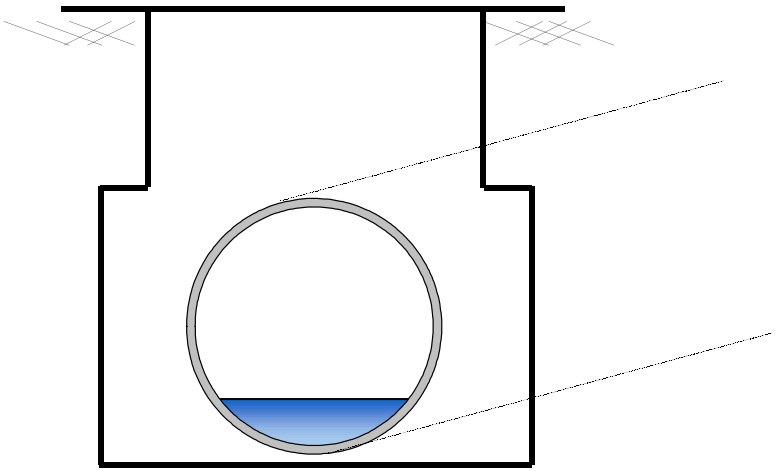


SITE 8

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

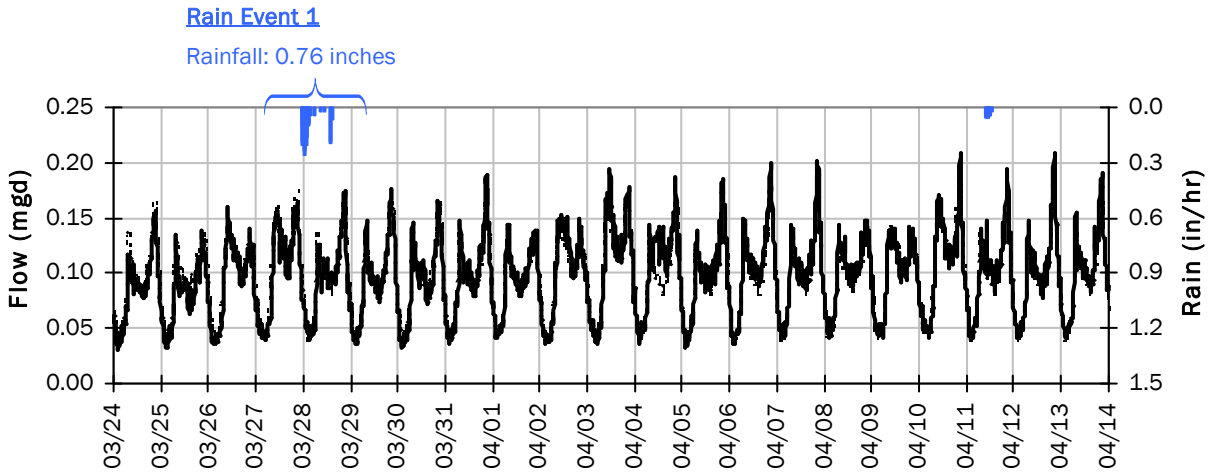




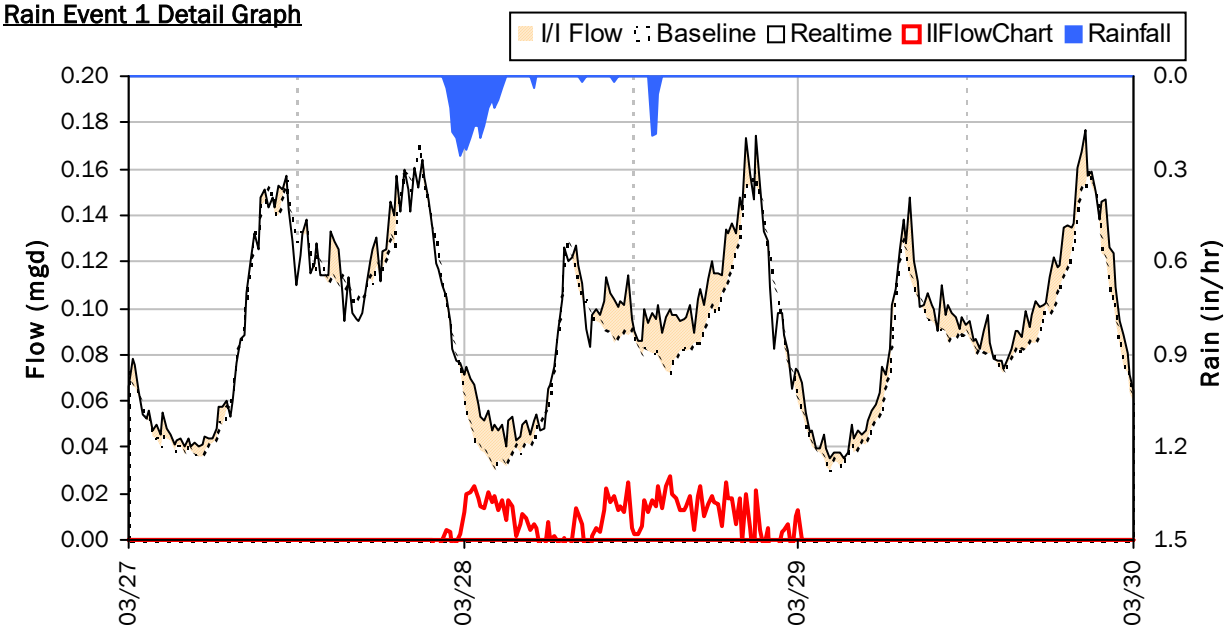
Pipe Diameter:	17.5	*inches*
Peak Measured Level:	3.40	*inches*
Peak d/D Ratio:	0.19	

SITE 8
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



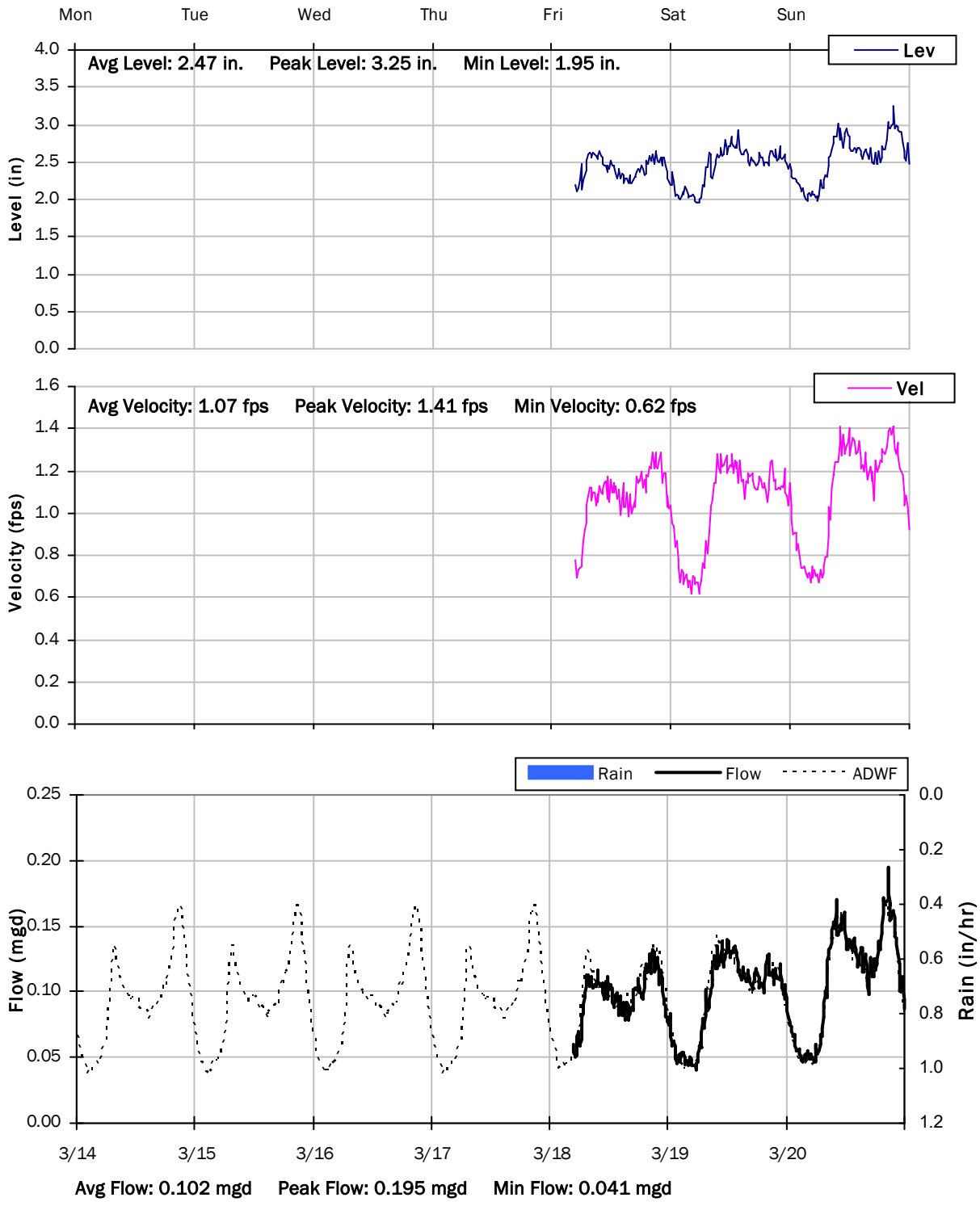
Storm Event I/I Analysis (Rain = 0.76 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.174 *mgd*	**Peak I/I Rate:**	0.028 *mgd*
PF:	1.85	**Total I/I:**	10,000 *gallons*
Peak Level:	3.18 *in*		
d/D Ratio:	0.18		

SITE 8

Weekly Level, Velocity and Flow Hydrographs

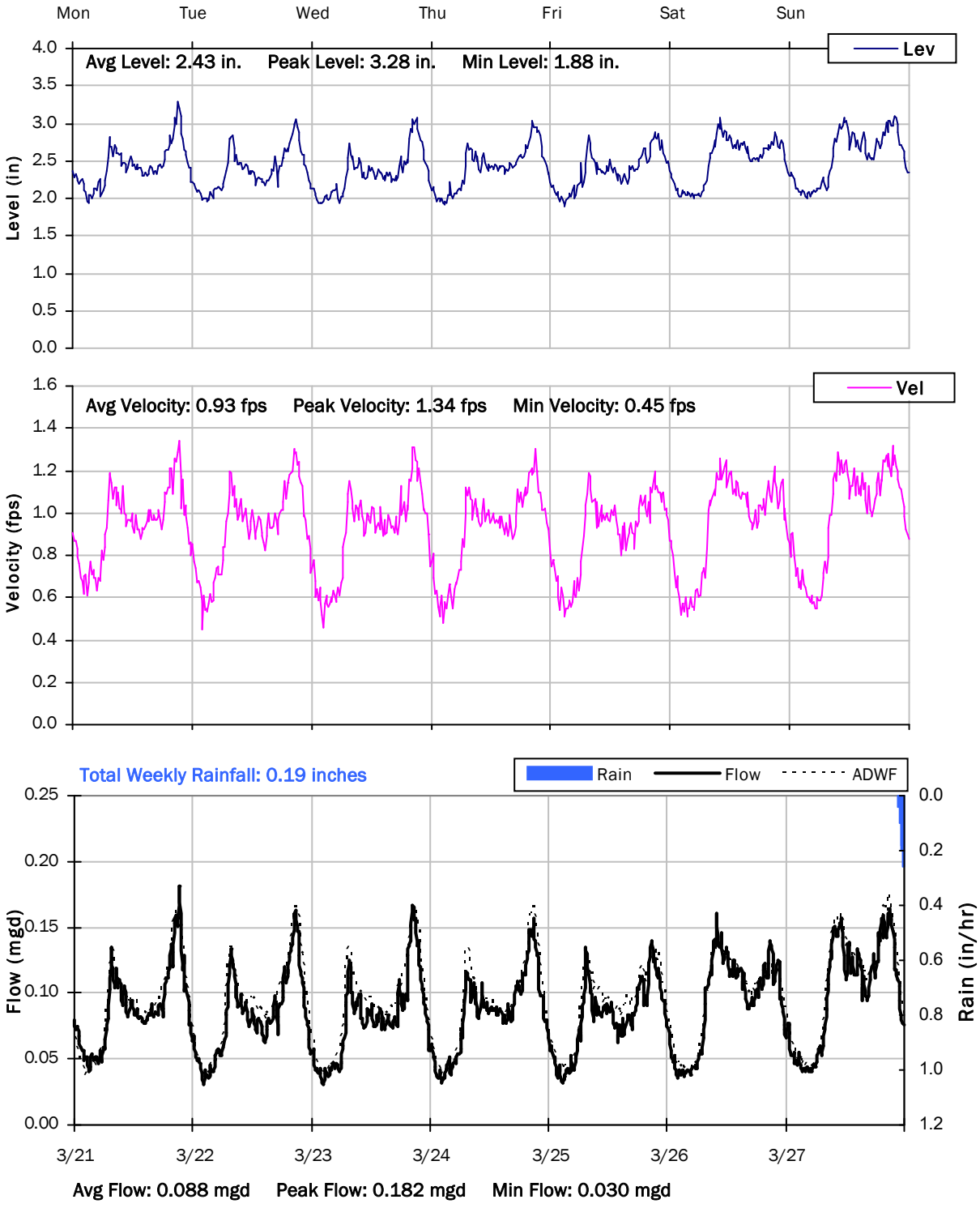
3/14/2022 to 3/21/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

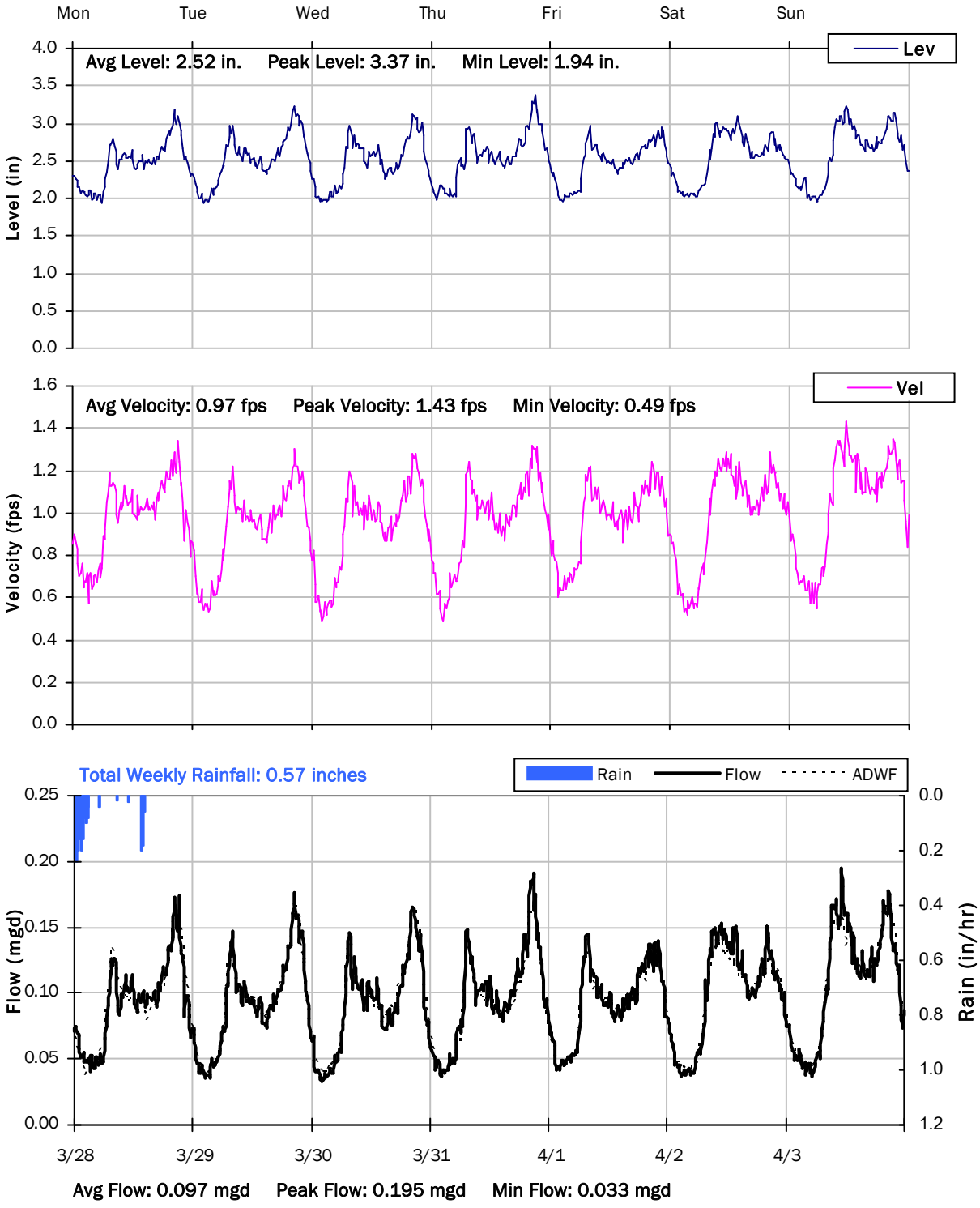
3/21/2022 to 3/28/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

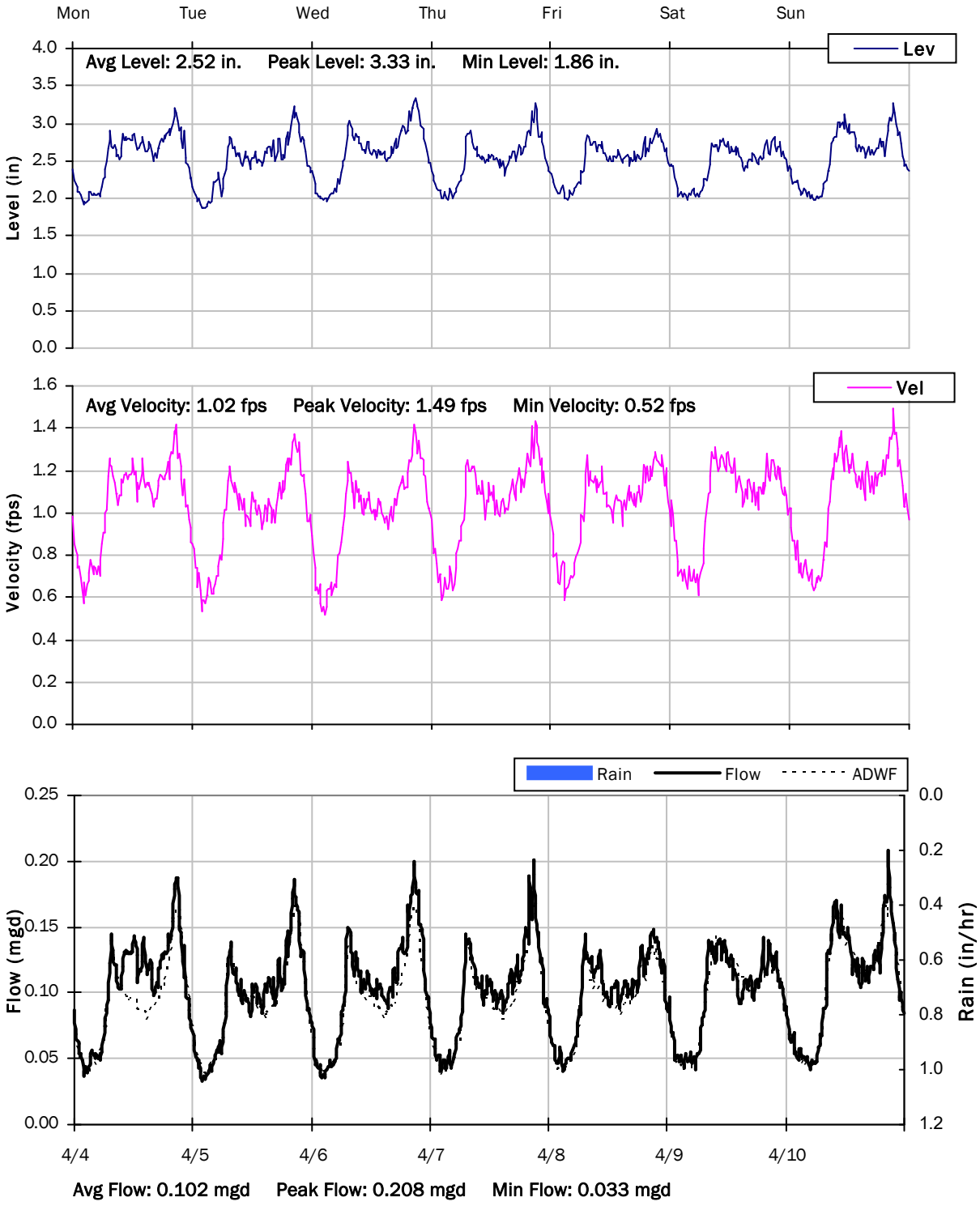
3/28/2022 to 4/4/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

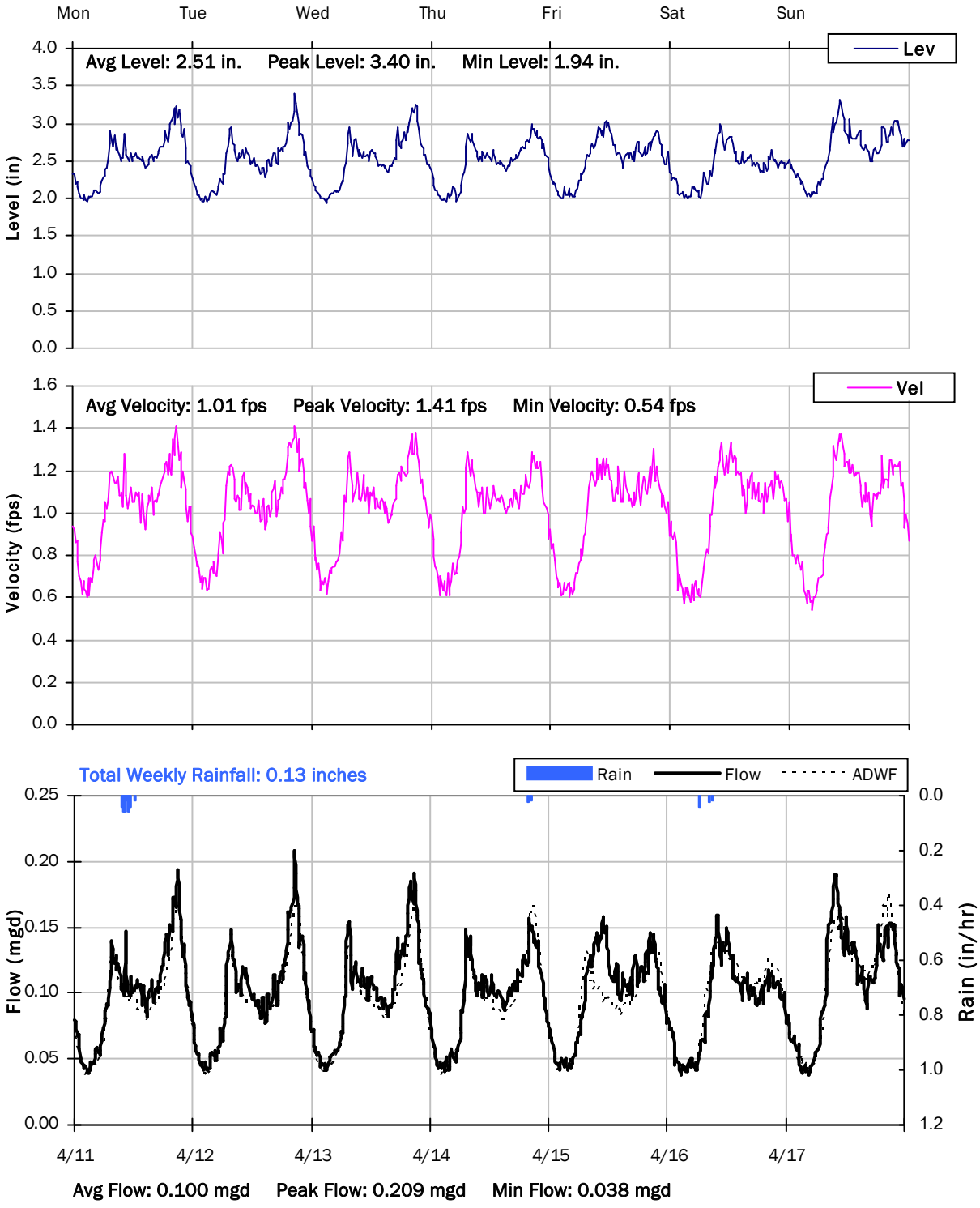
4/4/2022 to 4/11/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

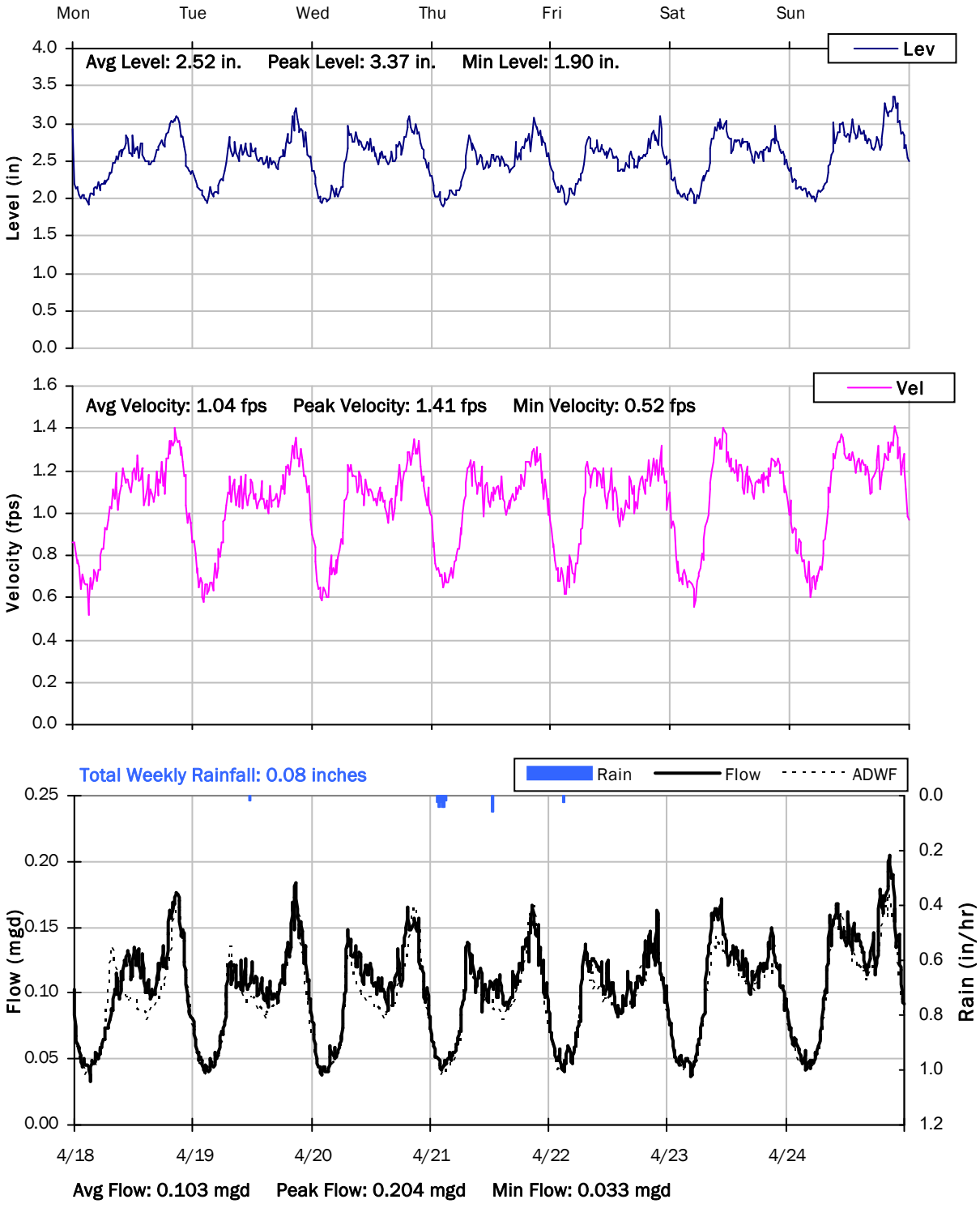
4/11/2022 to 4/18/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

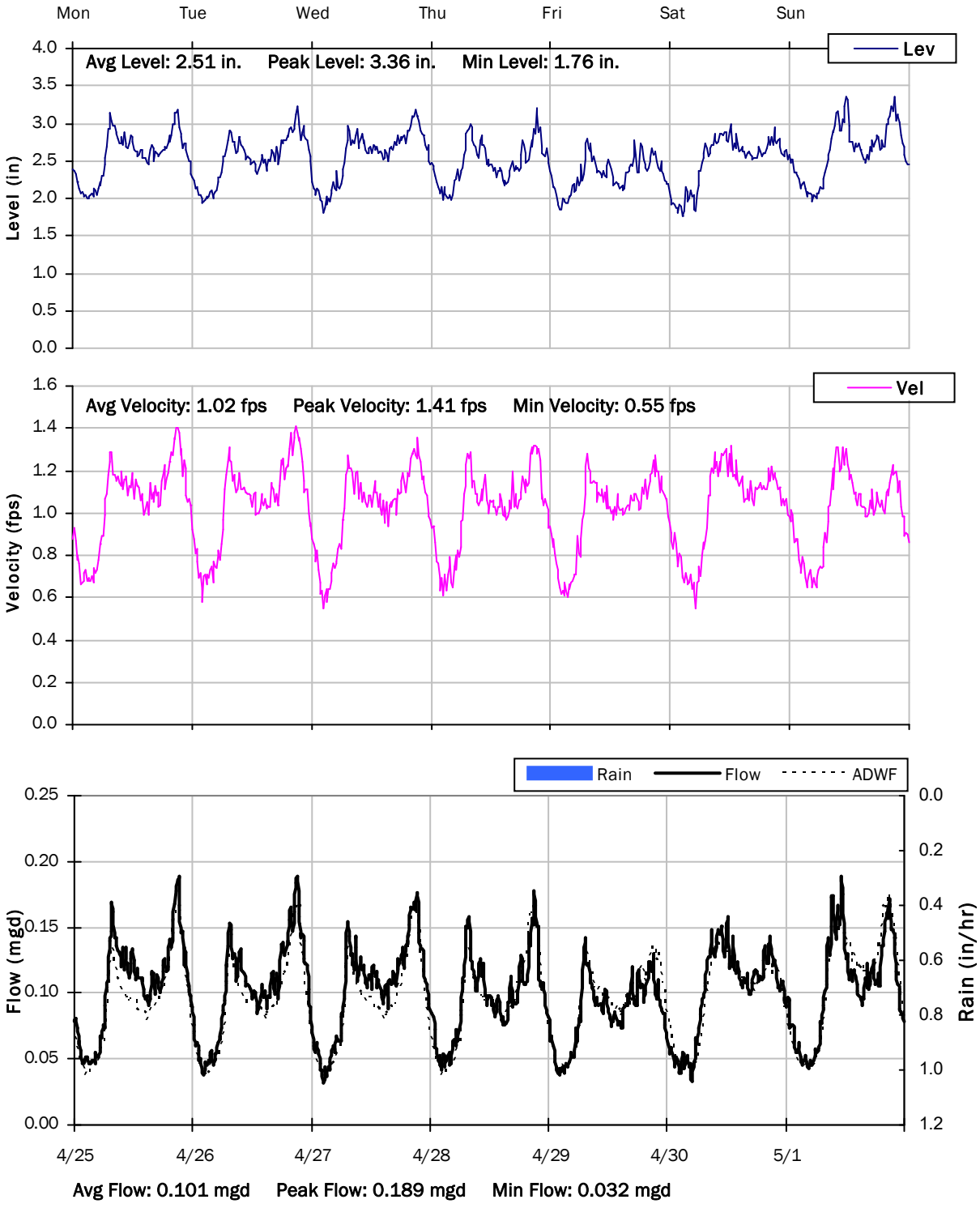
4/18/2022 to 4/25/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

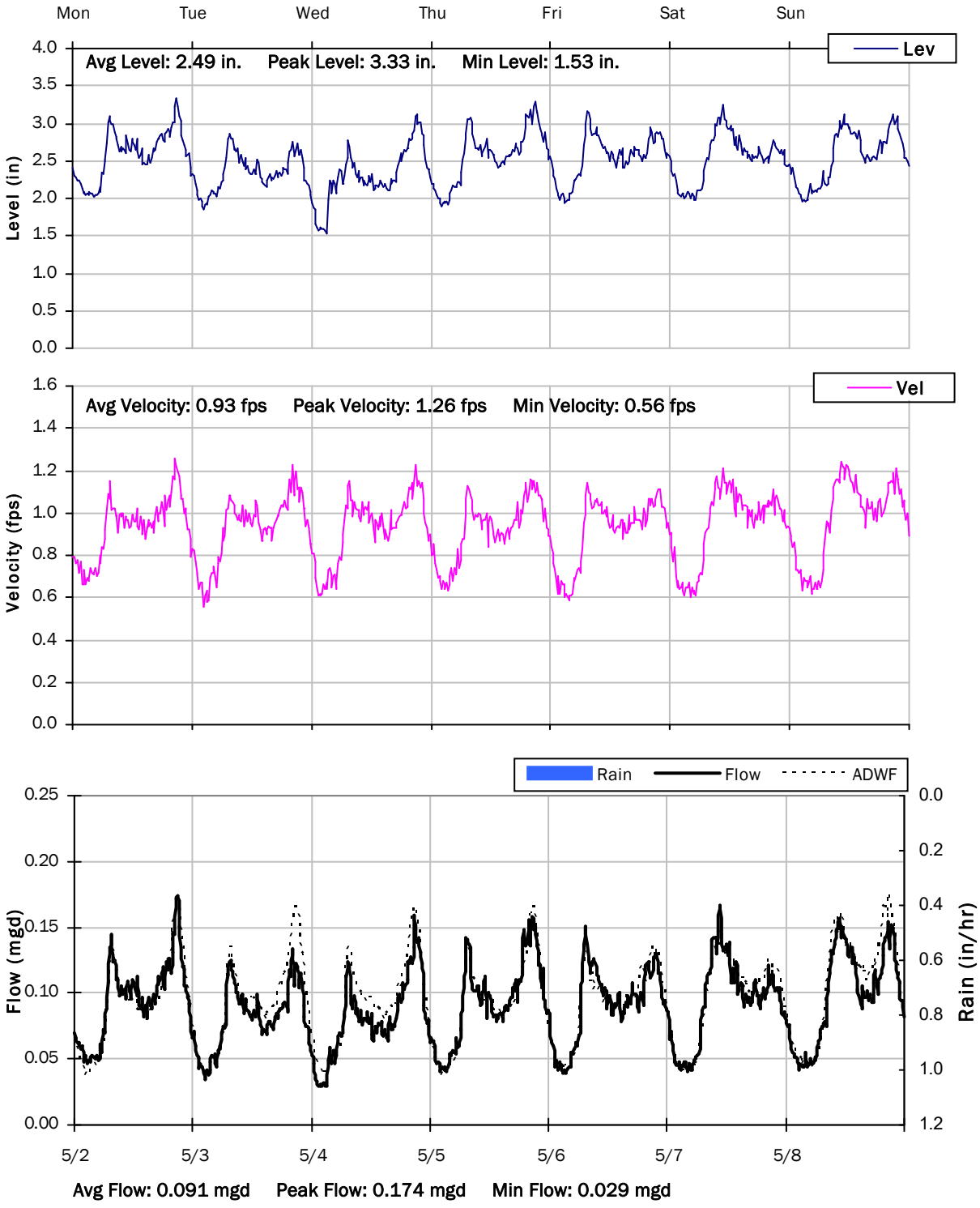
4/25/2022 to 5/2/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

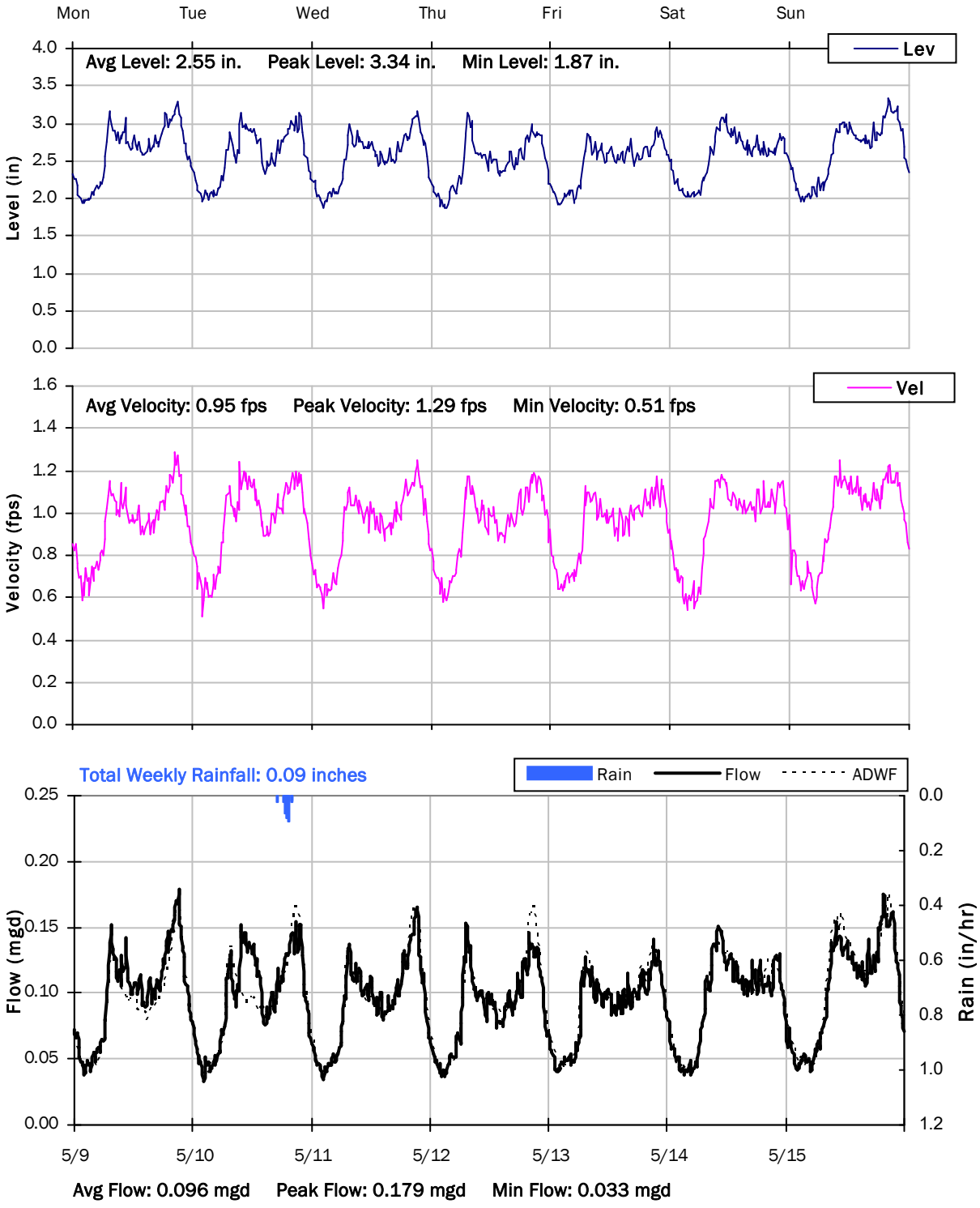
5/2/2022 to 5/9/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

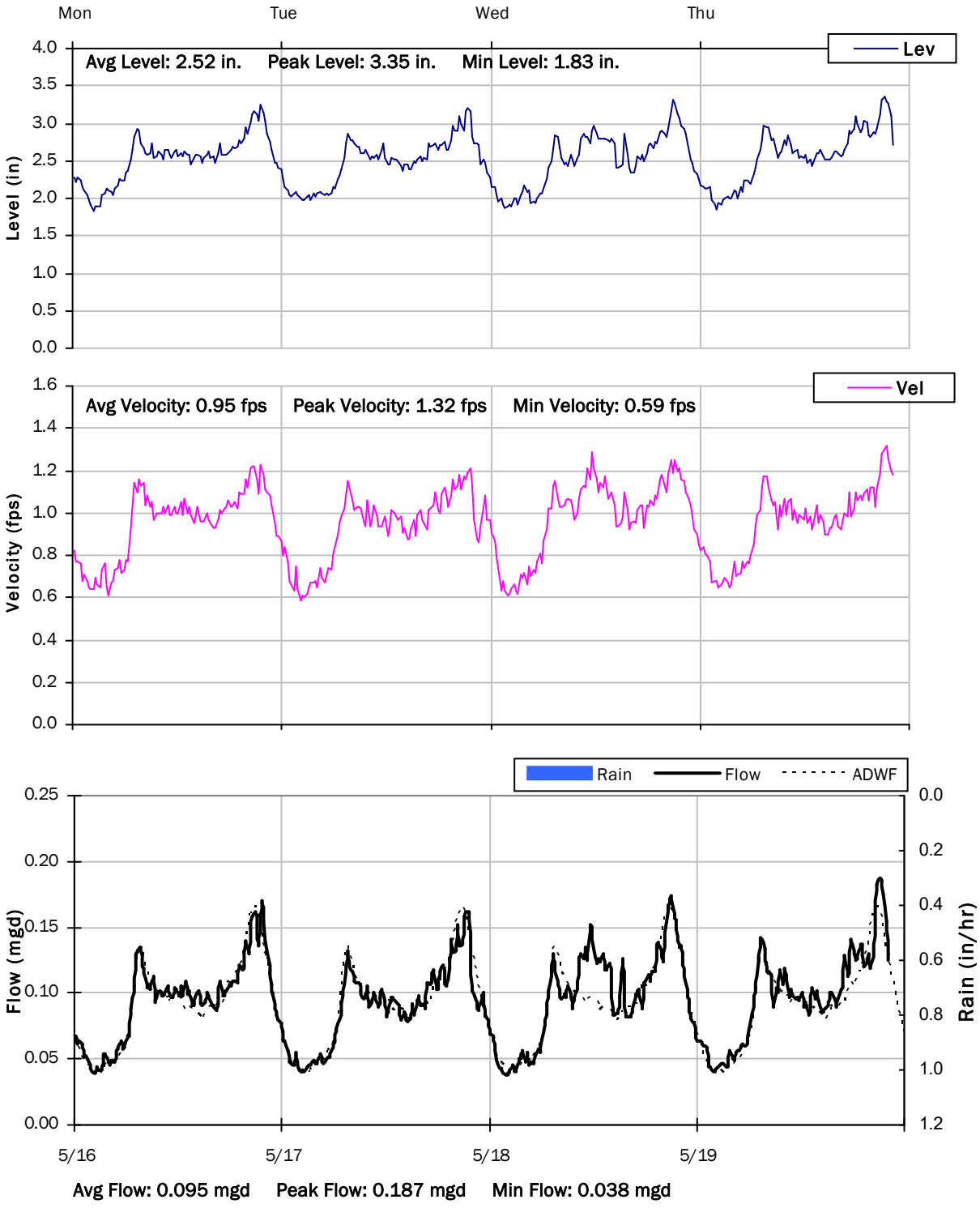
5/9/2022 to 5/16/2022



SITE 8

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 9

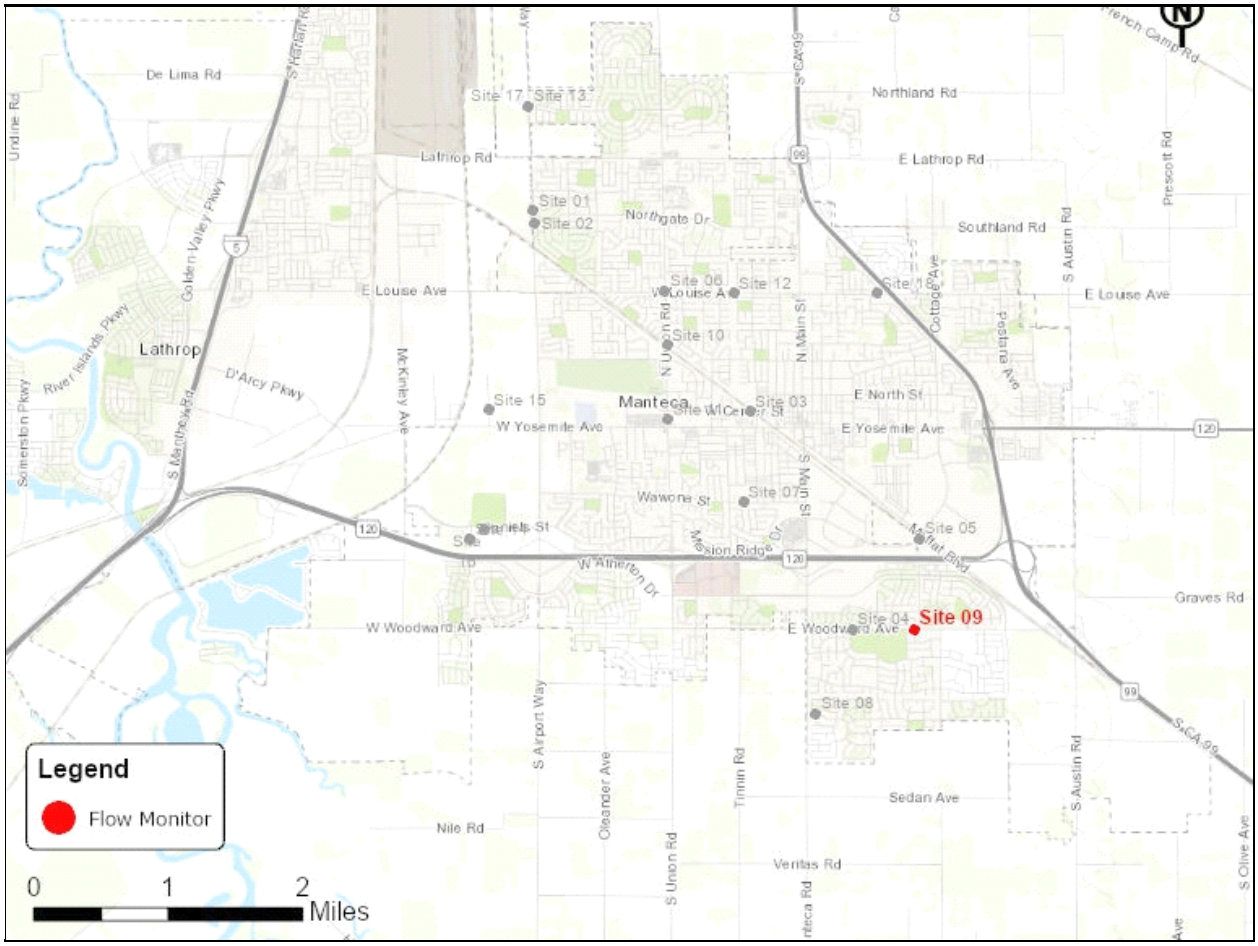
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Woodward Avenue East of Bridewell Avenue

Data Summary Report



Vicinity Map: Site 9

SITE 9

Additional Site Photos

Effluent Pipe

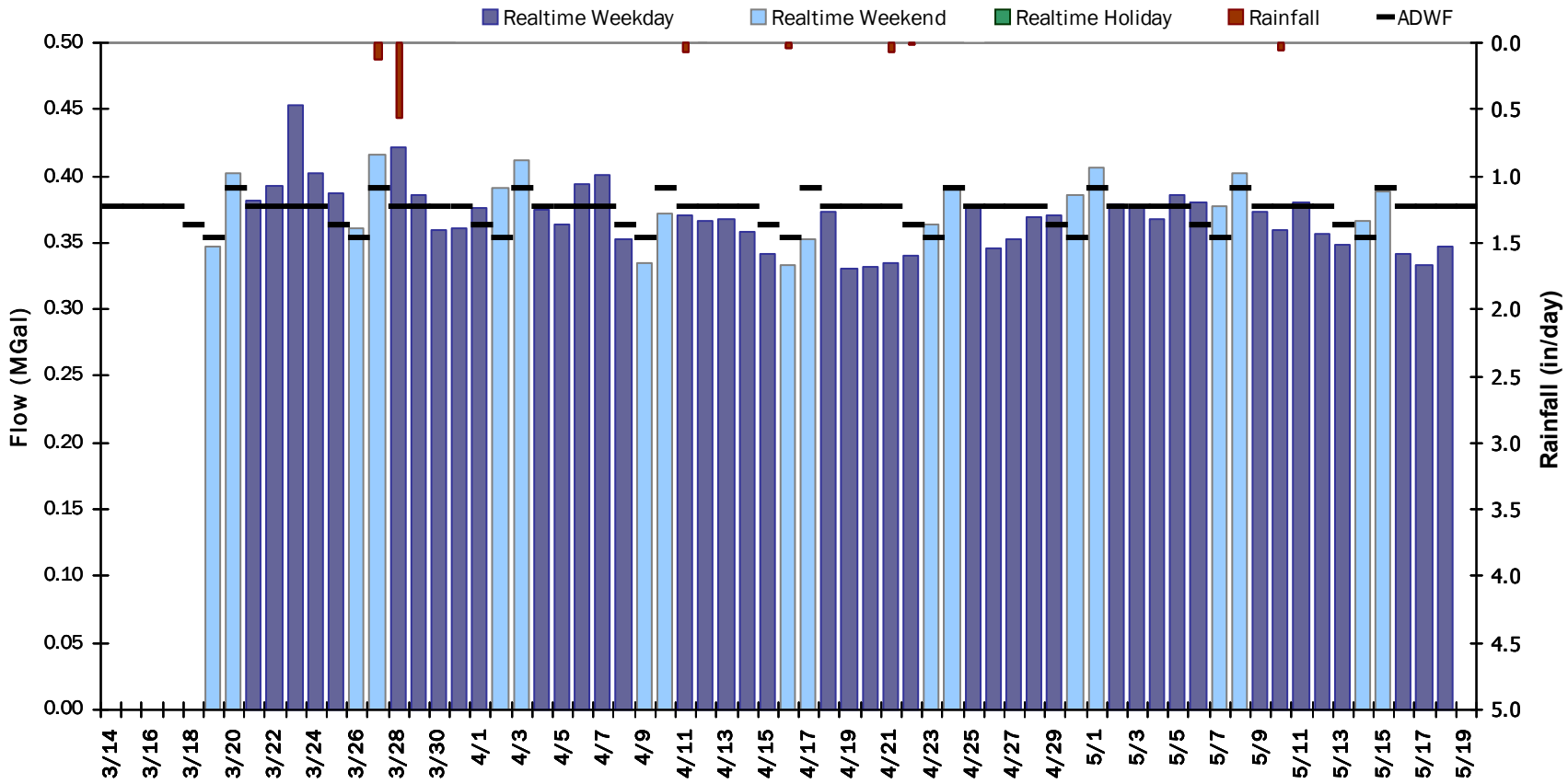
Monitored East Influent Pipe

SITE 9

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.371 MGal Peak Daily Flow: 0.453 MGal Min Daily Flow: 0.330 MGal

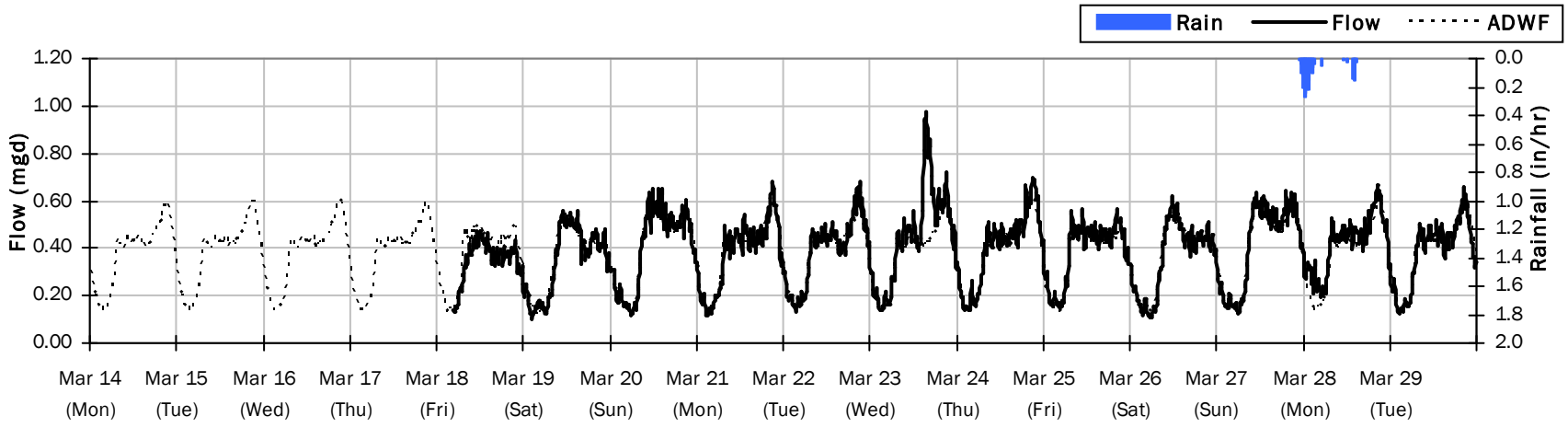
Total Rainfall: 0.94 inches

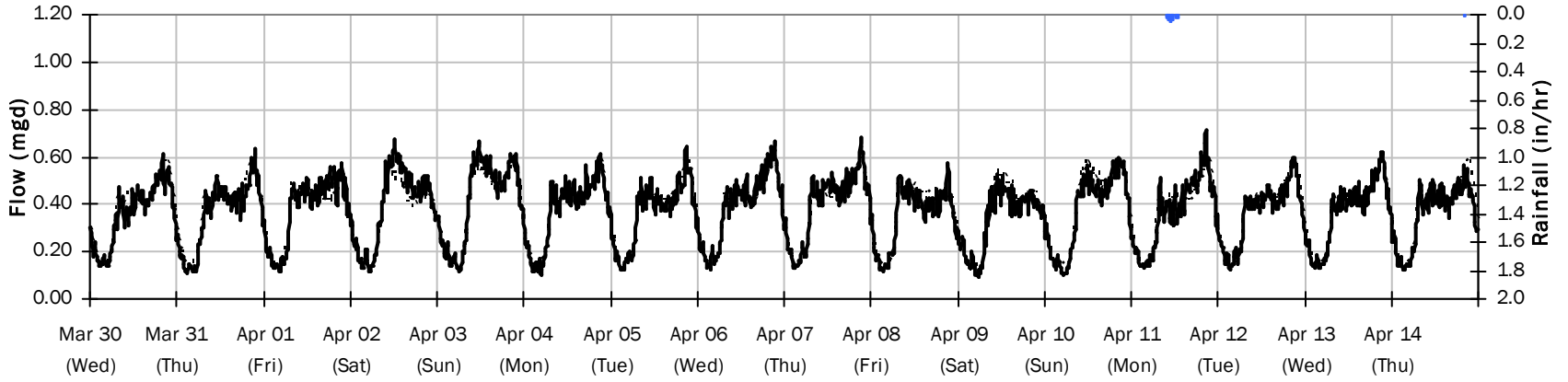


SITE 9

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.381 mgd Period Peak Flow: 0.974 mgd Period Min Flow: 0.089 mgd

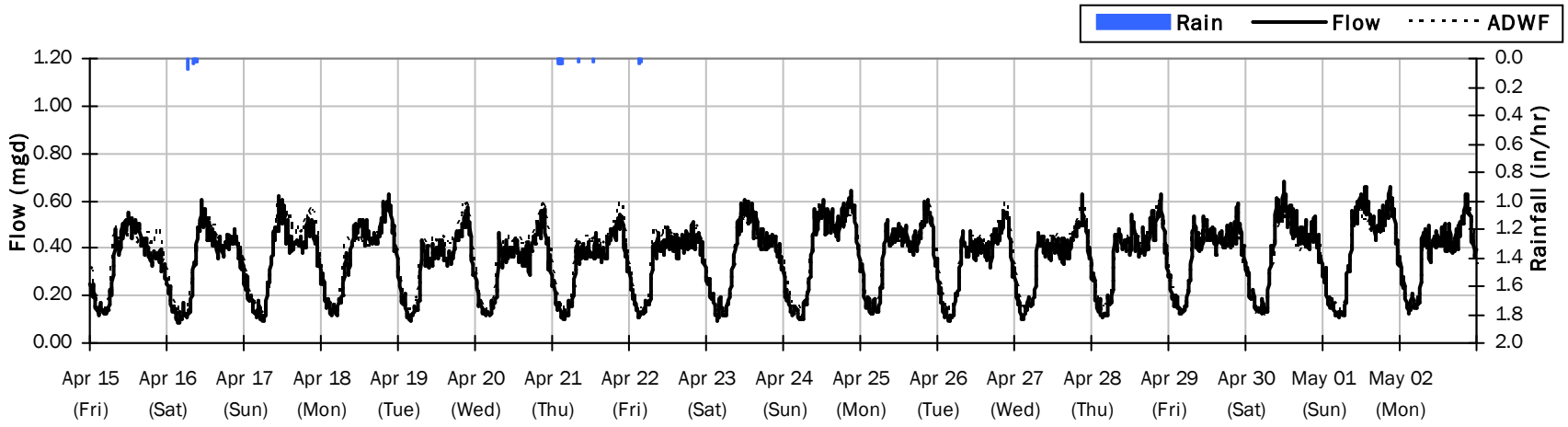


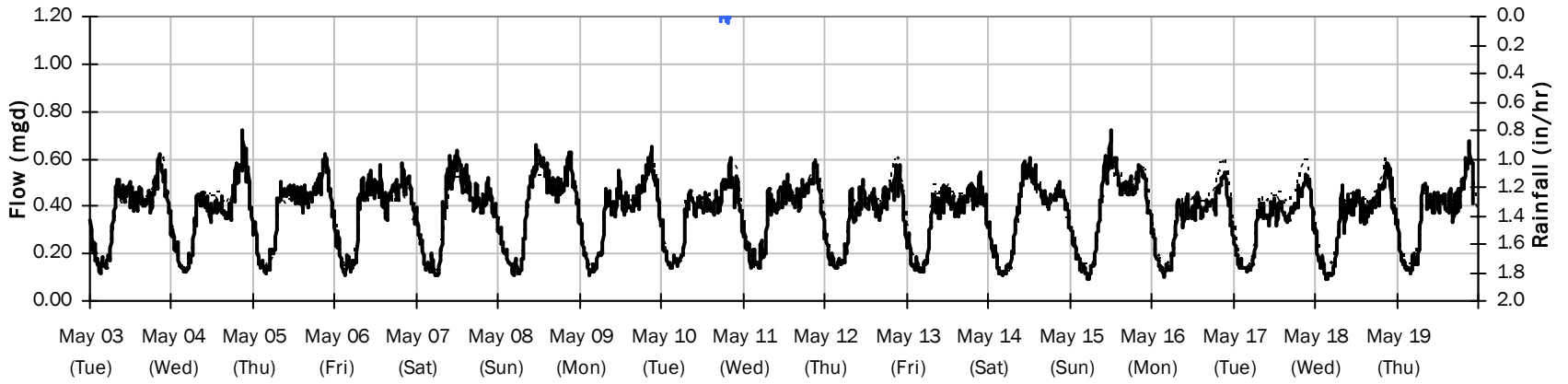


SITE 9

Flow Summary: 4/15/2022 to 5/19/2022

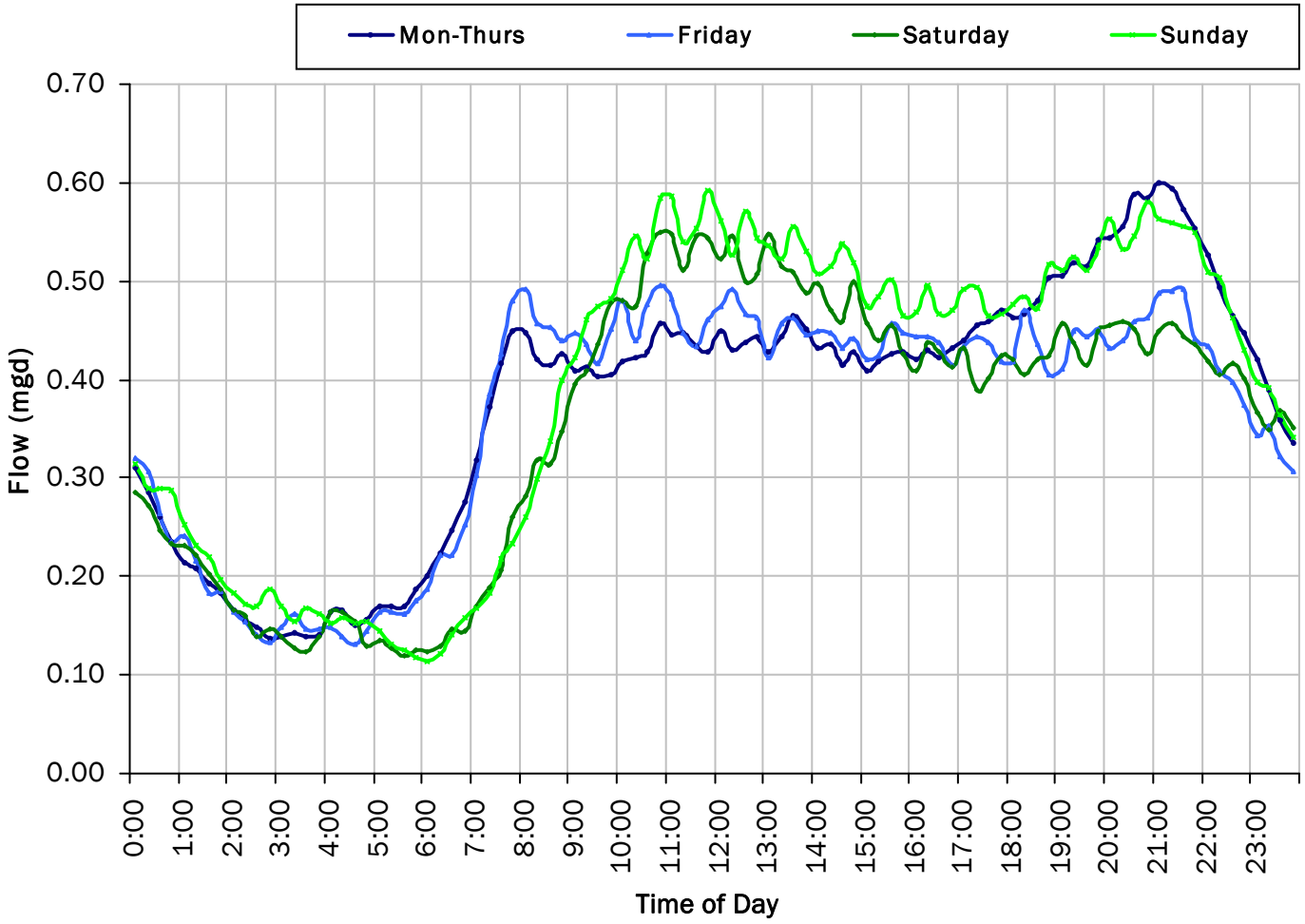
Period Rainfall: 0.18 inches Period Avg Flow: 0.364 mgd Period Peak Flow: 0.717 mgd Period Min Flow: 0.083 mgd





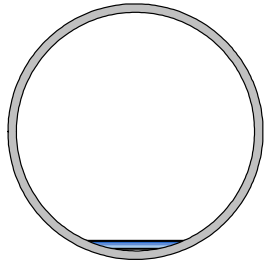
SITE 9

Average Dry Weather Flow Hydrographs



ADWF:

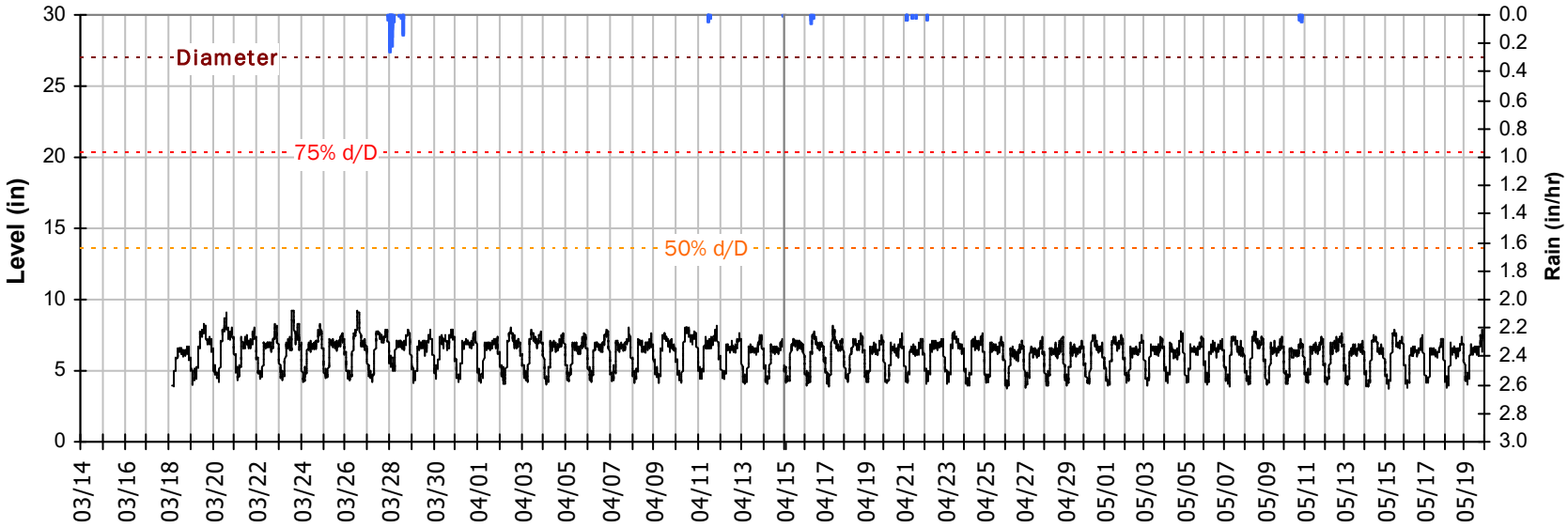
0.374 *mgd*

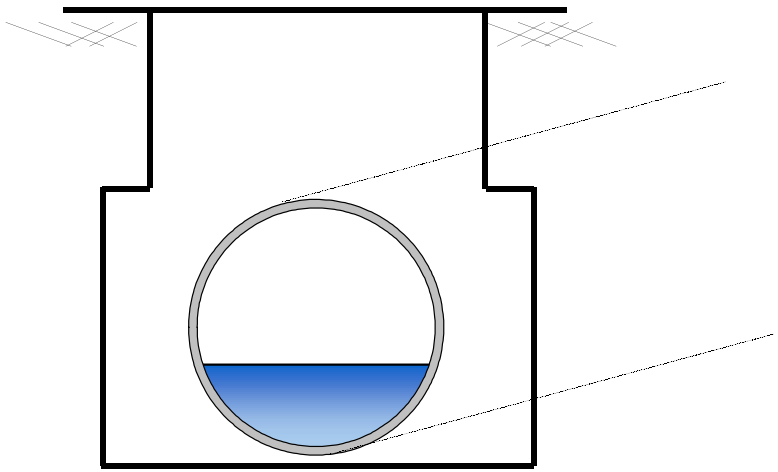


SITE 9

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

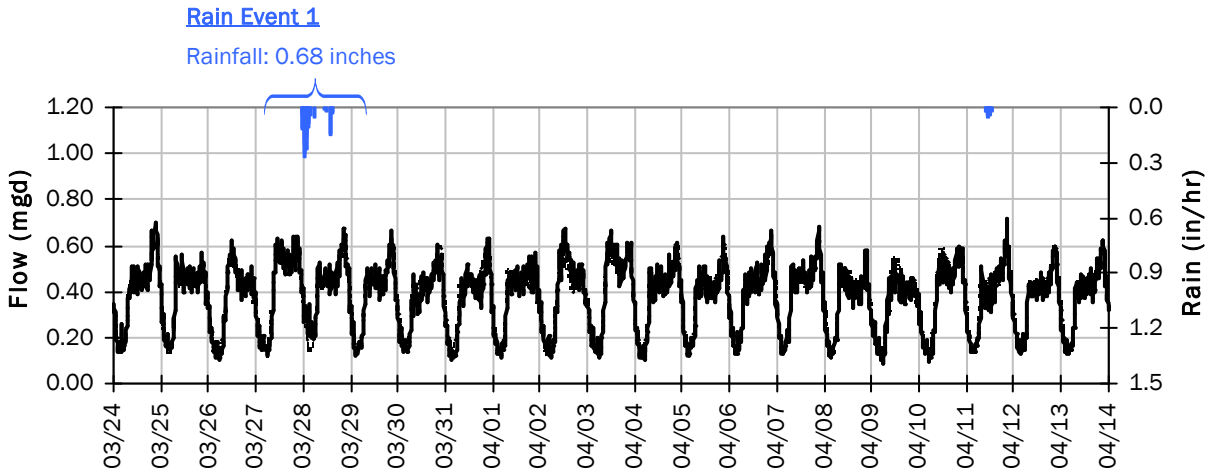




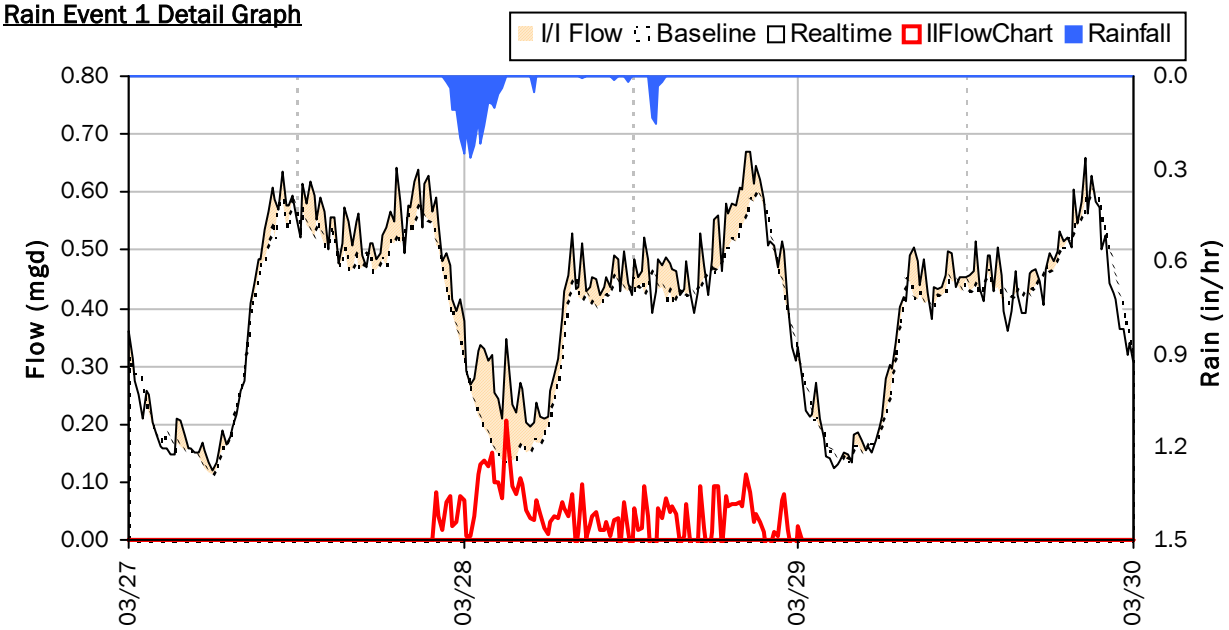
Pipe Diameter:	27	*inches*
Peak Measured Level:	9.26	*inches*
Peak d/D Ratio:	0.34	

SITE 9
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



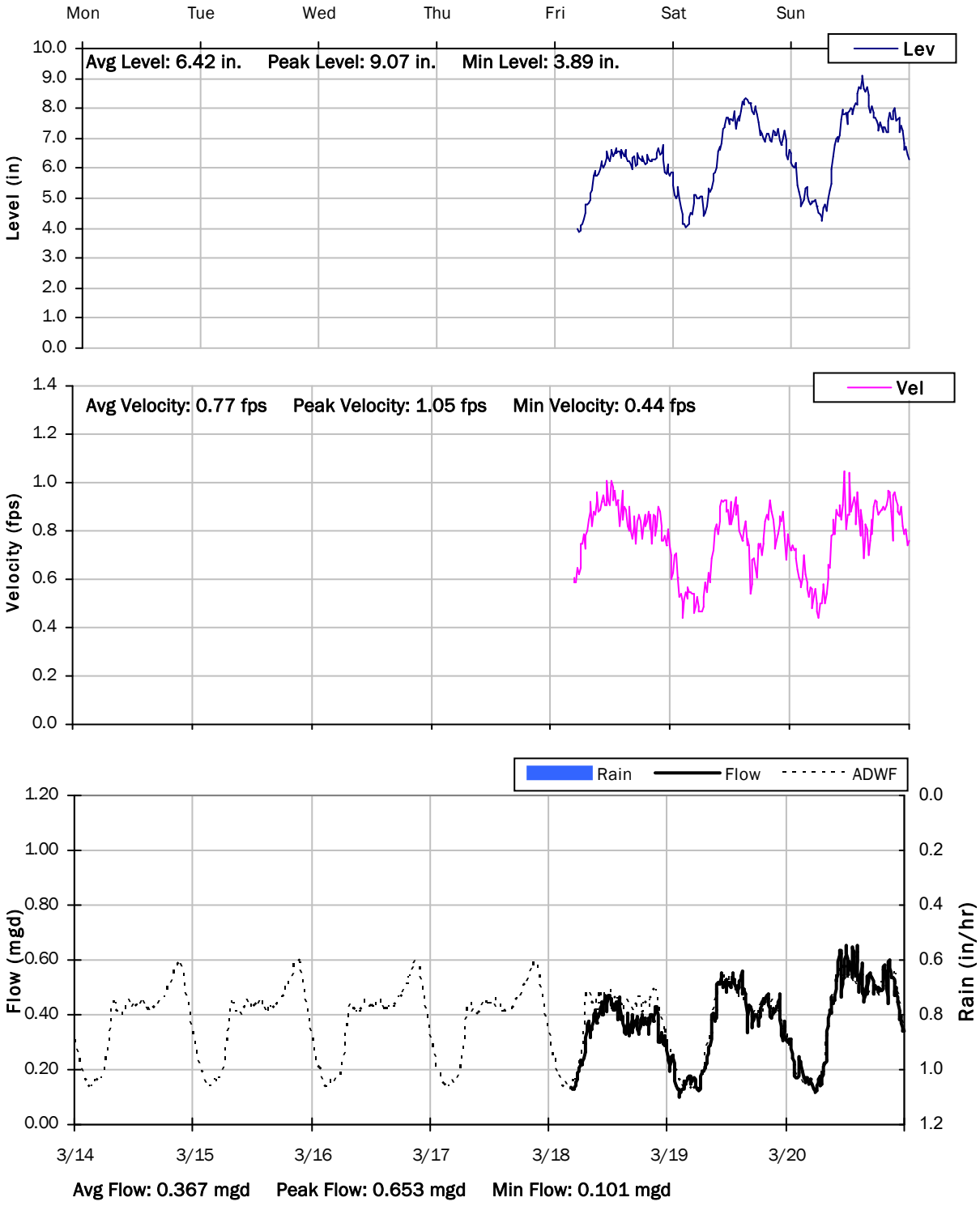
Storm Event I/I Analysis (Rain = 0.68 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.670 *mgd*	**Peak I/I Rate:**	0.207 *mgd*
PF:	1.79	**Total I/I:**	49,000 *gallons*
Peak Level:	7.93 *in*		
d/D Ratio:	0.29		

SITE 9

Weekly Level, Velocity and Flow Hydrographs

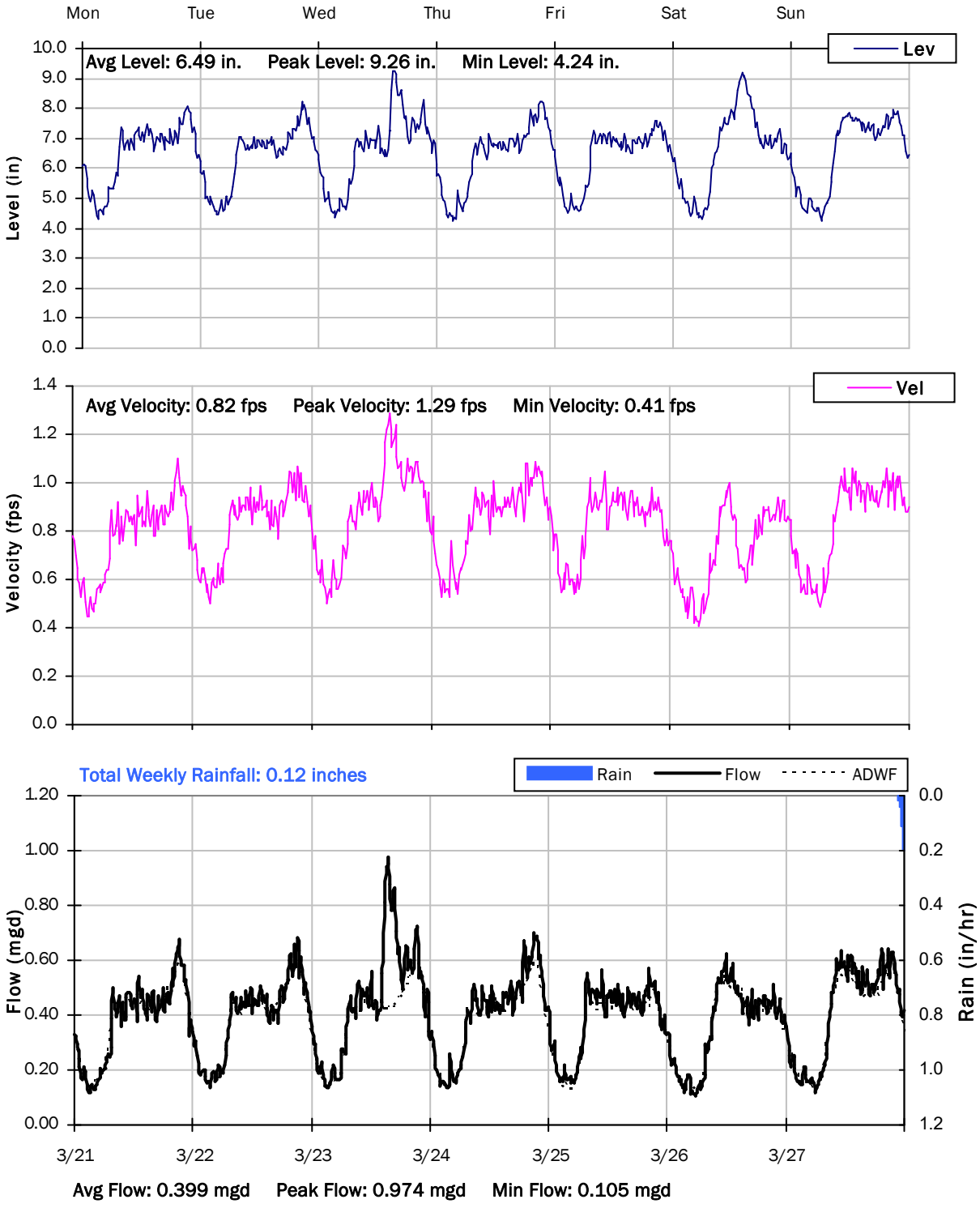
3/14/2022 to 3/21/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

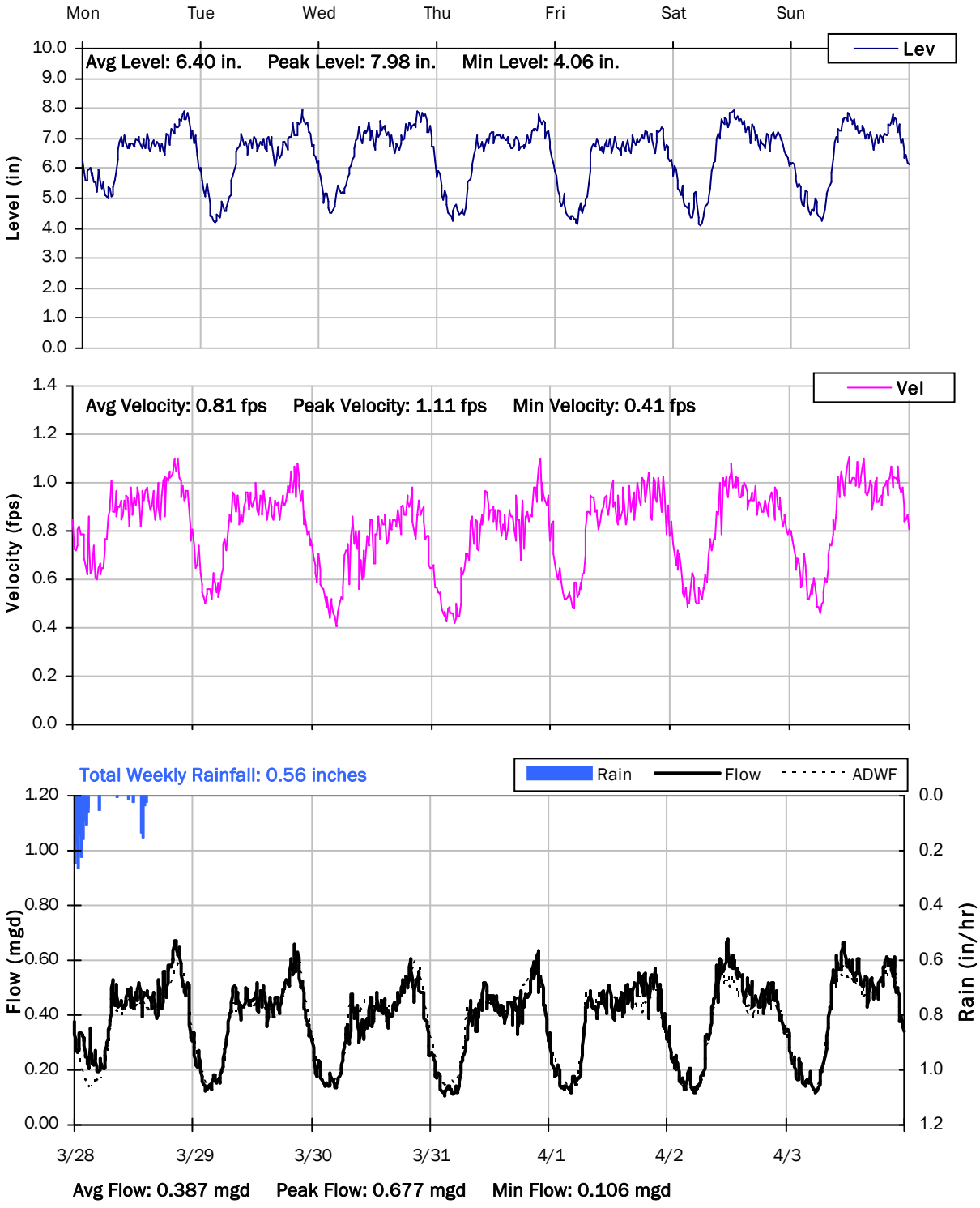
3/21/2022 to 3/28/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

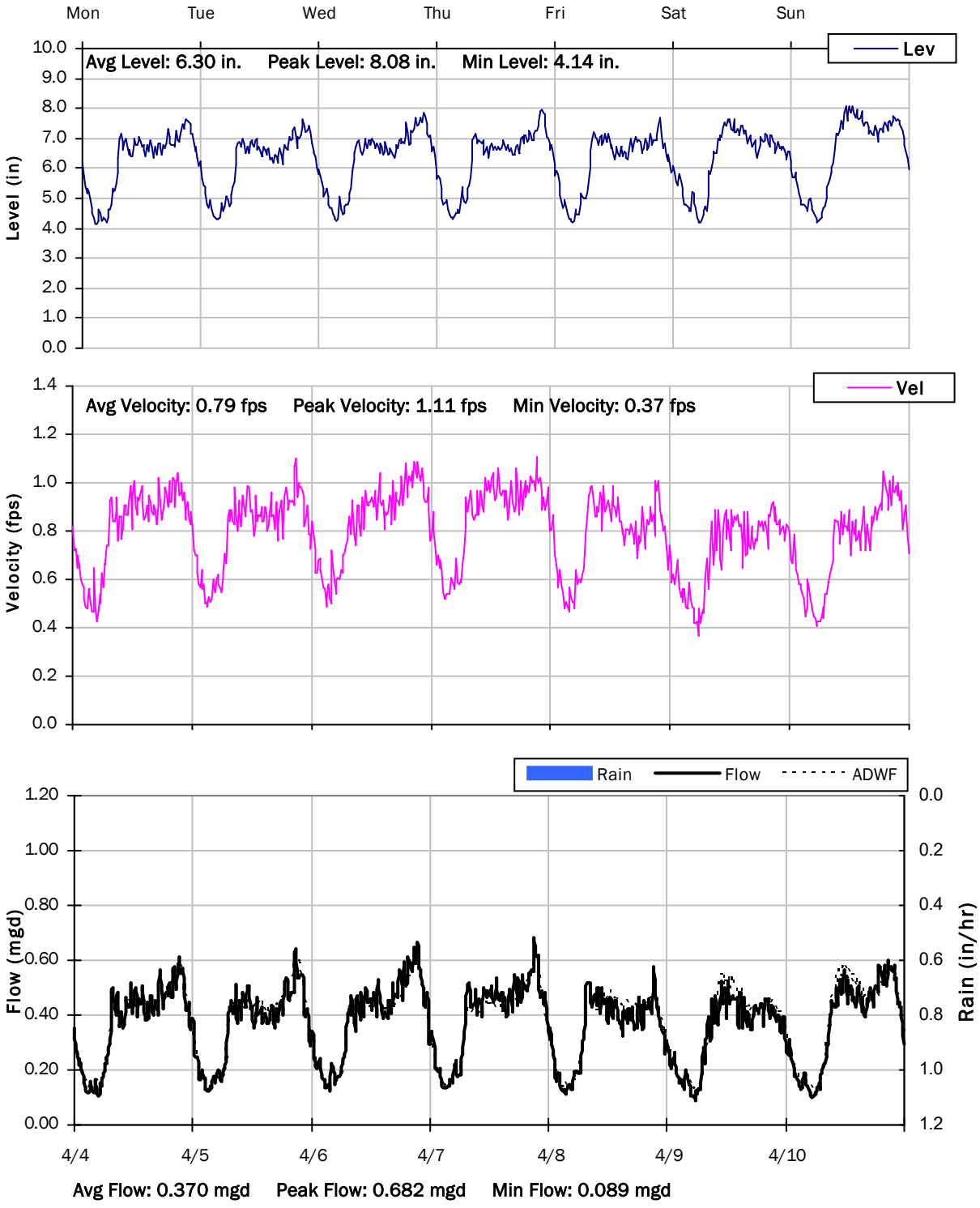
3/28/2022 to 4/4/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

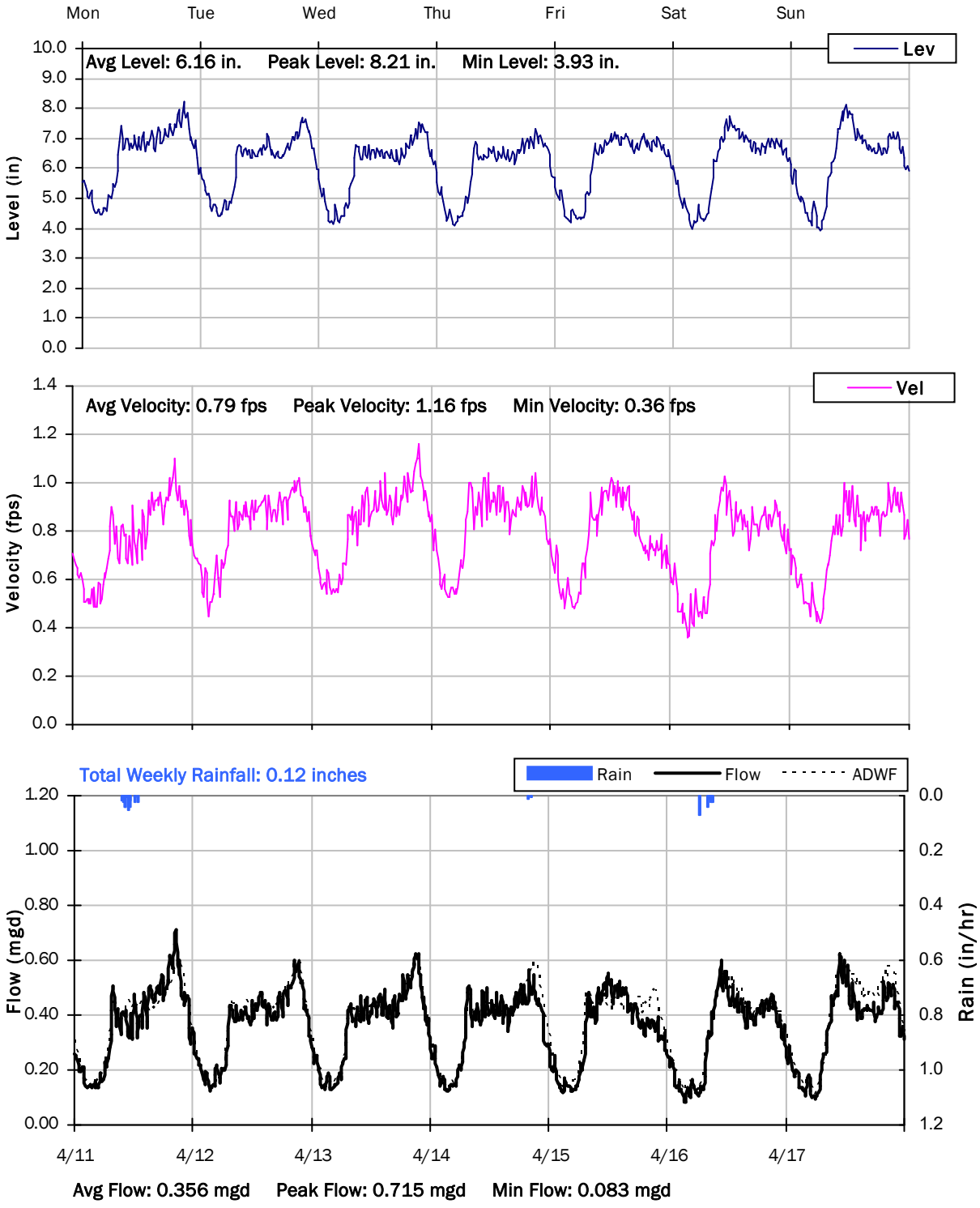
4/4/2022 to 4/11/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

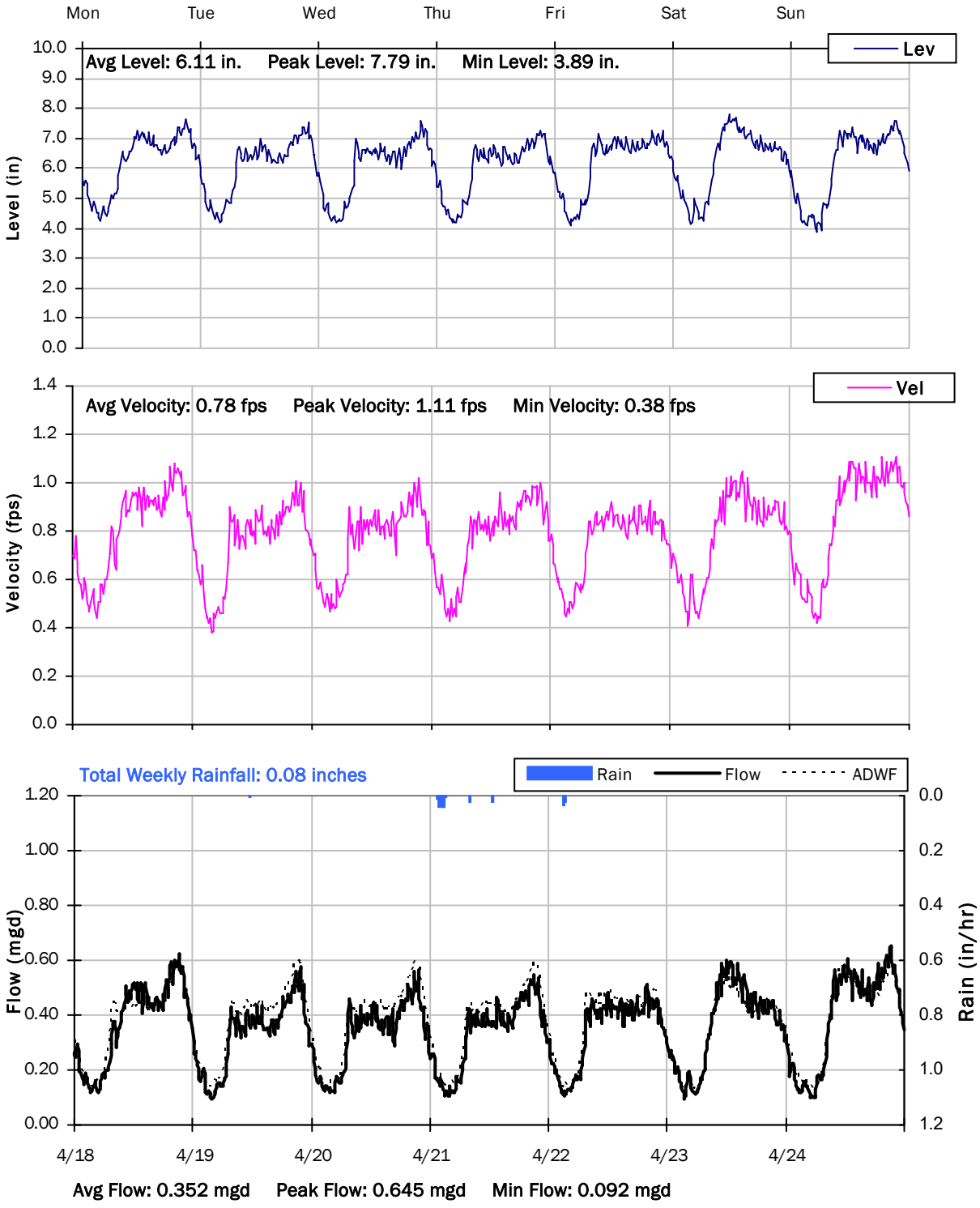
4/11/2022 to 4/18/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

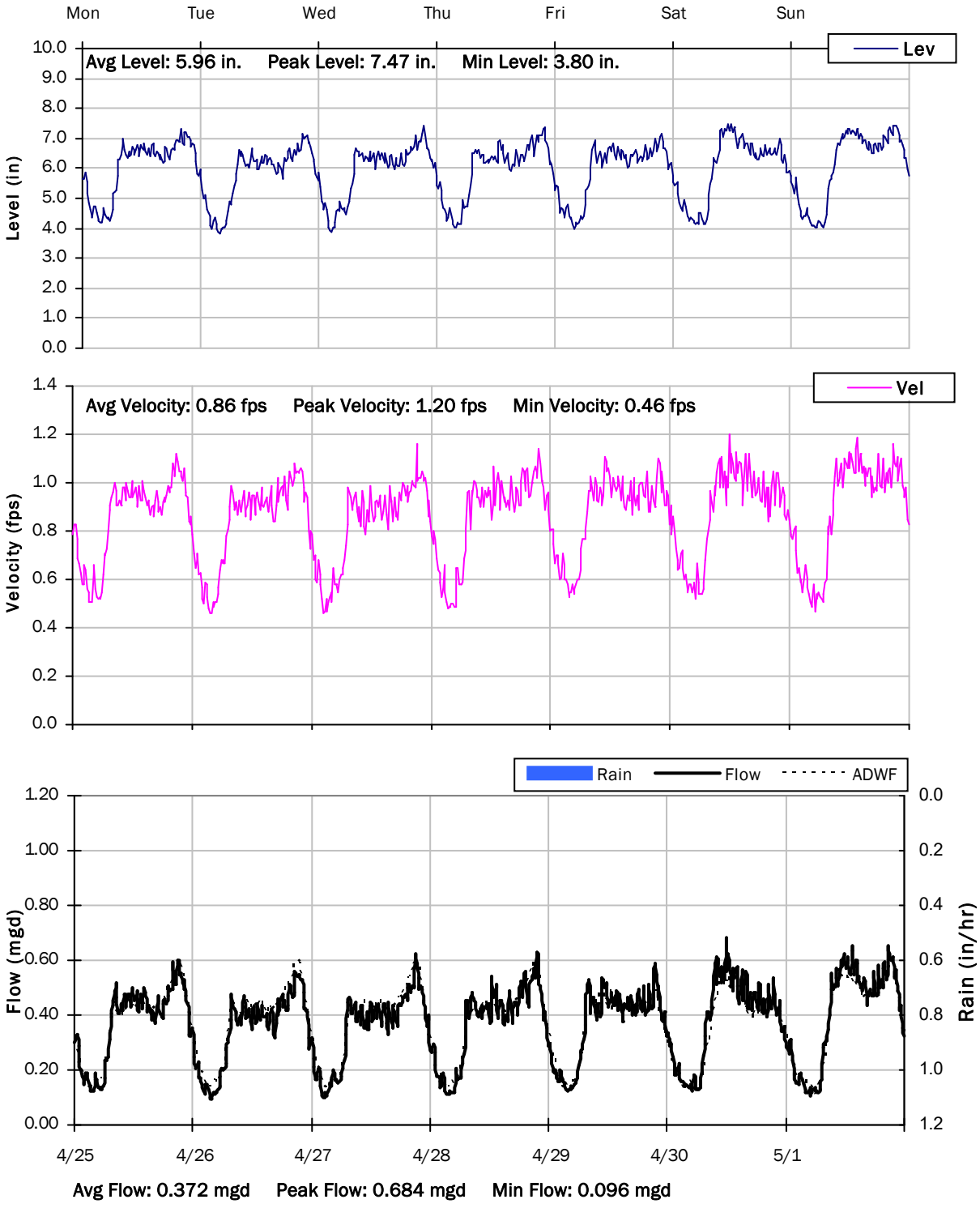
4/18/2022 to 4/25/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

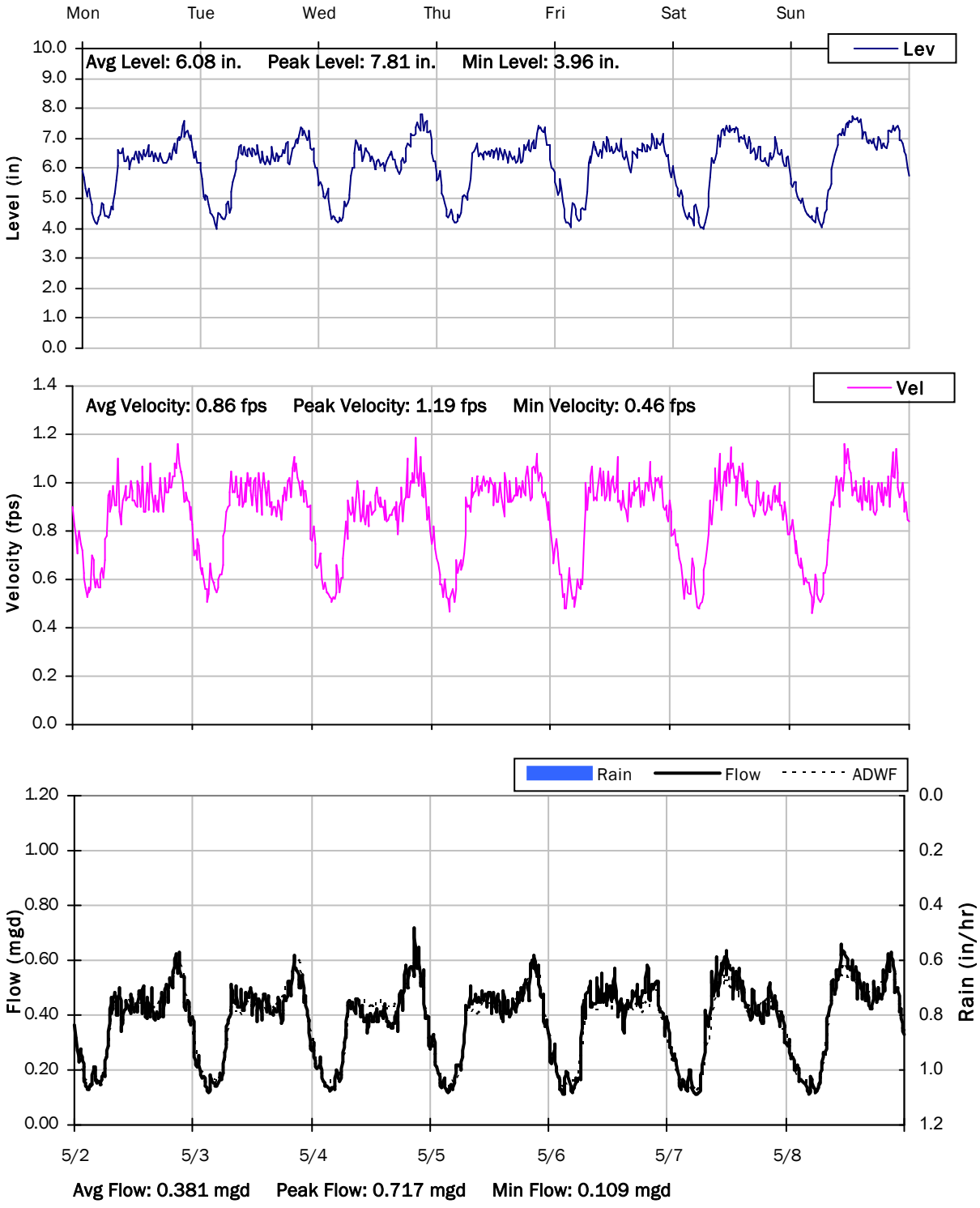
4/25/2022 to 5/2/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

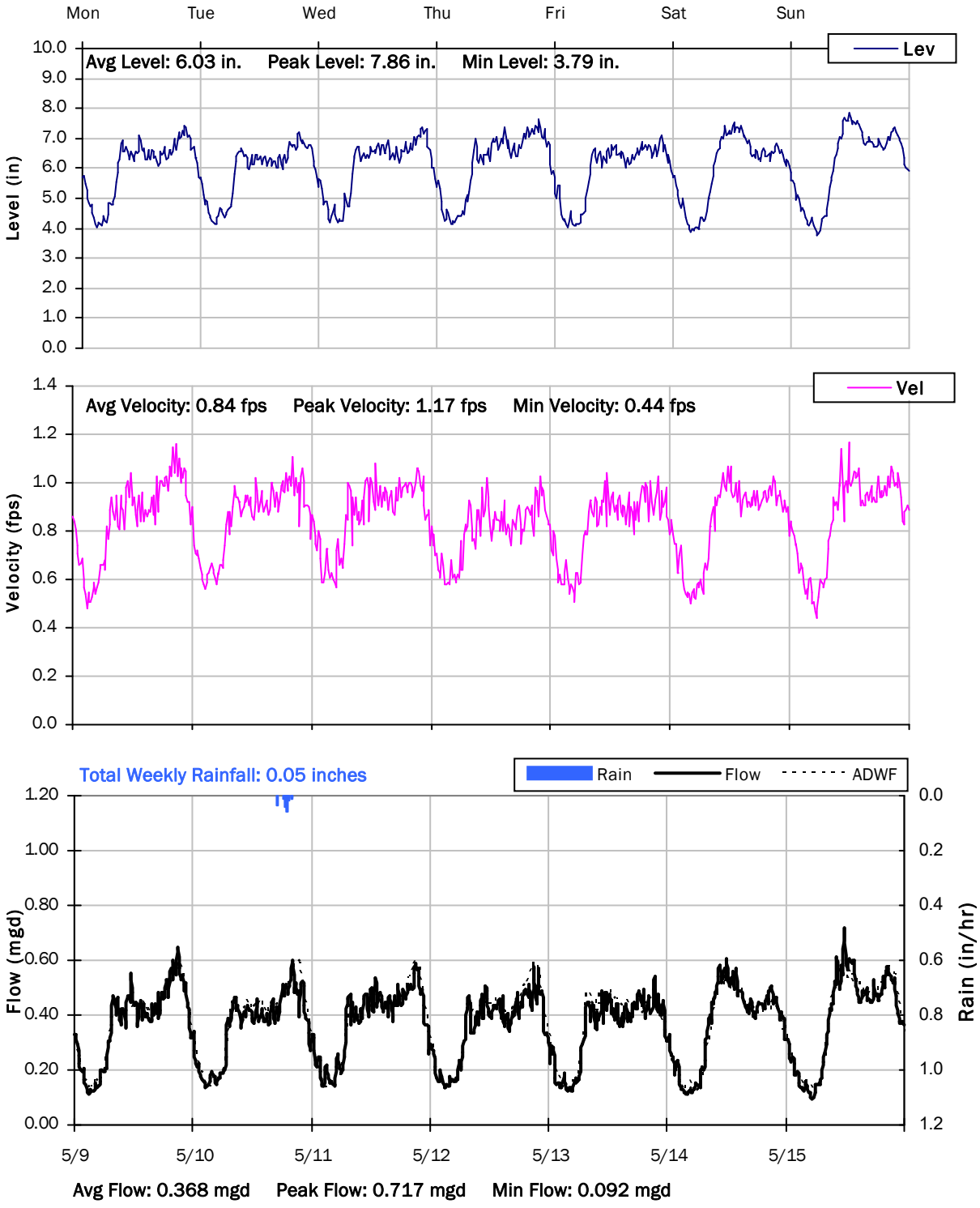
5/2/2022 to 5/9/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

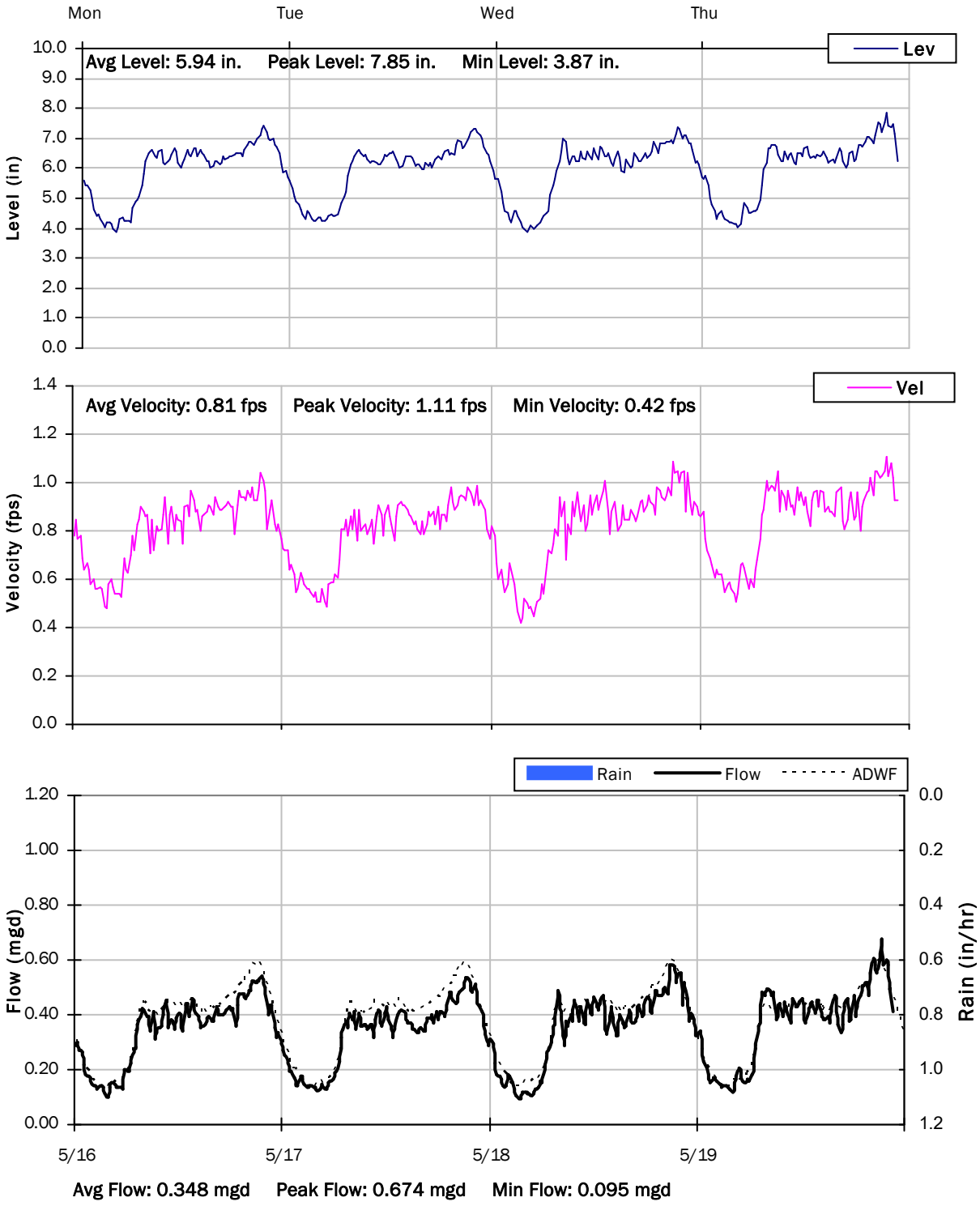
5/9/2022 to 5/16/2022



SITE 9

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 10

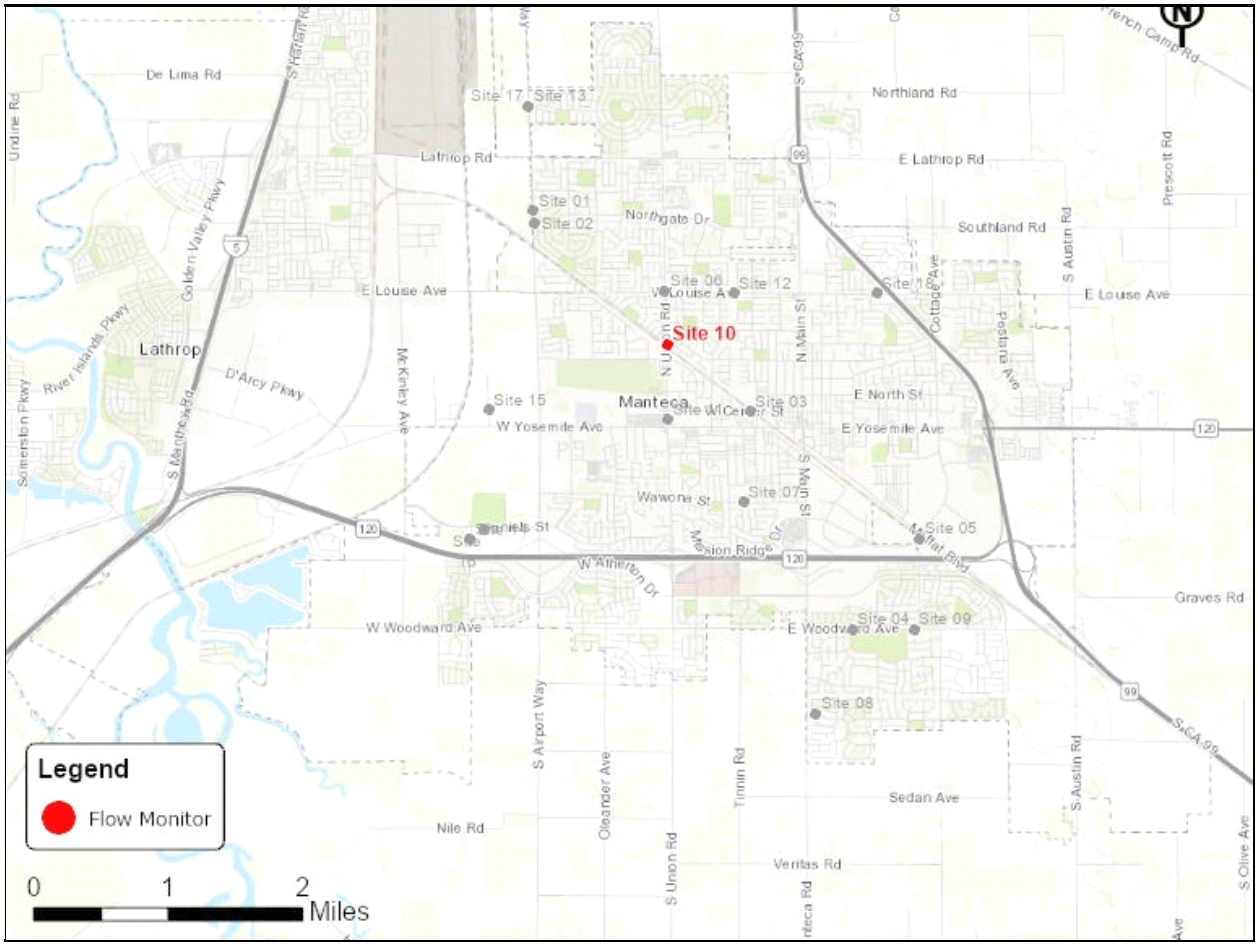
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: N. Union Road South of W. Alameda Street

Data Summary Report

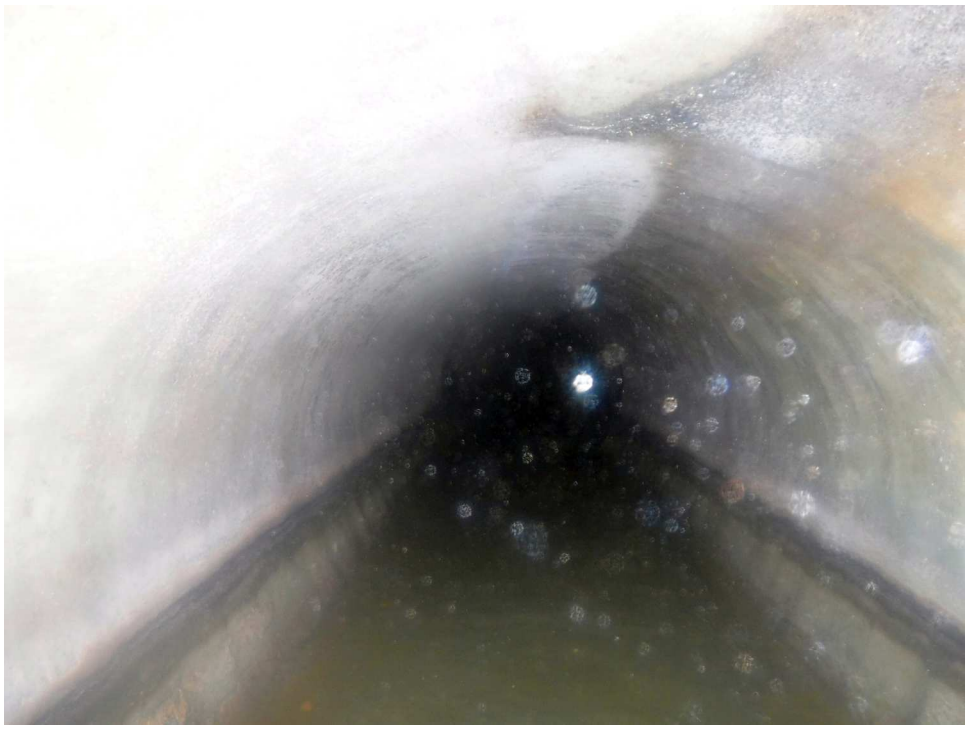


Vicinity Map: Site 10

SITE 10

Additional Site Photos

Effluent Pipe



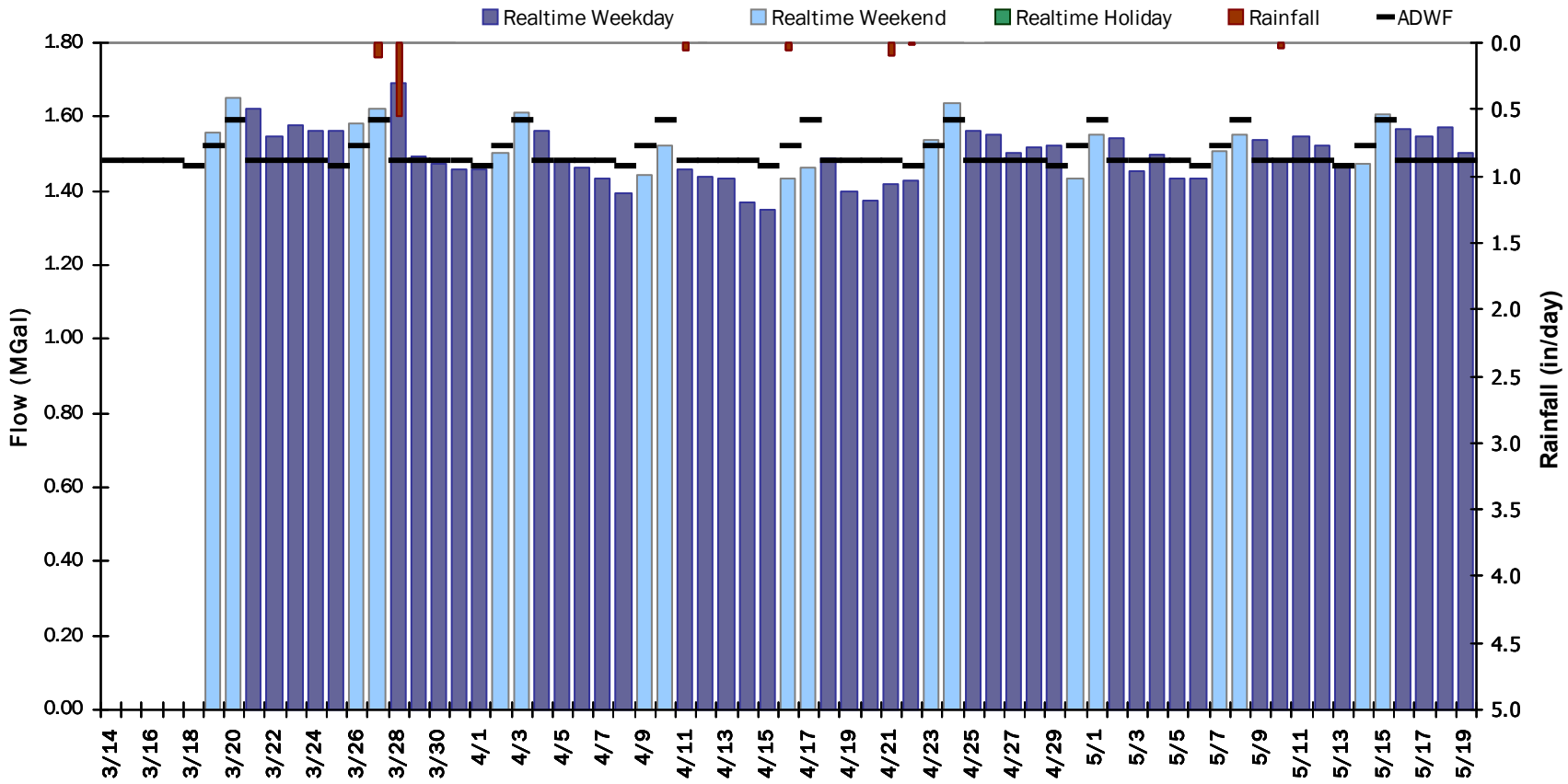
Monitored North Influent Pipe

SITE 10

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 1.506 MGal Peak Daily Flow: 1.690 MGal Min Daily Flow: 1.348 MGal

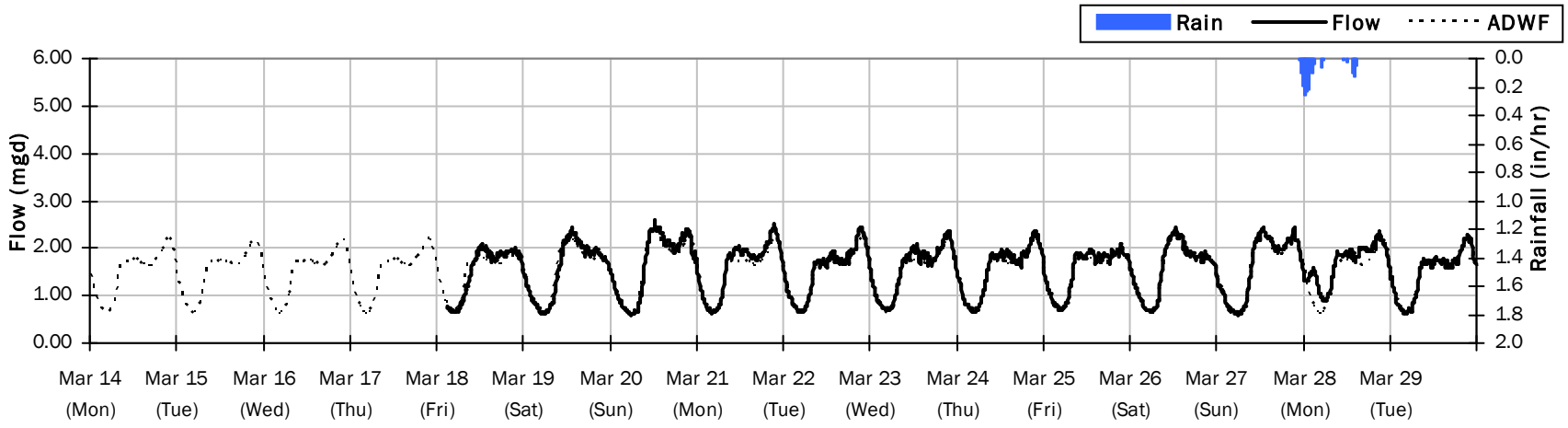
Total Rainfall: 0.94 inches

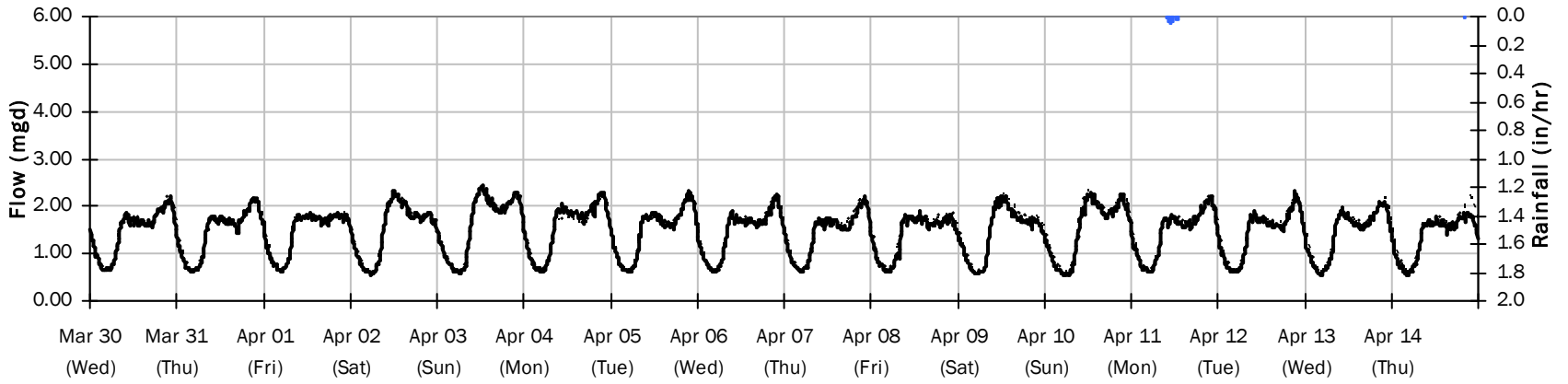


SITE 10

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.73 inches Period Avg Flow: 1.518 mgd Period Peak Flow: 2.597 mgd Period Min Flow: 0.535 mgd

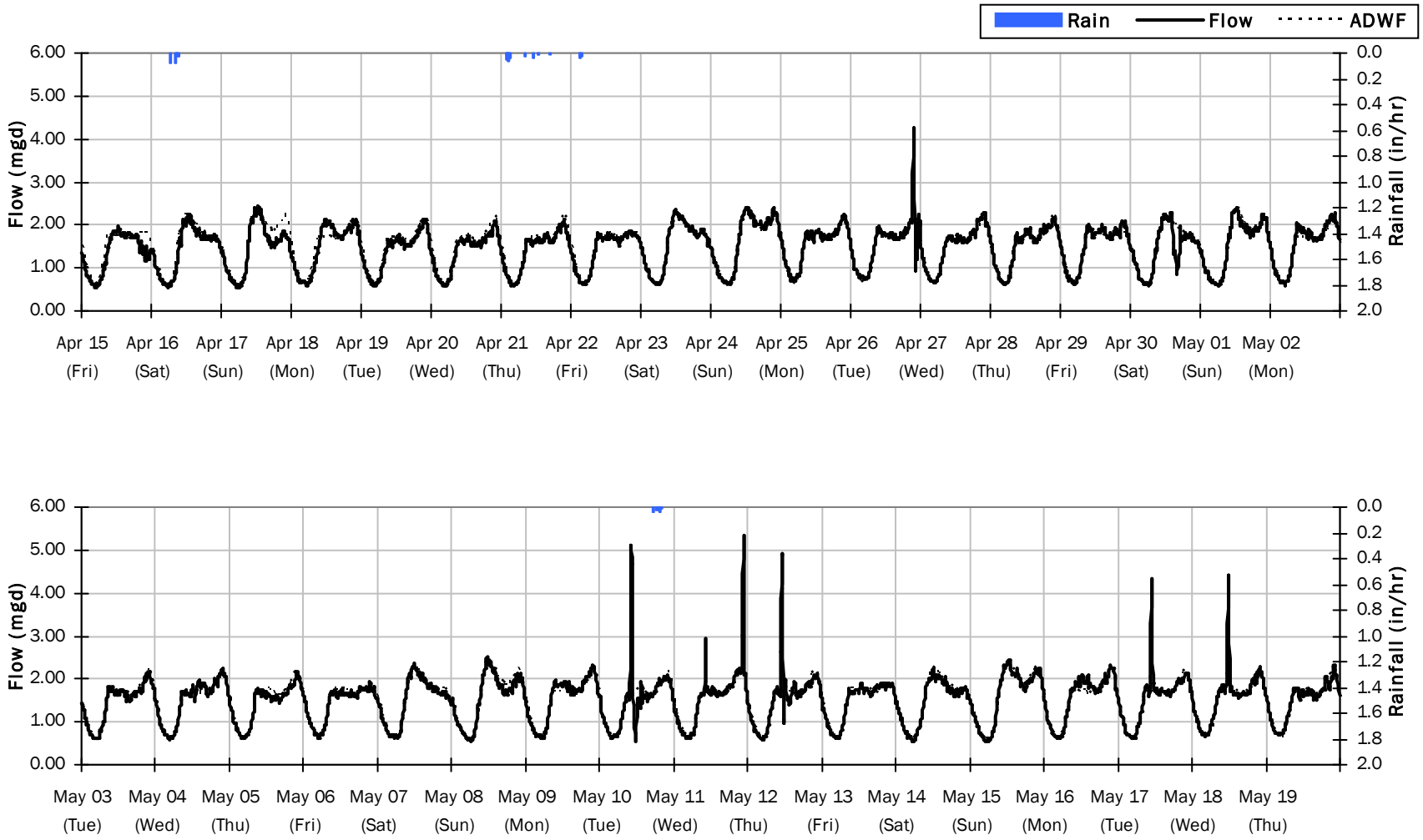




SITE 10

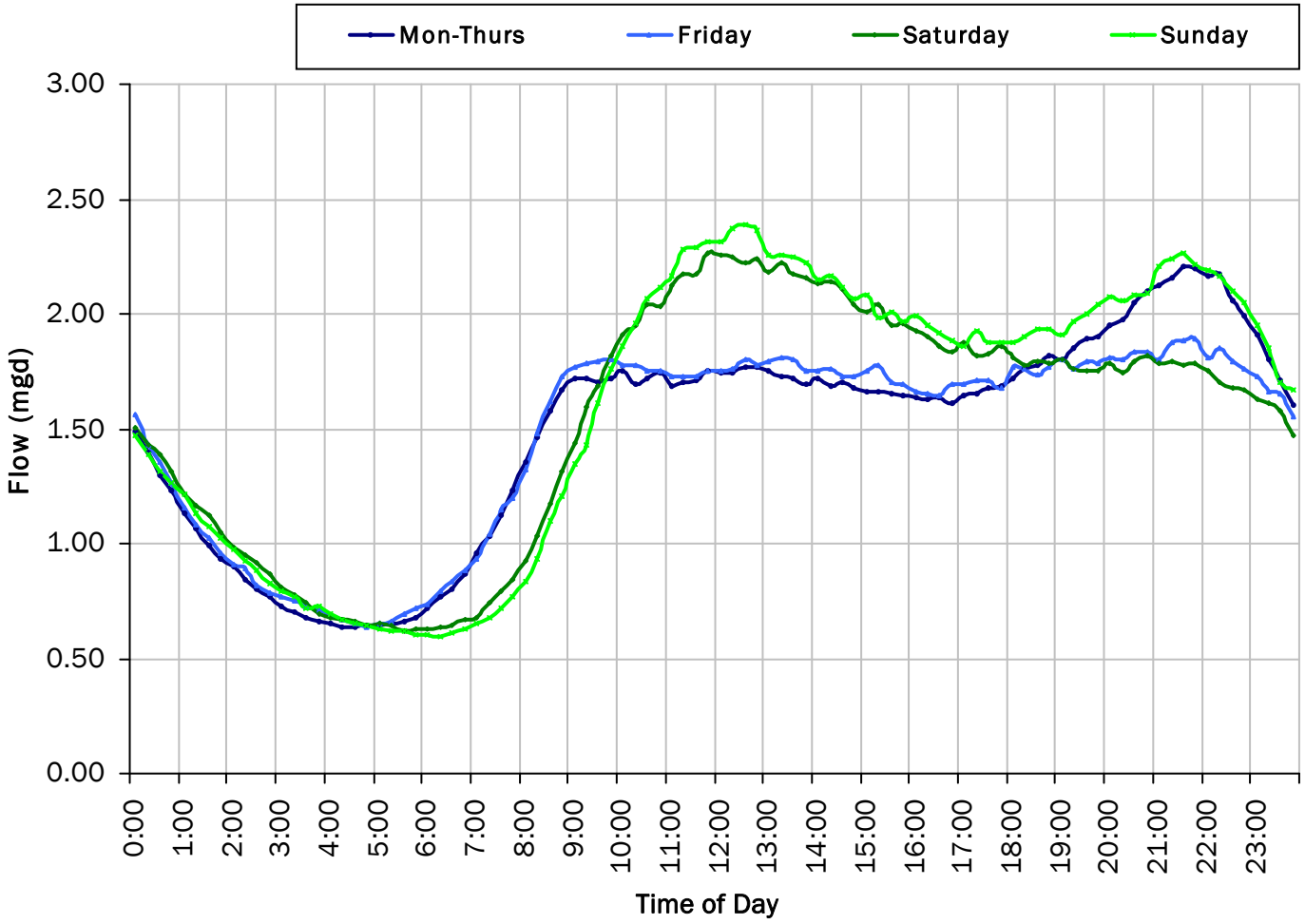
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.21 inches Period Avg Flow: 1.497 mgd Period Peak Flow: 5.332 mgd Period Min Flow: 0.532 mgd



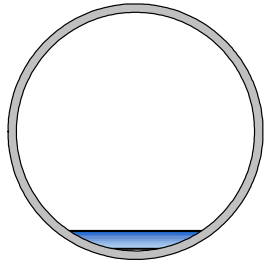
SITE 10

Average Dry Weather Flow Hydrographs



ADWF:

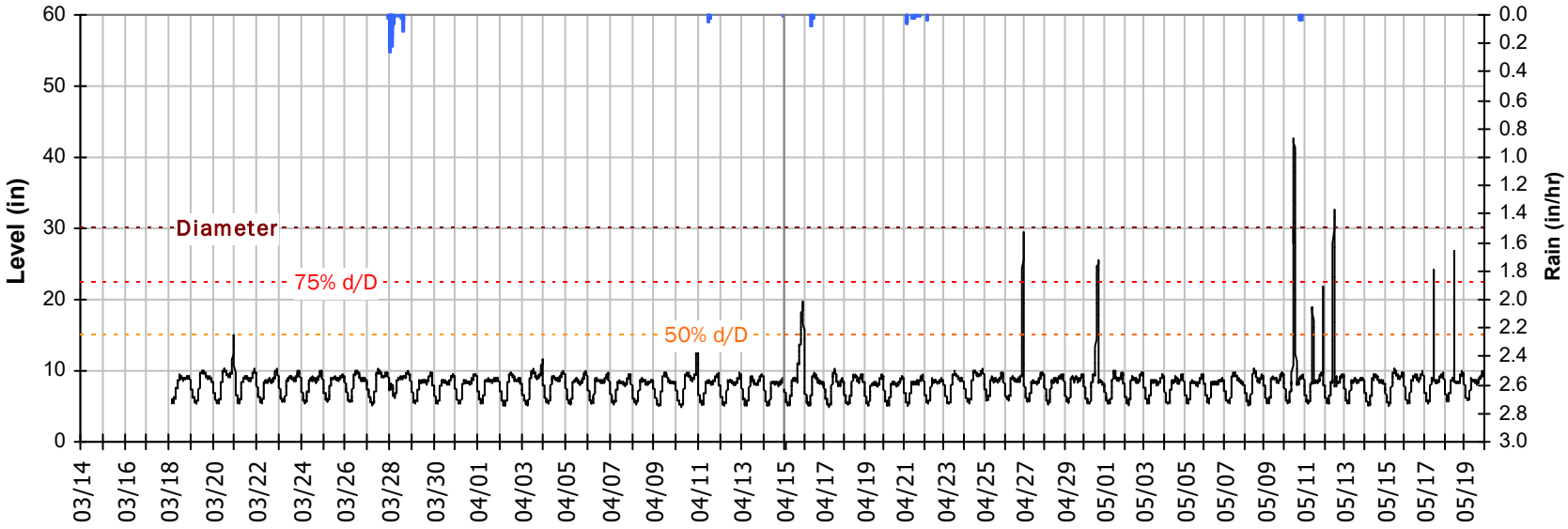
1.499 *mgd*

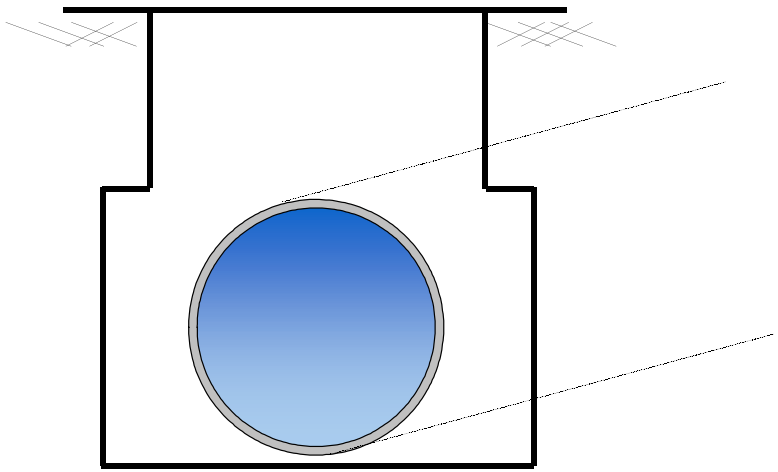


SITE 10

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



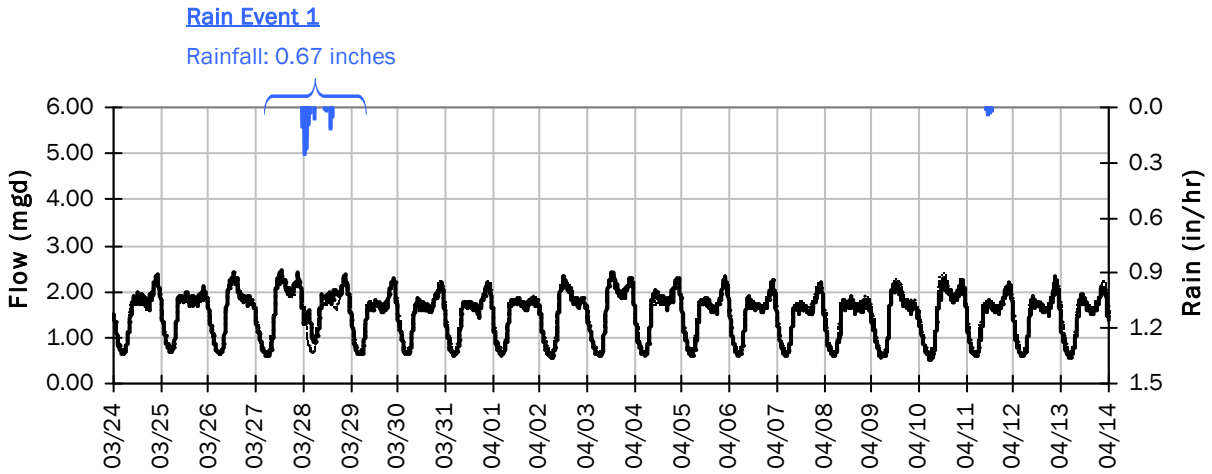


Pipe Diameter:	30	*inches*
Peak Measured Level:	42.7	*inches*
Peak d/D Ratio:	1.42	

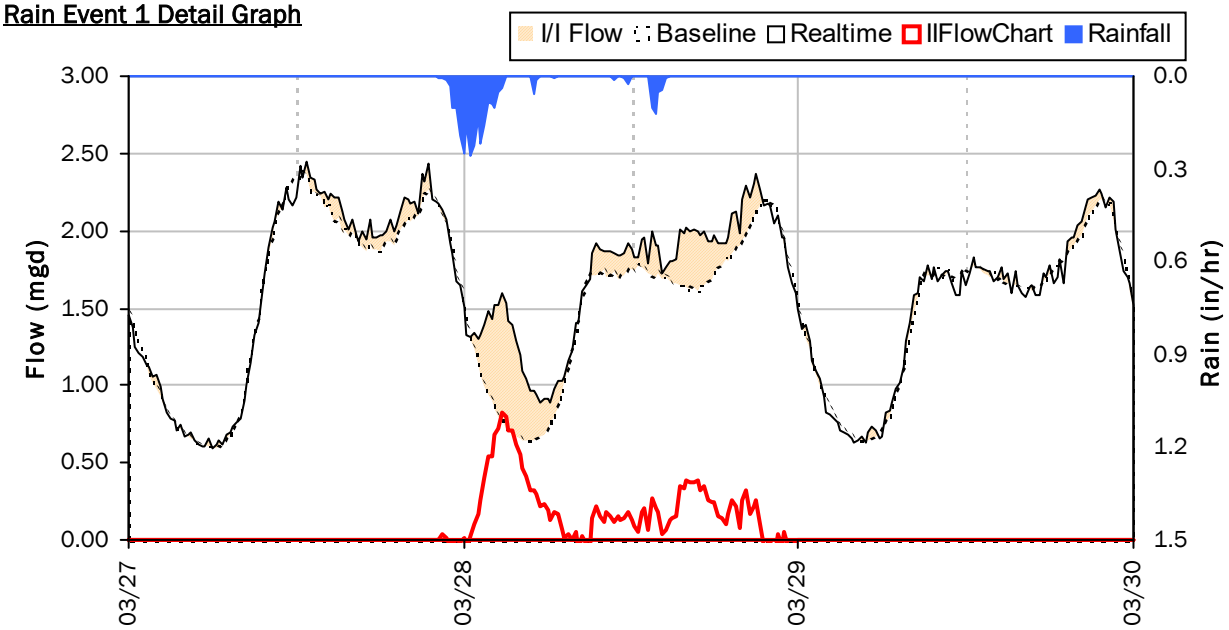
Surcharged 12.7 inches over crown

SITE 10
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



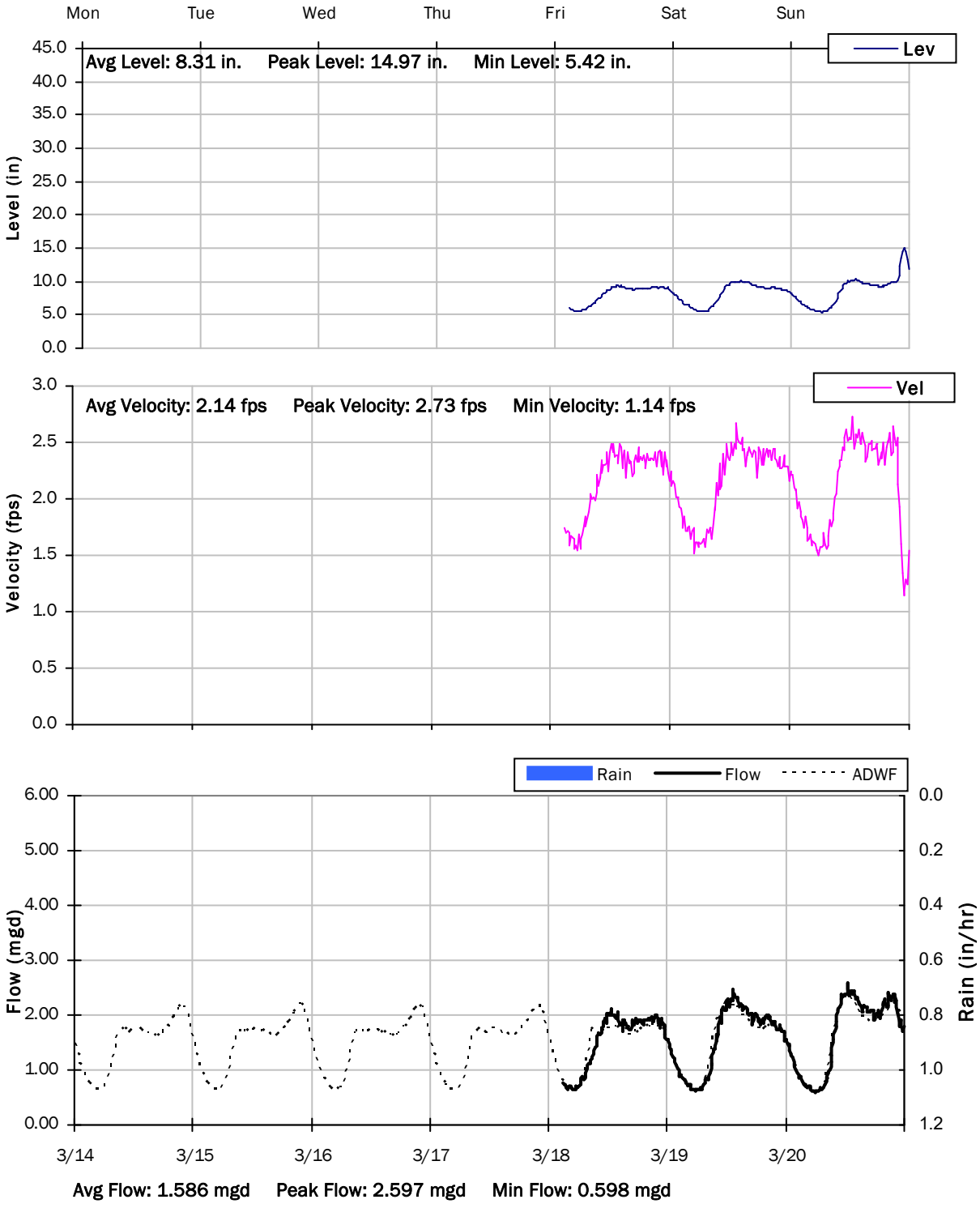
Storm Event I/I Analysis (Rain = 0.67 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	2.375 *mgd*	**Peak I/I Rate:**	0.829 *mgd*
PF:	1.58	**Total I/I:**	208,000 *gallons*
Peak Level:	9.97 *in*		
d/D Ratio:	0.33		

SITE 10

Weekly Level, Velocity and Flow Hydrographs

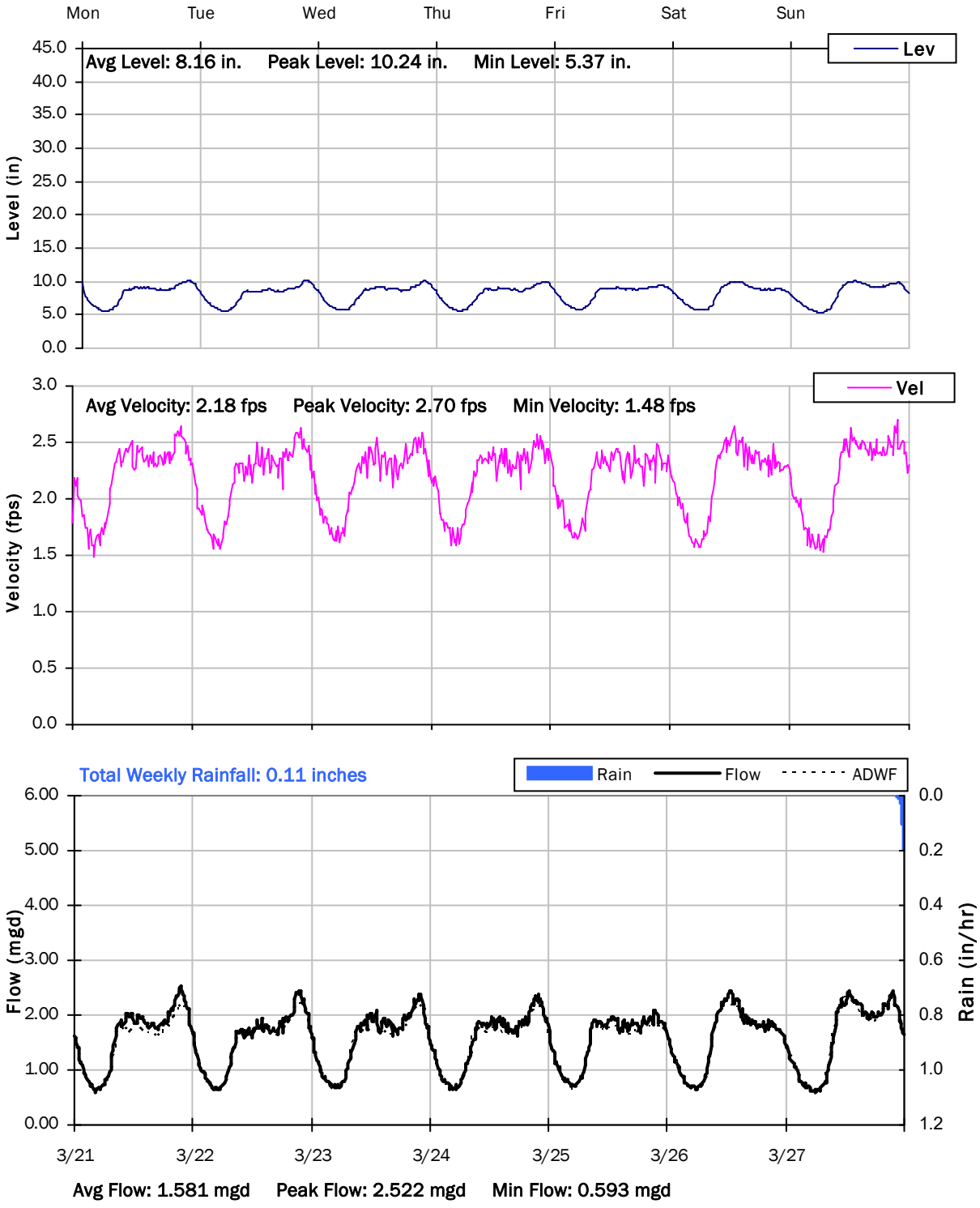
3/14/2022 to 3/21/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

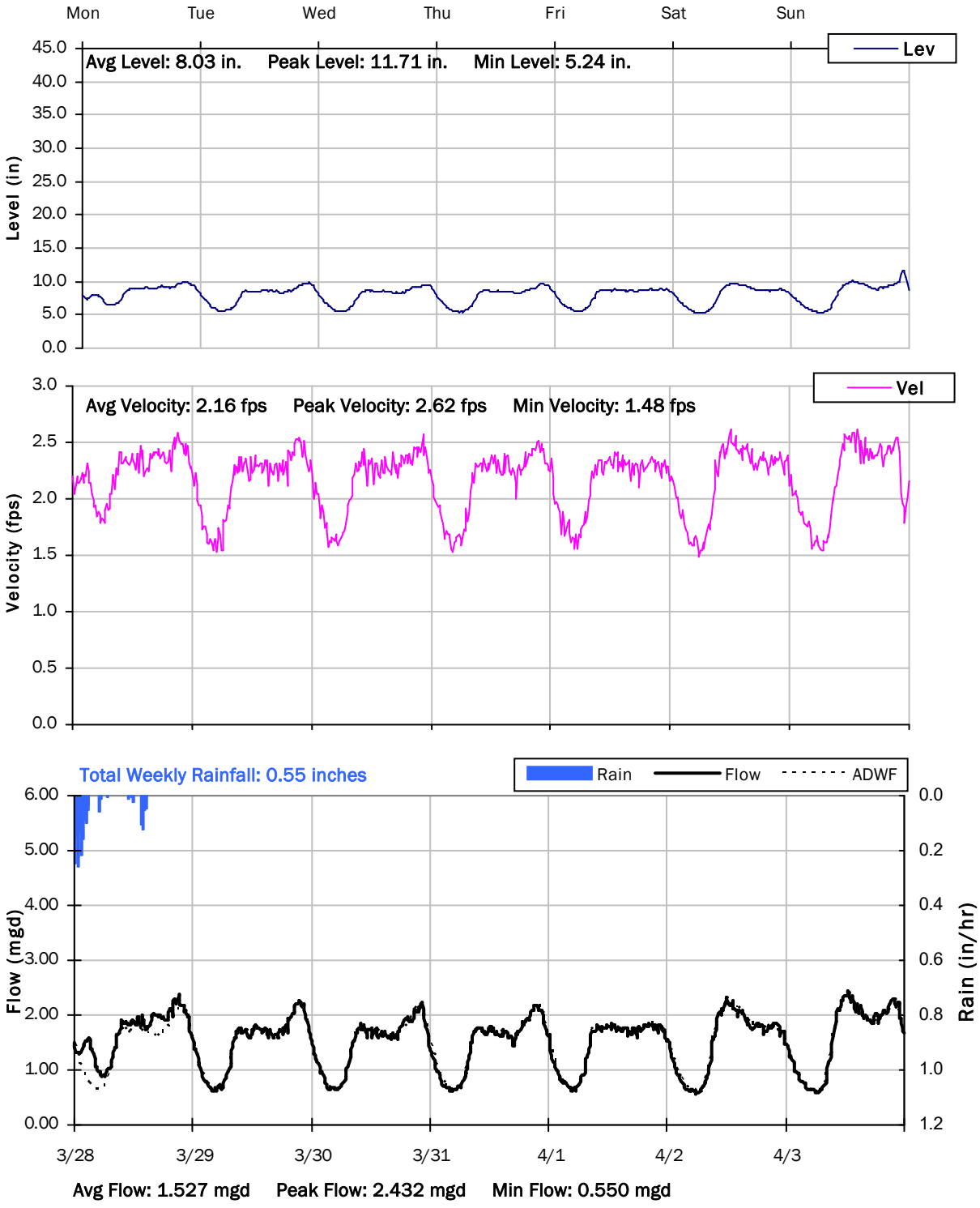
3/21/2022 to 3/28/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

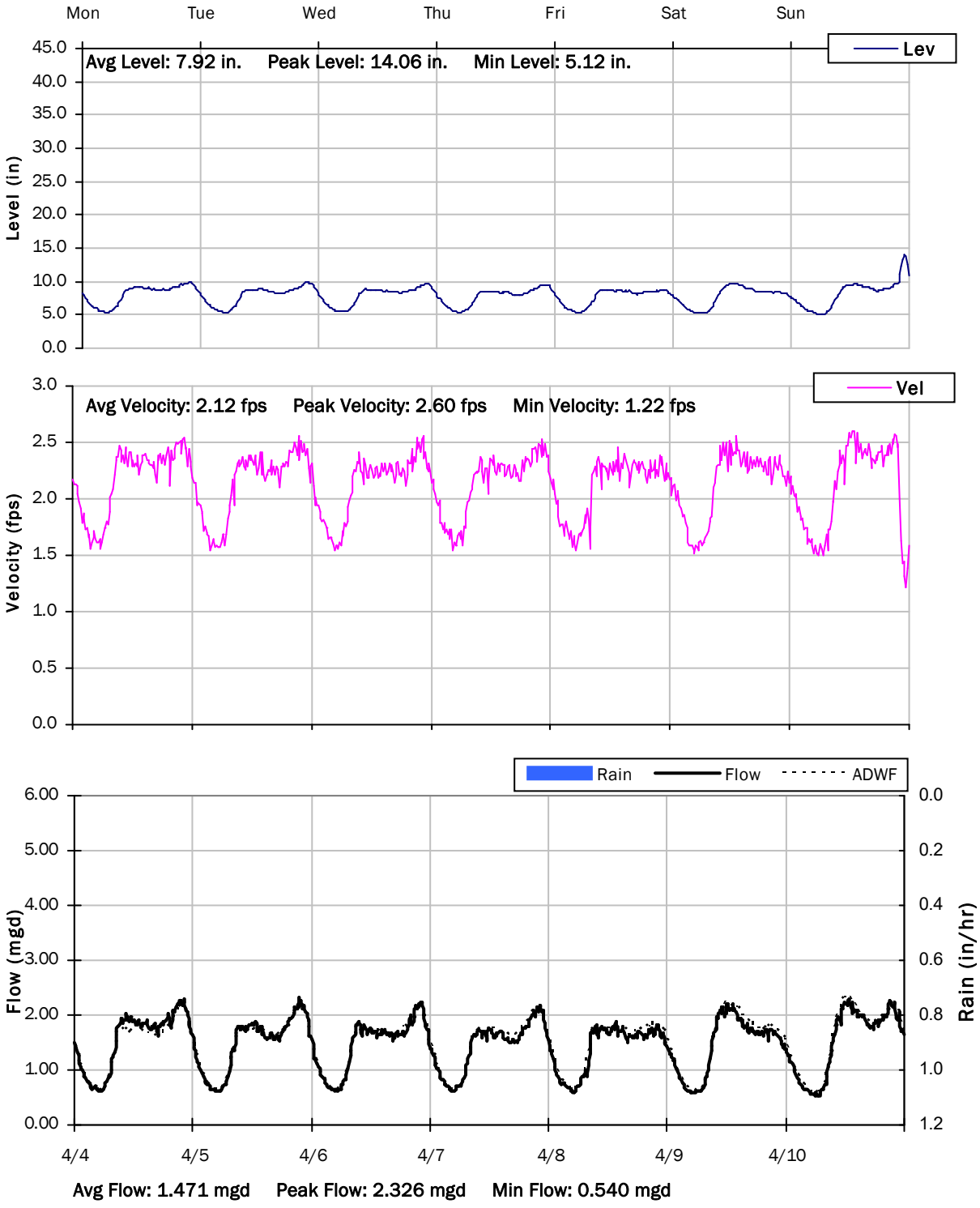
3/28/2022 to 4/4/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

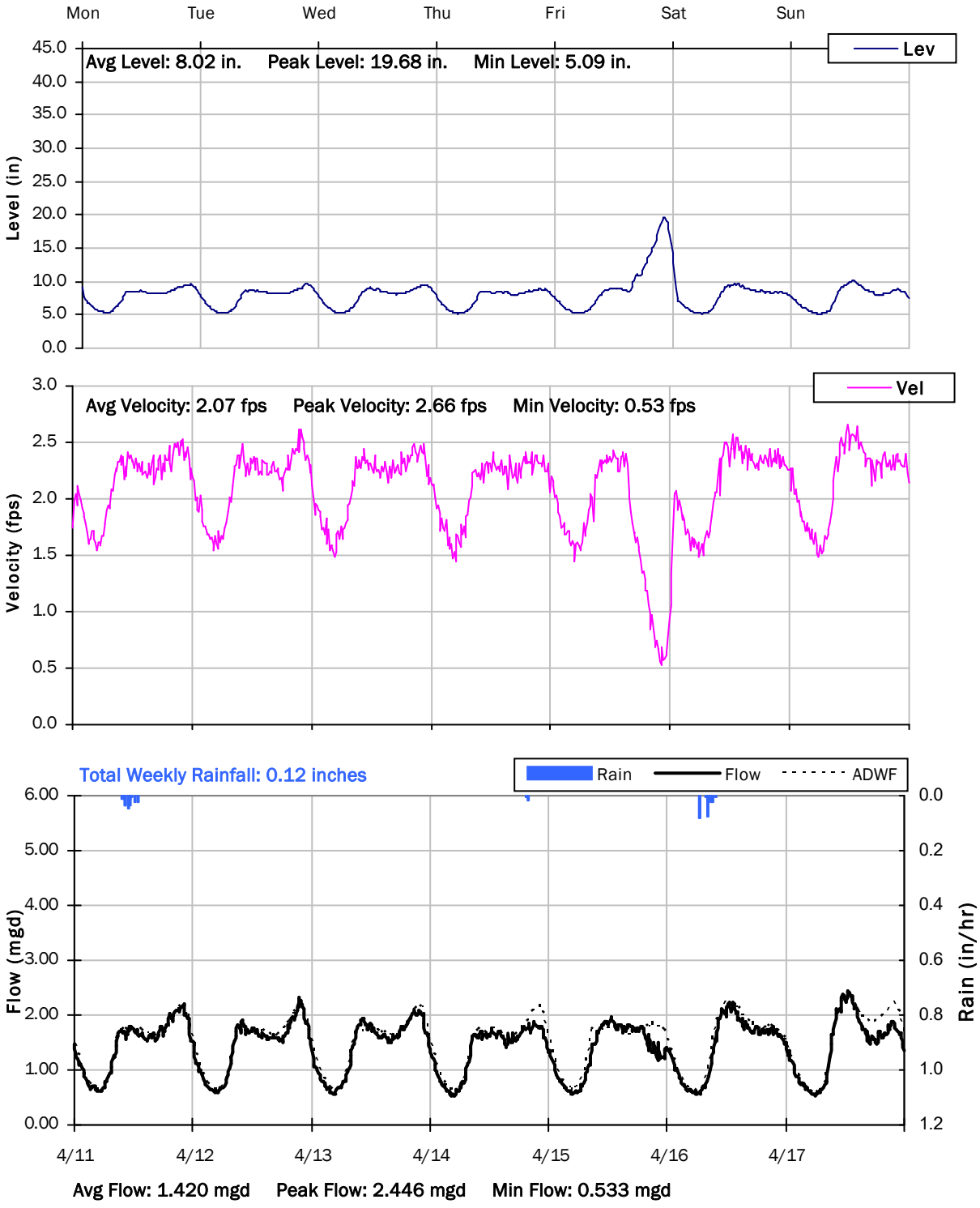
4/4/2022 to 4/11/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

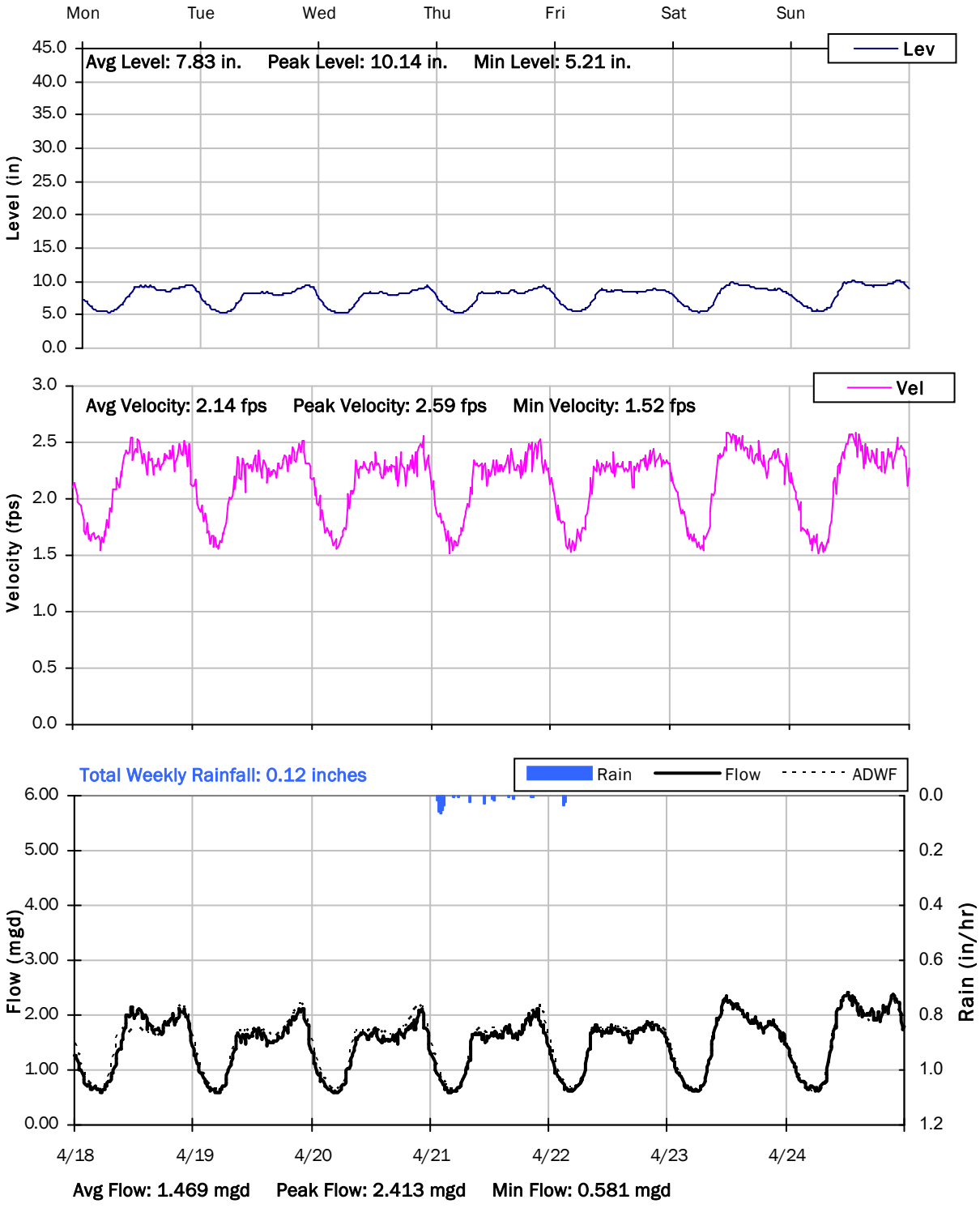
4/11/2022 to 4/18/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

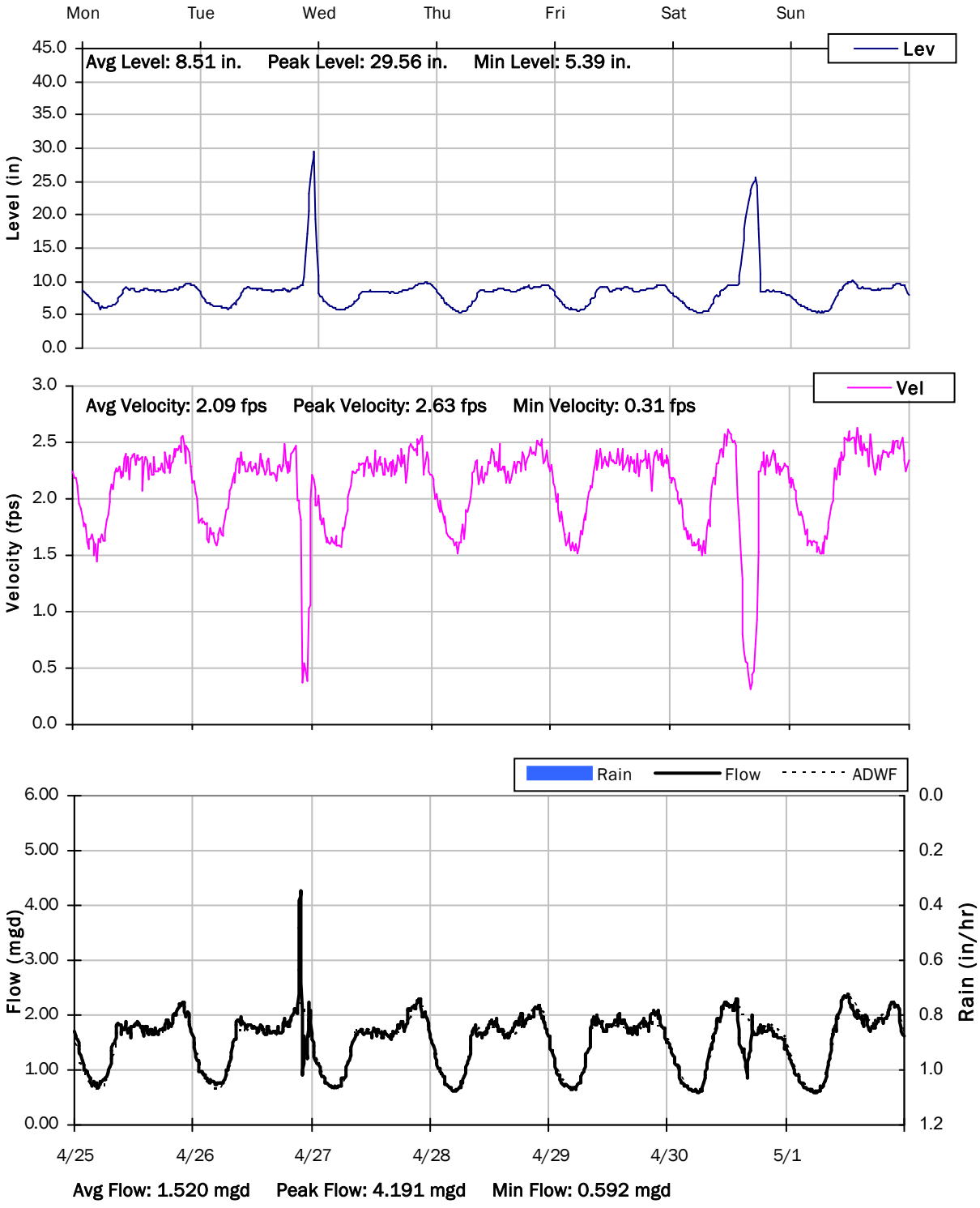
4/18/2022 to 4/25/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

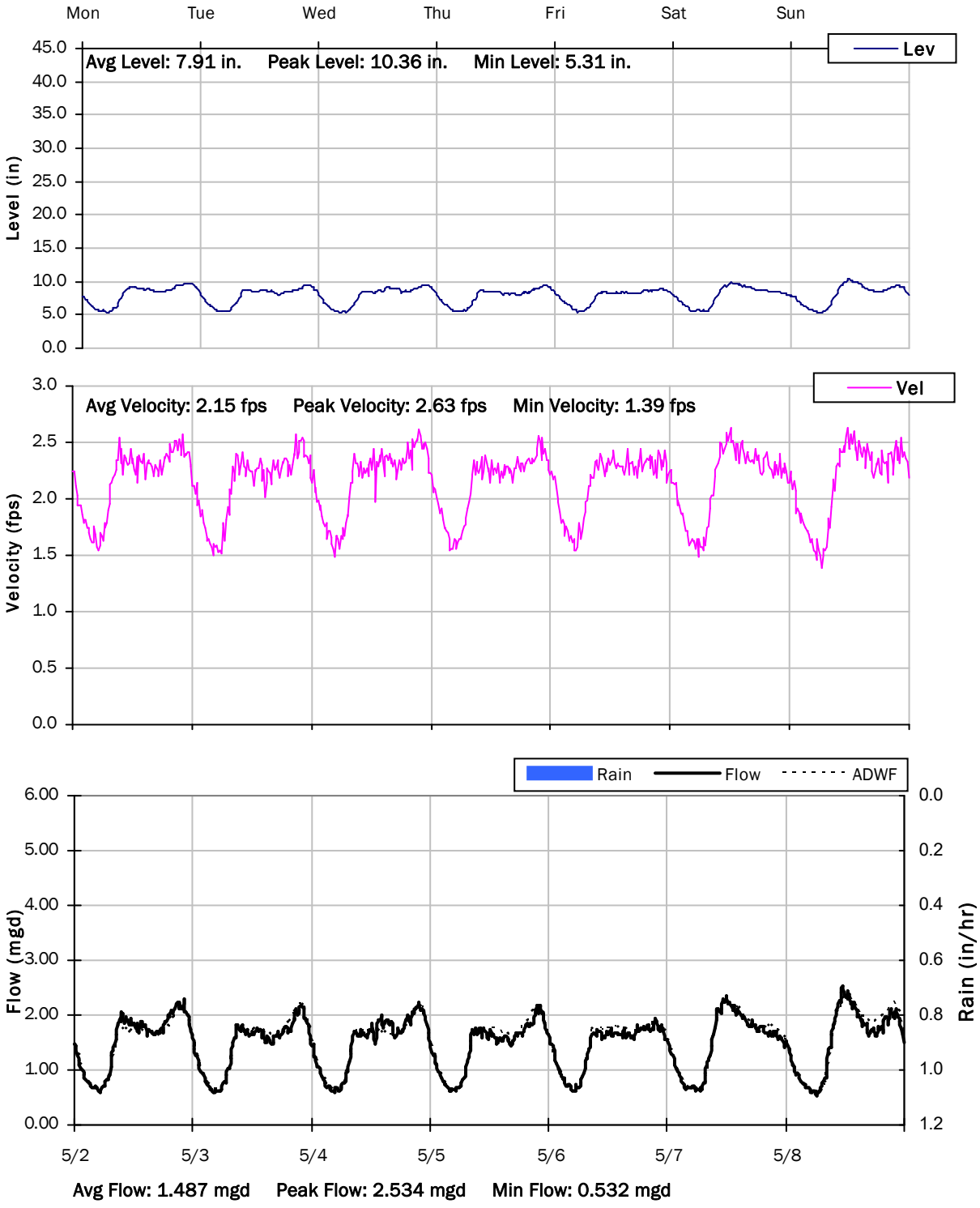
4/25/2022 to 5/2/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

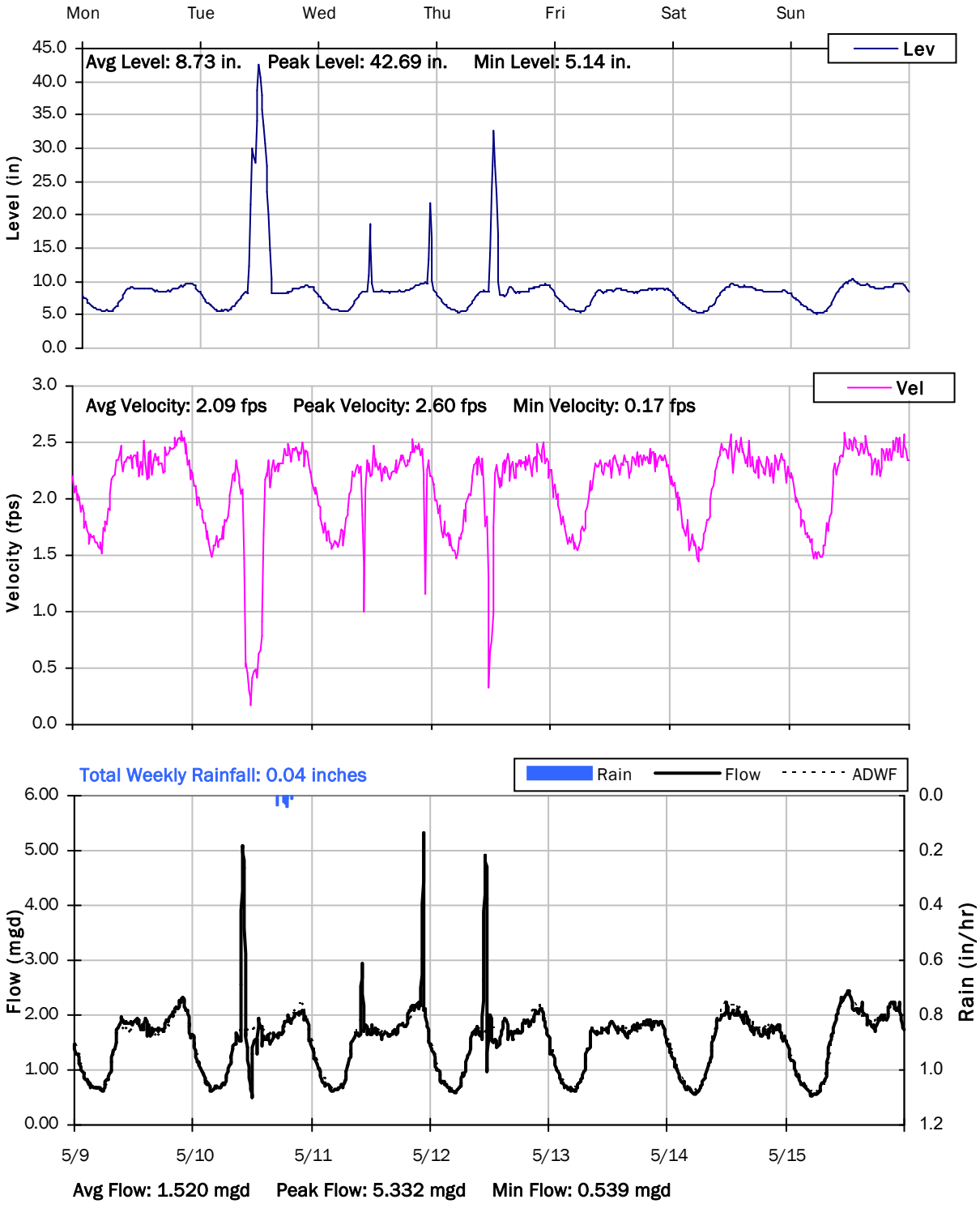
5/2/2022 to 5/9/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

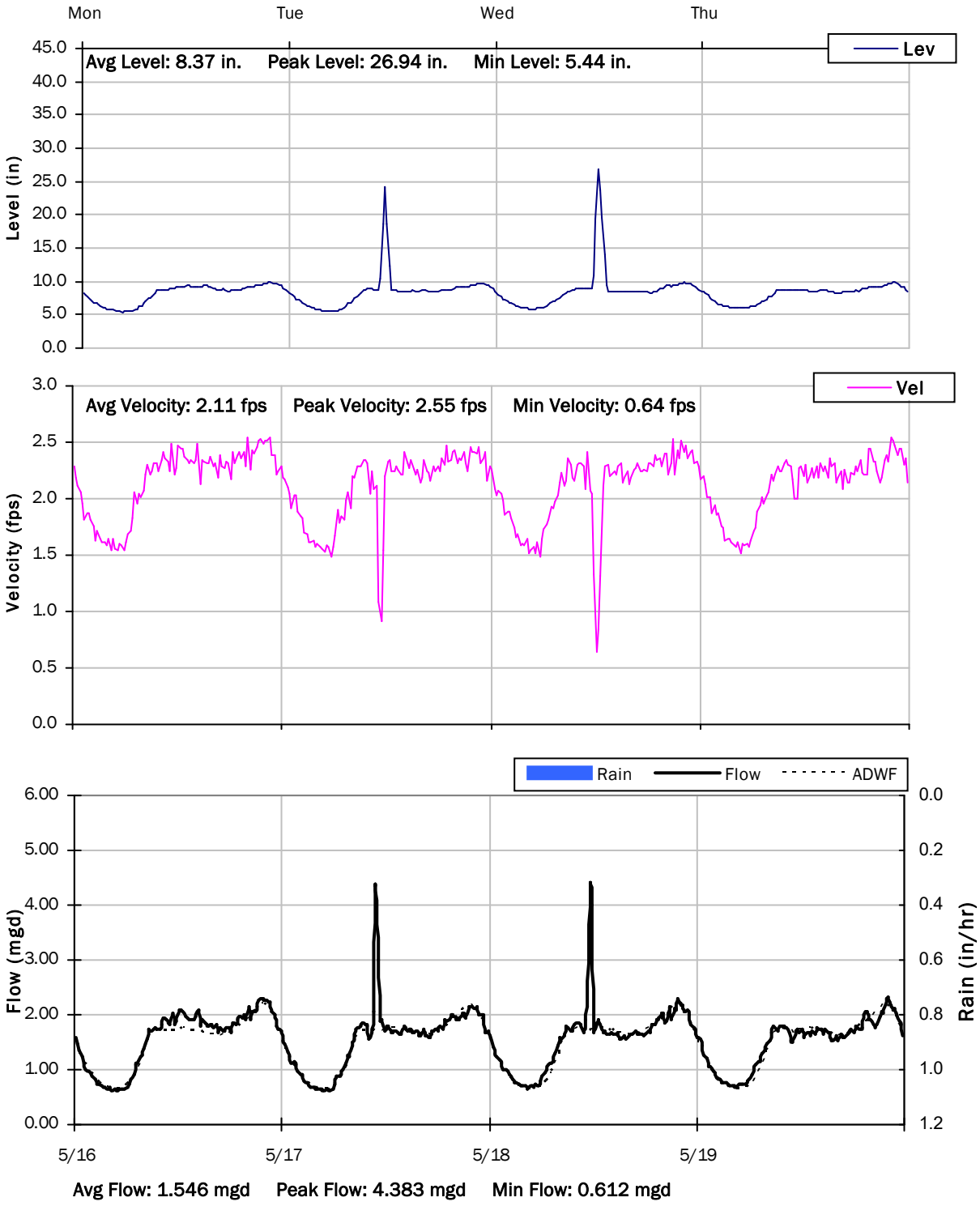
5/9/2022 to 5/16/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 11

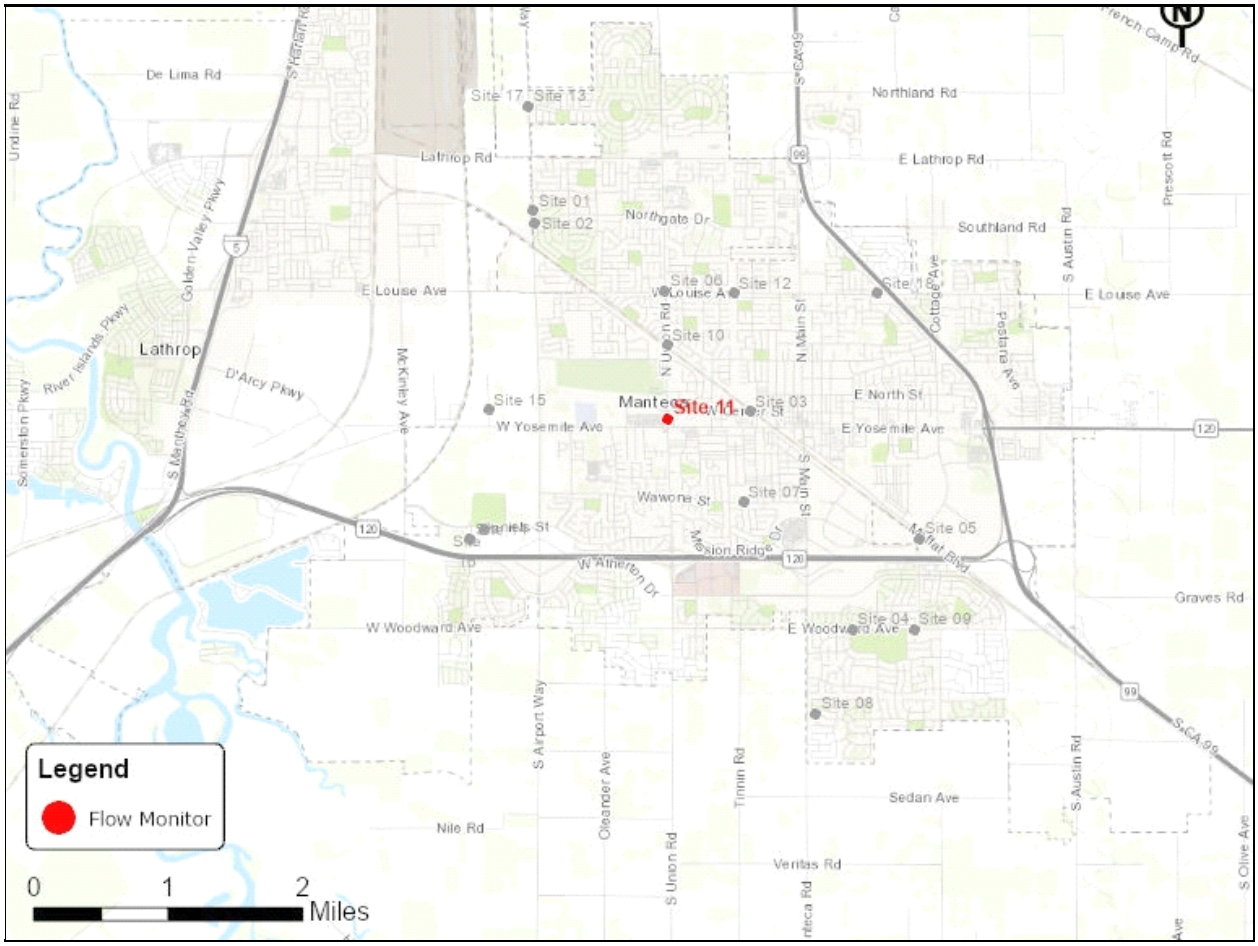
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: N. Union Road North of W. Yosemite Avenue

Data Summary Report



Vicinity Map: Site 11

SITE 11

Additional Site Photos

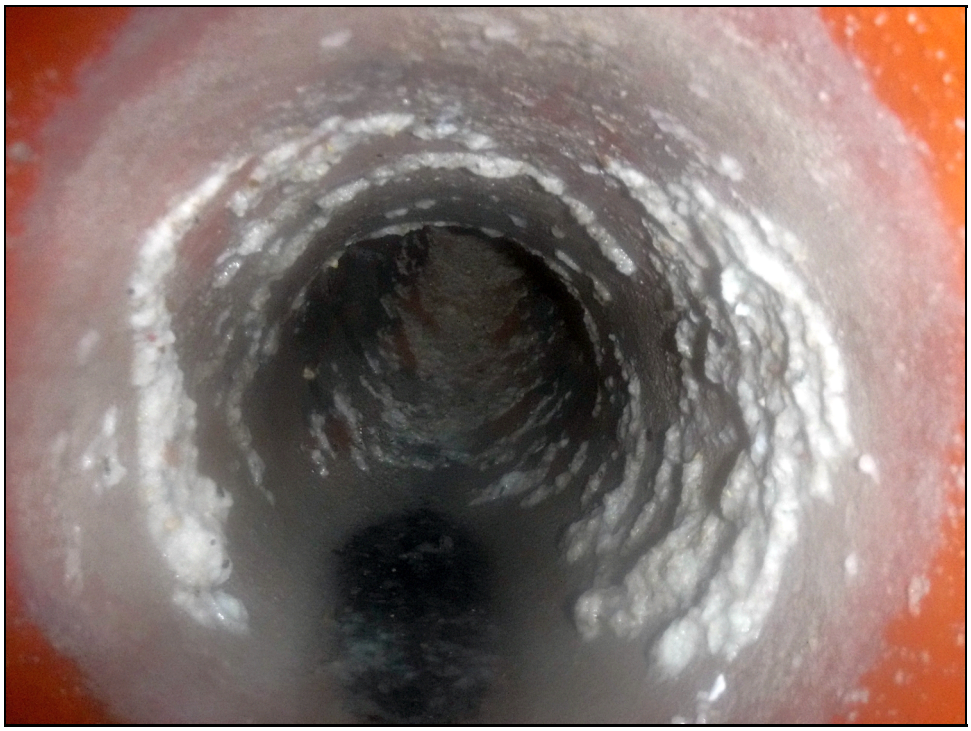
Effluent Pipe

Monitored South Influent Pipe

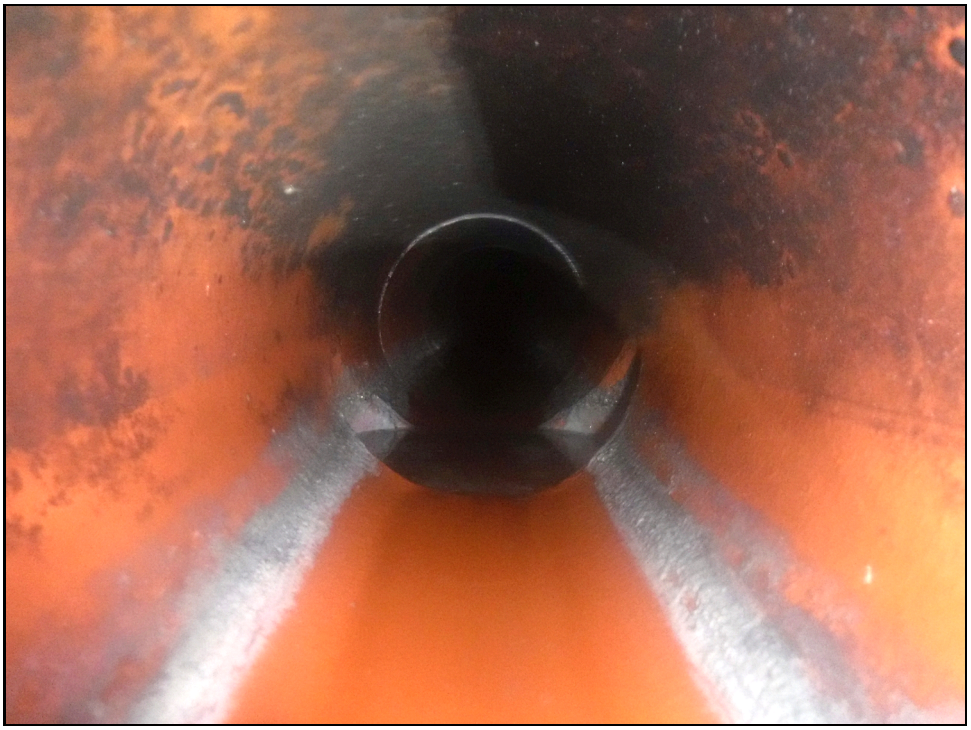
SITE 11

Additional Site Photos

West Influent Pipe (Lower)



West Influent Pipe (Upper)

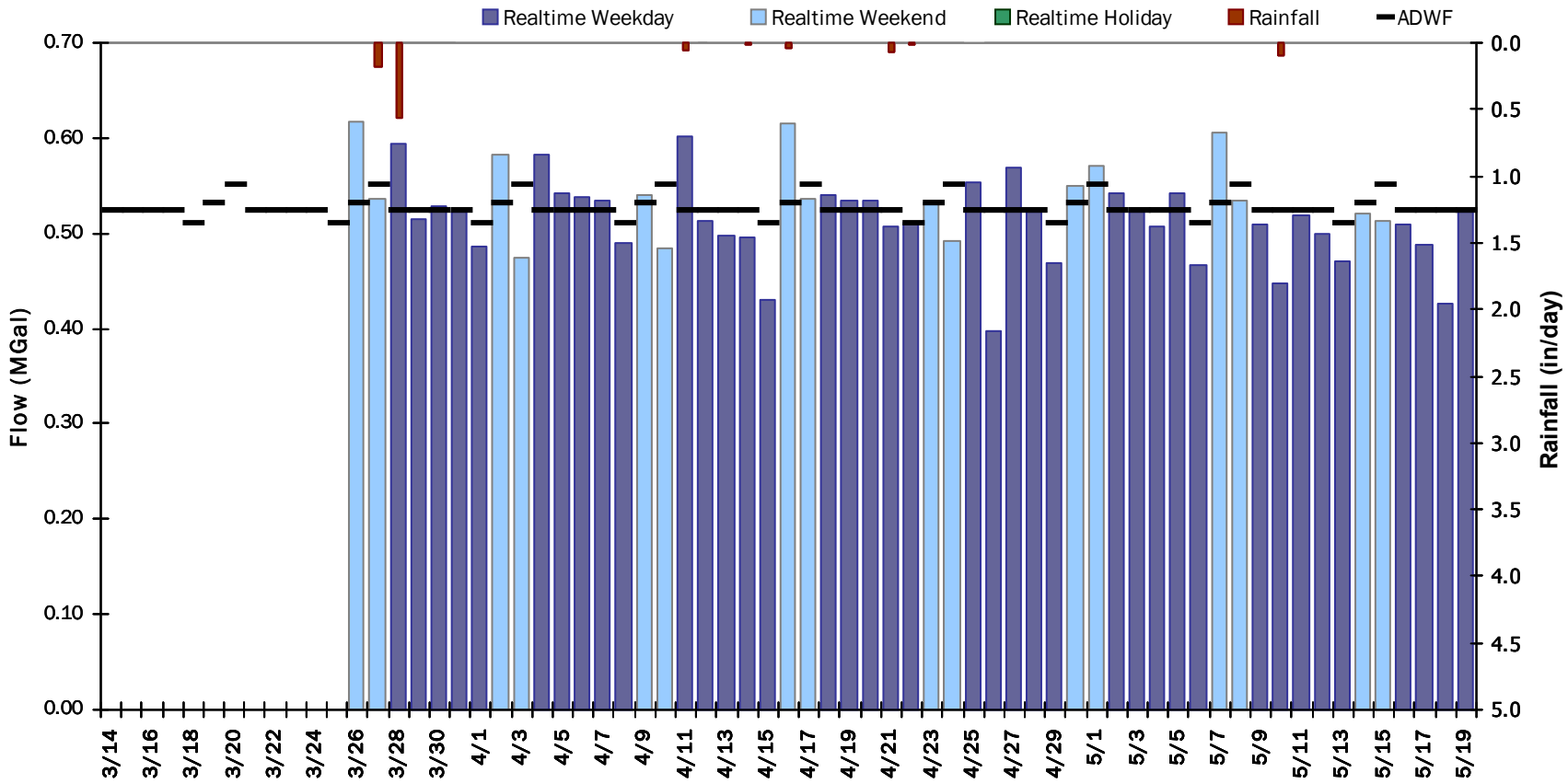


SITE 11

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.518 MGal Peak Daily Flow: 0.618 MGal Min Daily Flow: 0.355 MGal

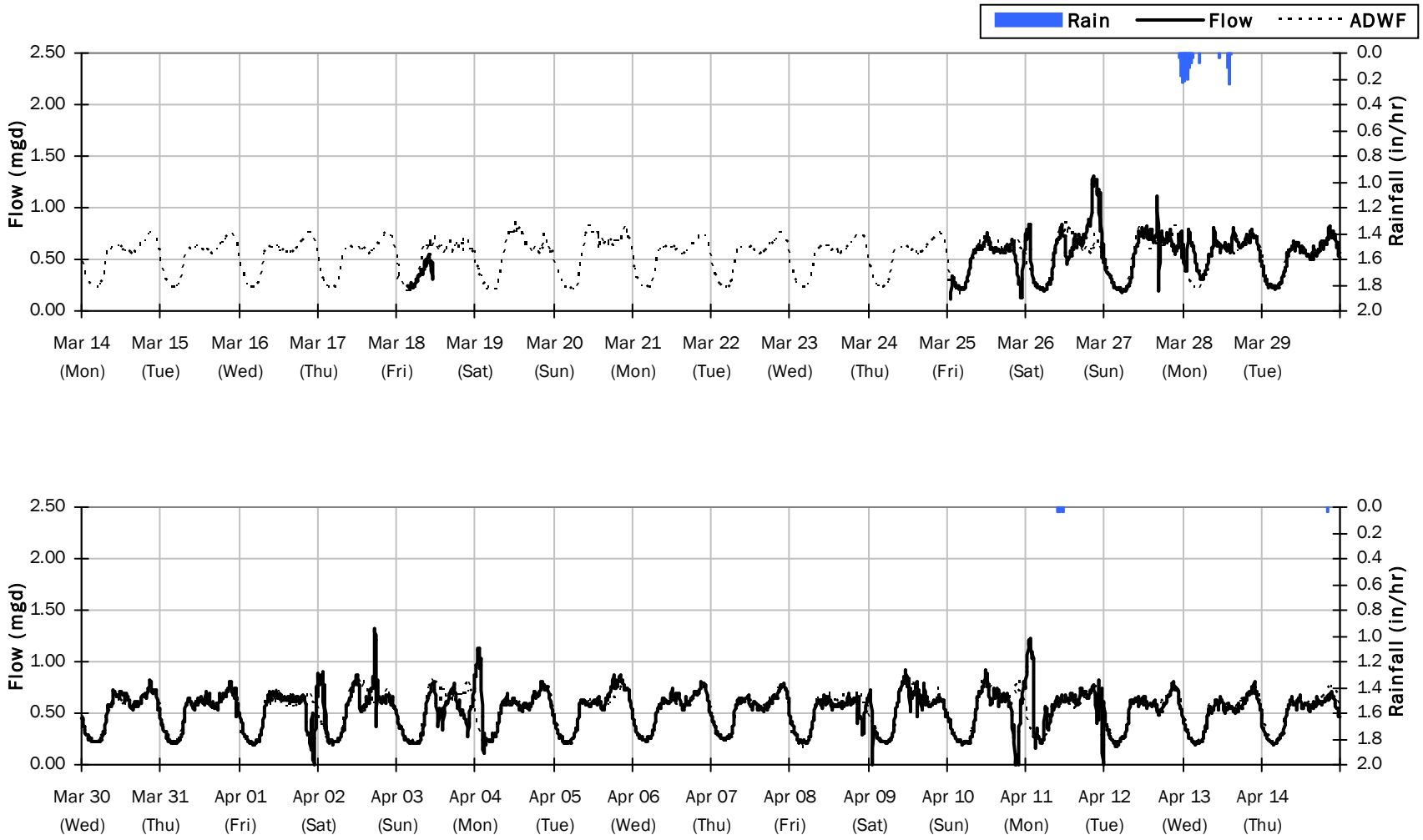
Total Rainfall: 1.04 inches



SITE 11

Flow Summary: 3/14/2022 to 4/14/2022

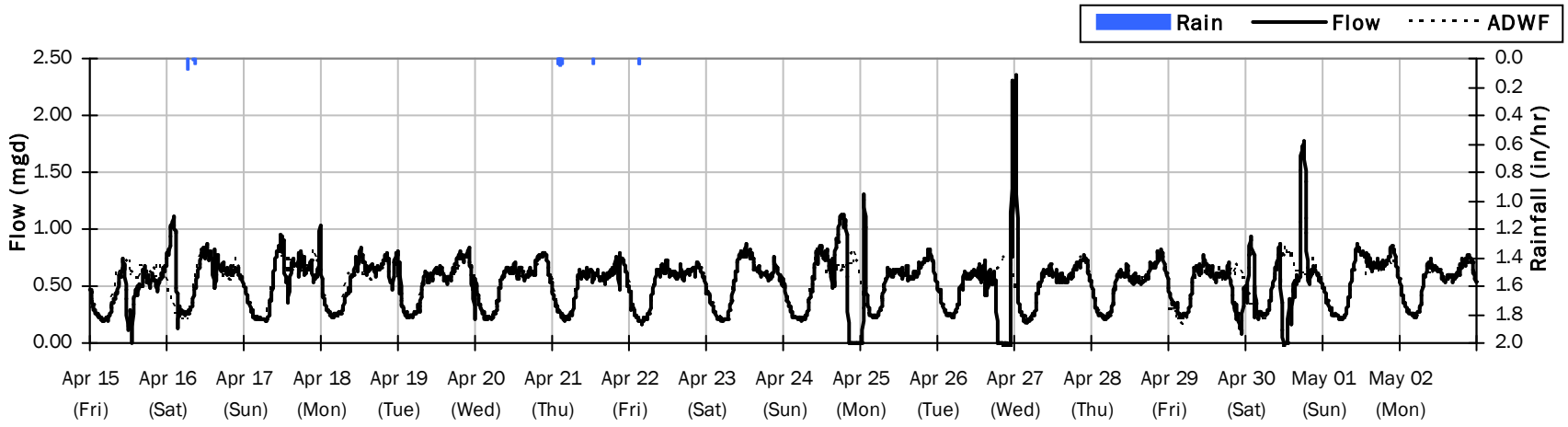
Period Rainfall: 0.82 inches Period Avg Flow: 0.529 mgd Period Peak Flow: 1.315 mgd Period Min Flow: 0.000 mgd

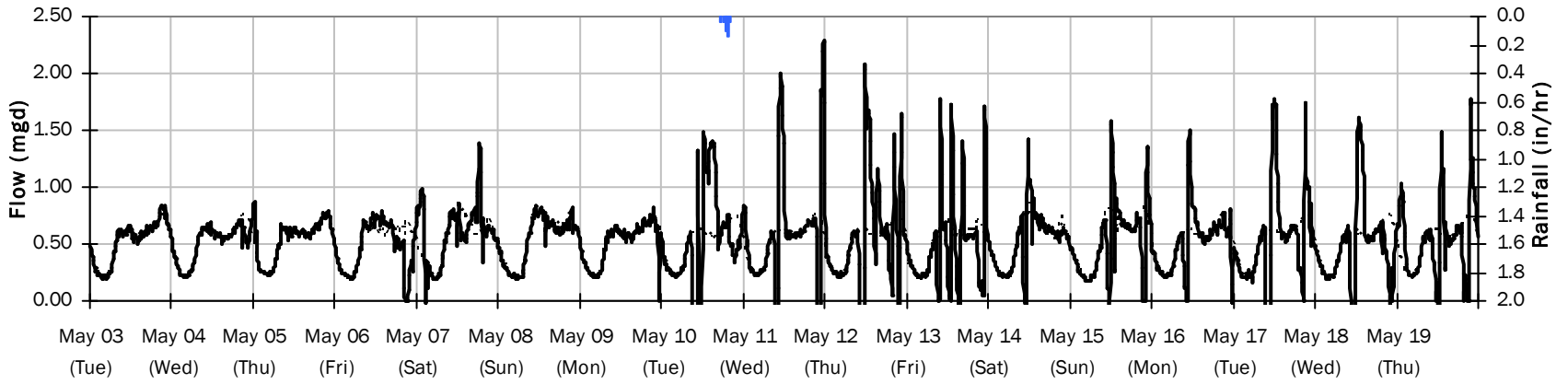


SITE 11

Flow Summary: 4/15/2022 to 5/19/2022

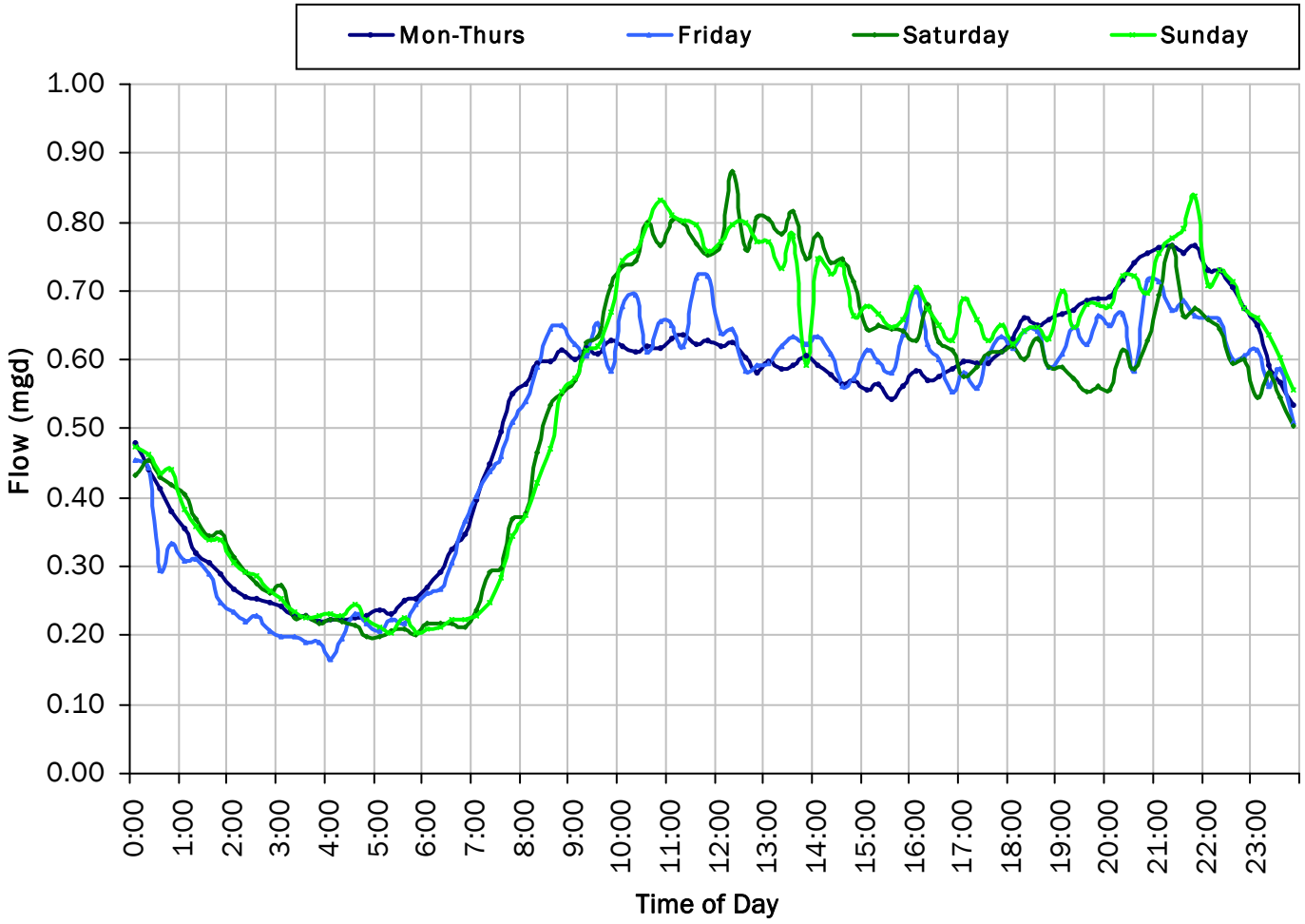
Period Rainfall: 0.22 inches Period Avg Flow: 0.515 mgd Period Peak Flow: 2.333 mgd Period Min Flow: -1.936 mgd





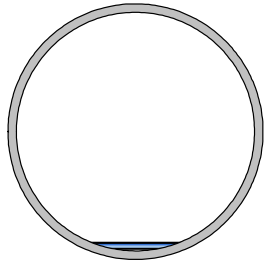
SITE 11

Average Dry Weather Flow Hydrographs



ADWF:

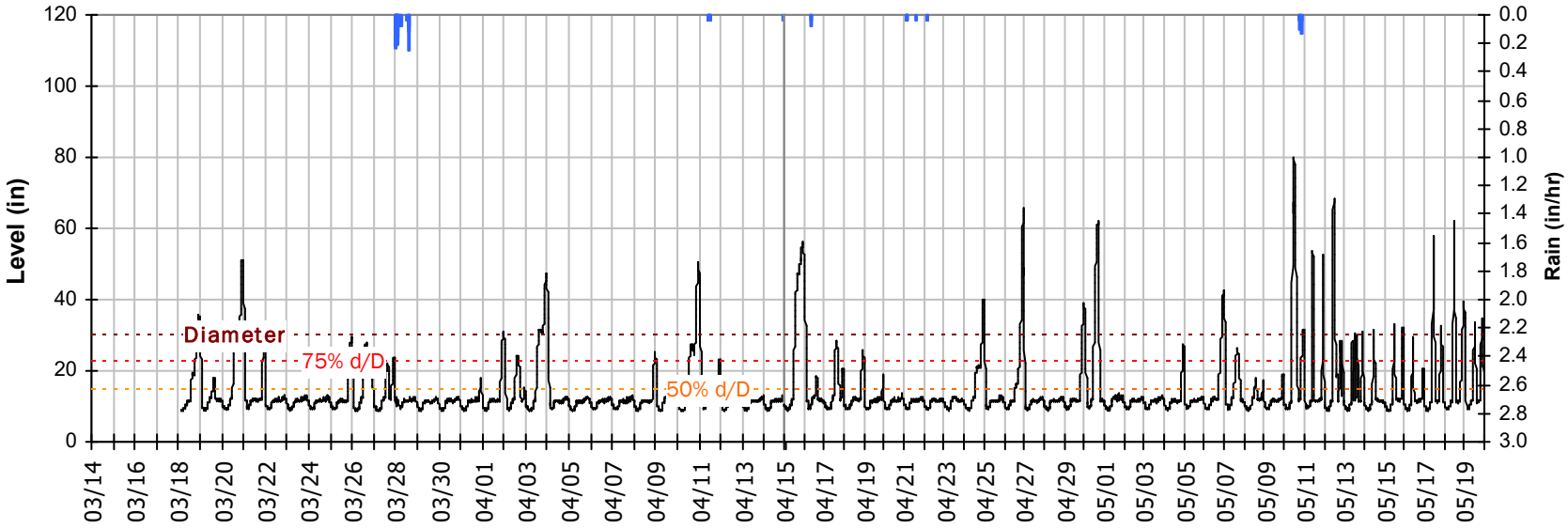
0.527 *mgd*

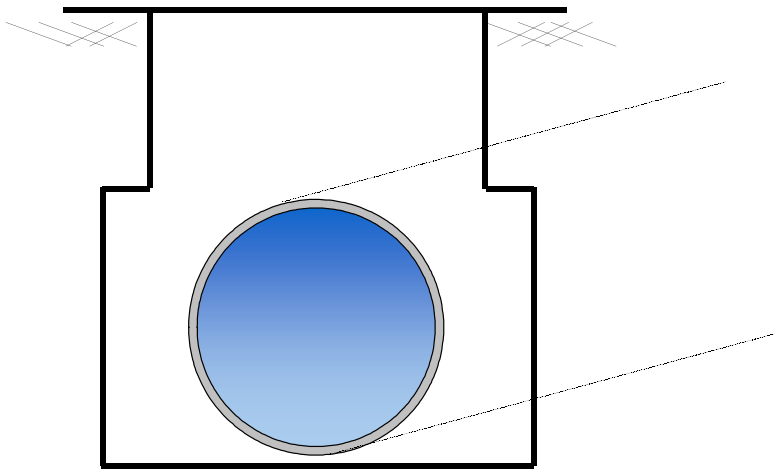


SITE 11

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



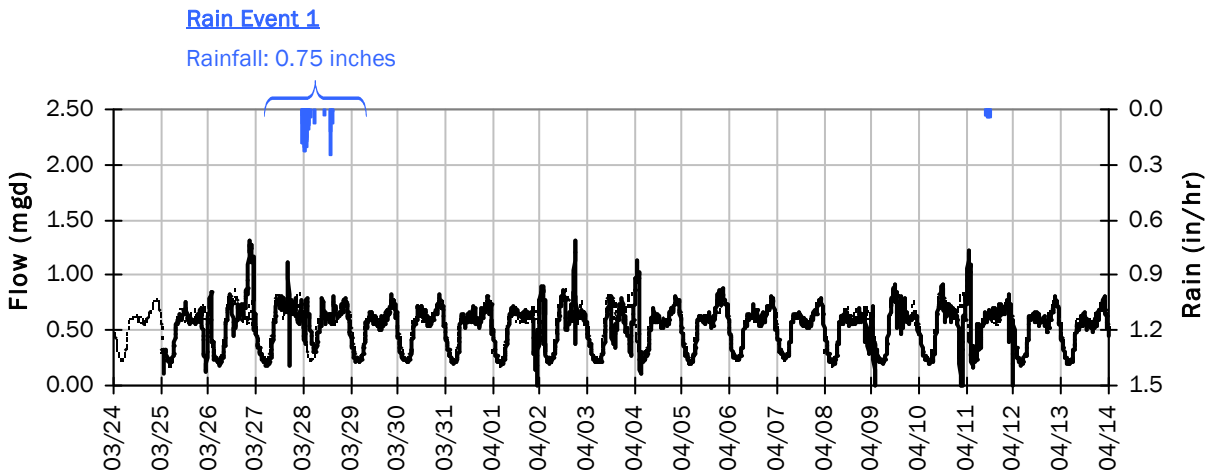


Pipe Diameter:	30	*inches*
Peak Measured Level:	80.1	*inches*
Peak d/D Ratio:	2.67	

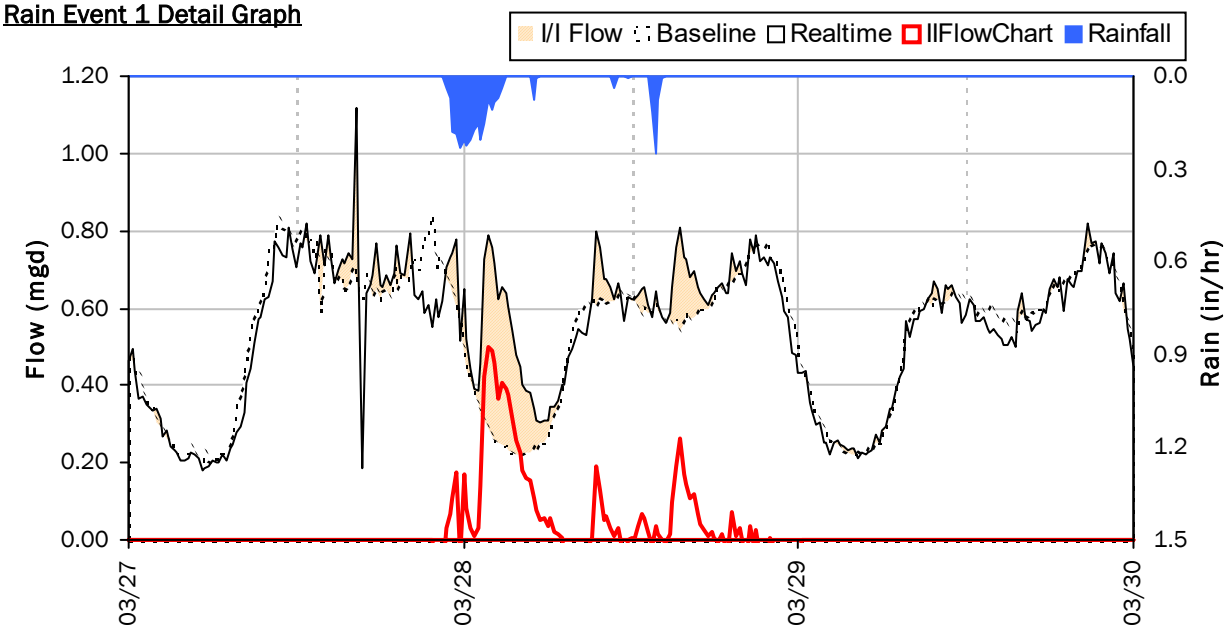
Surcharged 50.1 inches over crown

SITE 11
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



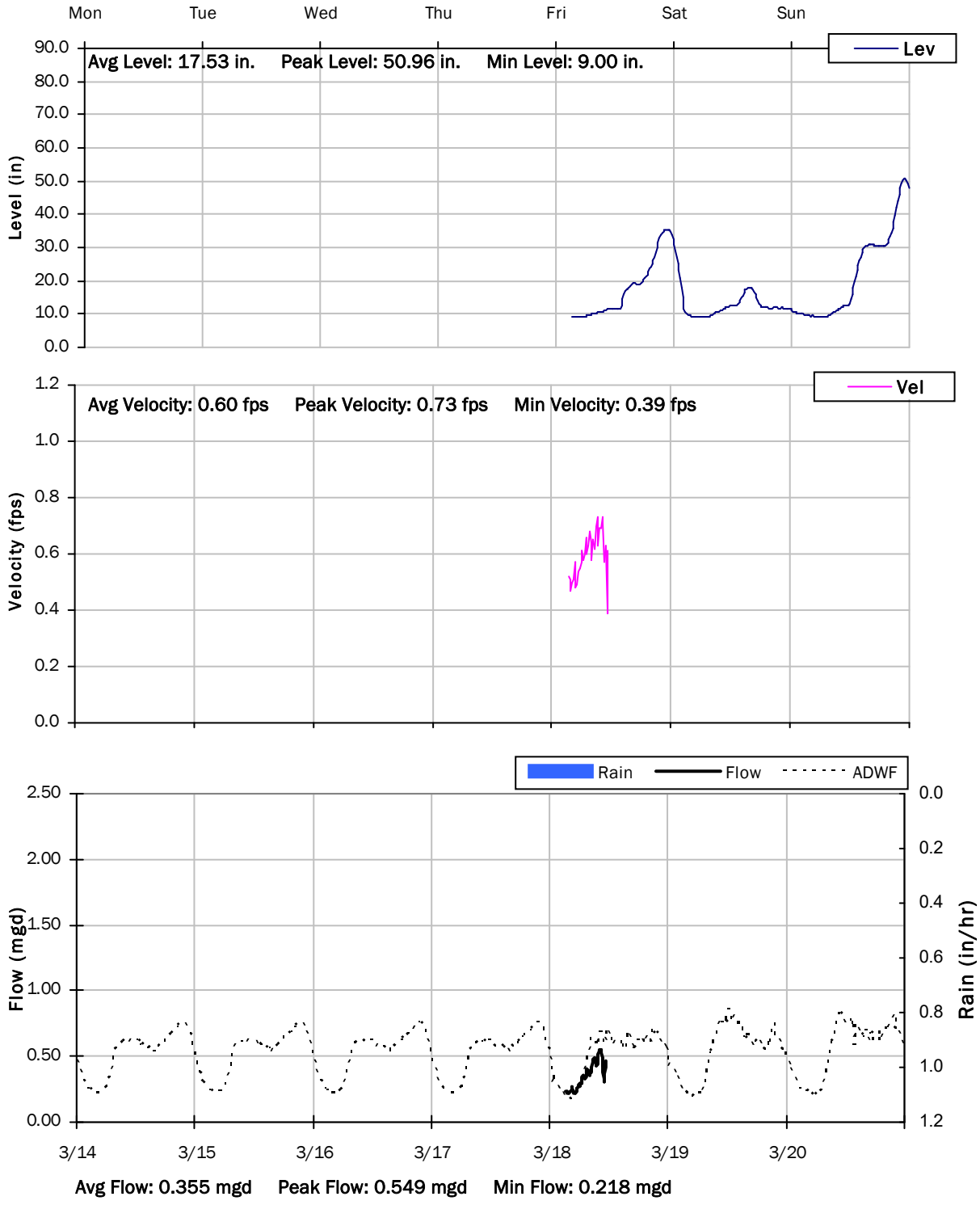
Storm Event I/I Analysis (Rain = 0.75 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.808 *mgd*	**Peak I/I Rate:**	0.501 *mgd*
PF:	1.53	**Total I/I:**	71,000 *gallons*
Peak Level:	23.87 *in*		
d/D Ratio:	0.80		

SITE 11

Weekly Level, Velocity and Flow Hydrographs

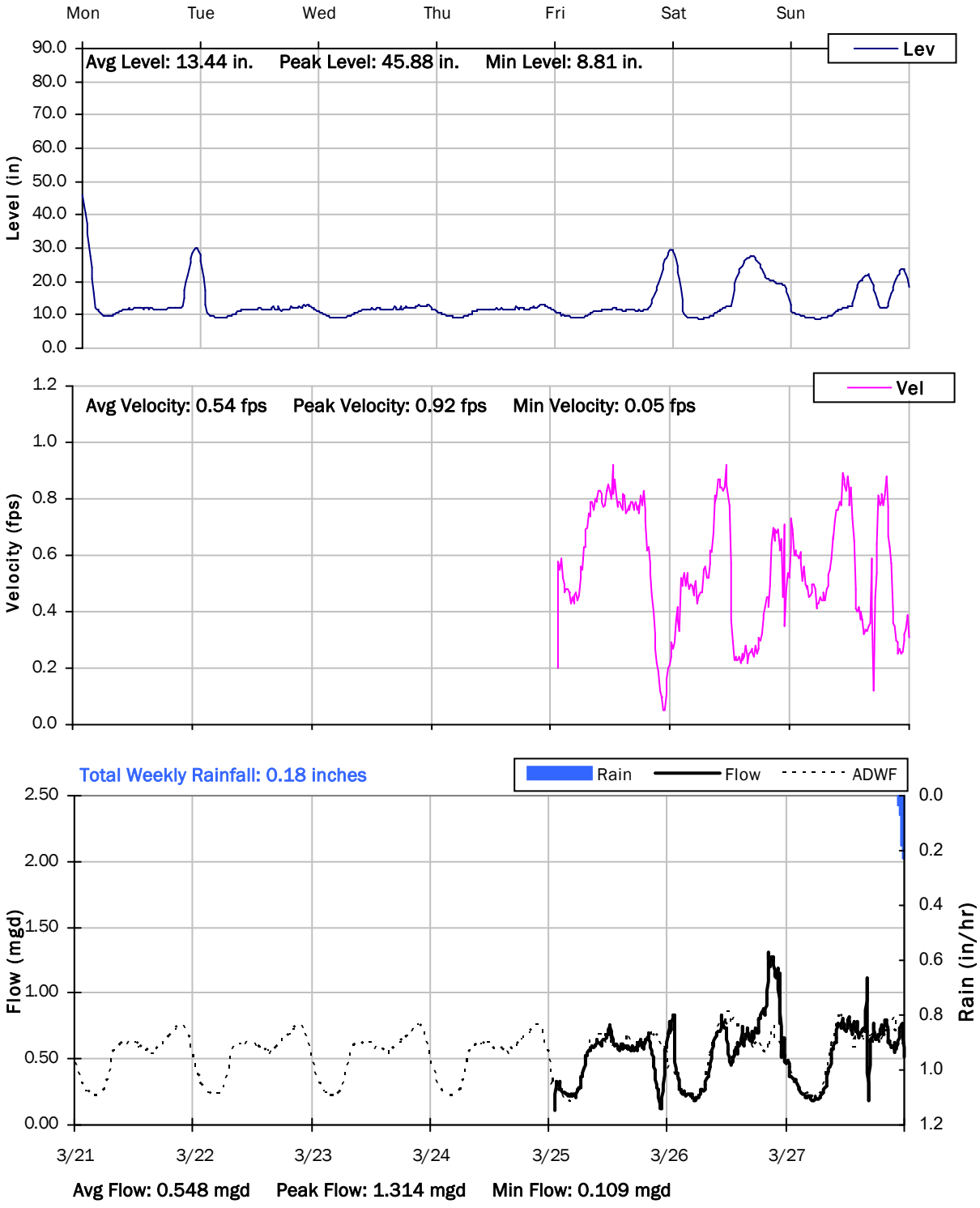
3/14/2022 to 3/21/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

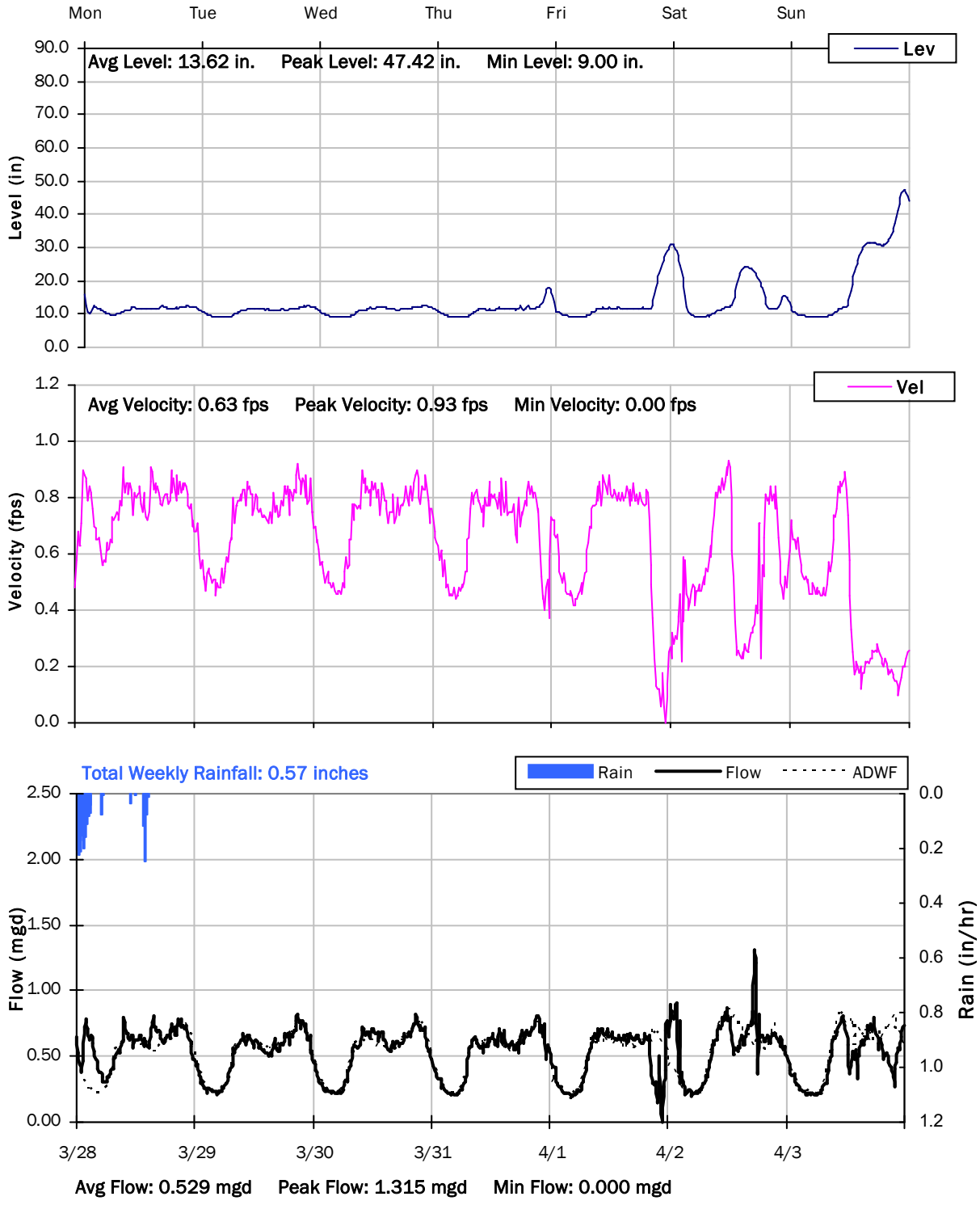
3/21/2022 to 3/28/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

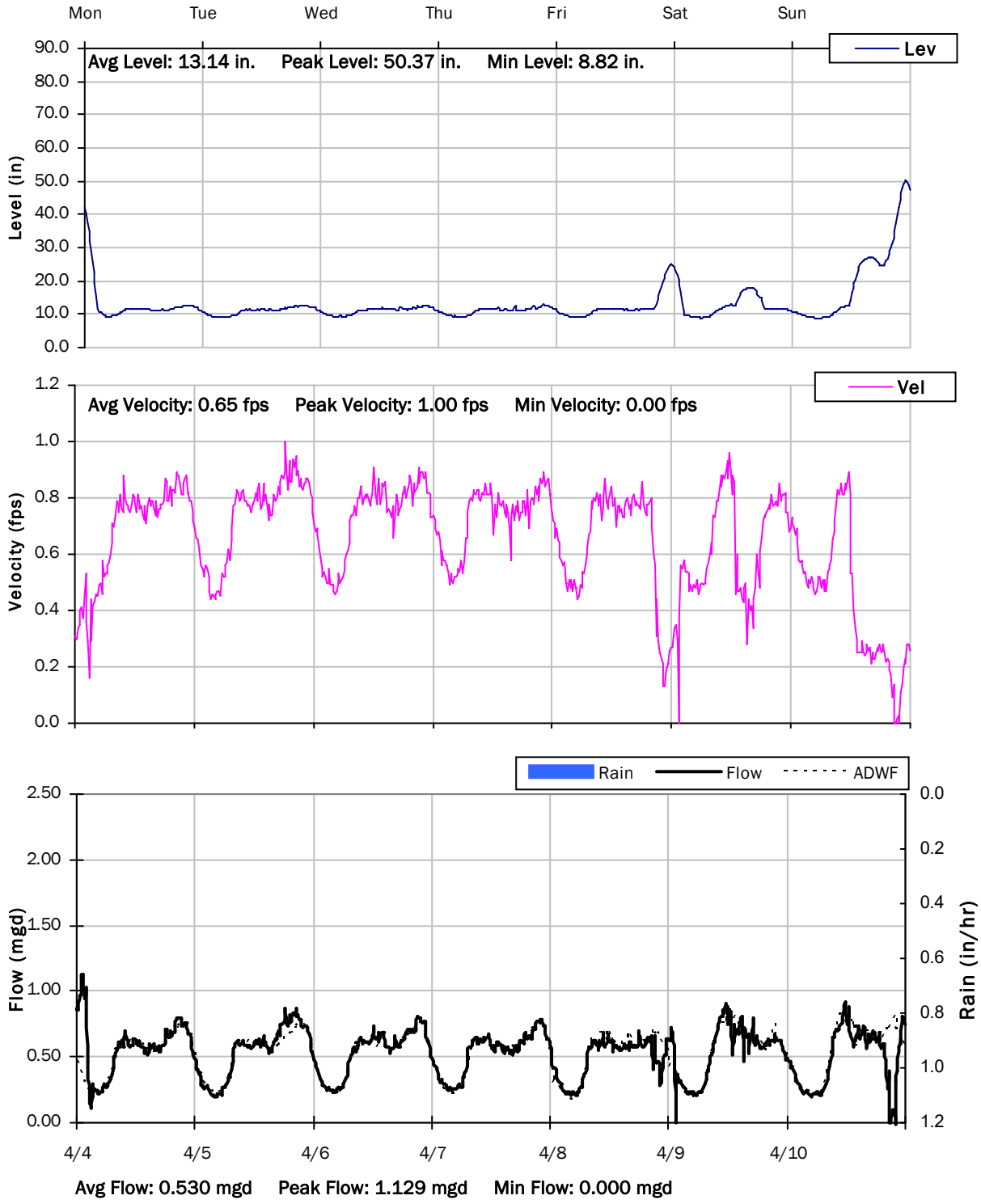
3/28/2022 to 4/4/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

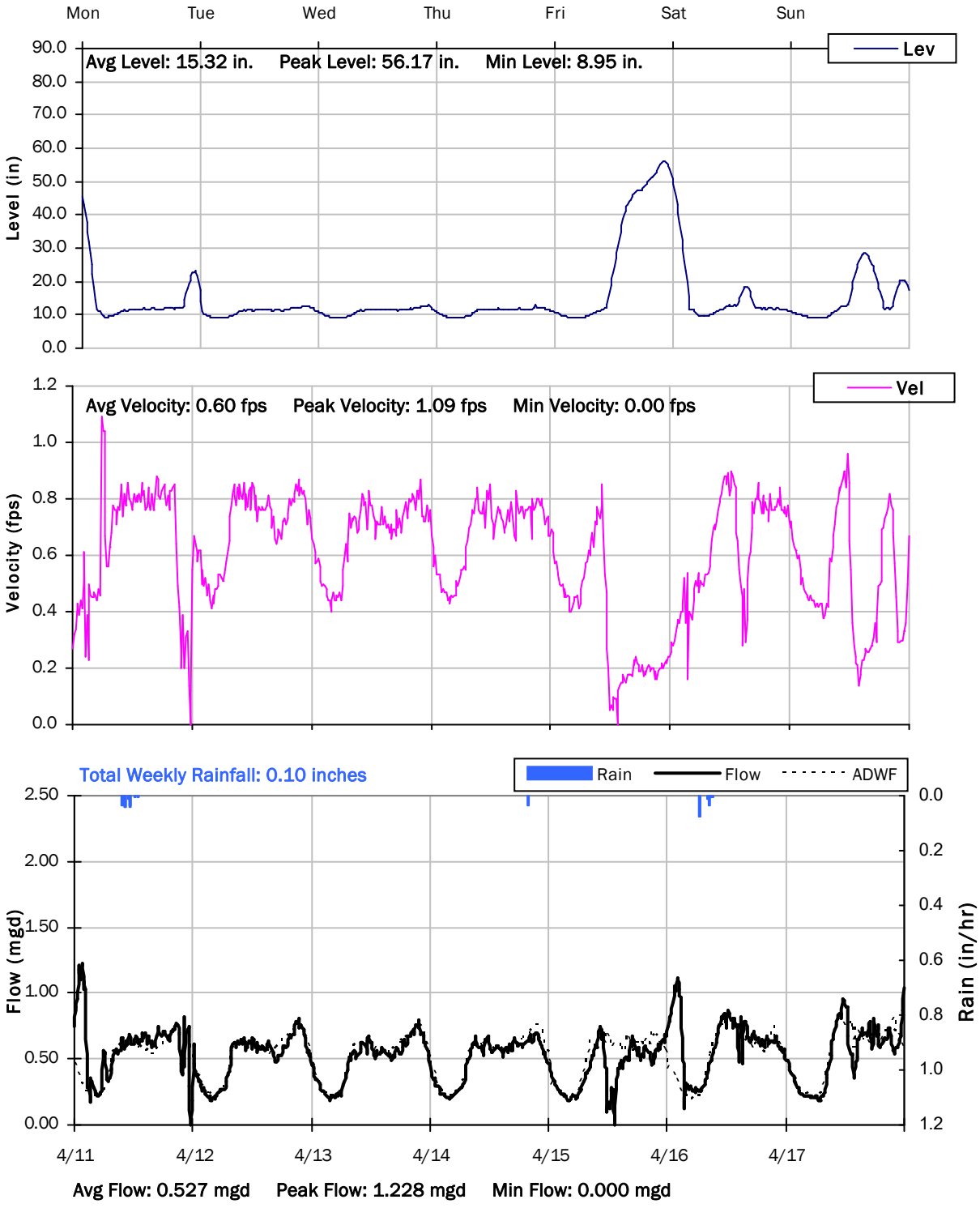
4/4/2022 to 4/11/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

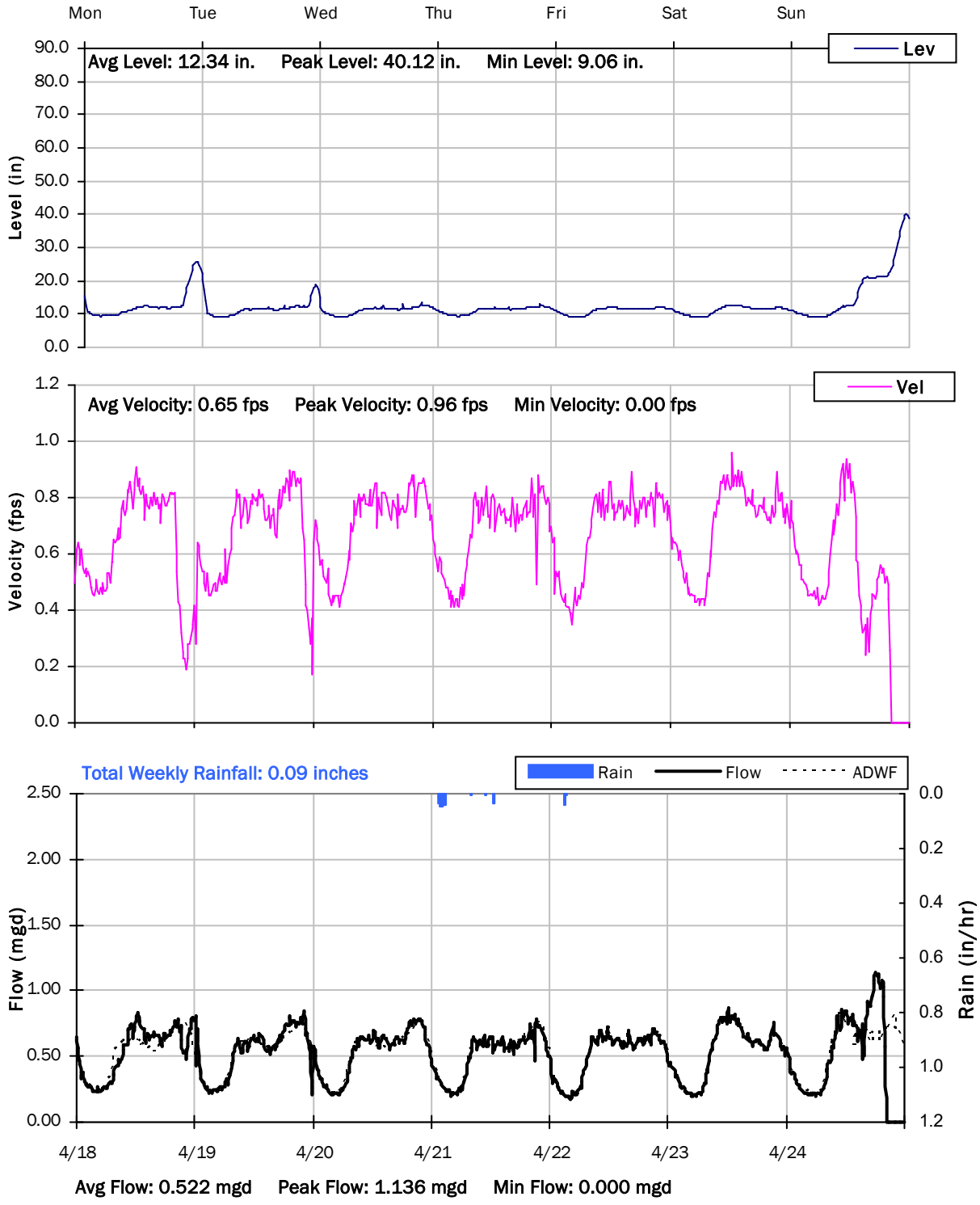
4/11/2022 to 4/18/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

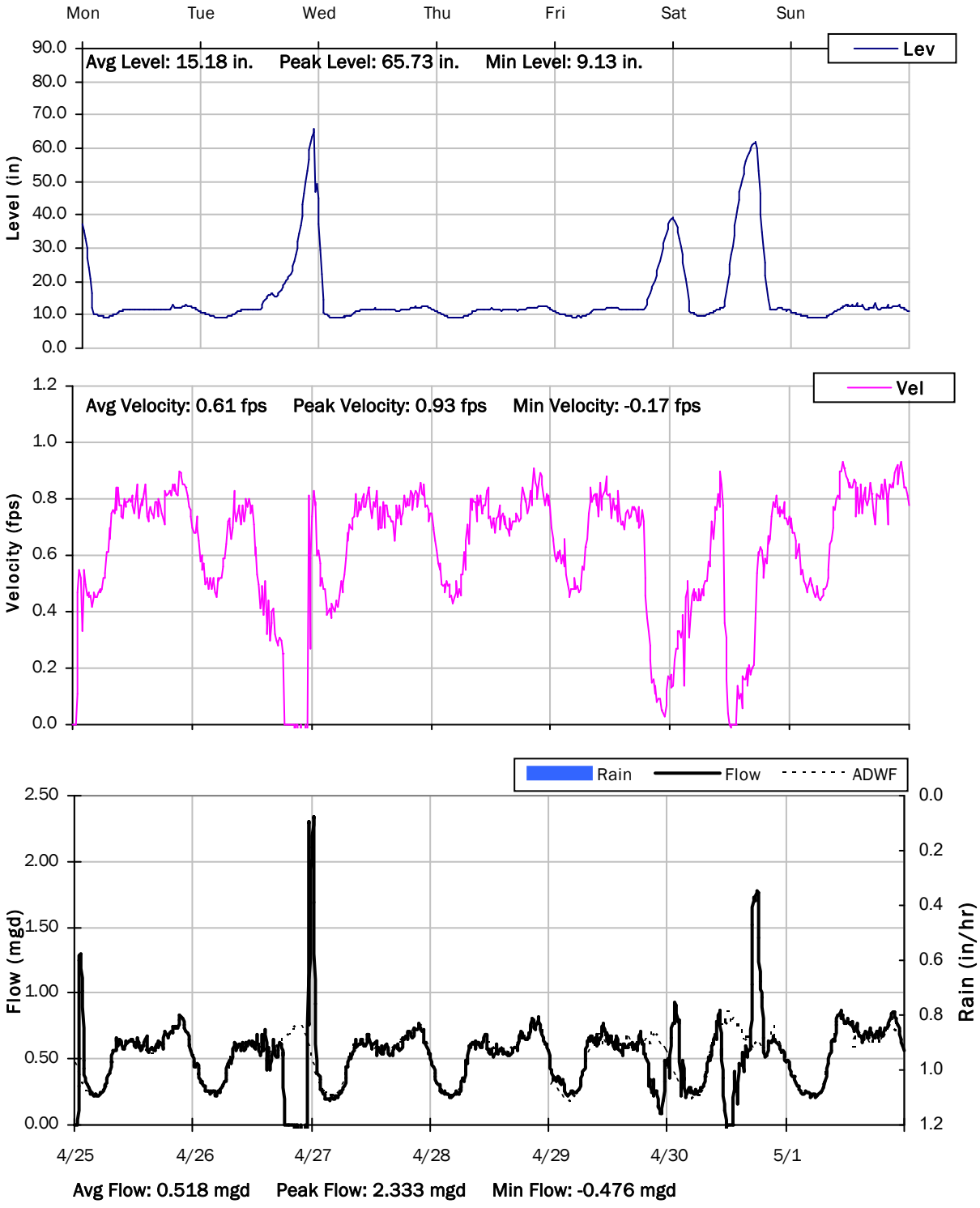
4/18/2022 to 4/25/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

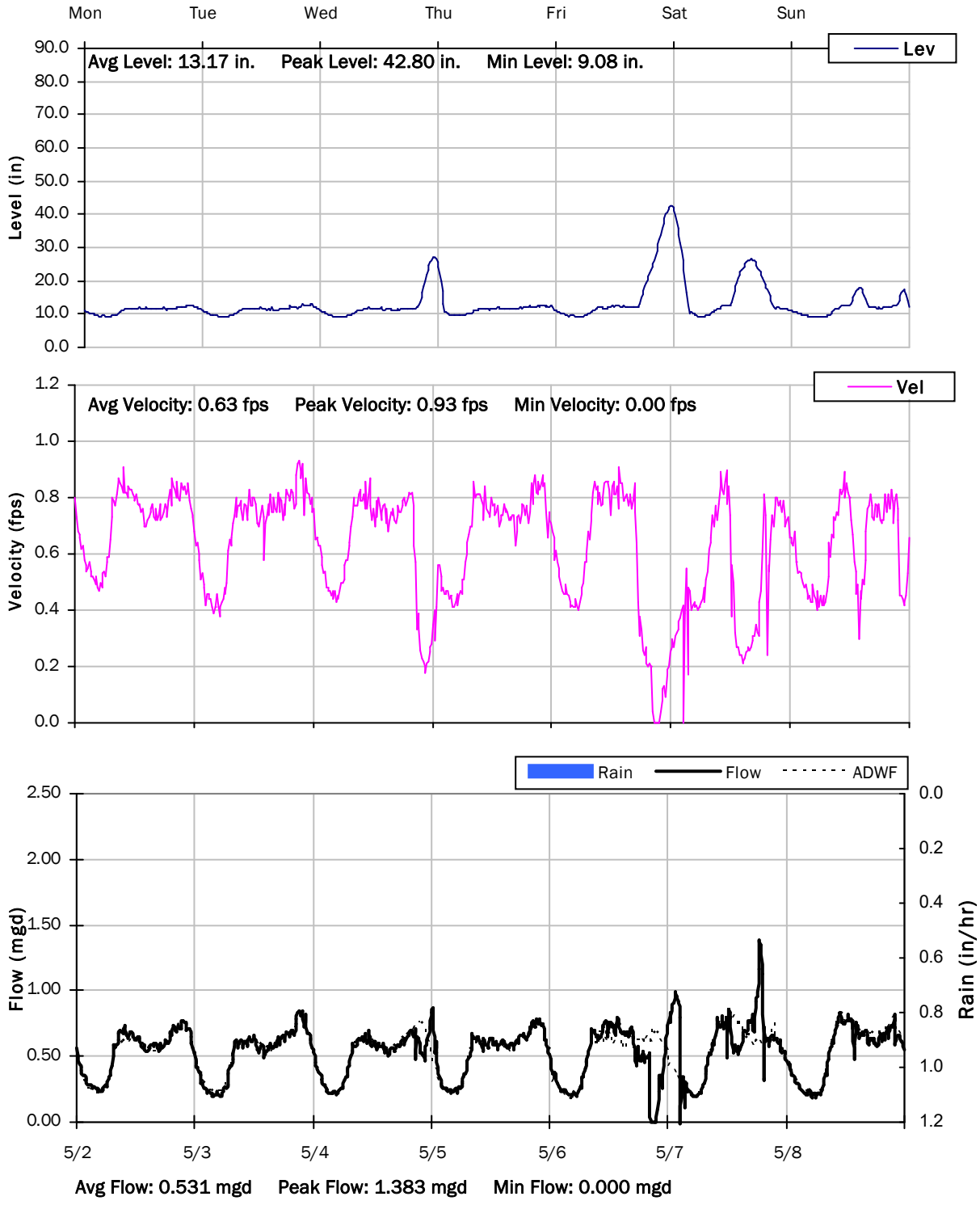
4/25/2022 to 5/2/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

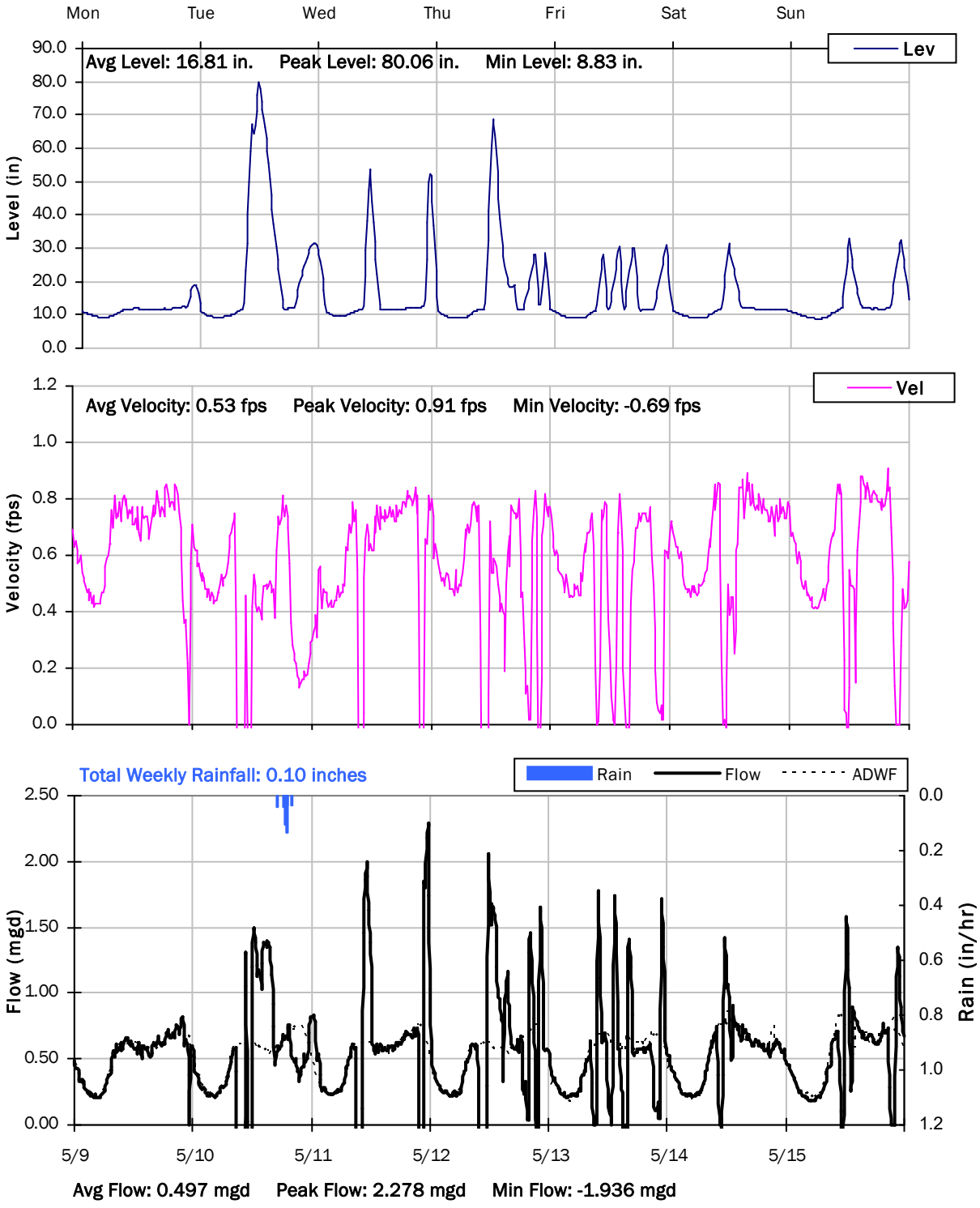
5/2/2022 to 5/9/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

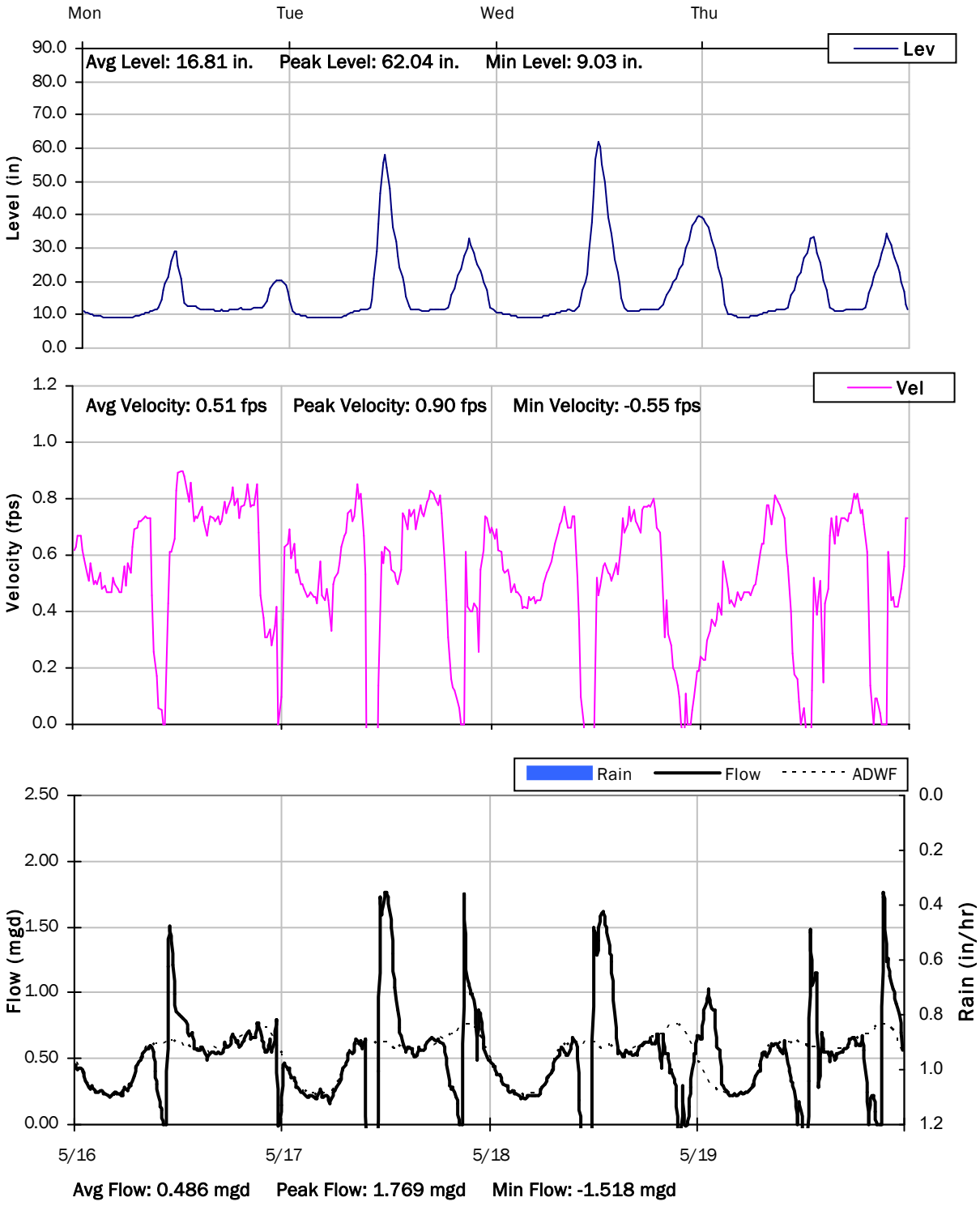
5/9/2022 to 5/16/2022



SITE 11

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 12

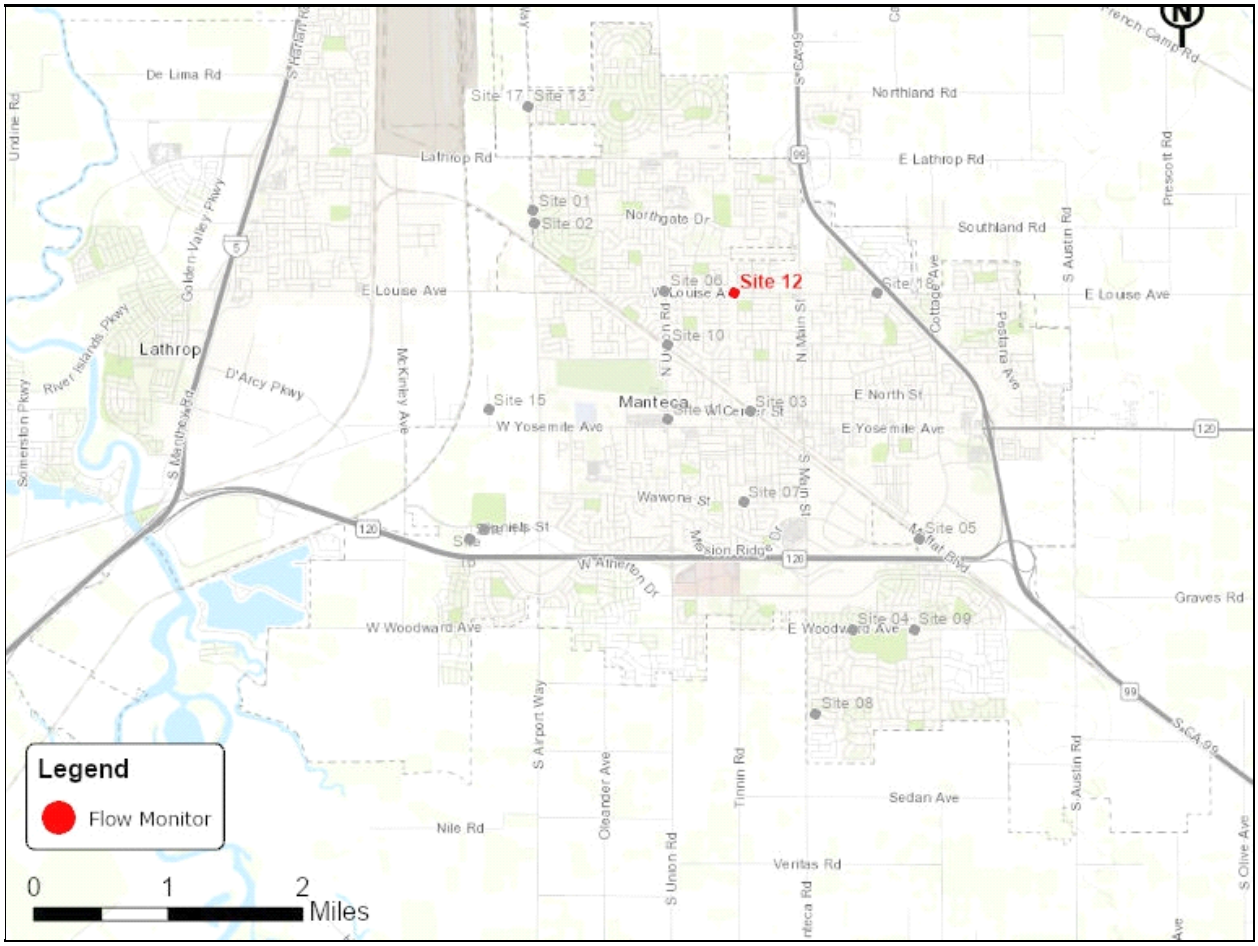
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: W. Louise Avenue West of Lorene Avenue

Data Summary Report



Vicinity Map: Site 12

SITE 12

Additional Site Photos

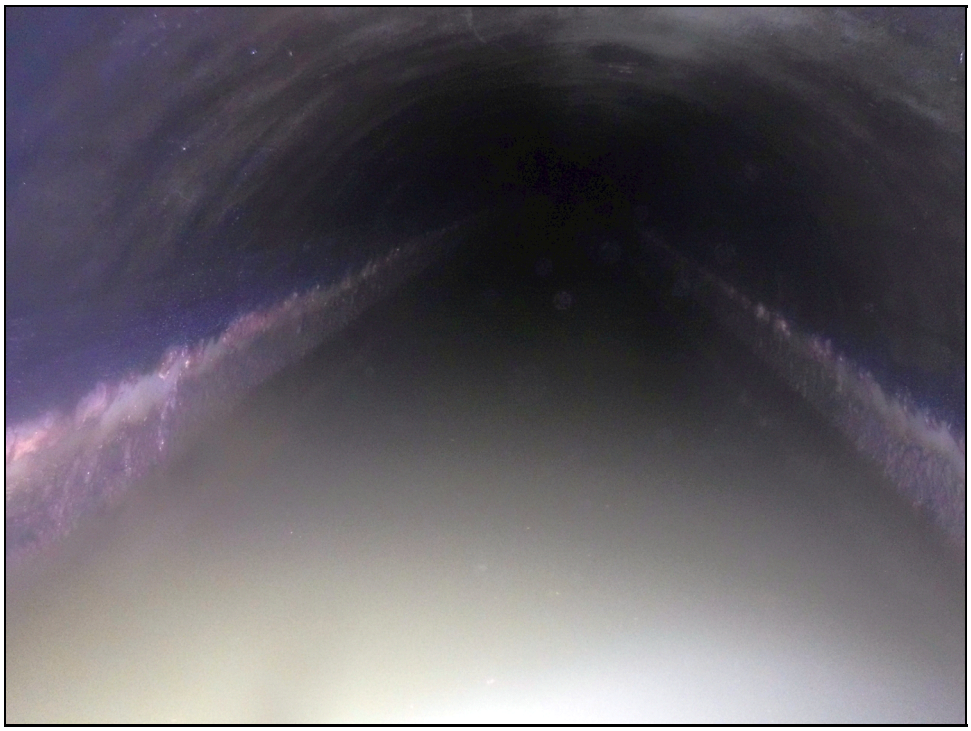
Effluent Pipe

Monitored North Influent Pipe

SITE 12

Additional Site Photos

East Influent Pipe

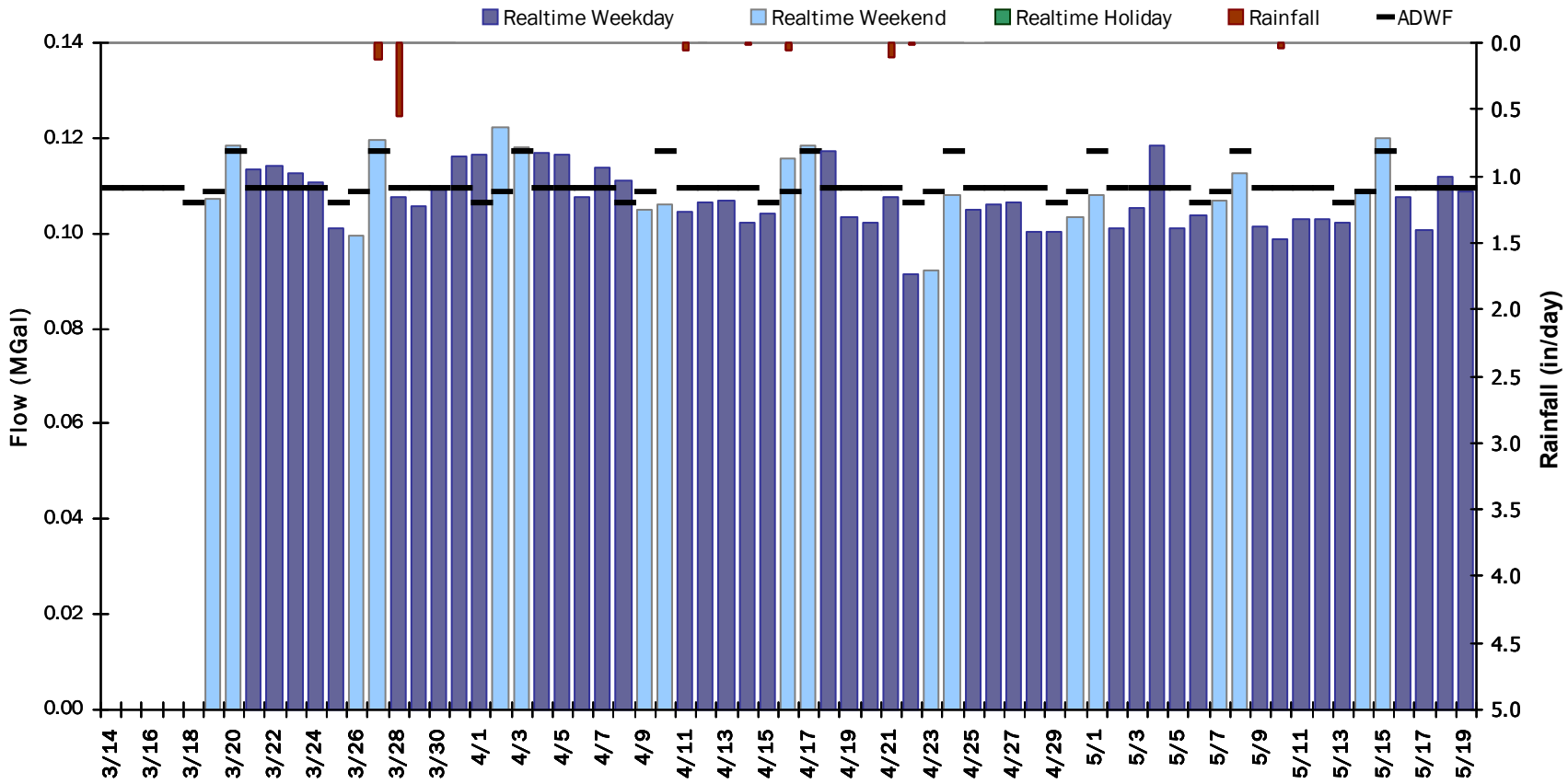


SITE 12

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.108 MGal Peak Daily Flow: 0.122 MGal Min Daily Flow: 0.091 MGal

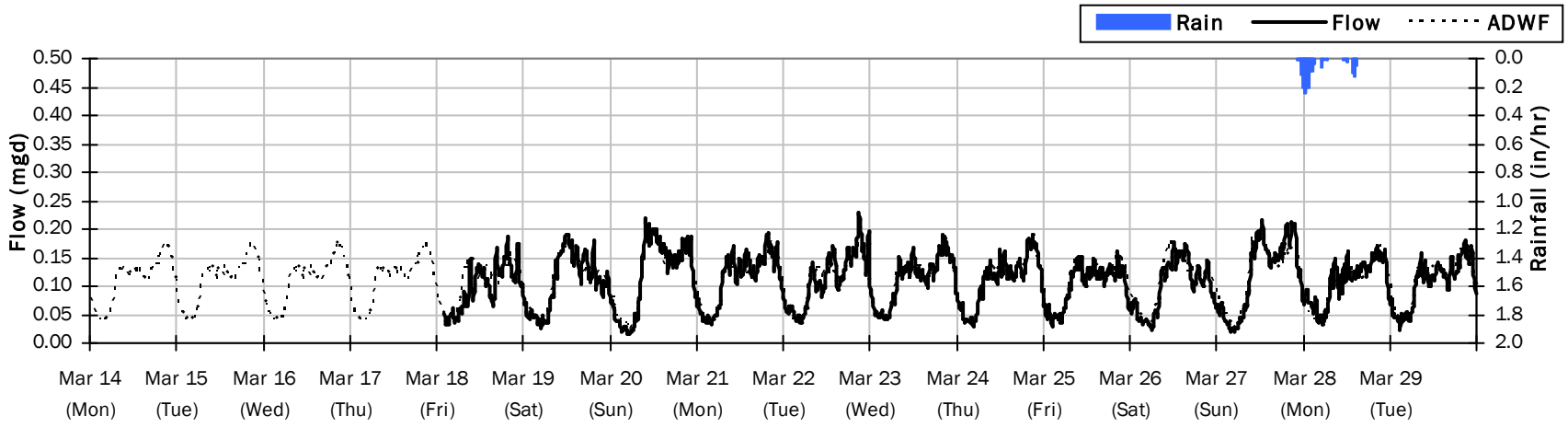
Total Rainfall: 0.97 inches

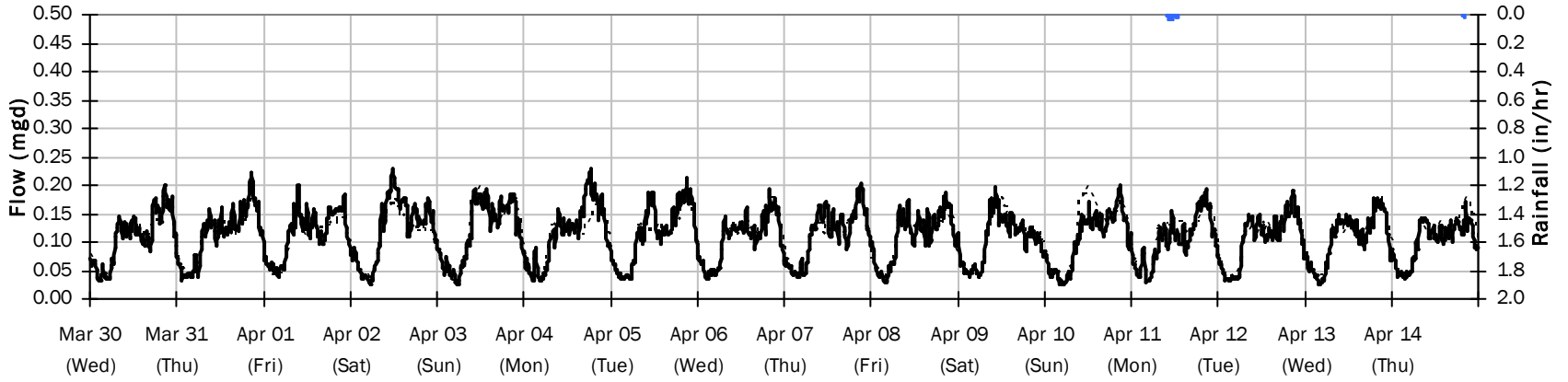


SITE 12

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.74 inches Period Avg Flow: 0.110 mgd Period Peak Flow: 0.230 mgd Period Min Flow: 0.016 mgd

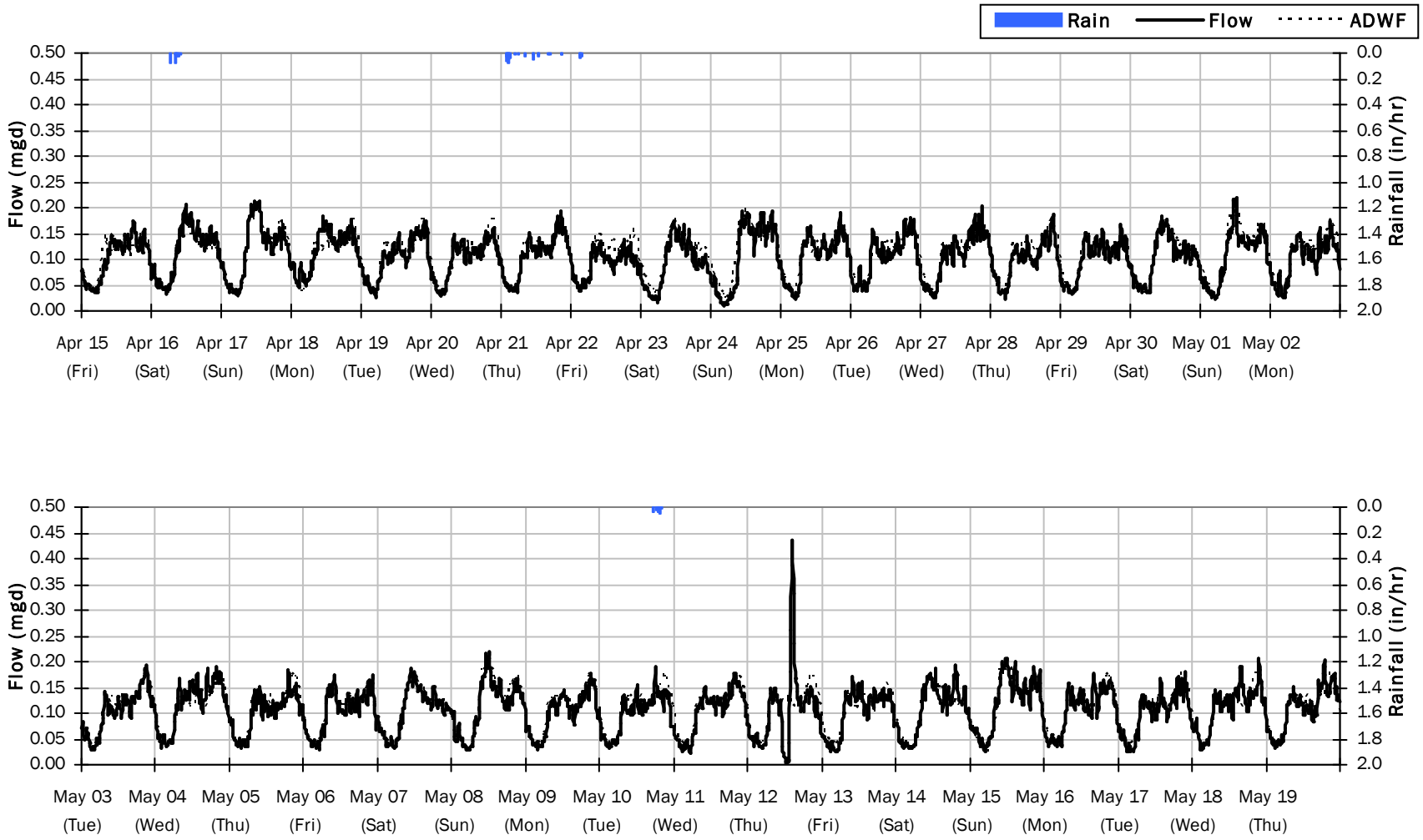




SITE 12

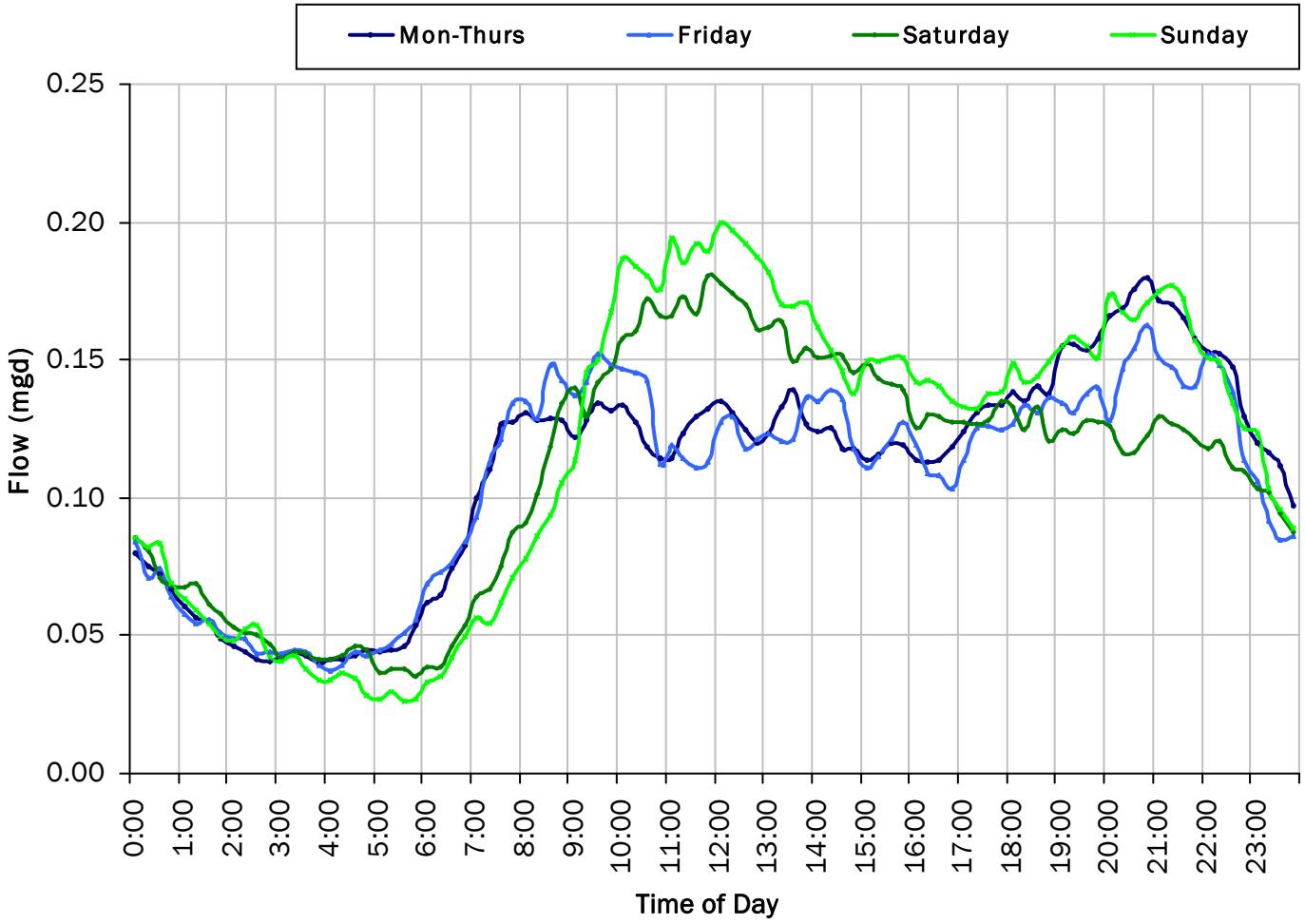
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.23 inches Period Avg Flow: 0.106 mgd Period Peak Flow: 0.436 mgd Period Min Flow: 0.004 mgd



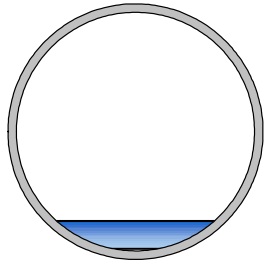
SITE 12

Average Dry Weather Flow Hydrographs



ADWF:

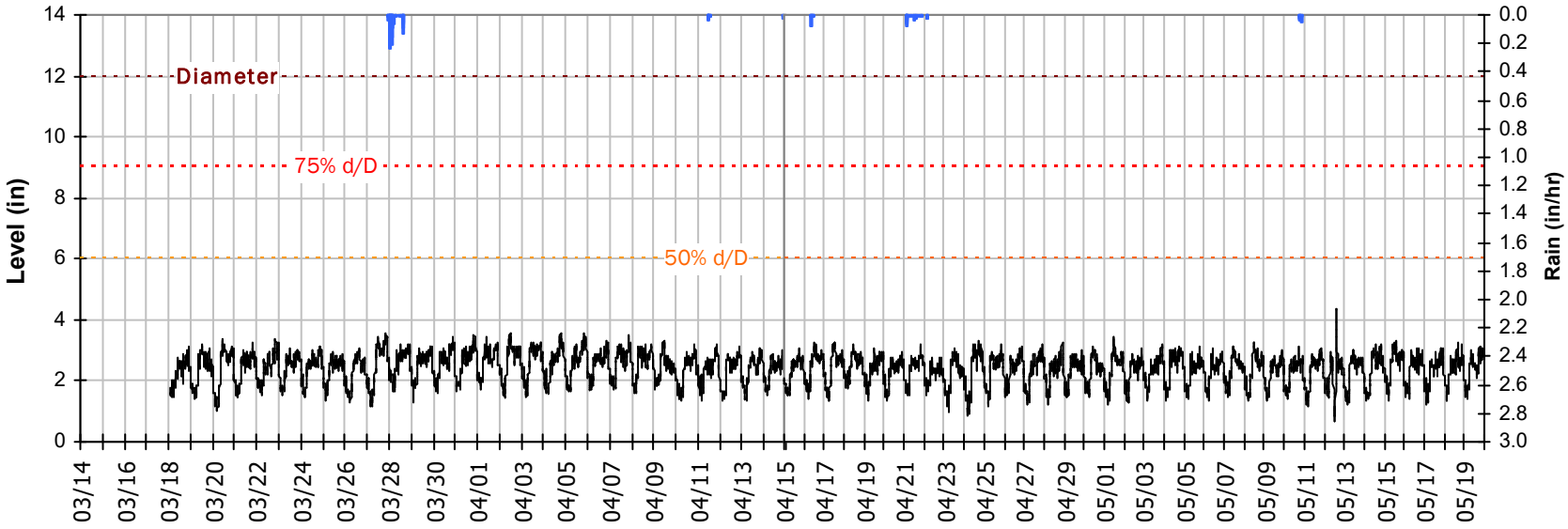
0.110 *mgd*

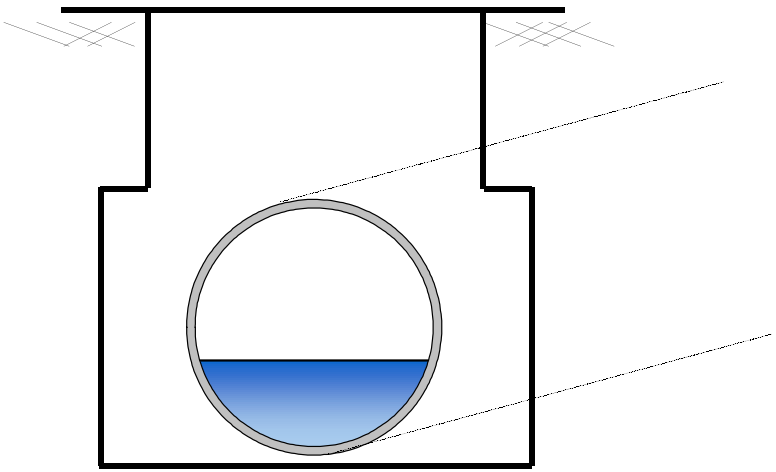


SITE 12

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





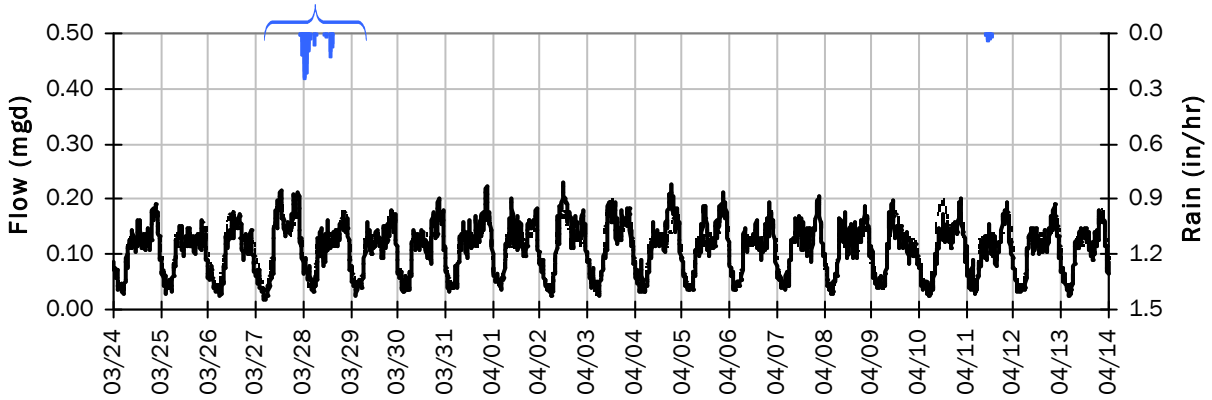
Pipe Diameter:	12	*inches*
Peak Measured Level:	4.38	*inches*
Peak d/D Ratio:	0.36	

SITE 12
I/I Summary: Rain Event 1

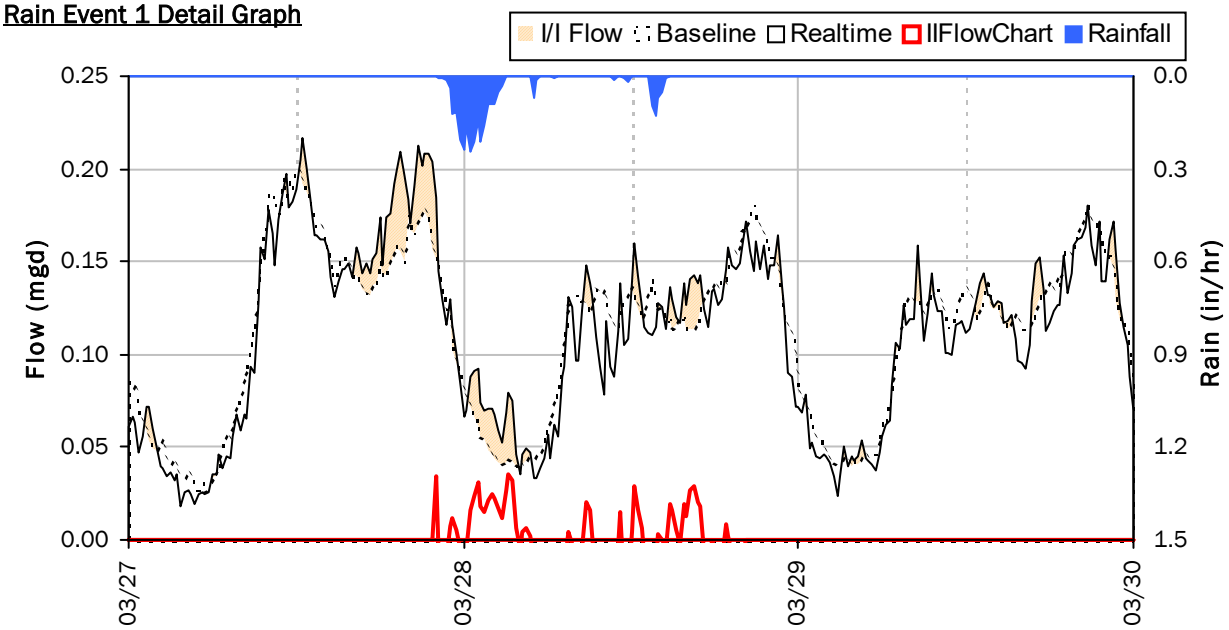
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Rain Event 1

Rainfall: 0.68 inches



Rain Event 1 Detail Graph



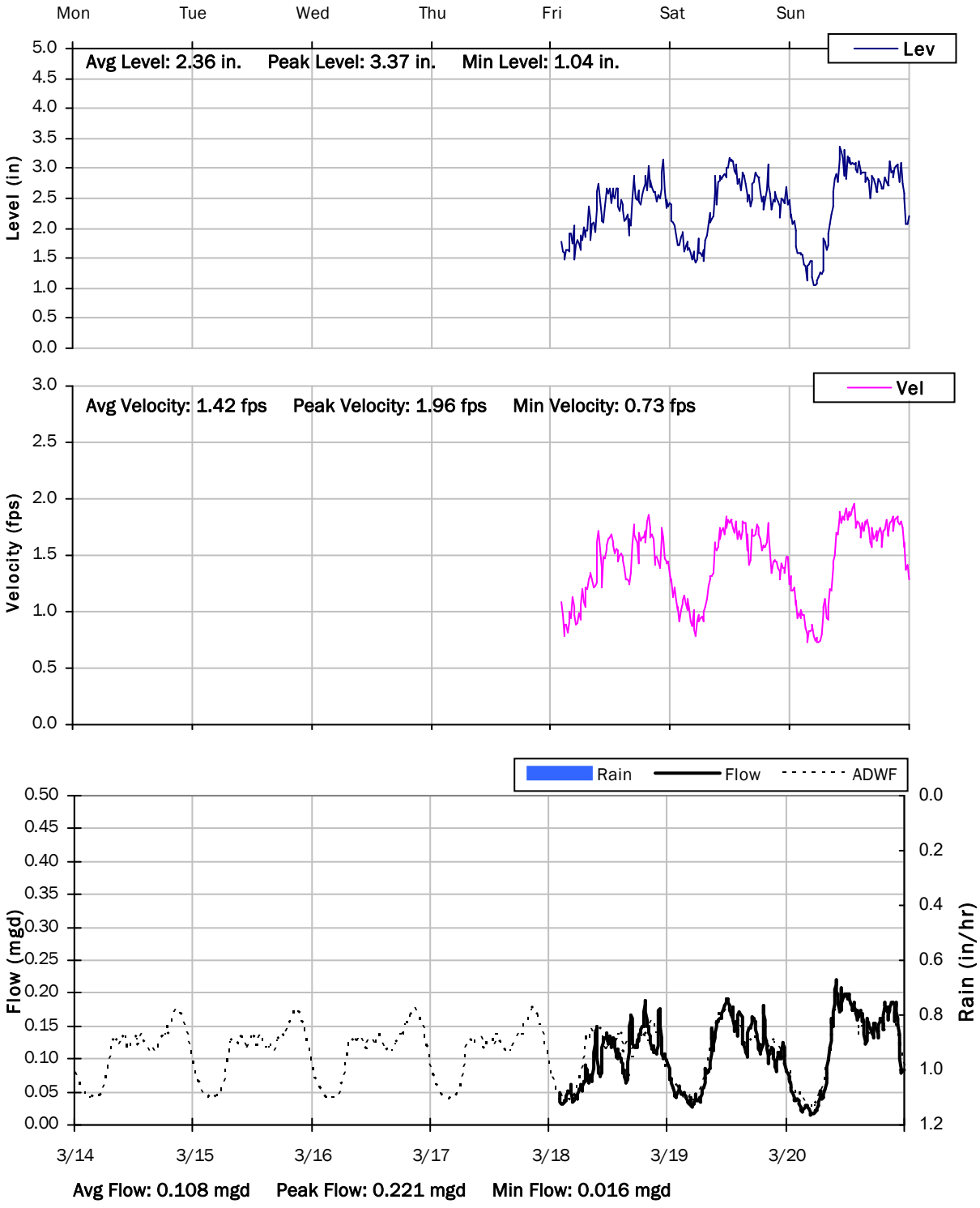
Storm Event I/I Analysis (Rain = 0.68 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.185 *mgd*	**Peak I/I Rate:**	0.036 *mgd*
PF:	1.68	**Total I/I:**	0 *gallons*
Peak Level:	3.31 *in*		
d/D Ratio:	0.28		

SITE 12

Weekly Level, Velocity and Flow Hydrographs

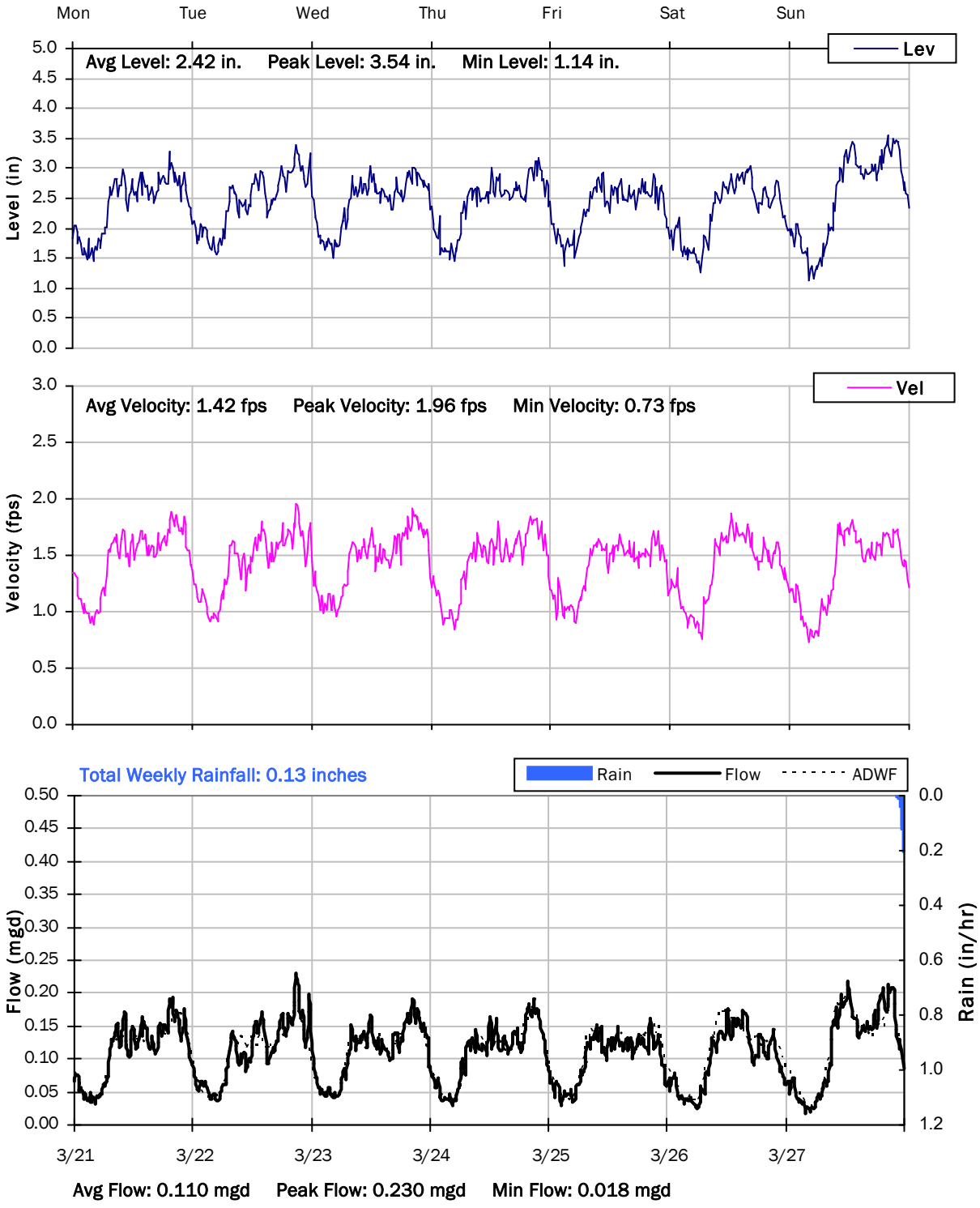
3/14/2022 to 3/21/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

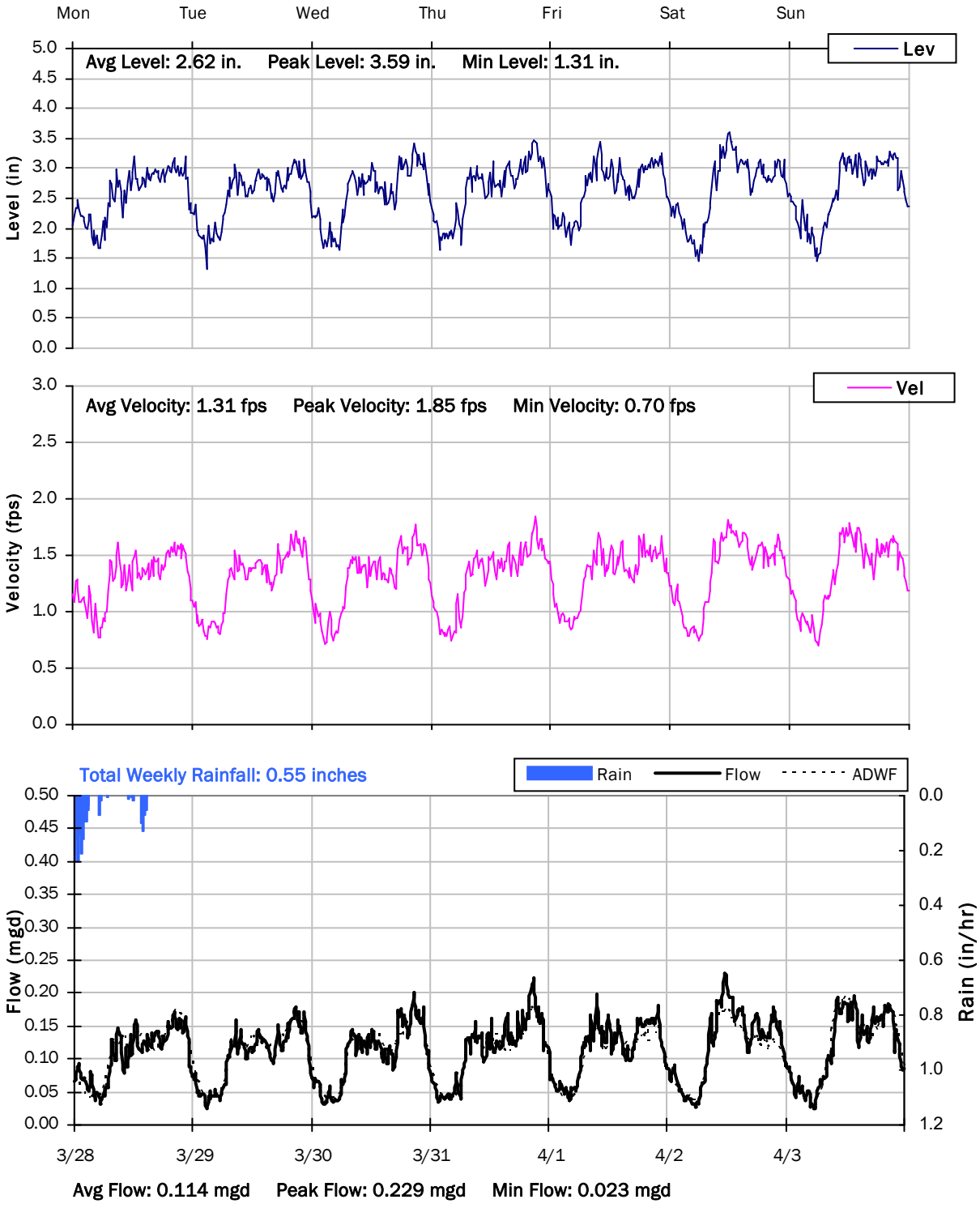
3/21/2022 to 3/28/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

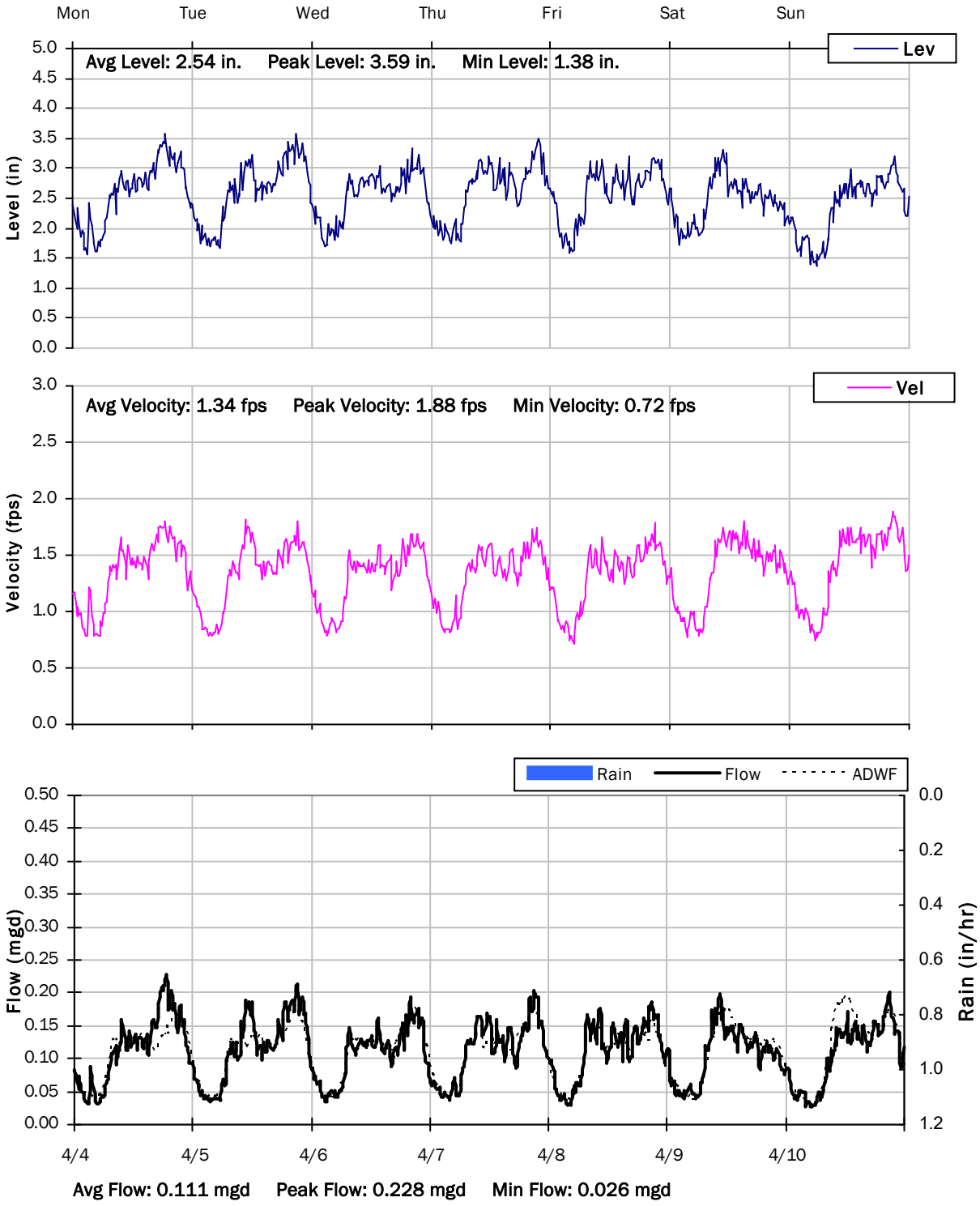
3/28/2022 to 4/4/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

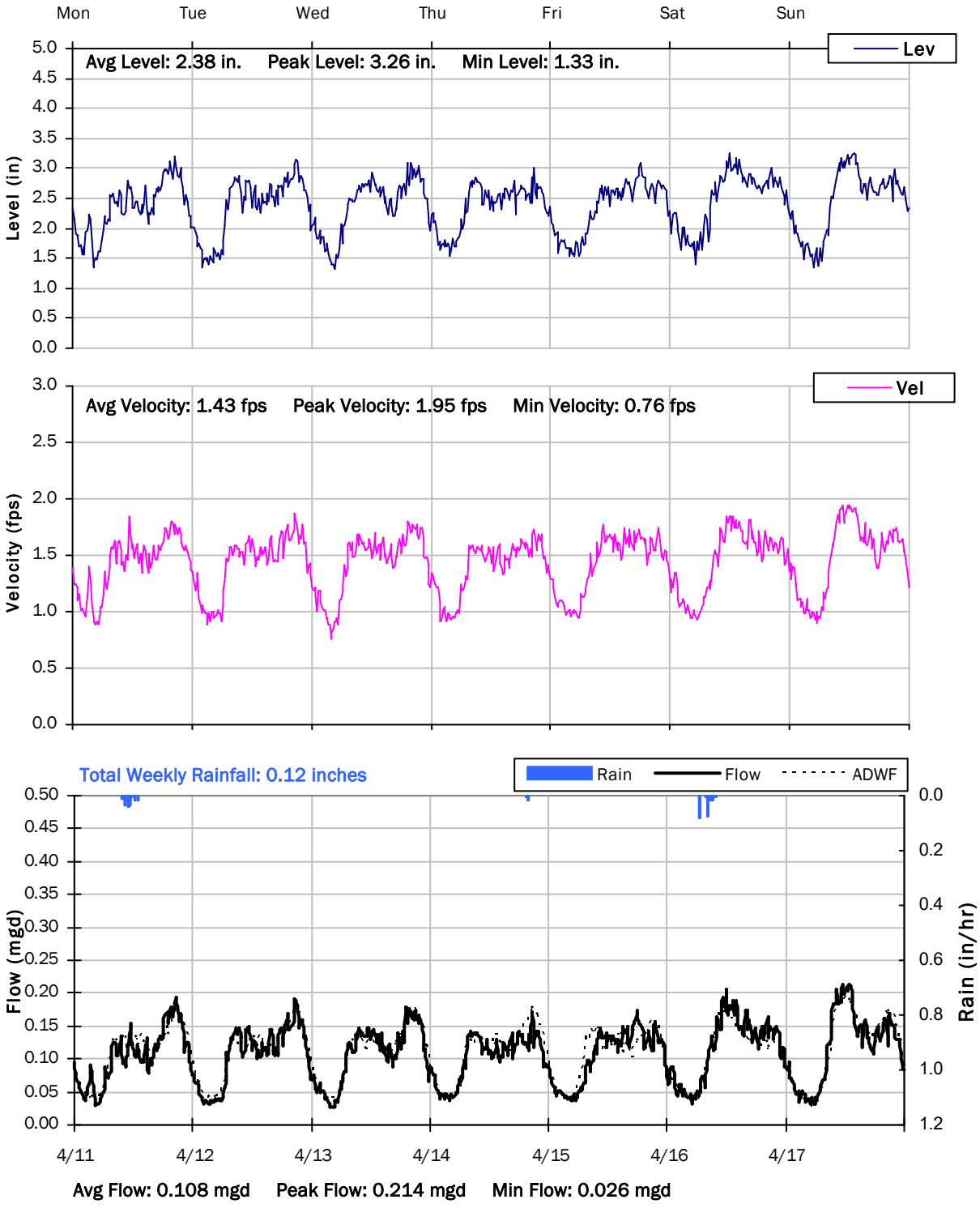
4/4/2022 to 4/11/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

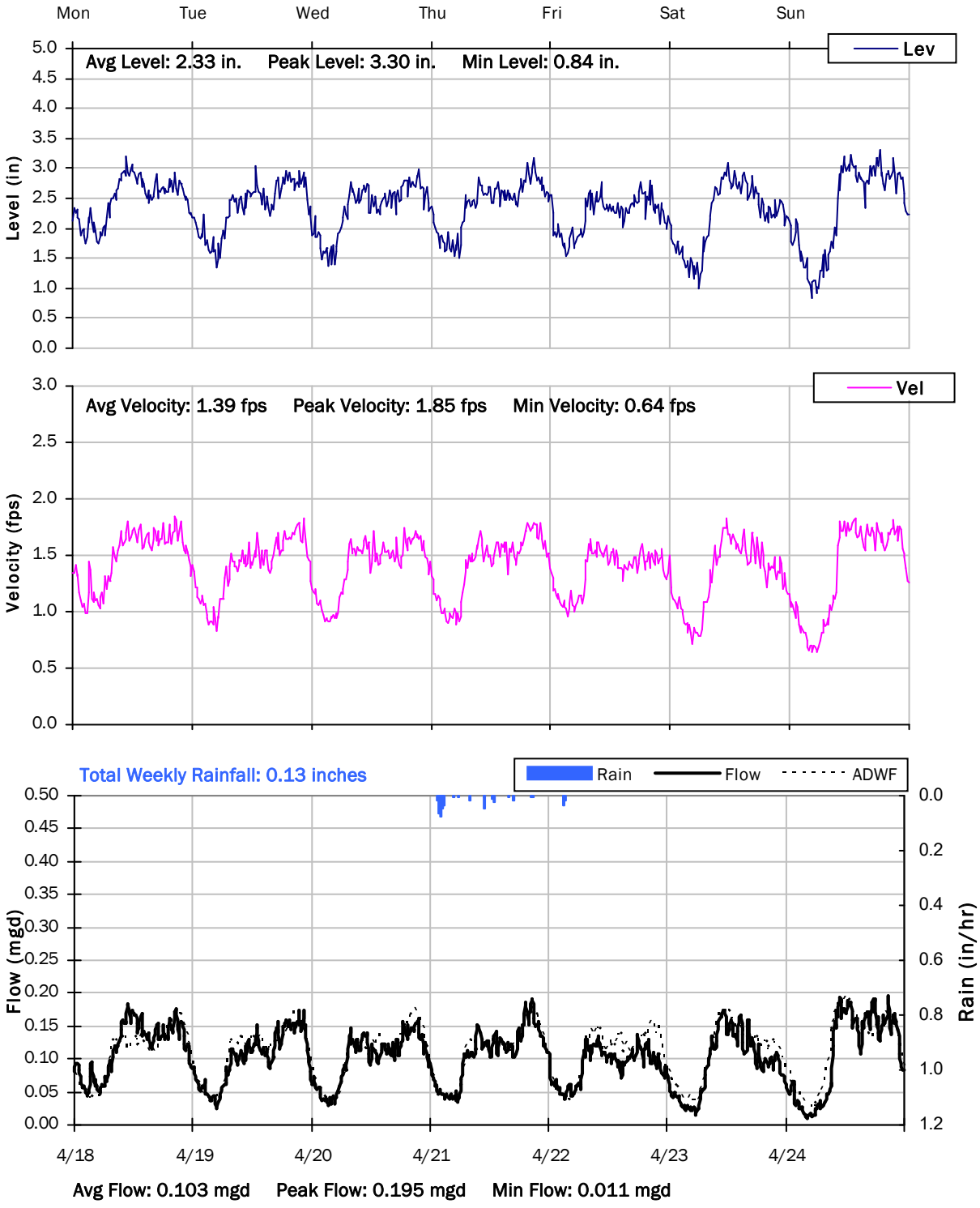
4/11/2022 to 4/18/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

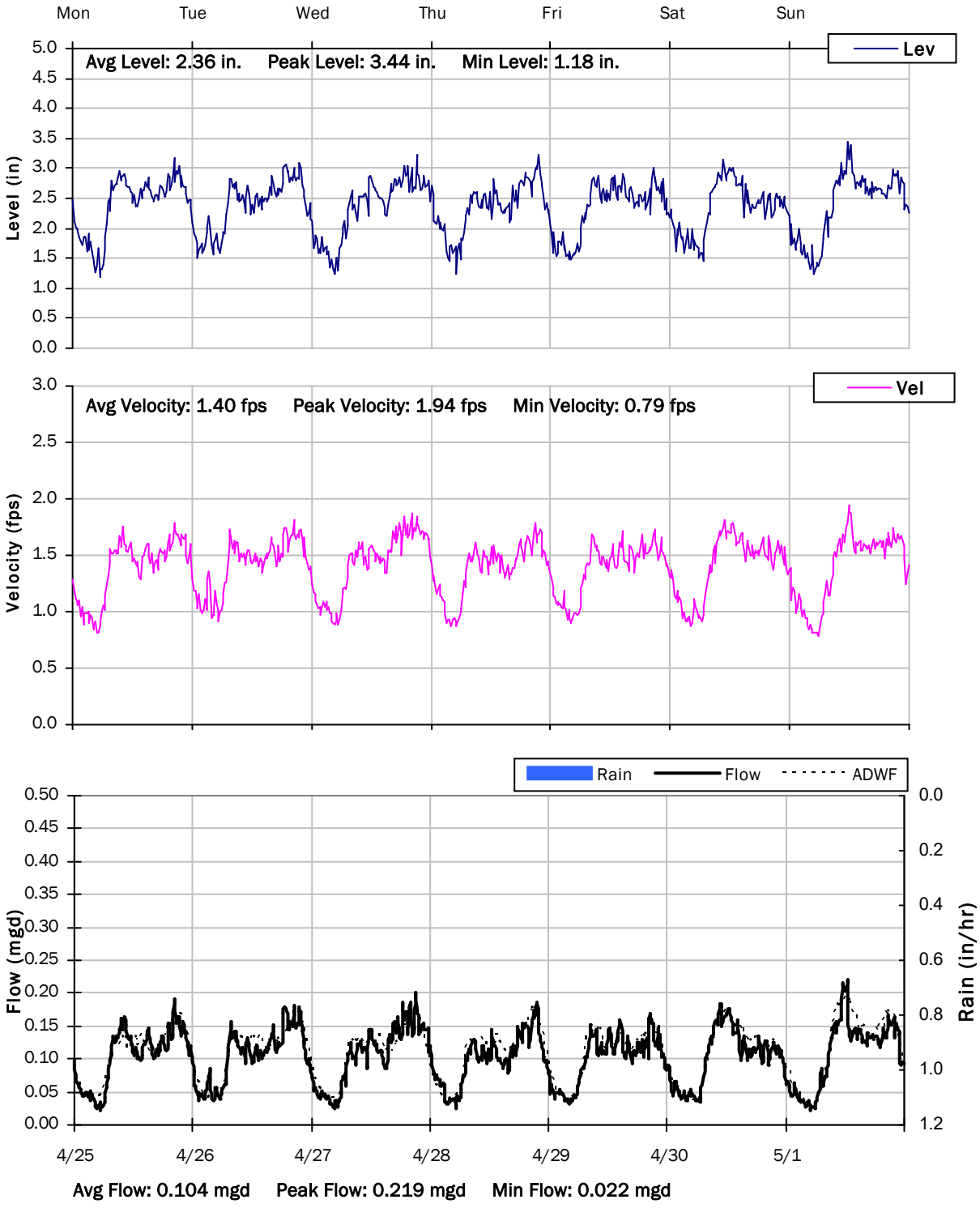
4/18/2022 to 4/25/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

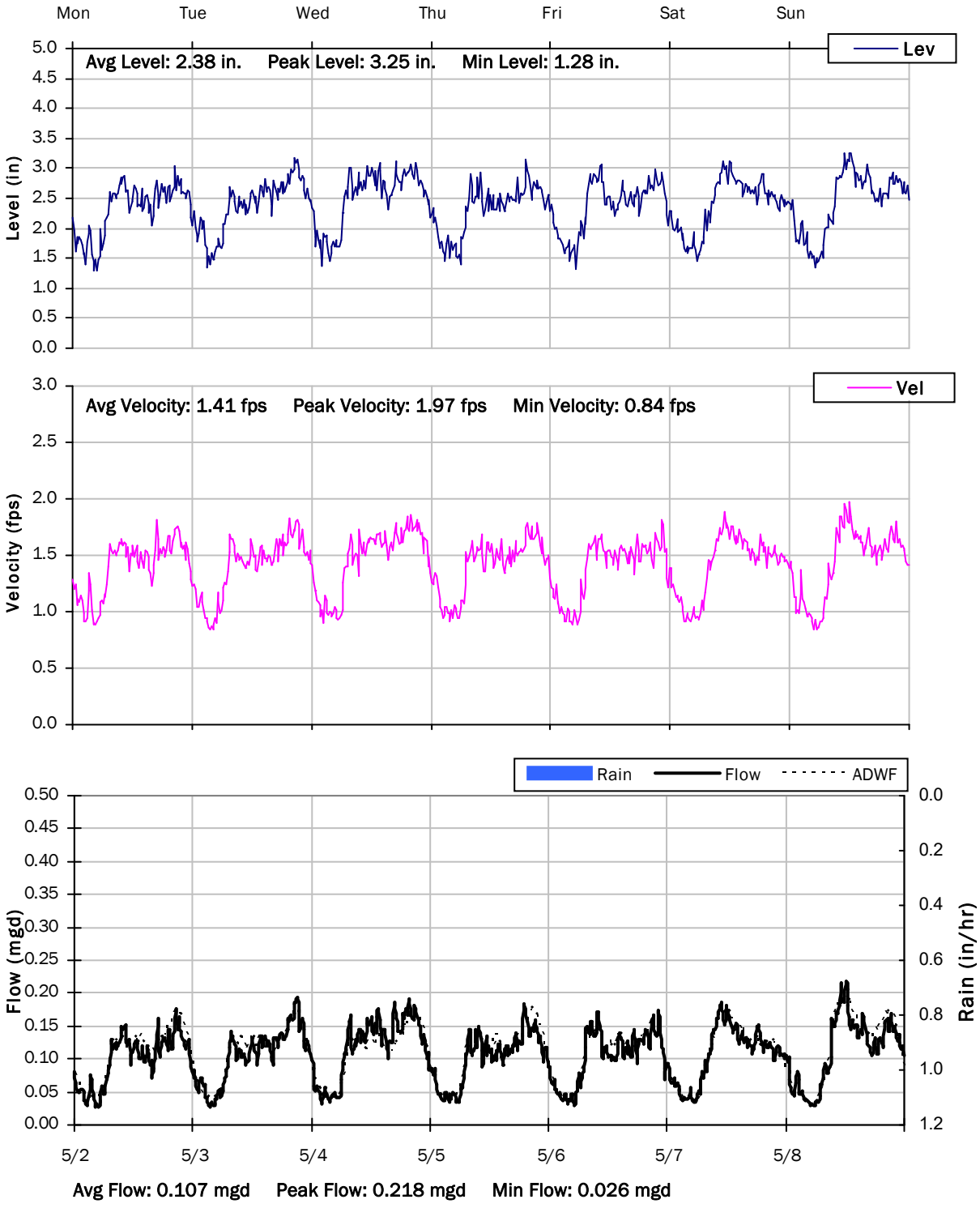
4/25/2022 to 5/2/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

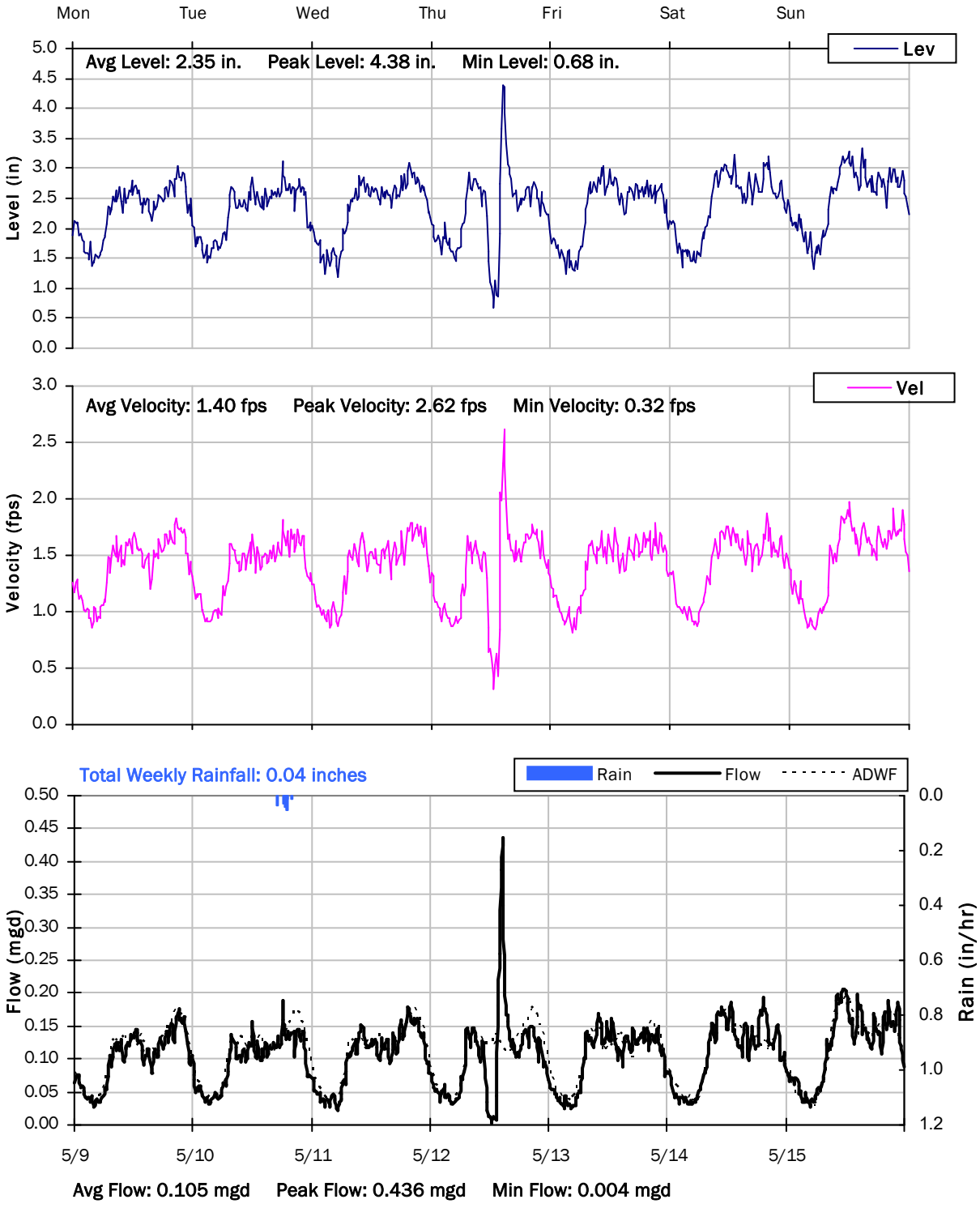
5/2/2022 to 5/9/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

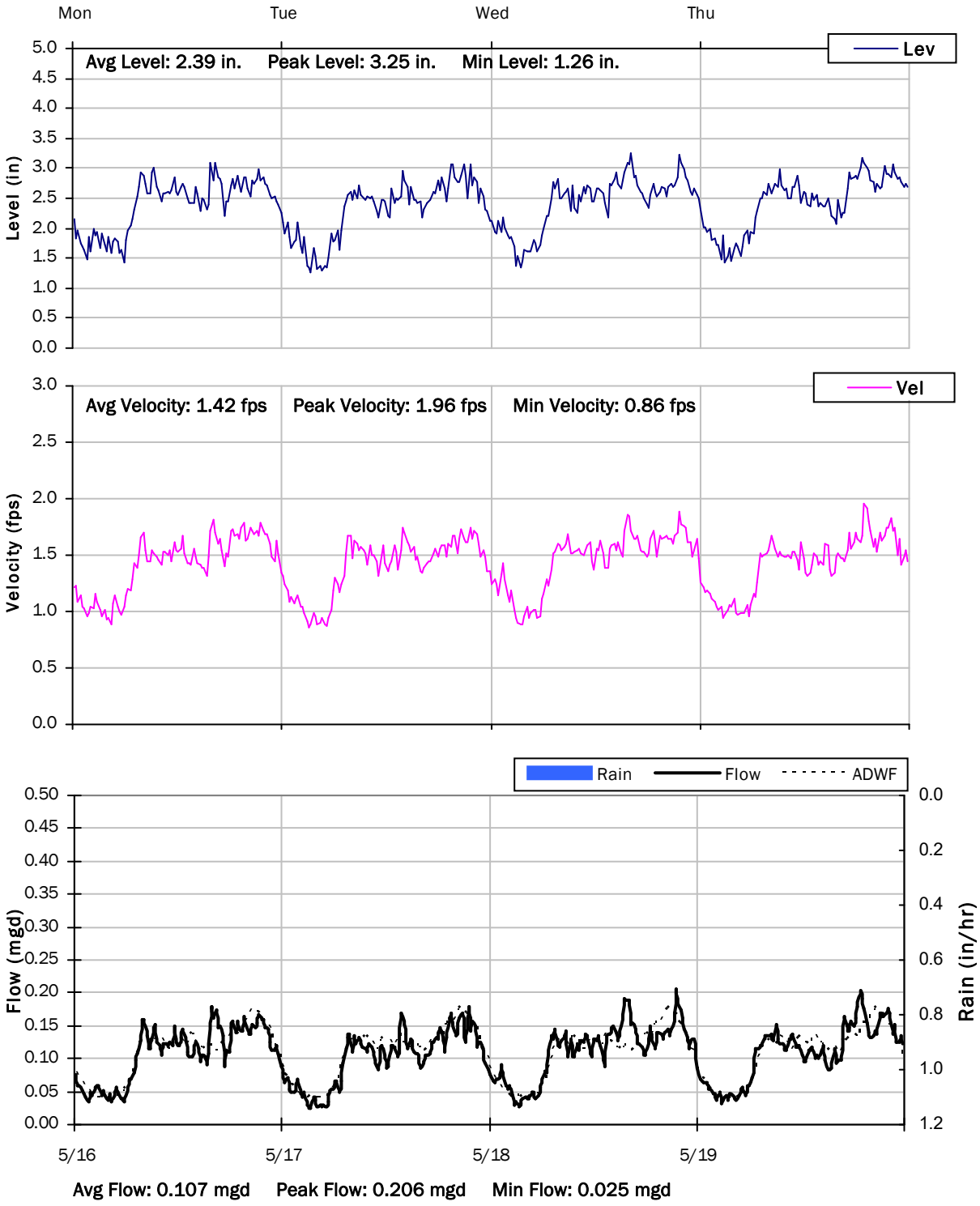
5/9/2022 to 5/16/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 13

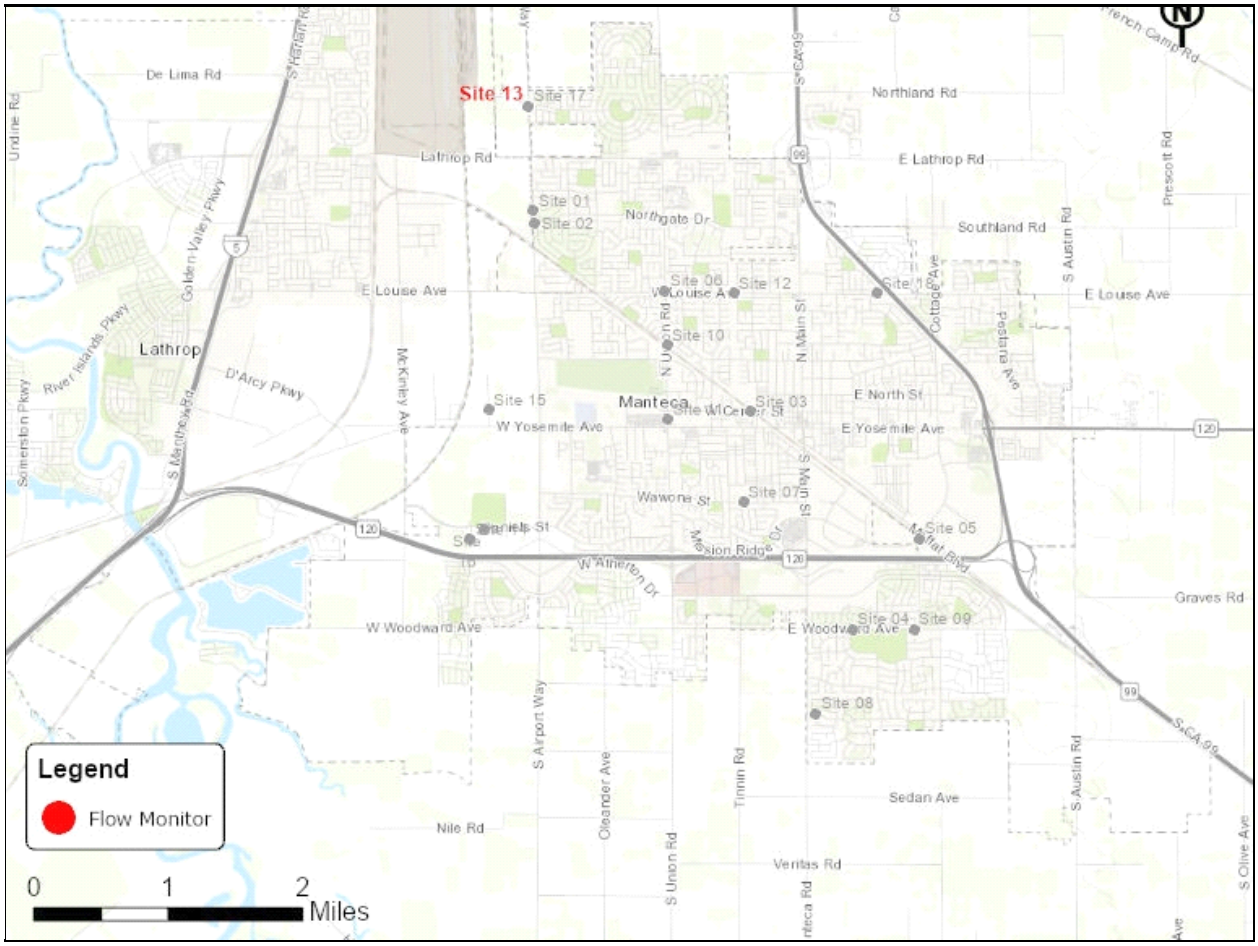
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Airport Way at Daisywood Drive

Data Summary Report



Vicinity Map: Site 13

SITE 13

Additional Site Photos

Effluent Pipe

Monitored Northwest Influent Pipe

SITE 13

Additional Site Photos

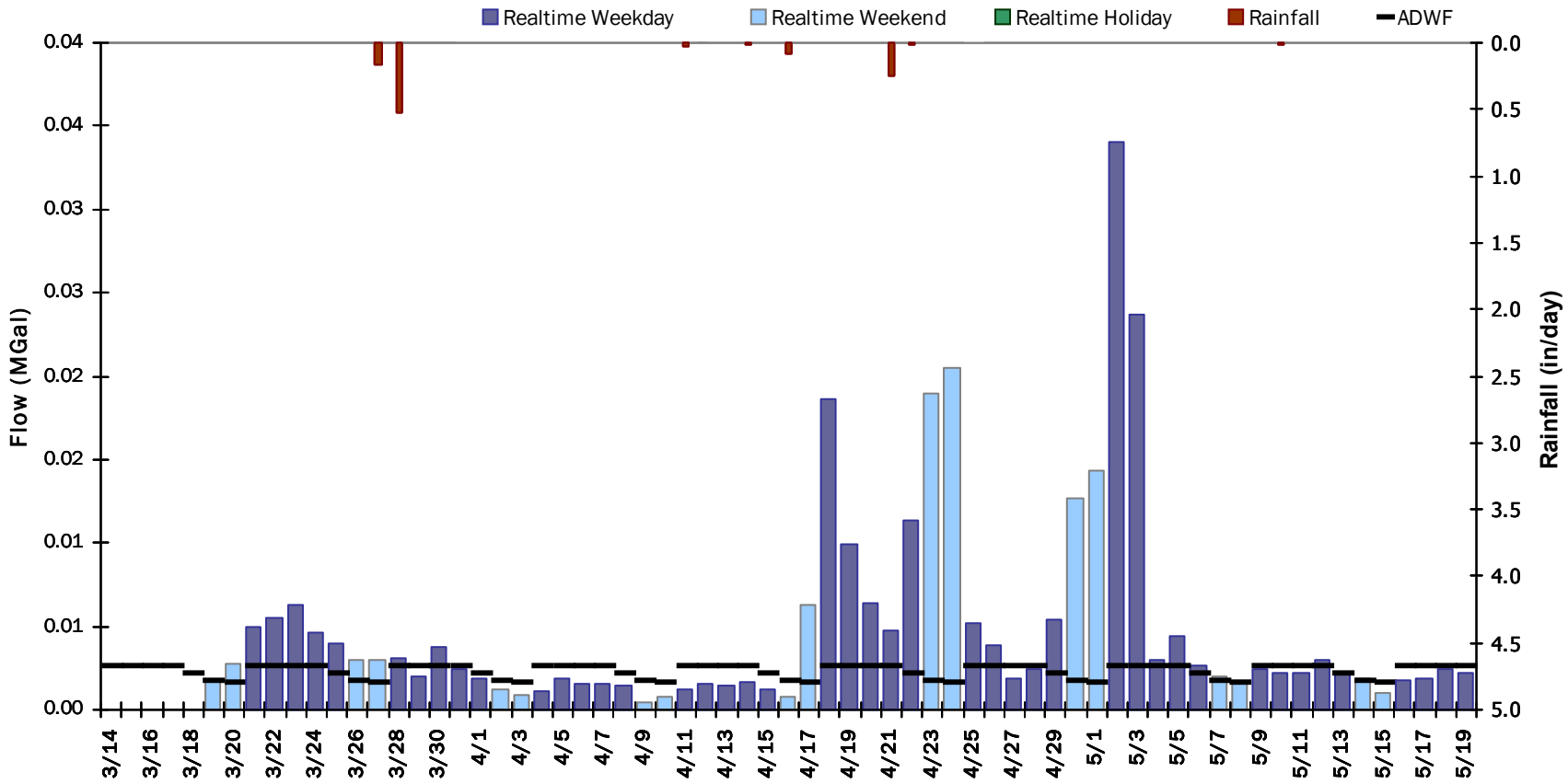
East Influent Pipe

SITE 13

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.005 MGal Peak Daily Flow: 0.034 MGal Min Daily Flow: 0.000 MGal

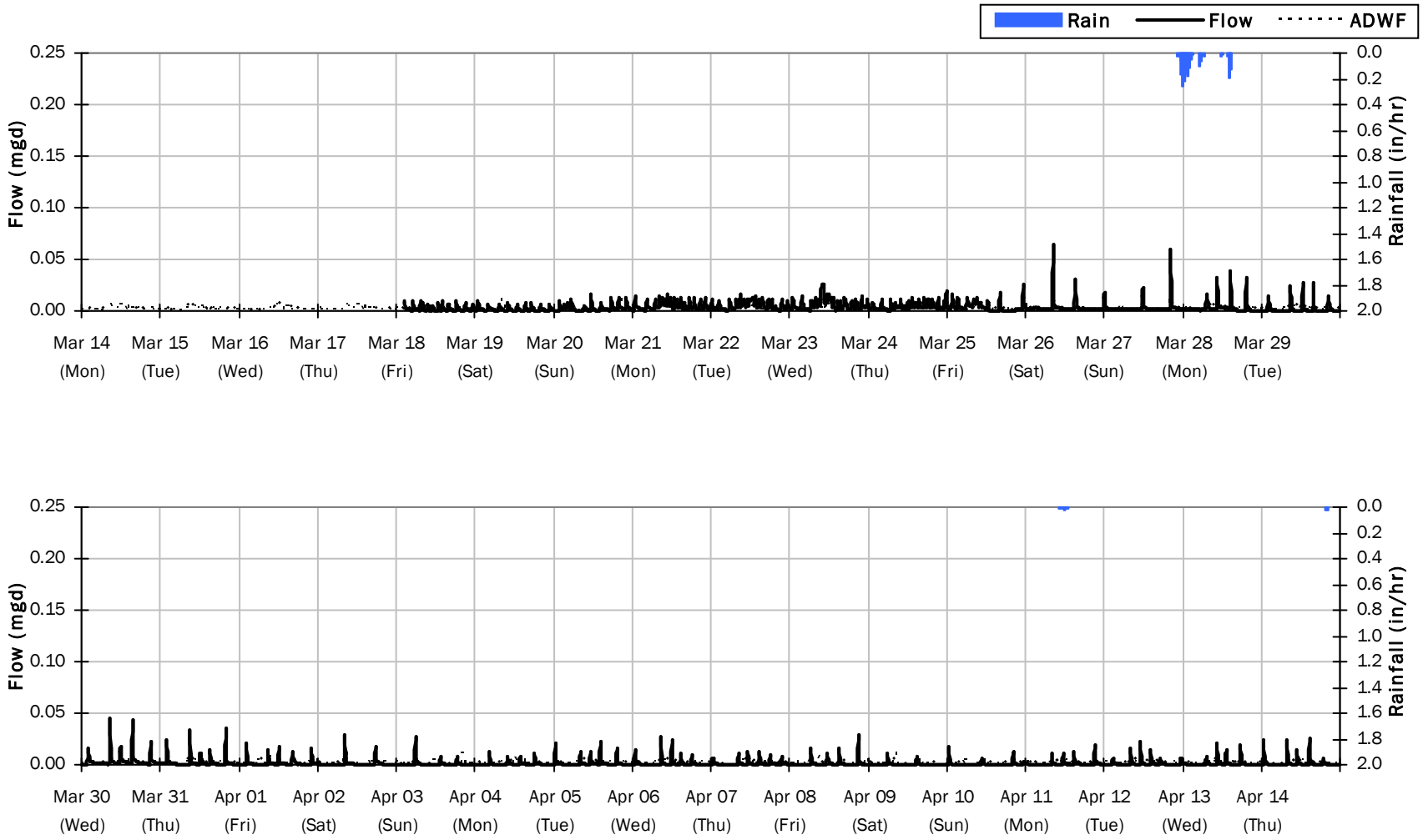
Total Rainfall: 1.10 inches



SITE 13

Flow Summary: 3/14/2022 to 4/14/2022

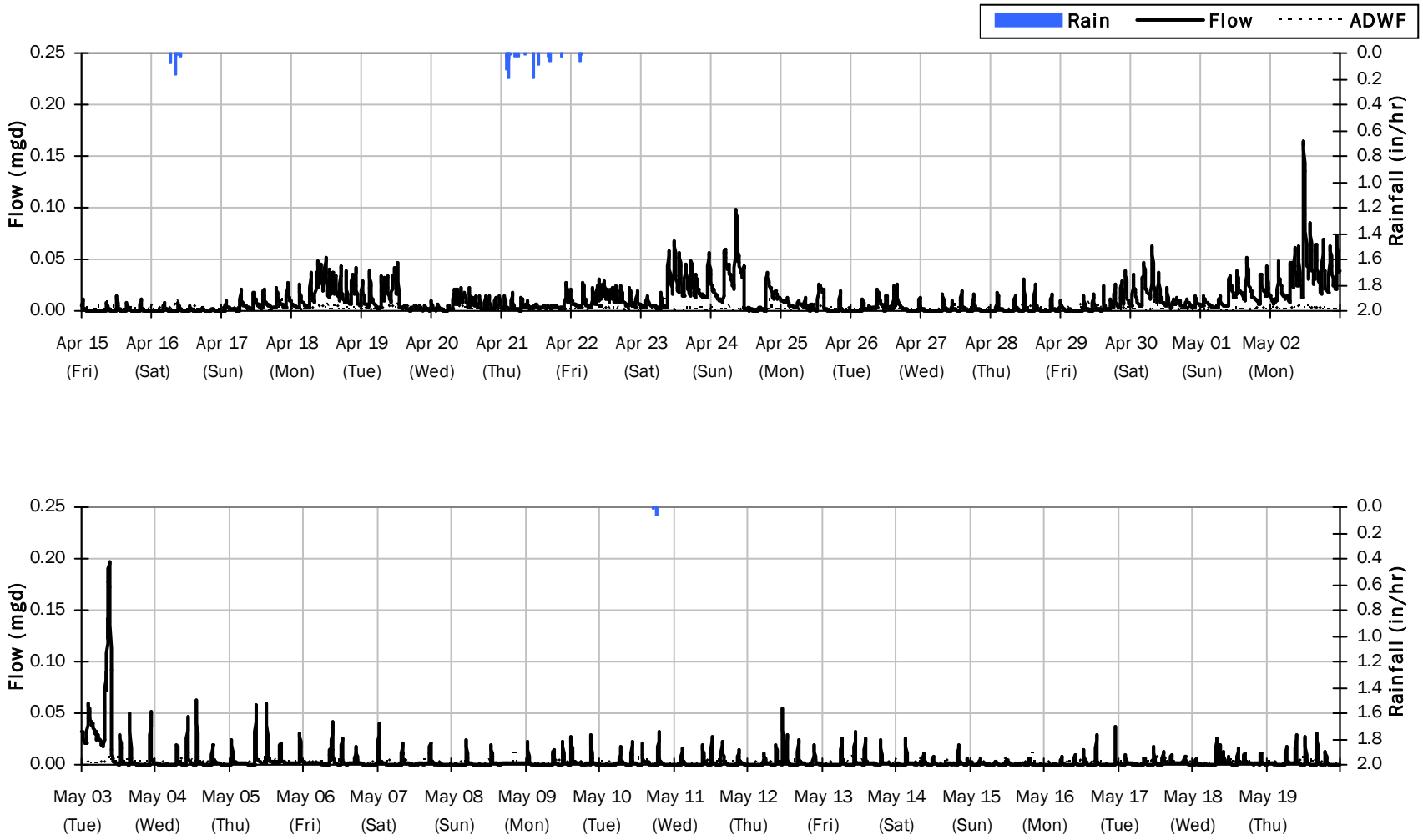
Period Rainfall: 0.73 inches Period Avg Flow: 0.002 mgd Period Peak Flow: 0.064 mgd Period Min Flow: 0.000 mgd



SITE 13

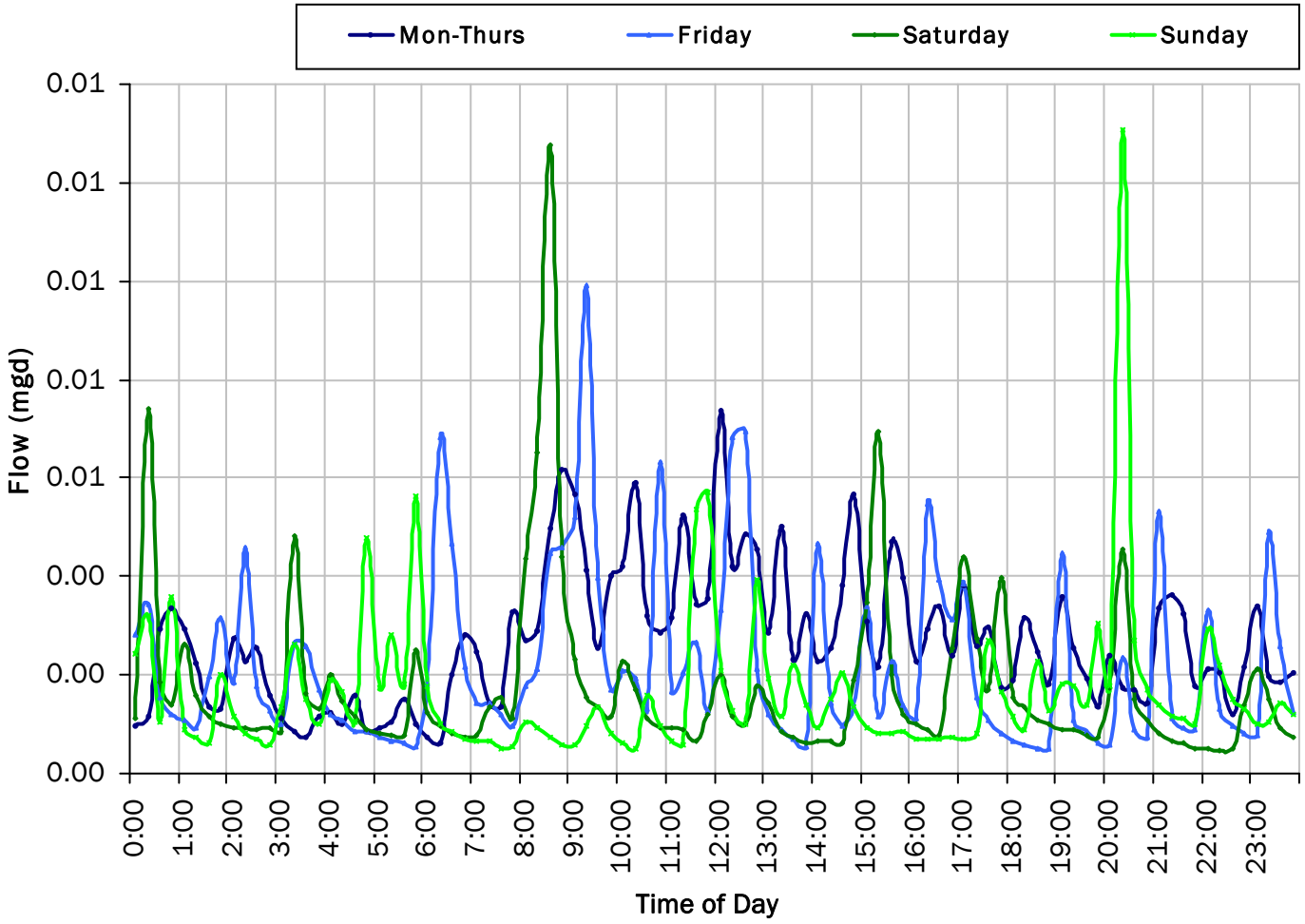
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.37 inches Period Avg Flow: 0.007 mgd Period Peak Flow: 0.196 mgd Period Min Flow: 0.000 mgd



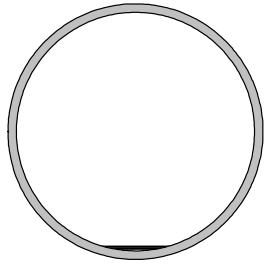
SITE 13

Average Dry Weather Flow Hydrographs



ADWF:

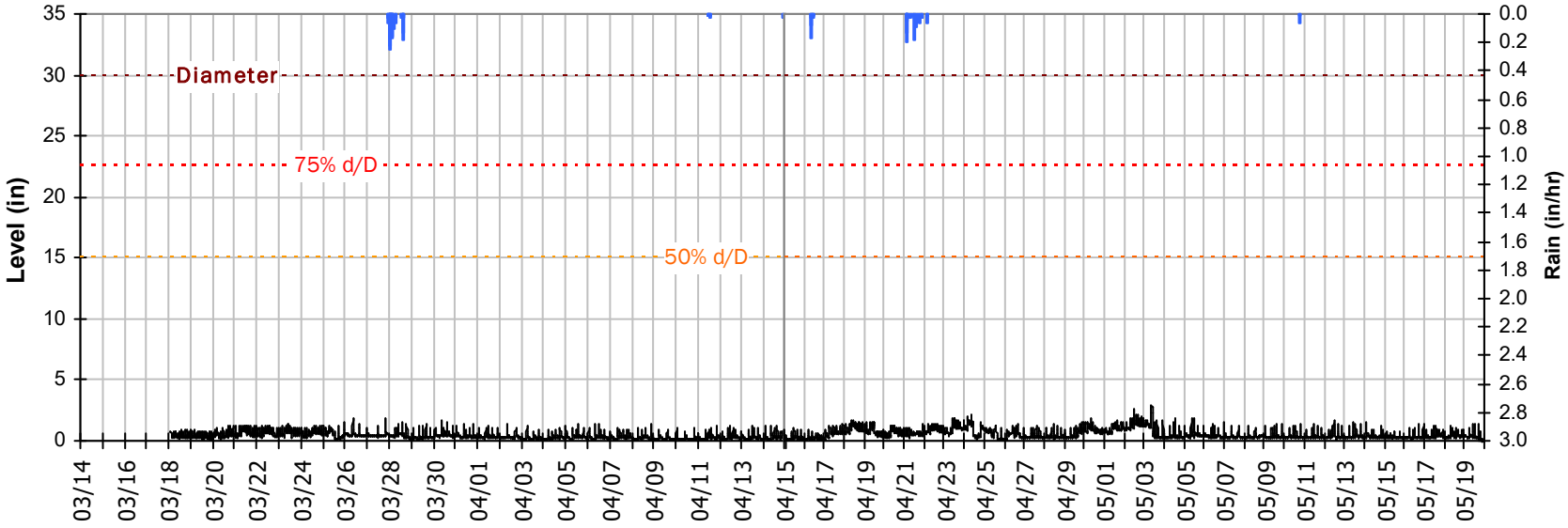
0.002 *mgd*

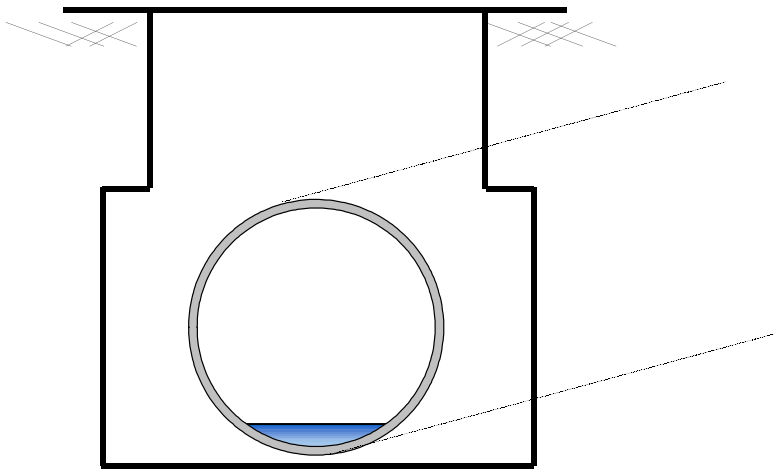


SITE 13

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



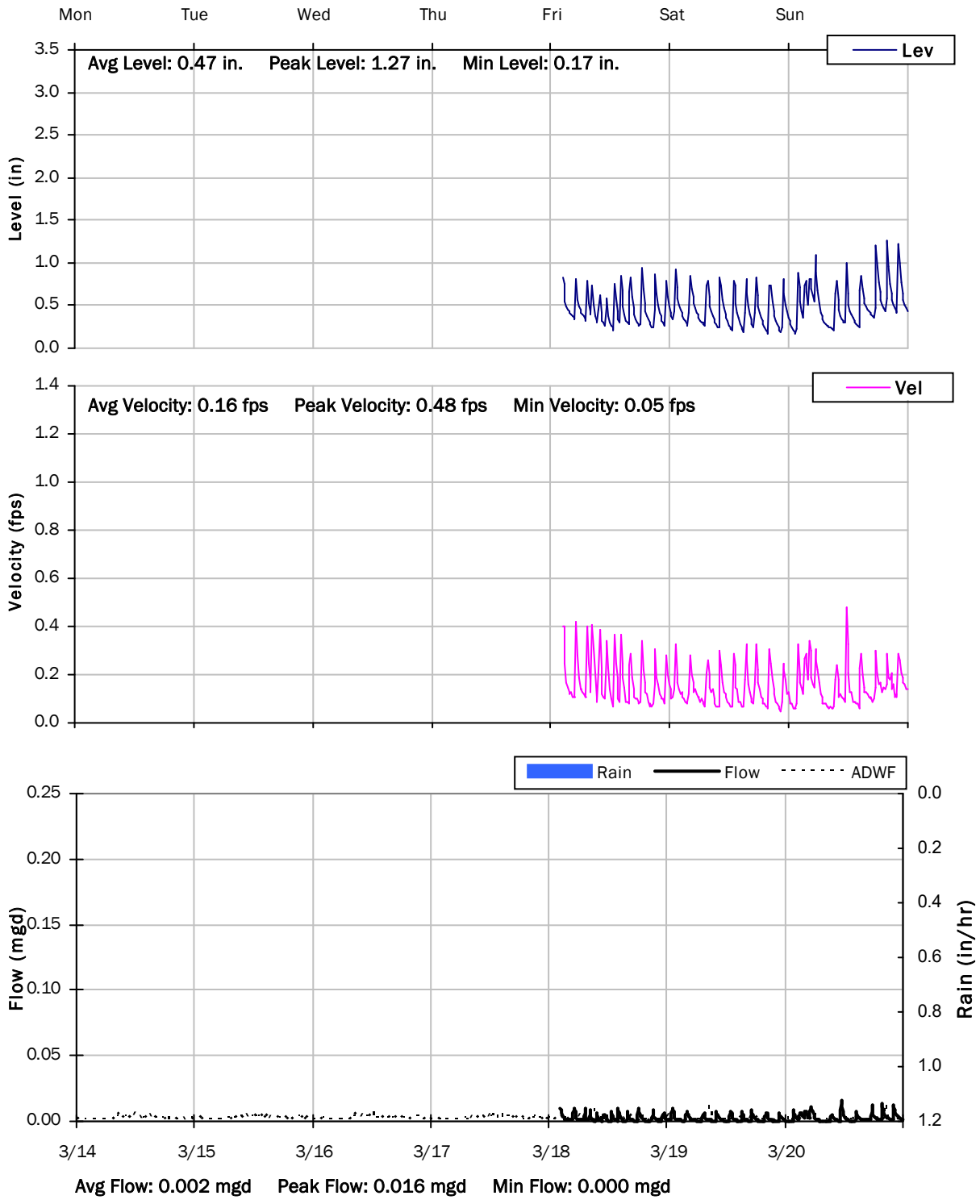


Pipe Diameter:	30	*inches*
Peak Measured Level:	2.86	*inches*
Peak d/D Ratio:	0.10	

SITE 13

Weekly Level, Velocity and Flow Hydrographs

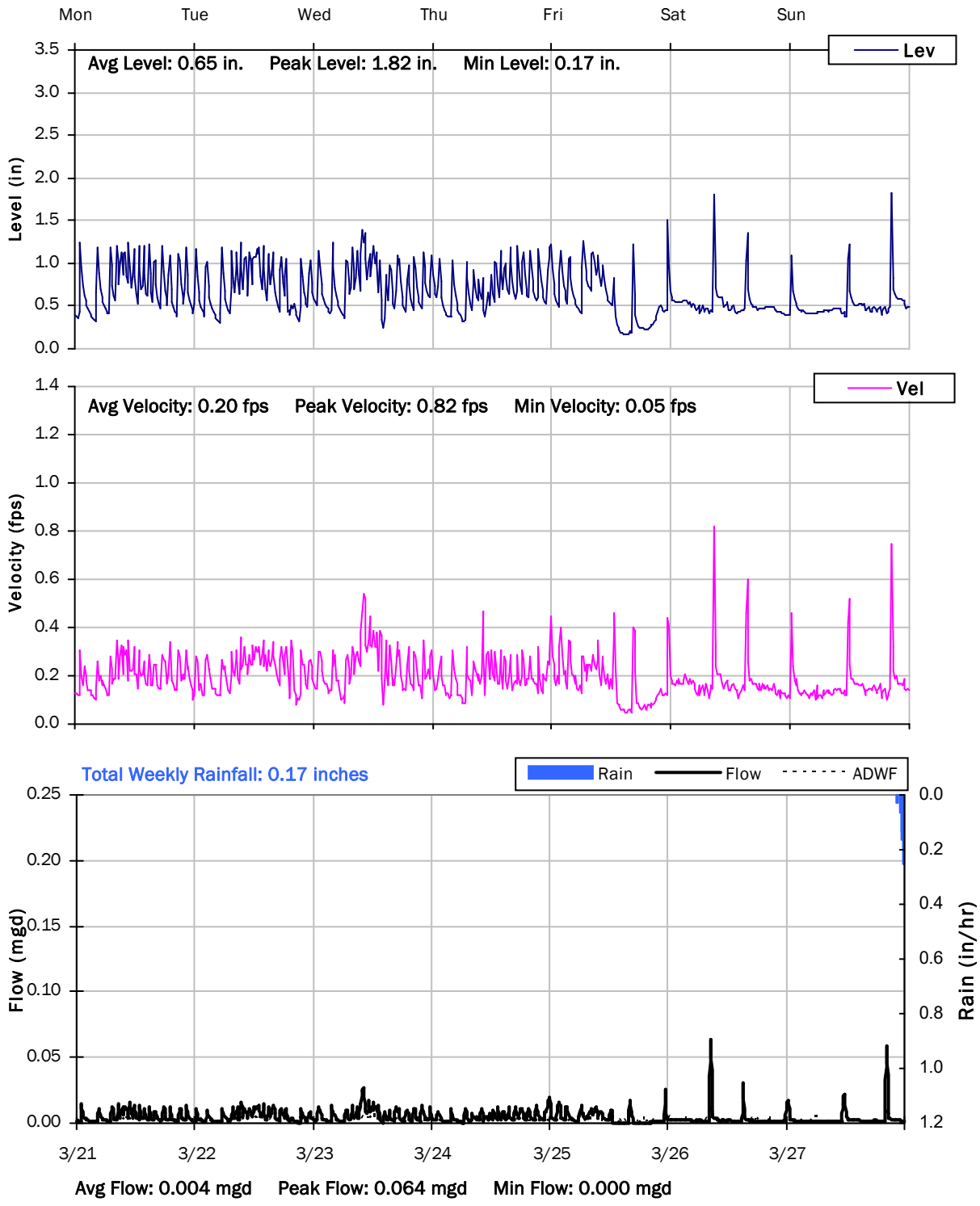
3/14/2022 to 3/21/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

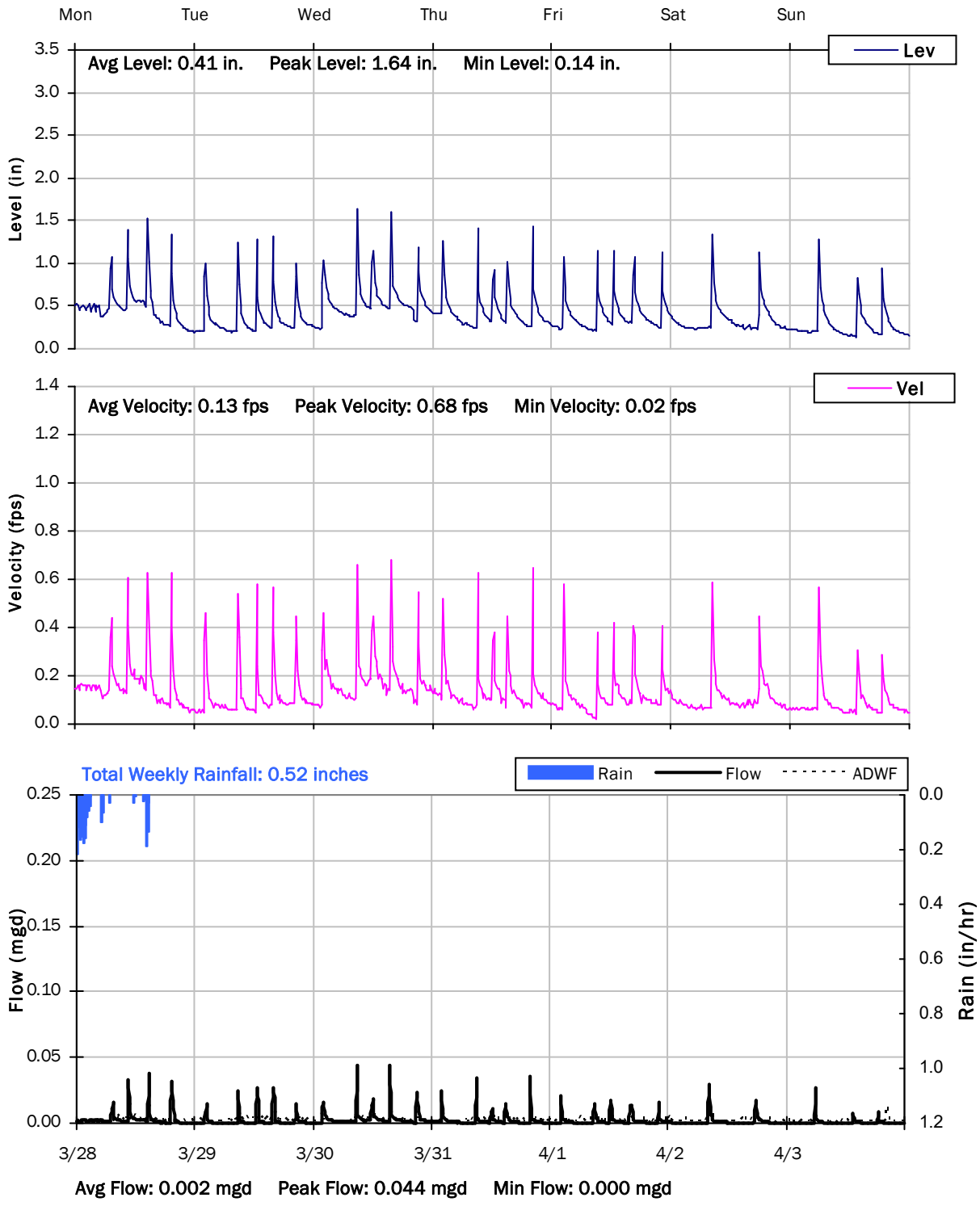
3/21/2022 to 3/28/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

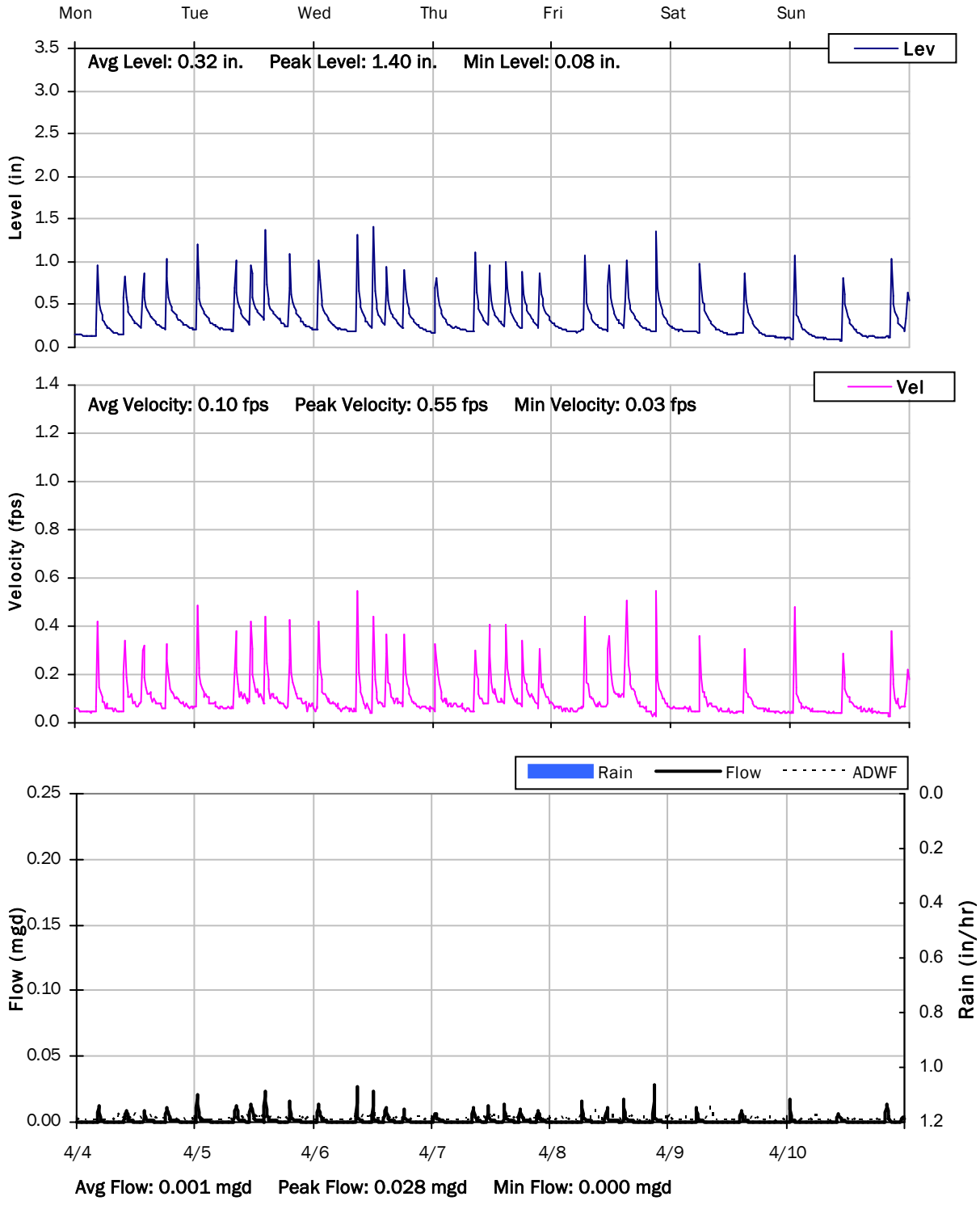
3/28/2022 to 4/4/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

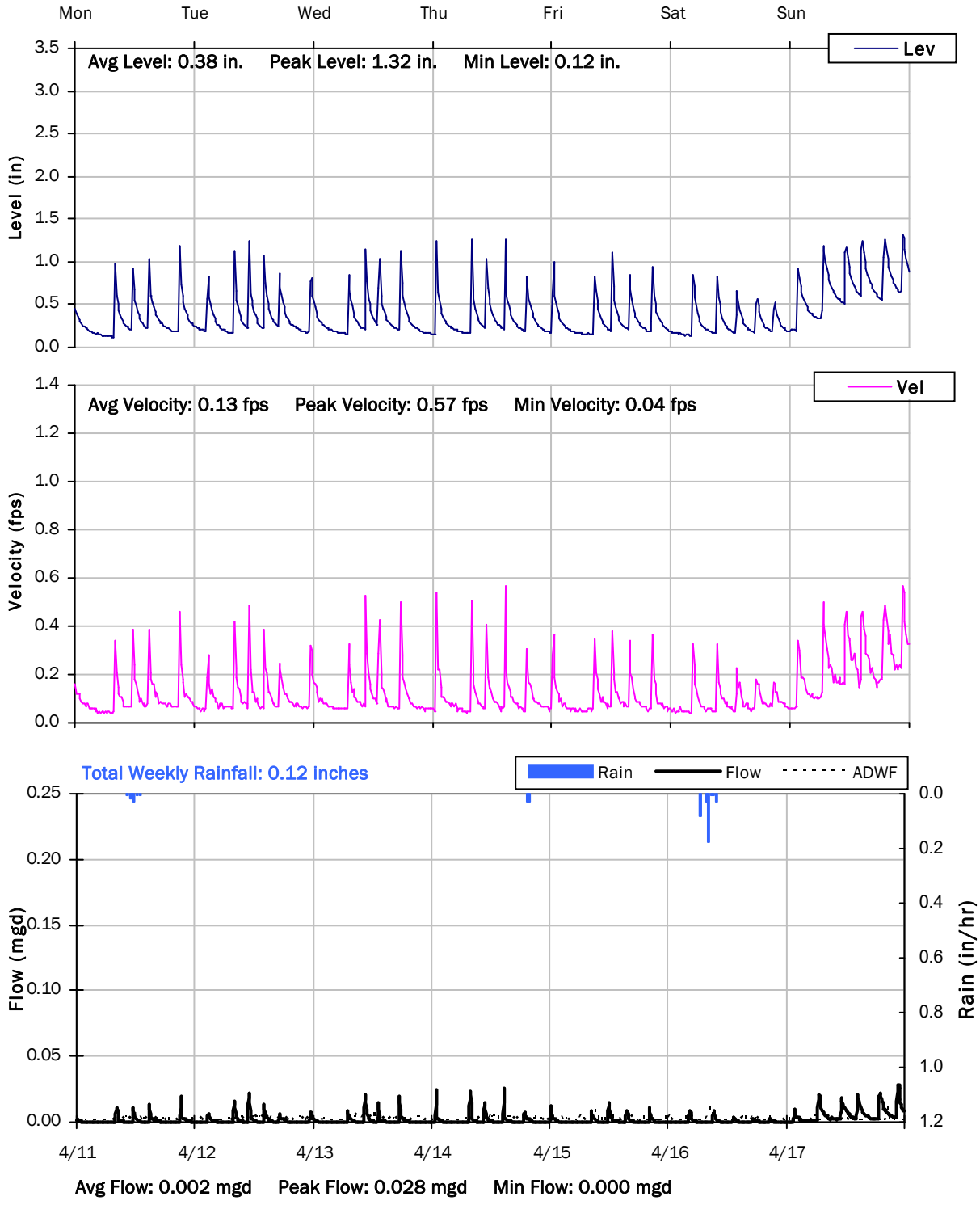
4/4/2022 to 4/11/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

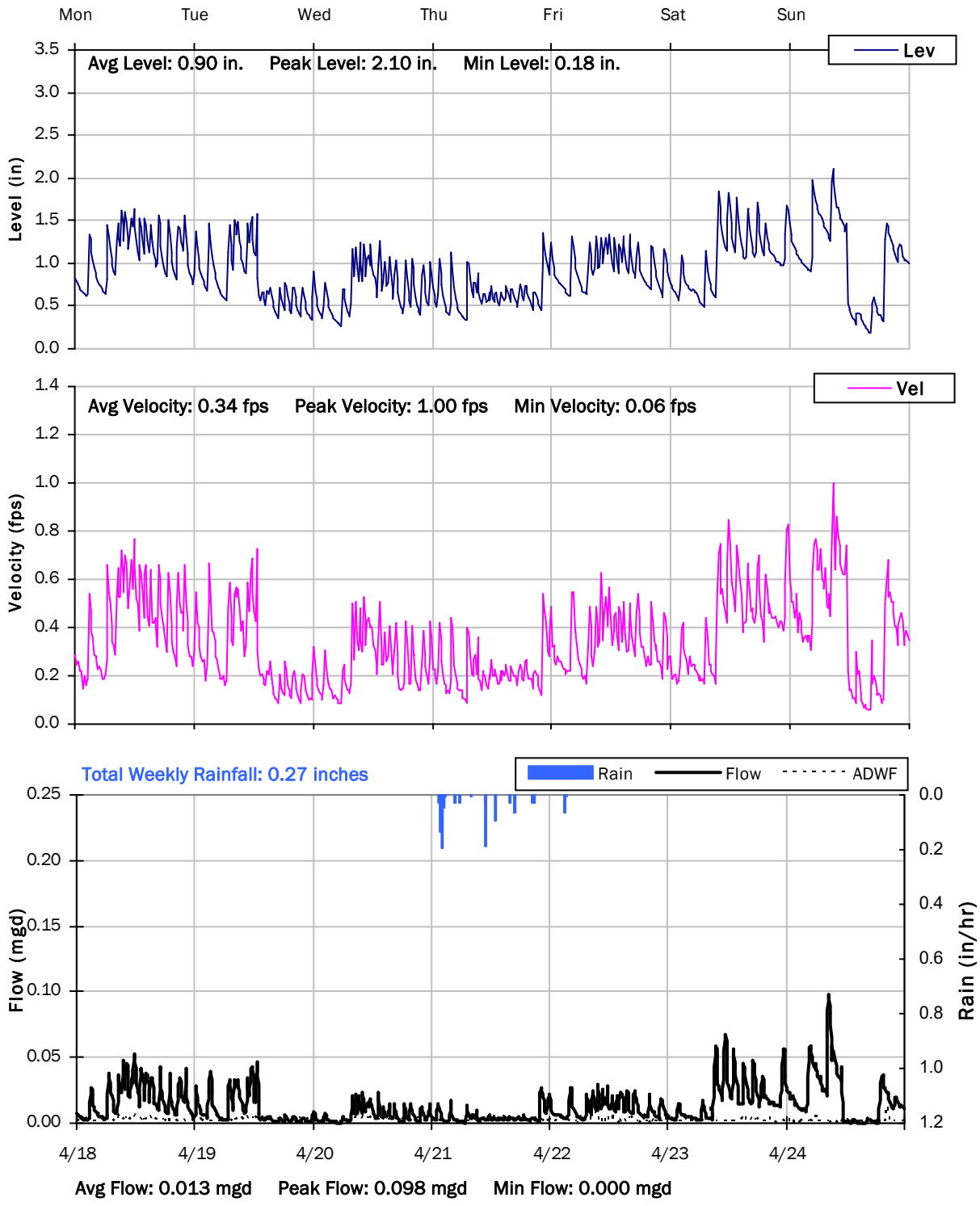
4/11/2022 to 4/18/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

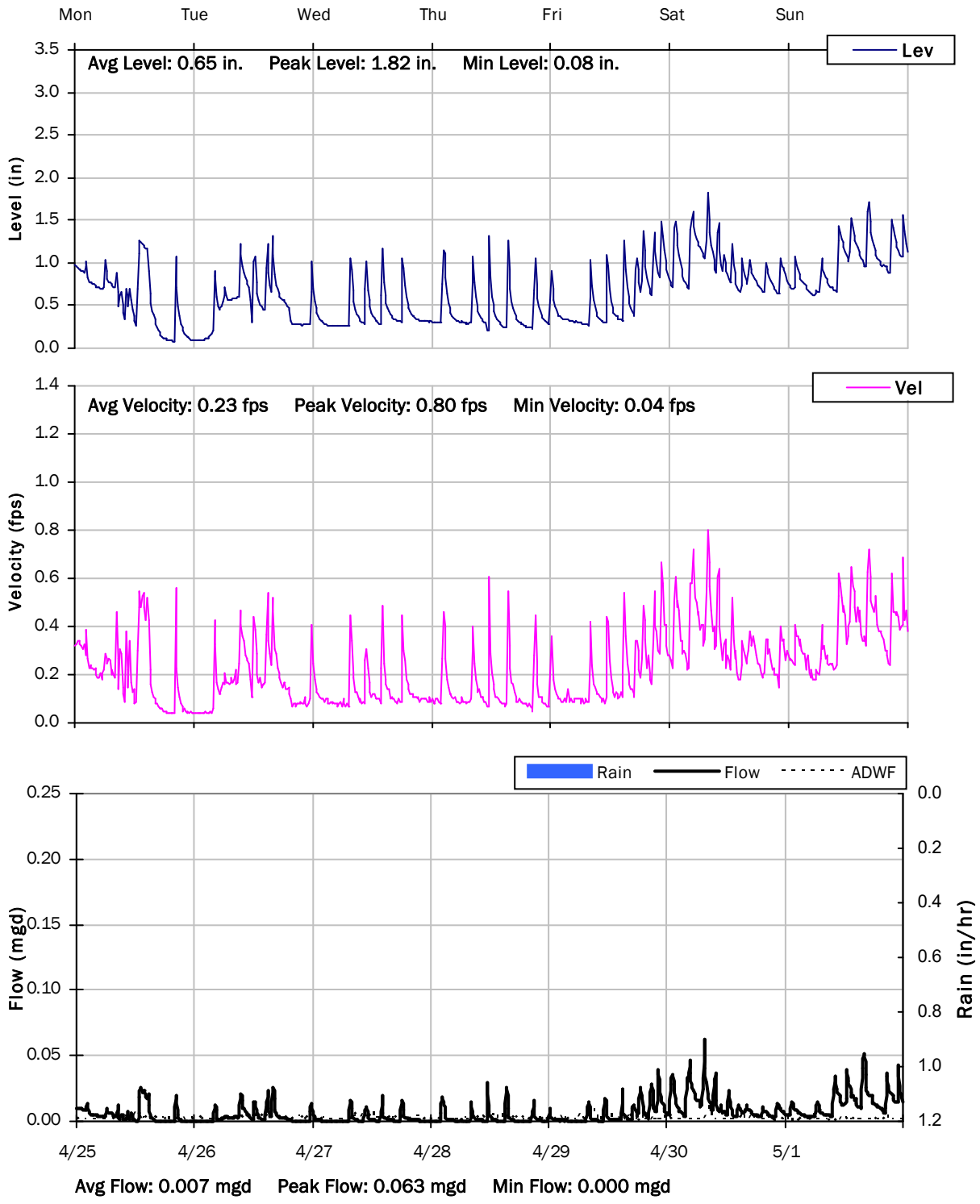
4/18/2022 to 4/25/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

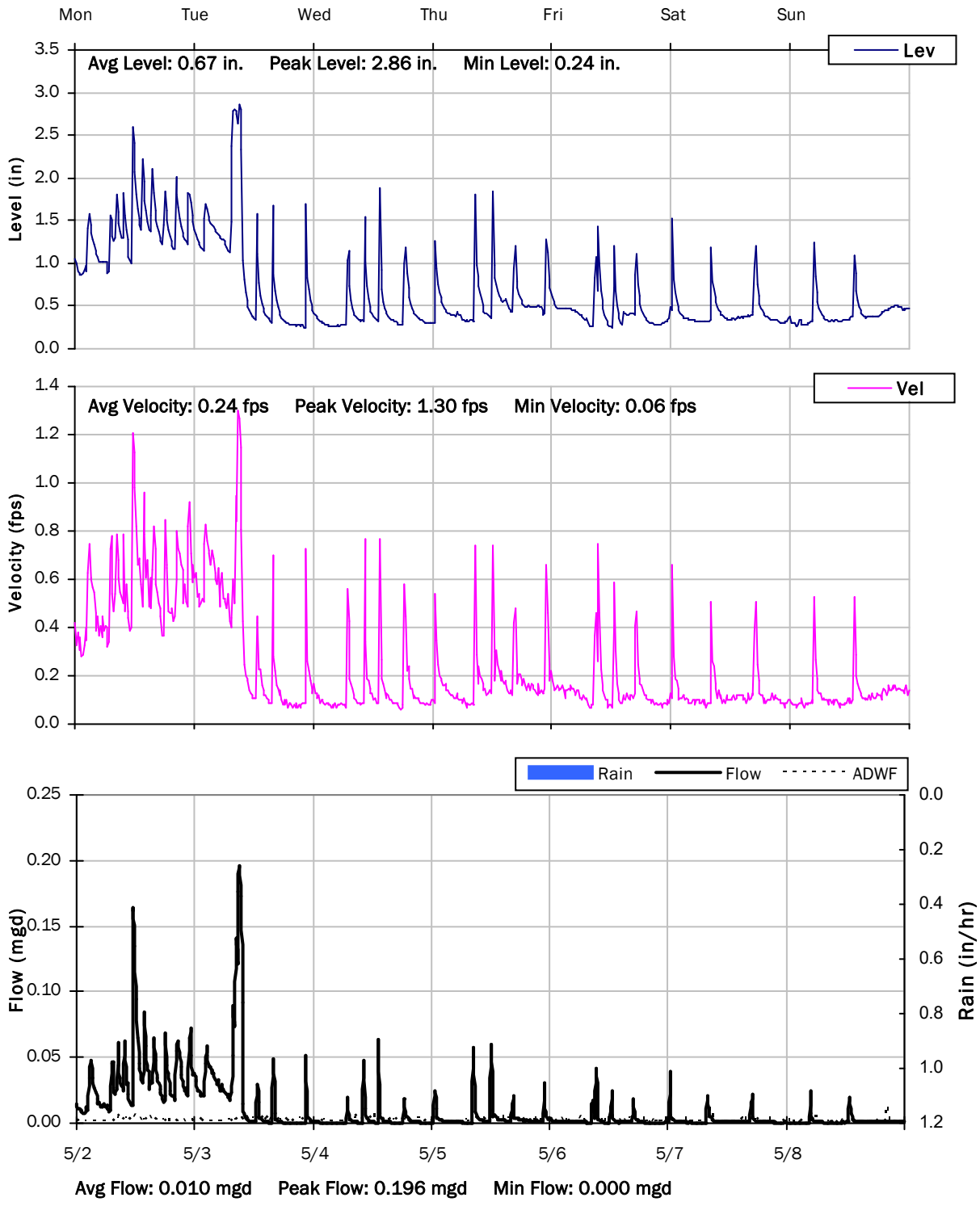
4/25/2022 to 5/2/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

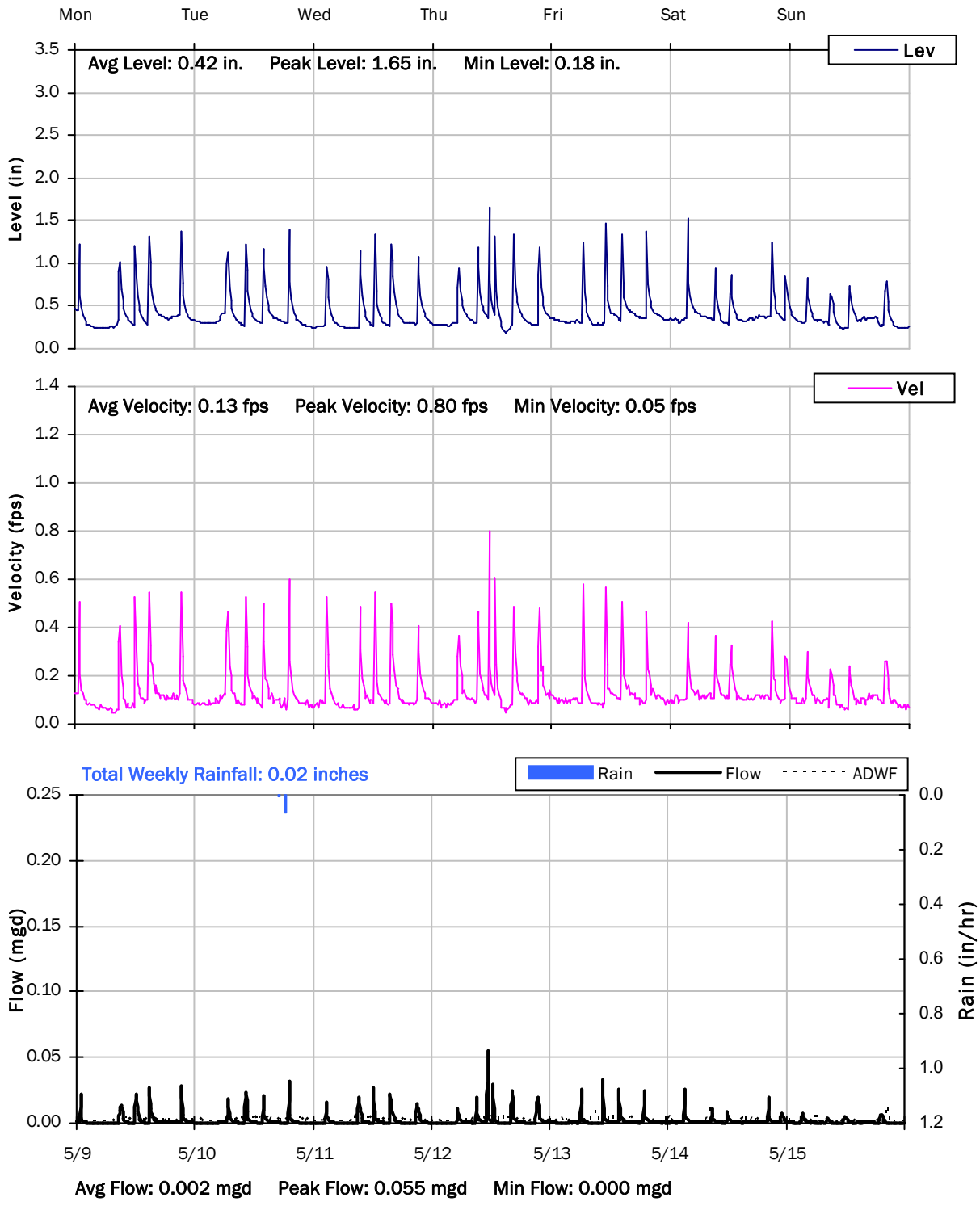
5/2/2022 to 5/9/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

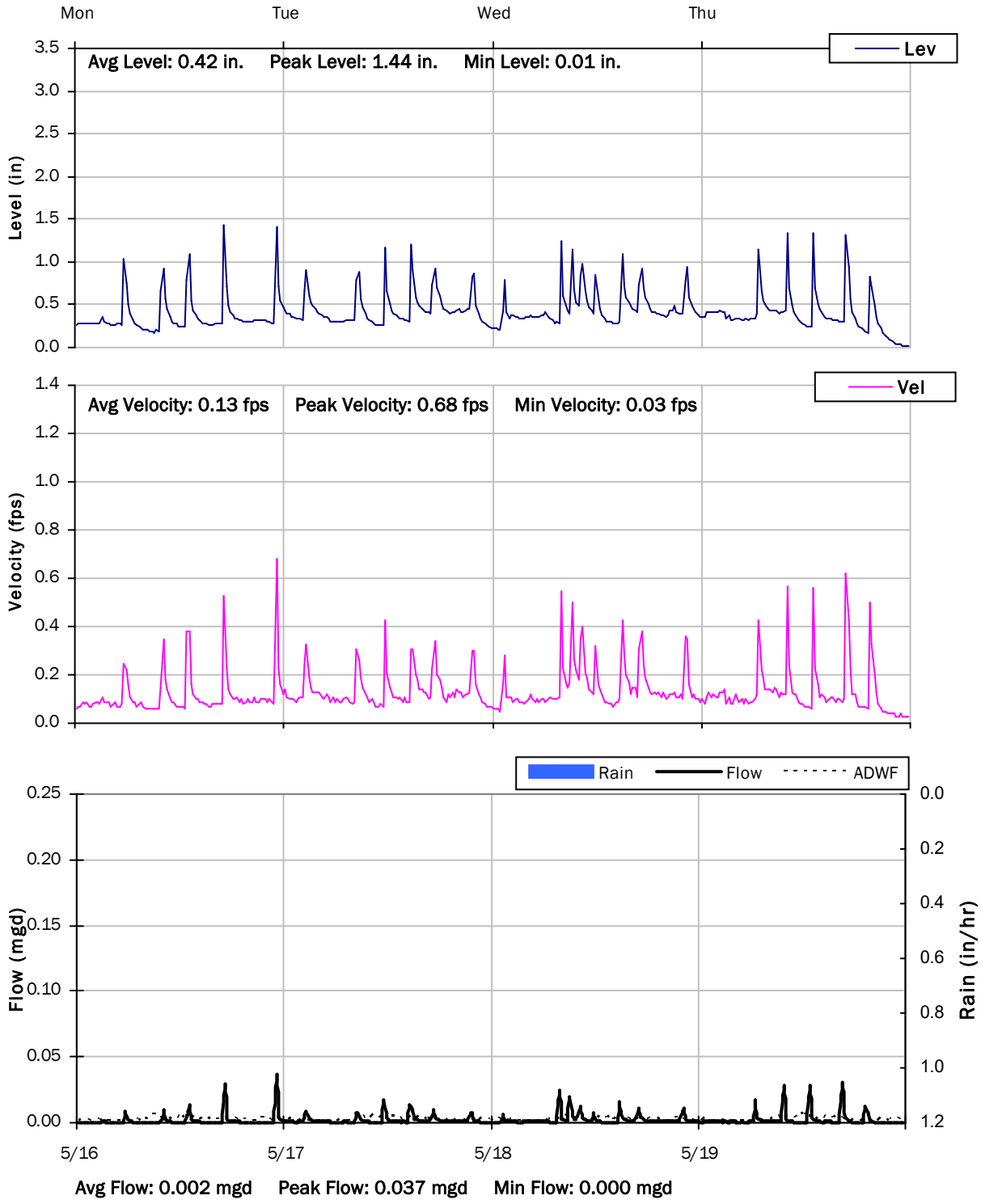
5/9/2022 to 5/16/2022



SITE 13

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 14

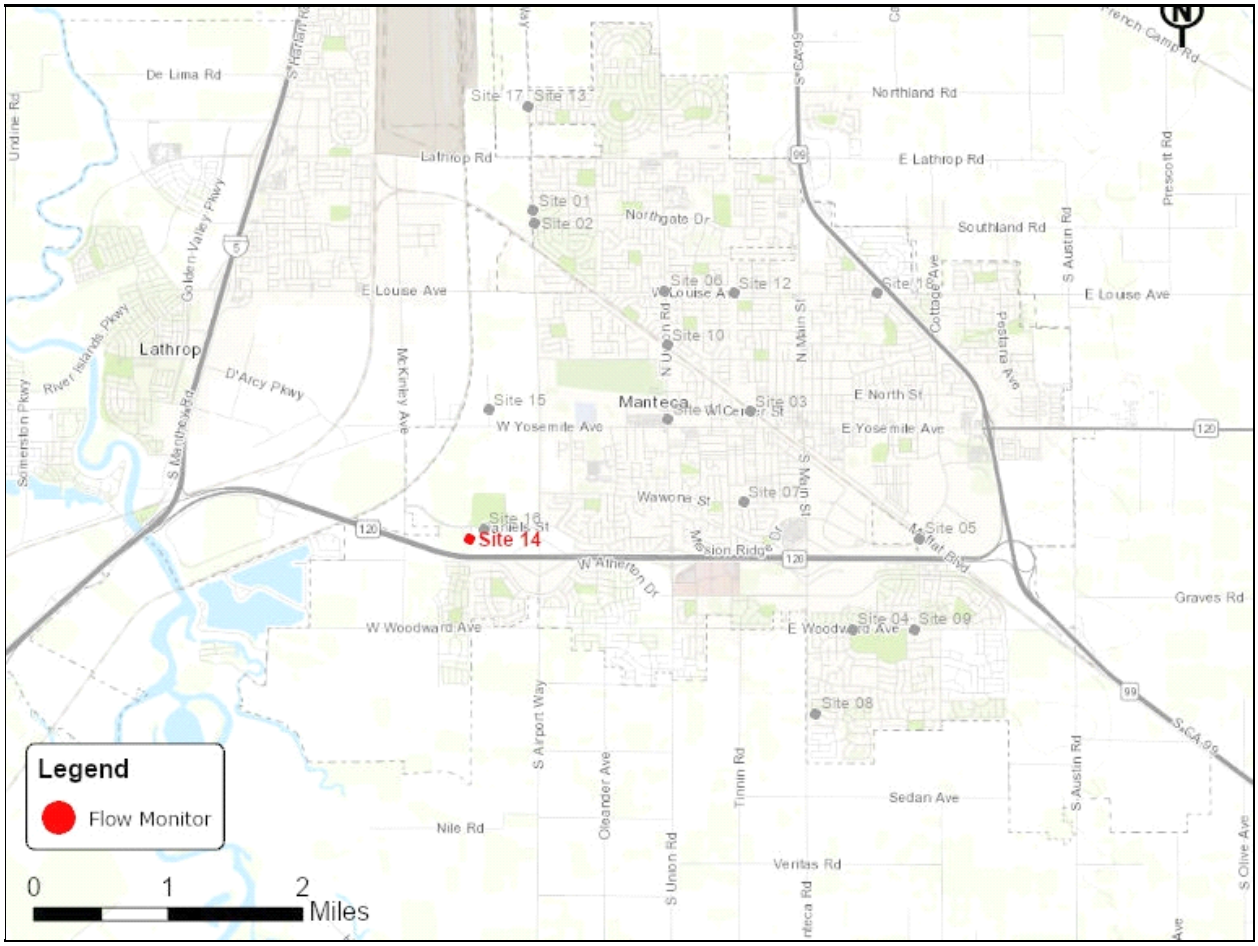
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Parking Lot West of Entertainment Way

Data Summary Report



Vicinity Map: Site 14

SITE 14

Additional Site Photos

Effluent Pipe

Monitored South Influent Pipe

SITE 14

Additional Site Photos

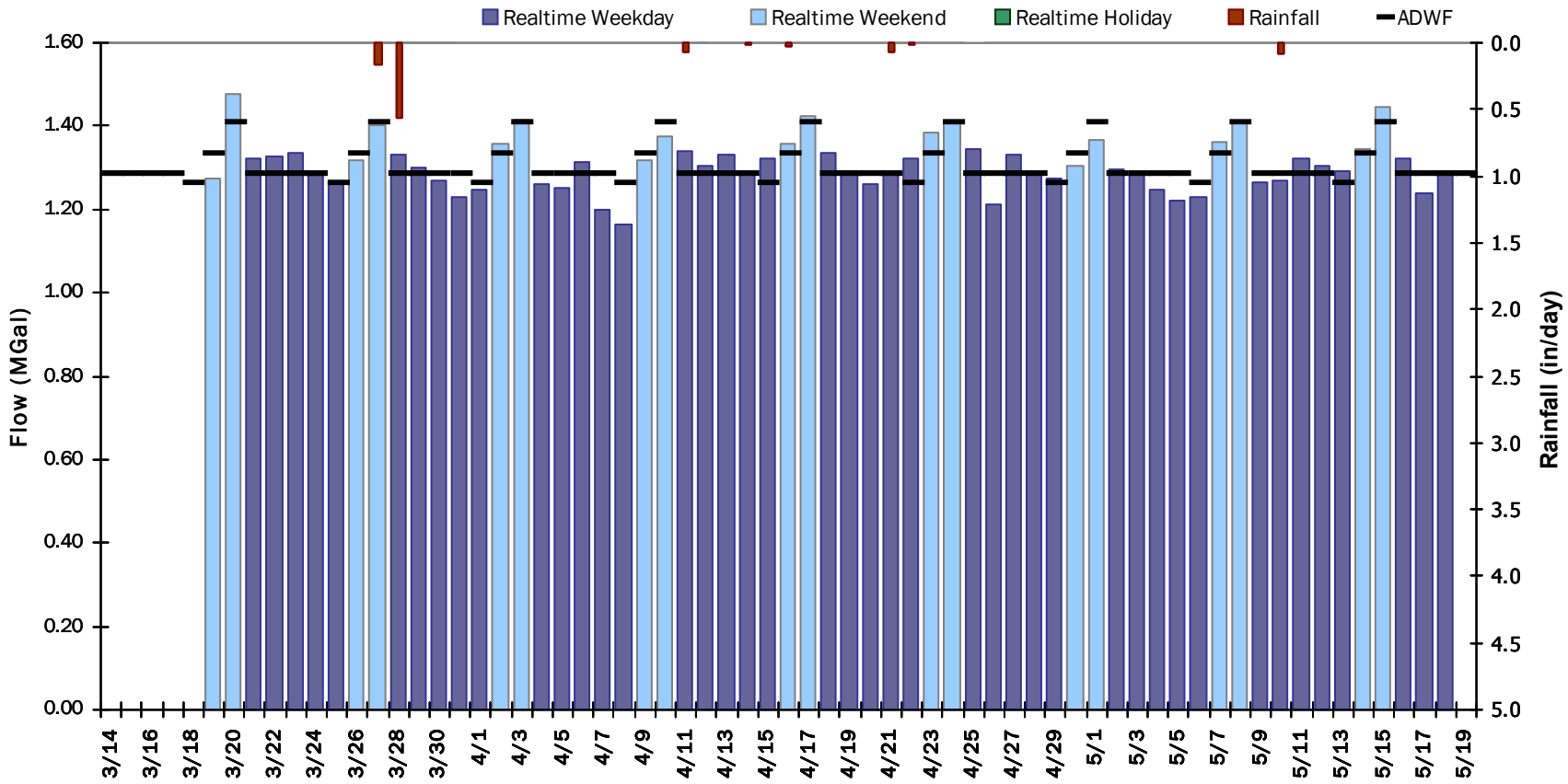
Northwest Drop Influent Pipe

SITE 14

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 1.310 MGal Peak Daily Flow: 1.475 MGal Min Daily Flow: 1.162 MGal

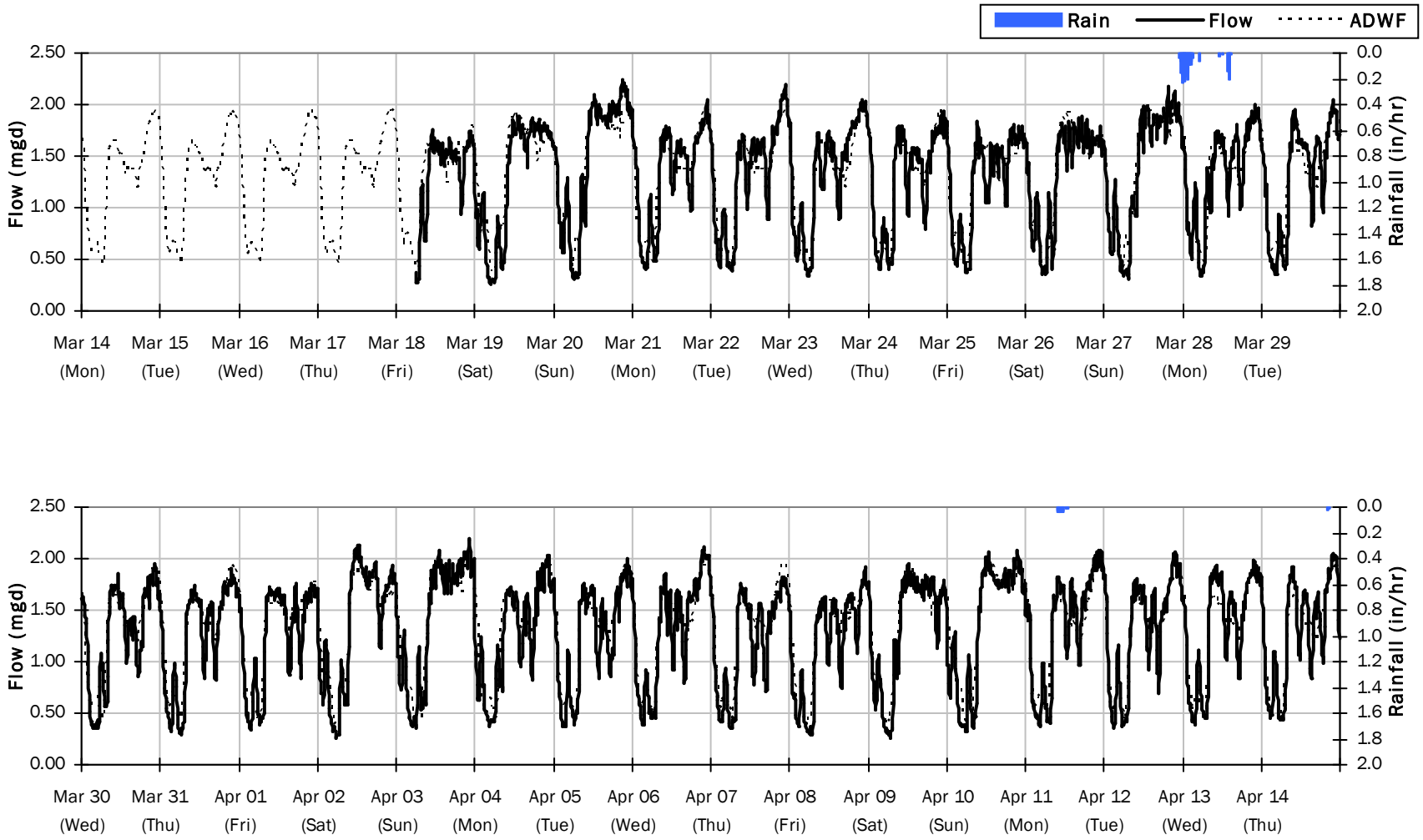
Total Rainfall: 1.01 inches



SITE 14

Flow Summary: 3/14/2022 to 4/14/2022

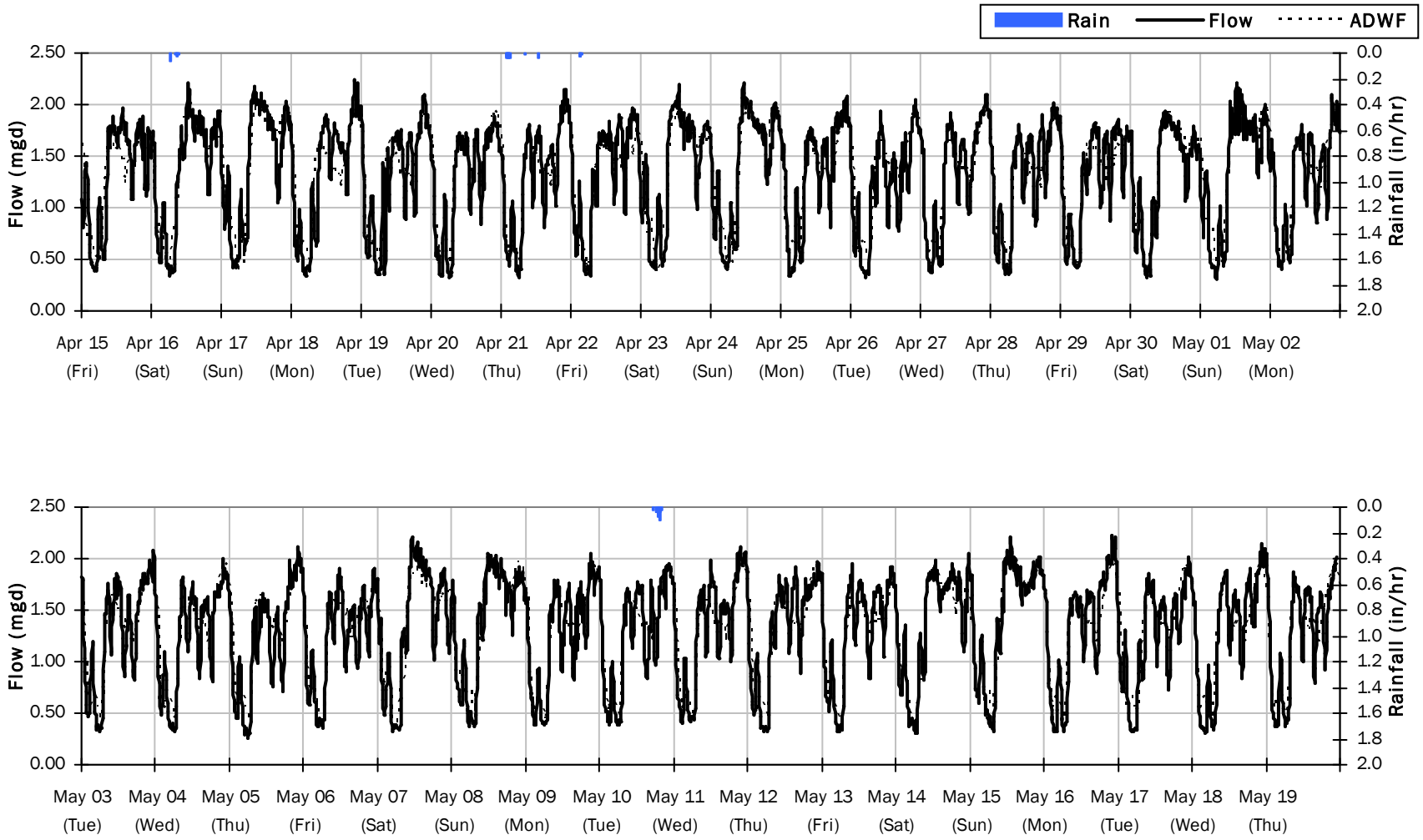
Period Rainfall: 0.81 inches Period Avg Flow: 1.308 mgd Period Peak Flow: 2.238 mgd Period Min Flow: 0.252 mgd



SITE 14

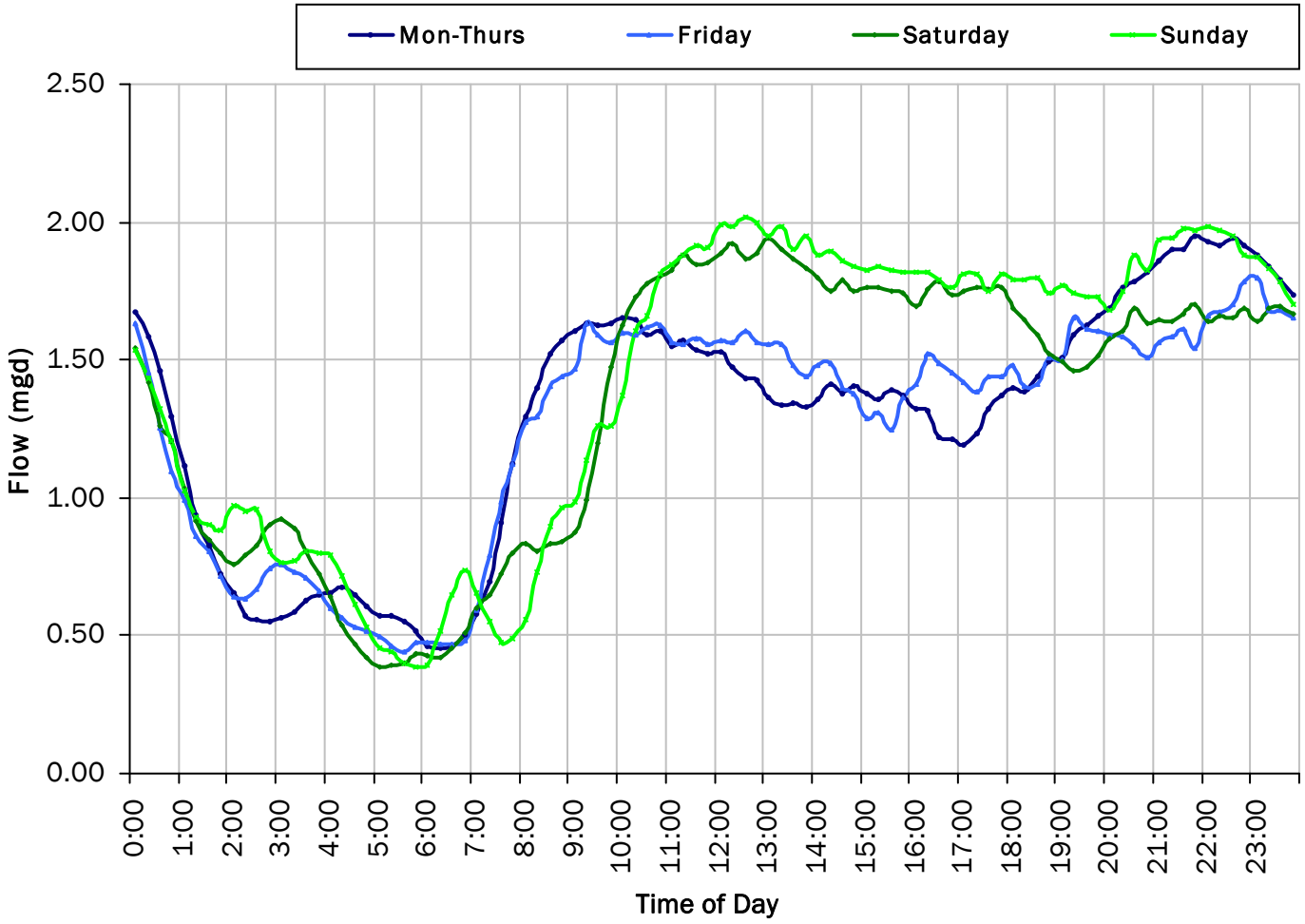
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.20 inches Period Avg Flow: 1.312 mgd Period Peak Flow: 2.240 mgd Period Min Flow: 0.266 mgd



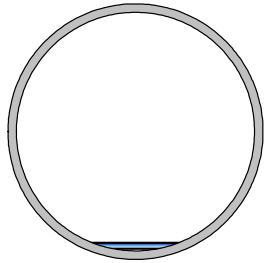
SITE 14

Average Dry Weather Flow Hydrographs



ADWF:

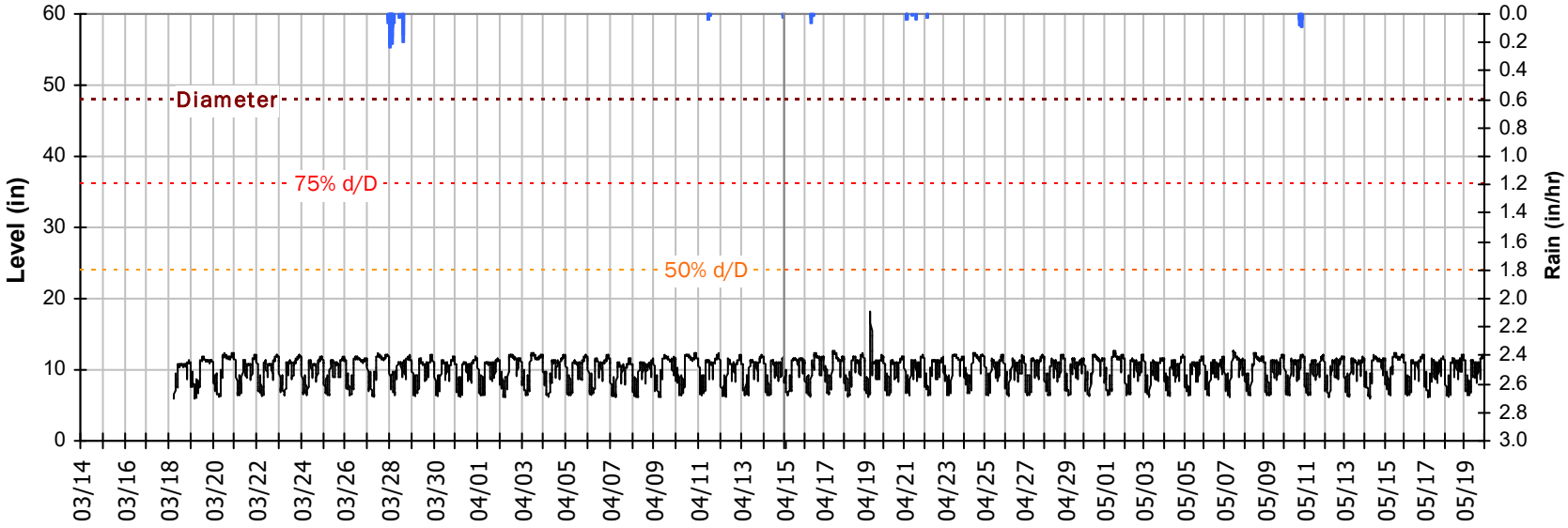
1.307 *mgd*

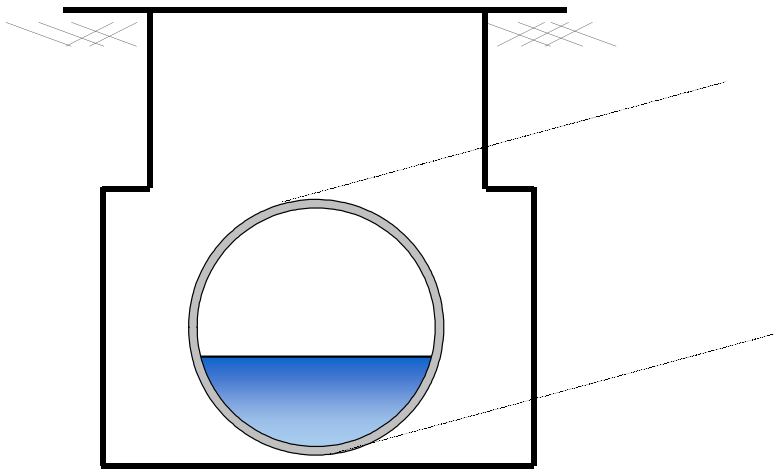


SITE 14

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



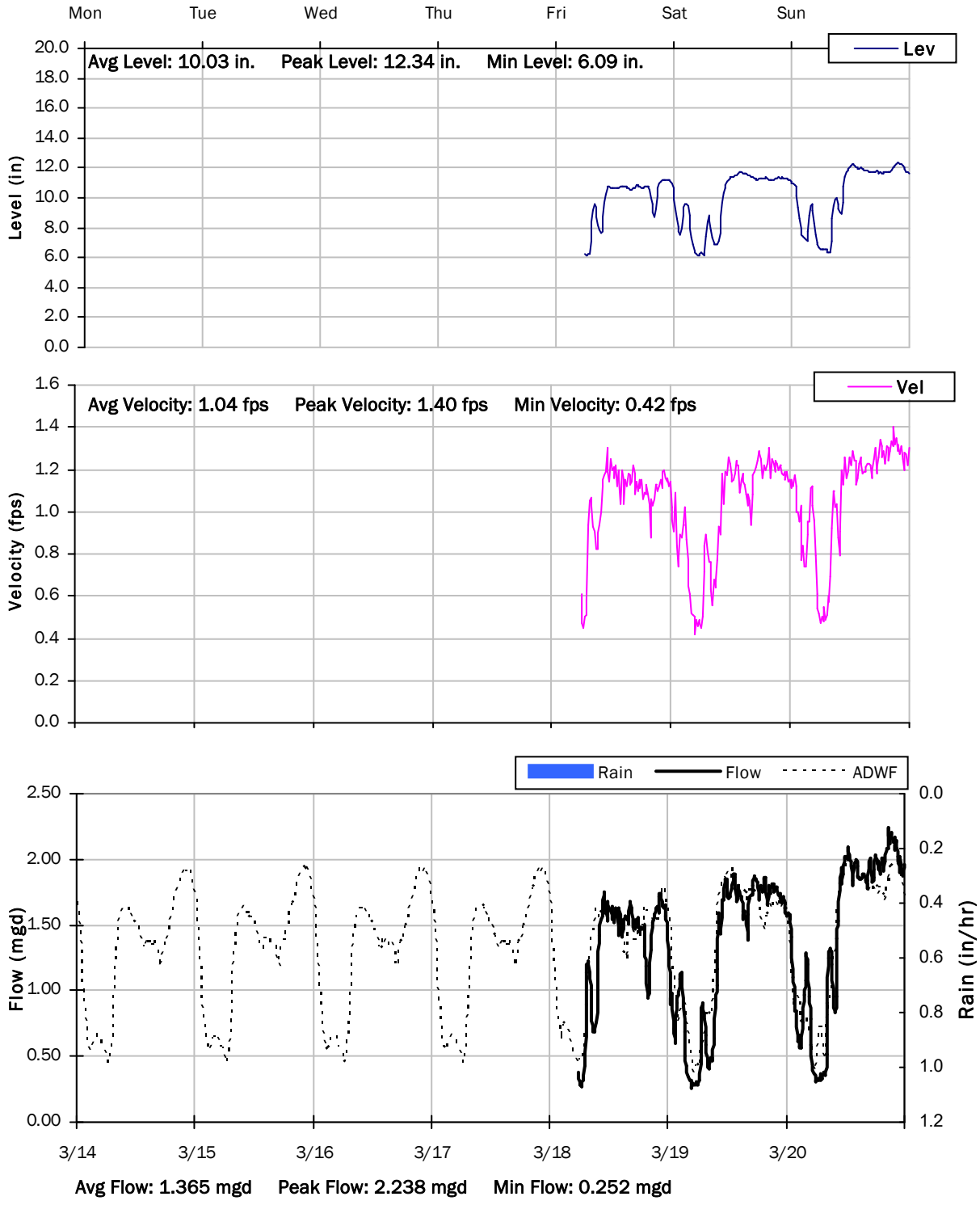


Pipe Diameter:	48	*inches*
Peak Measured Level:	18.2	*inches*
Peak d/D Ratio:	0.38	

SITE 14

Weekly Level, Velocity and Flow Hydrographs

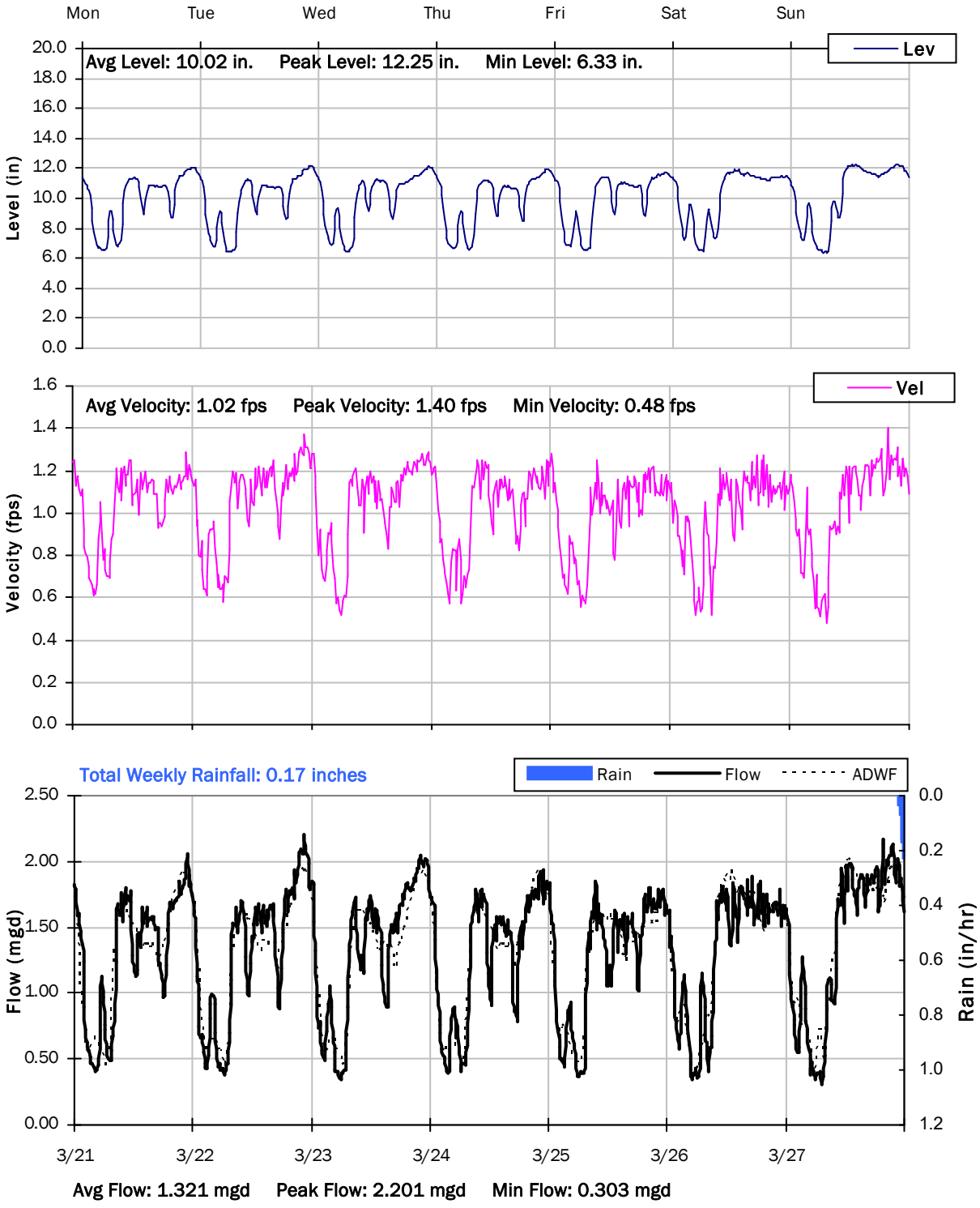
3/14/2022 to 3/21/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

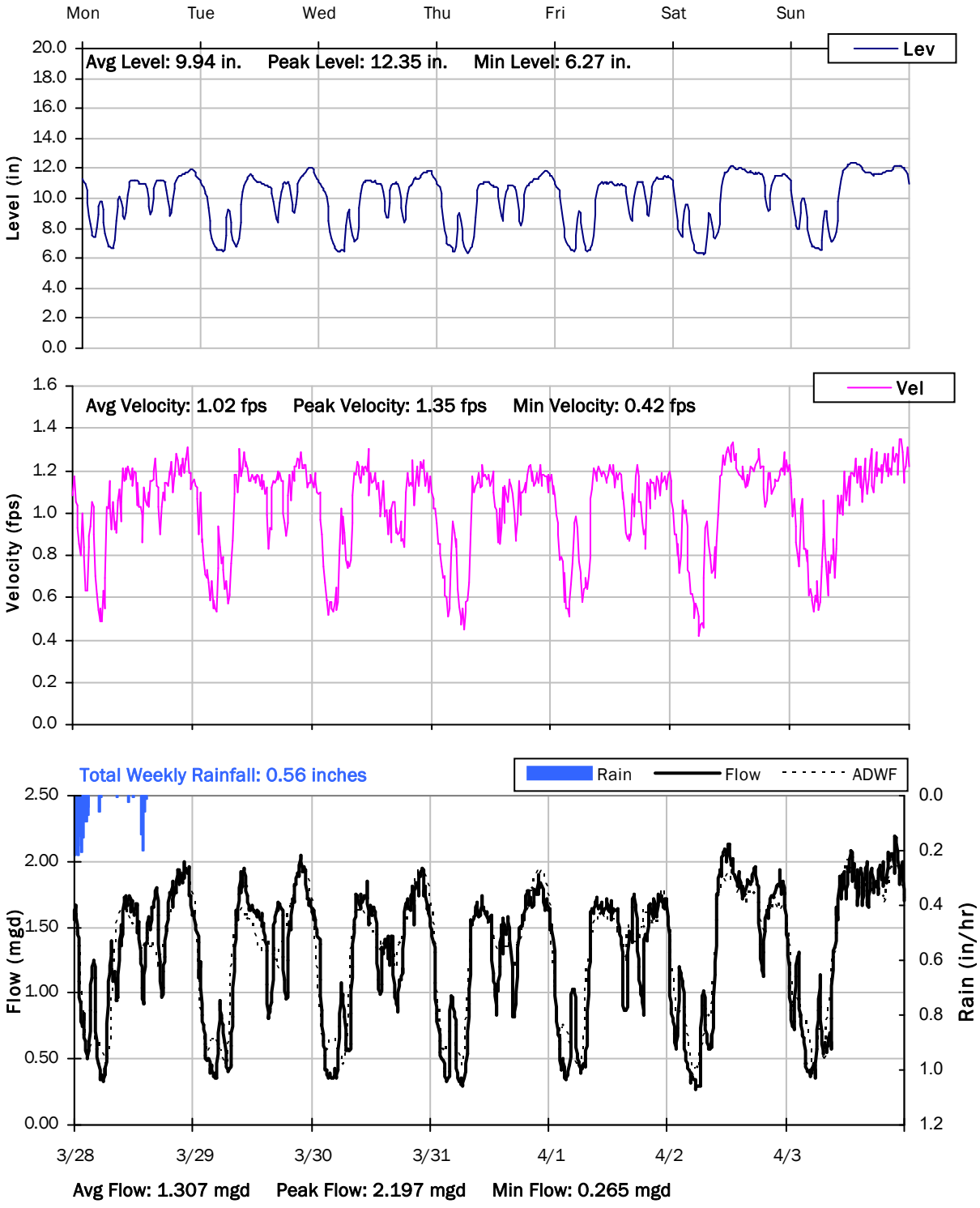
3/21/2022 to 3/28/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

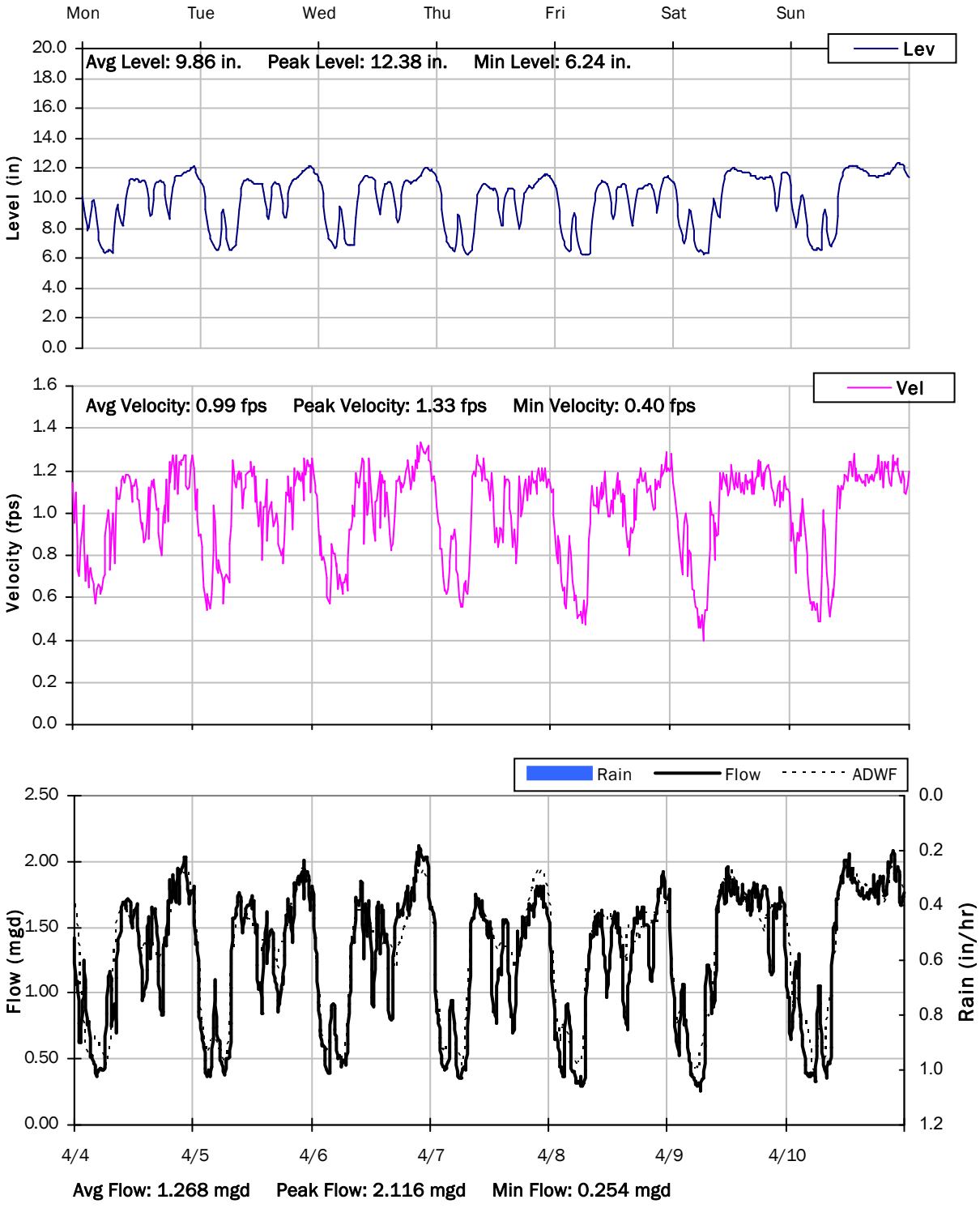
3/28/2022 to 4/4/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

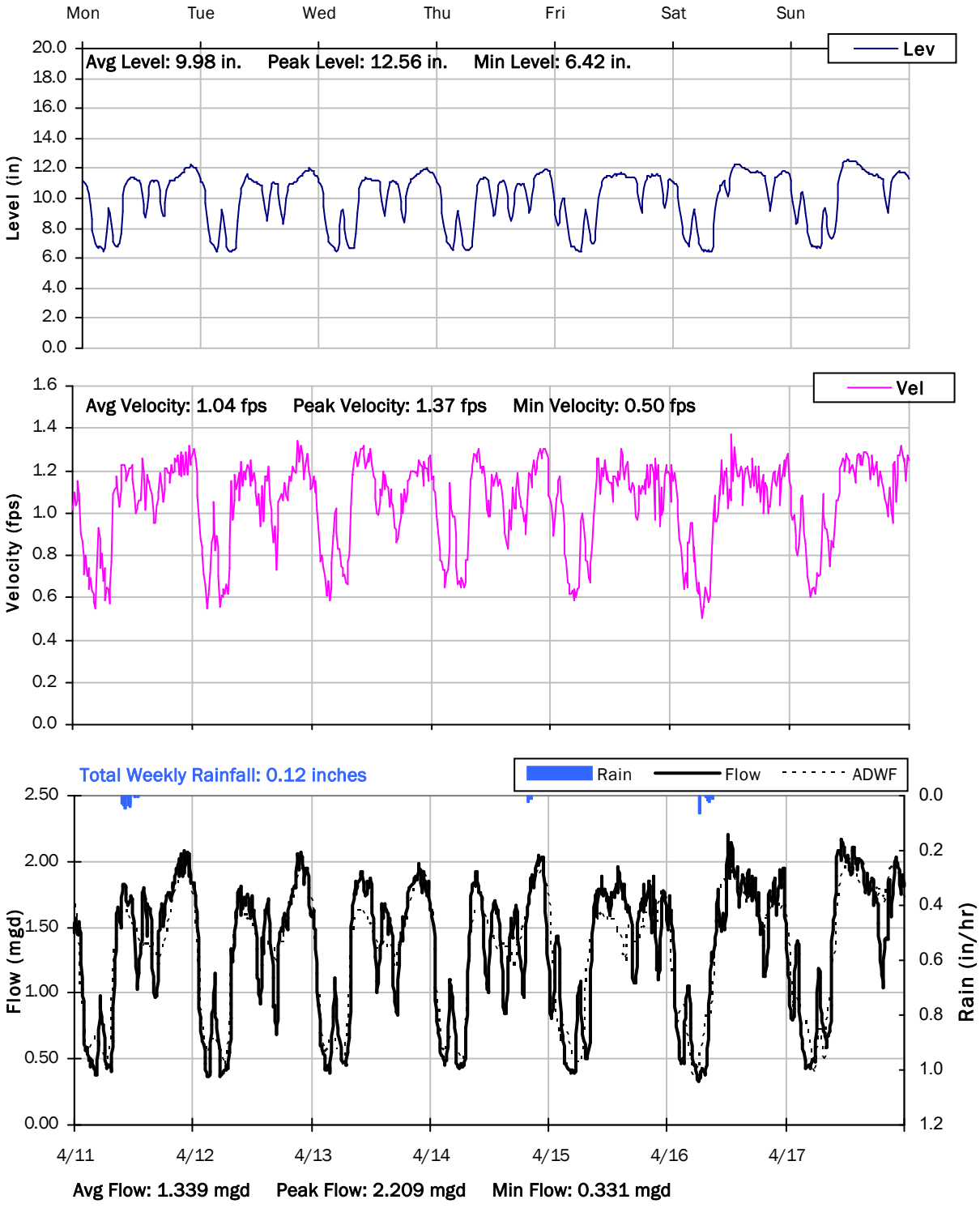
4/4/2022 to 4/11/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

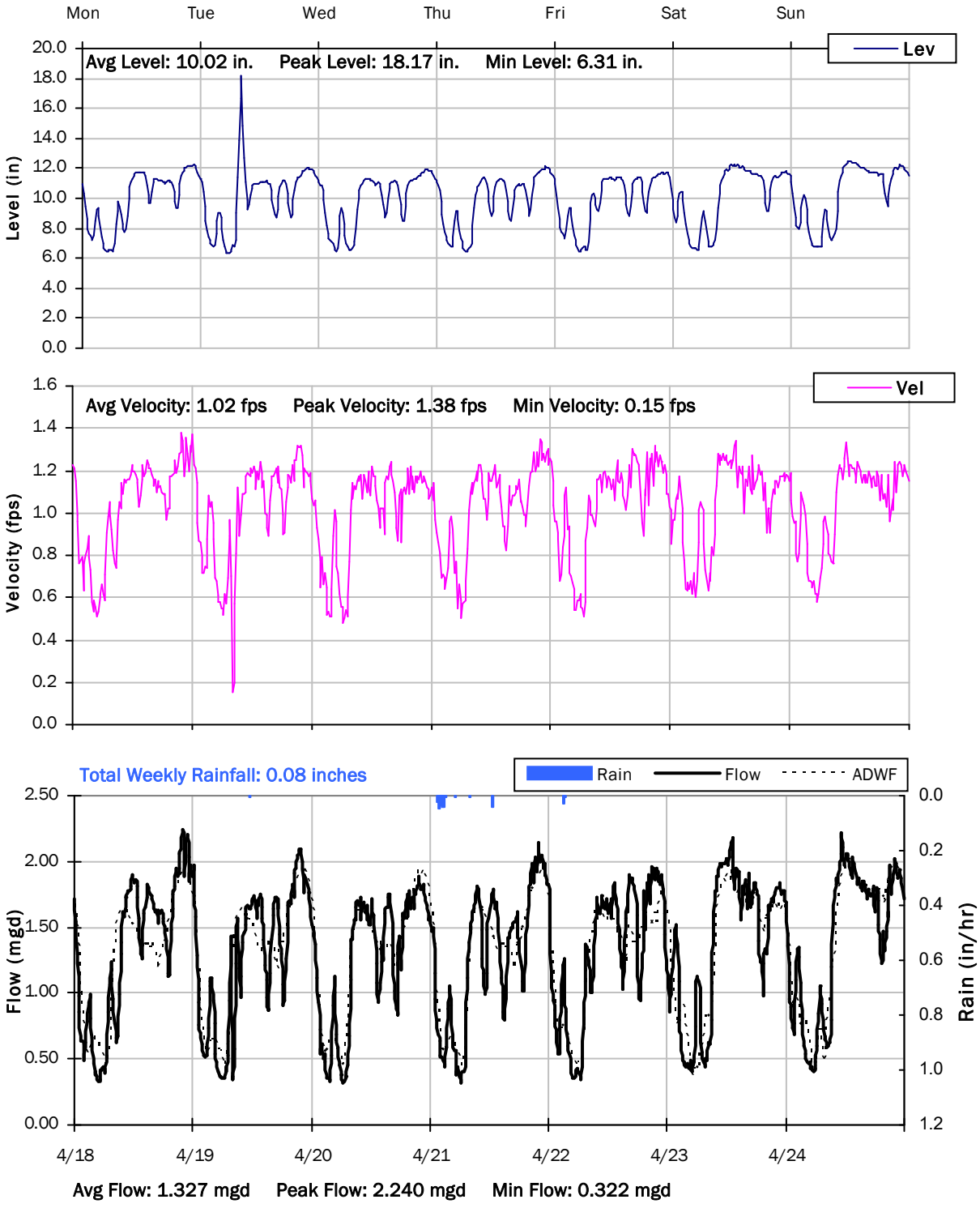
4/11/2022 to 4/18/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

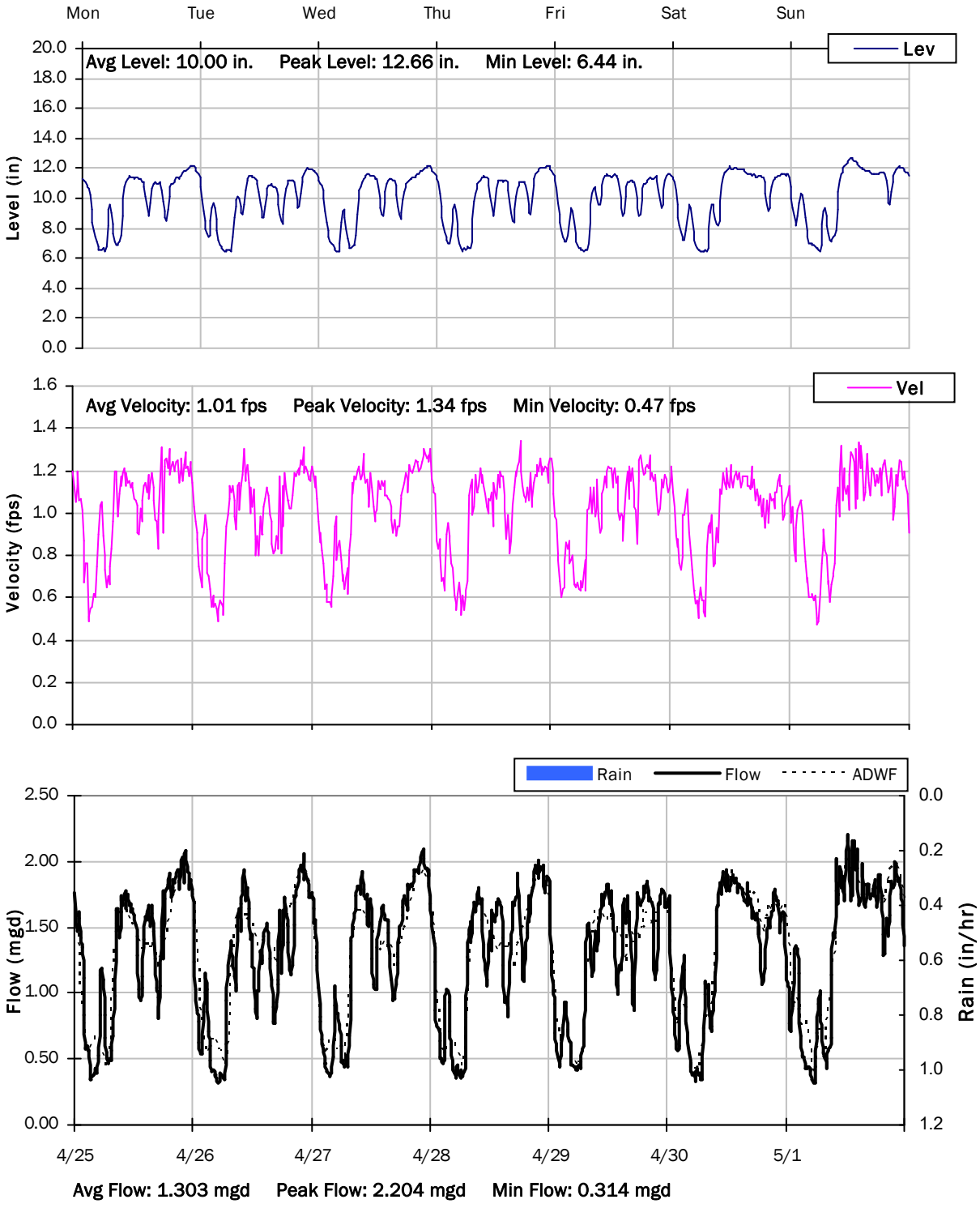
4/18/2022 to 4/25/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

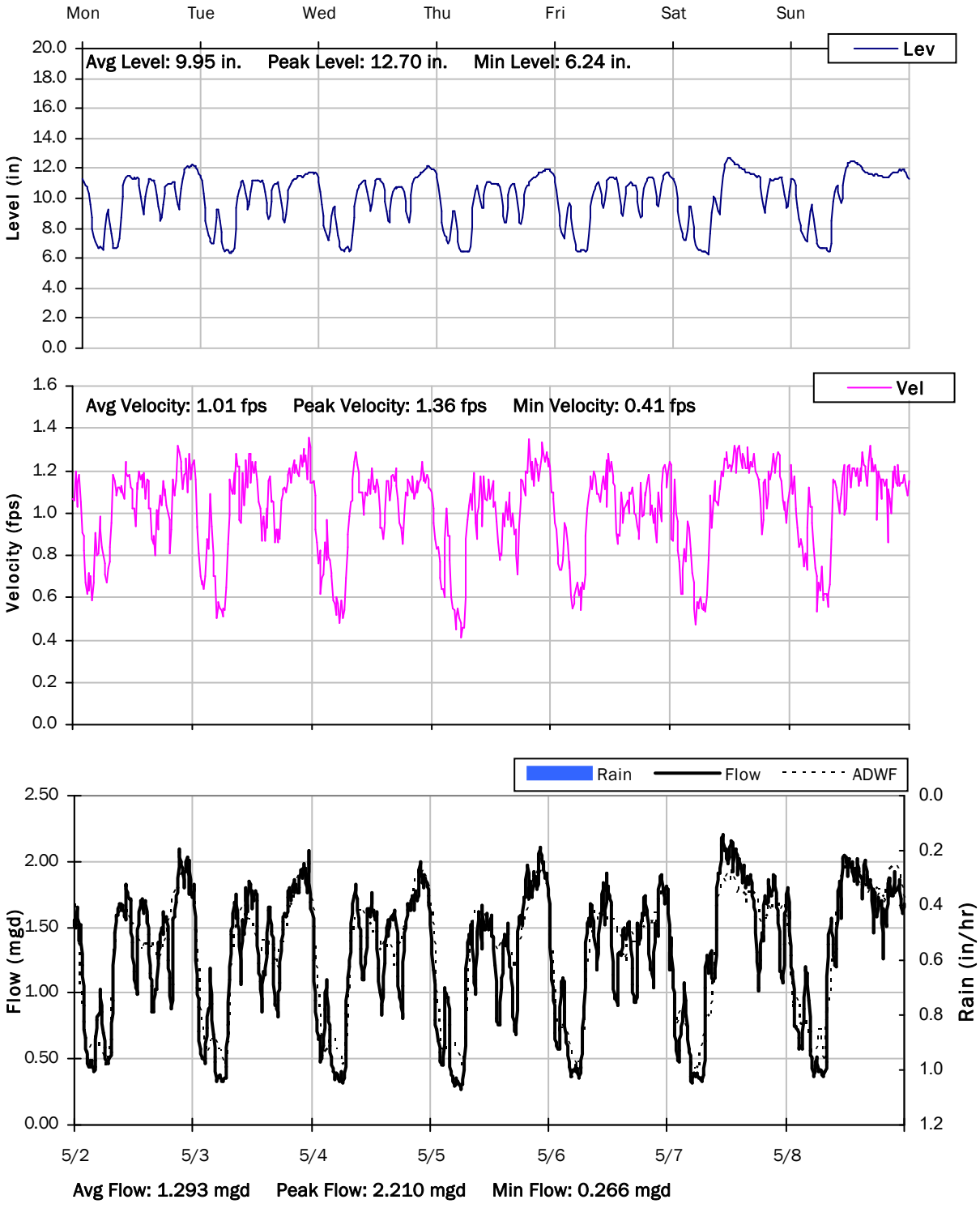
4/25/2022 to 5/2/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

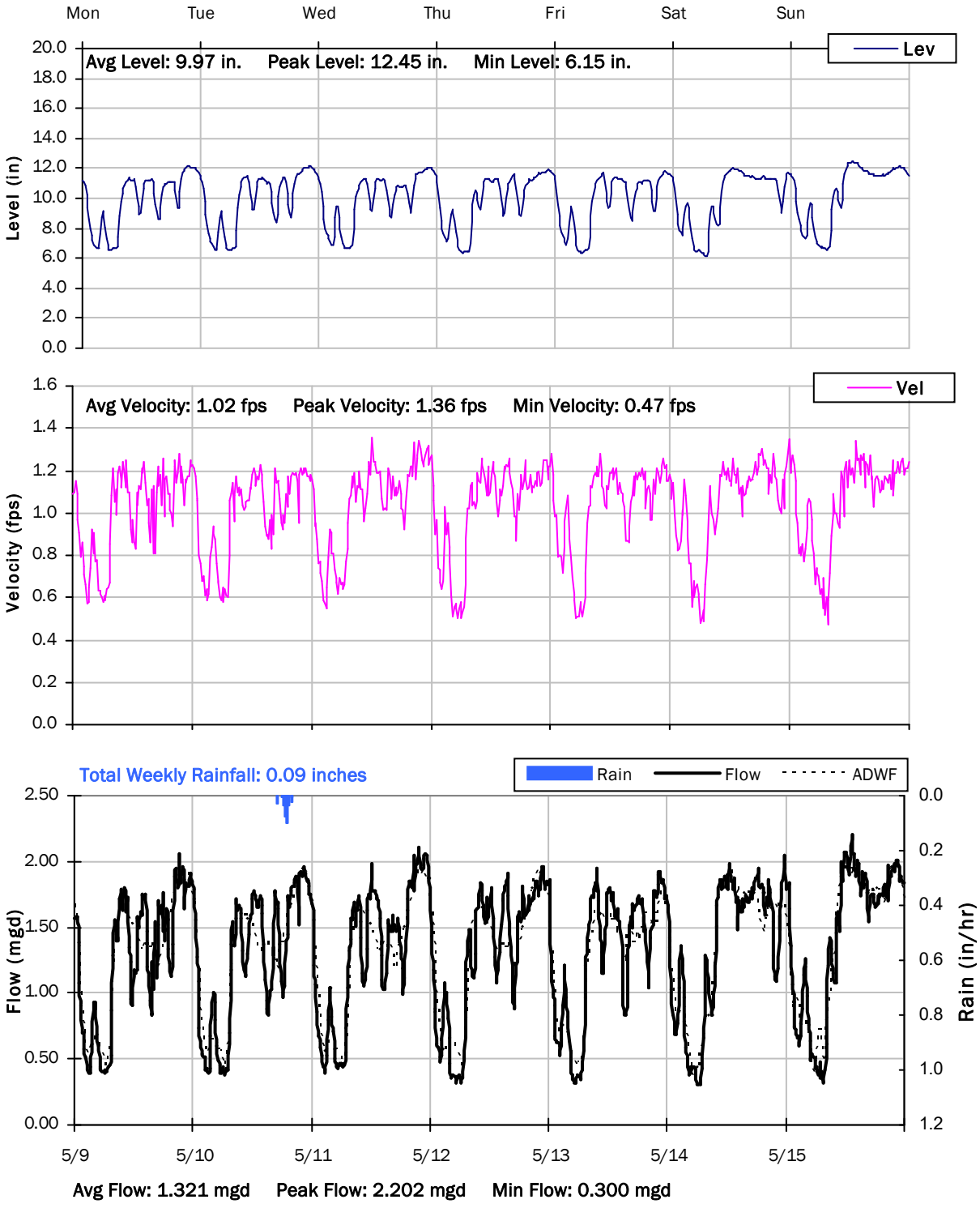
5/2/2022 to 5/9/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

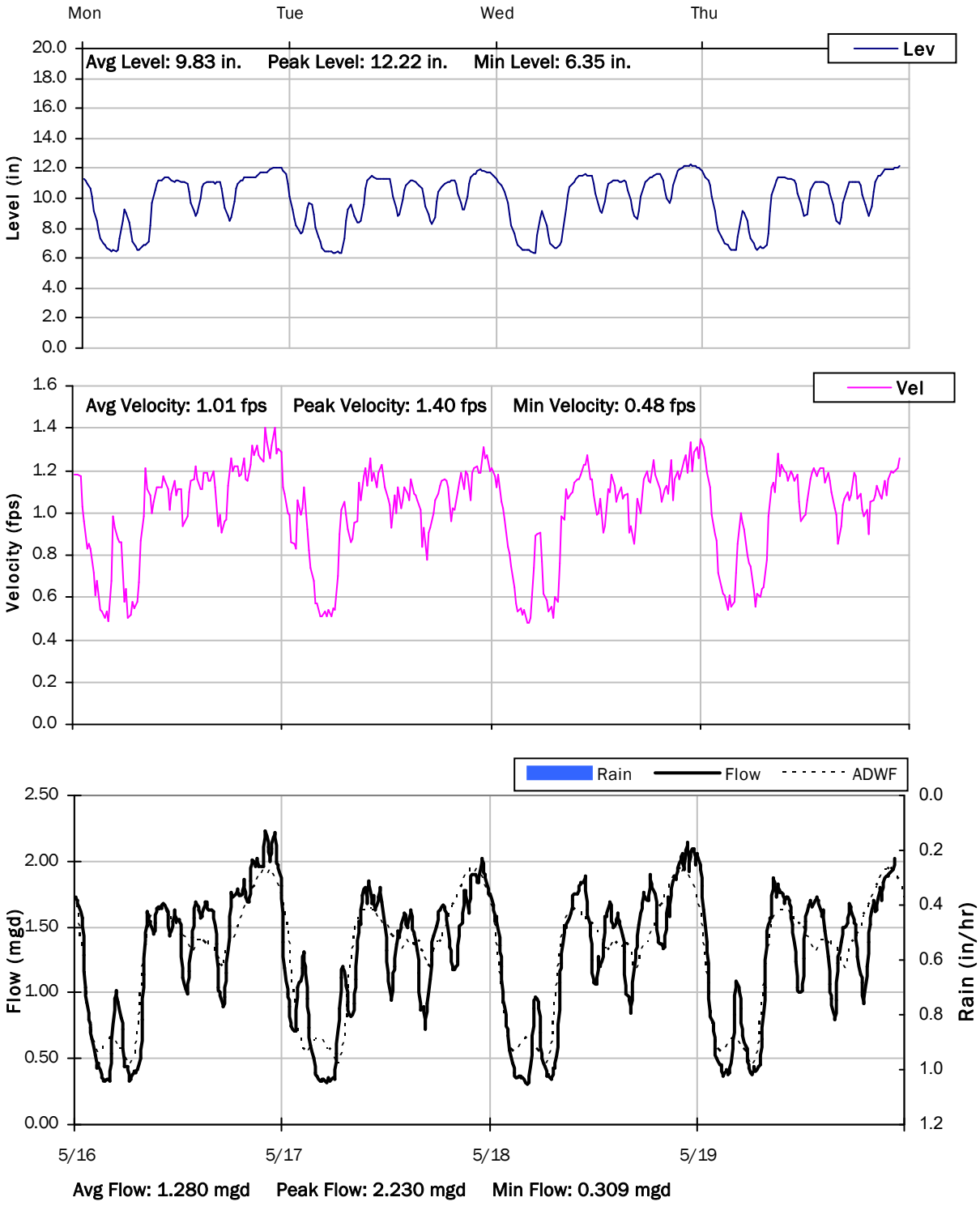
5/9/2022 to 5/16/2022



SITE 14

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 15

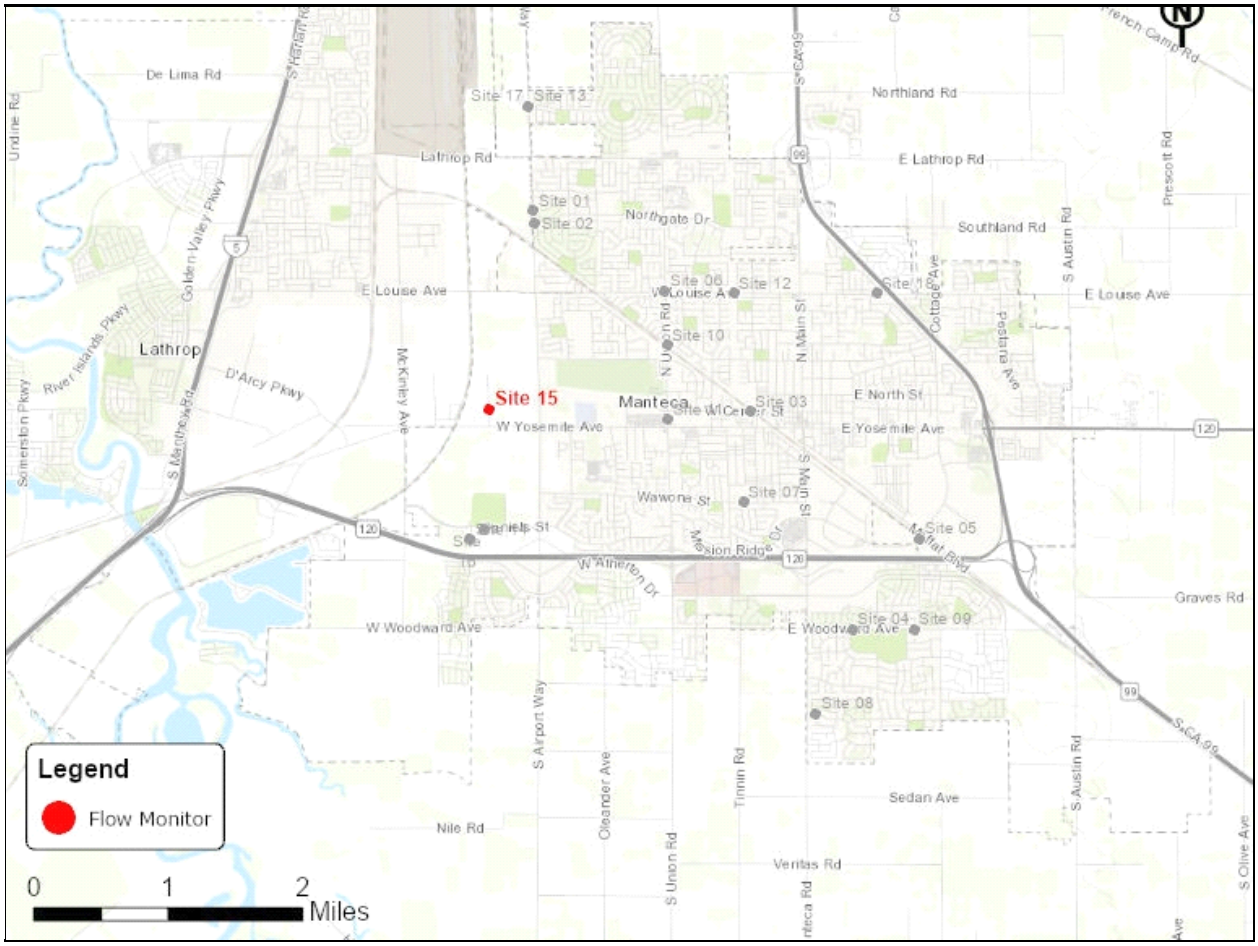
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Swanson Road North of W. Yosemite Avenue

Data Summary Report

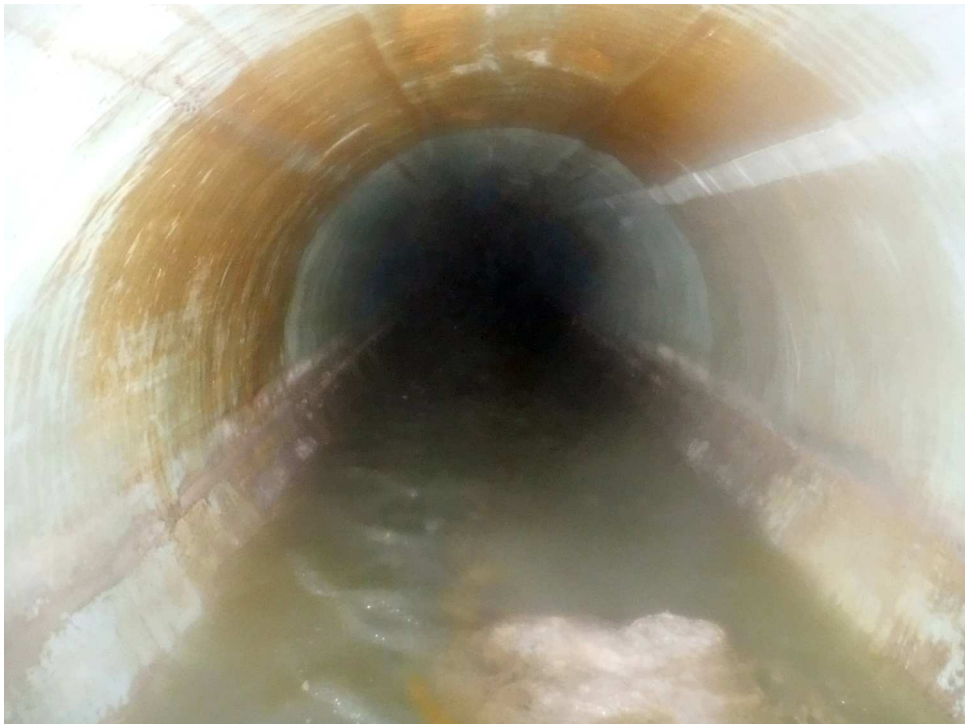


Vicinity Map: Site 15

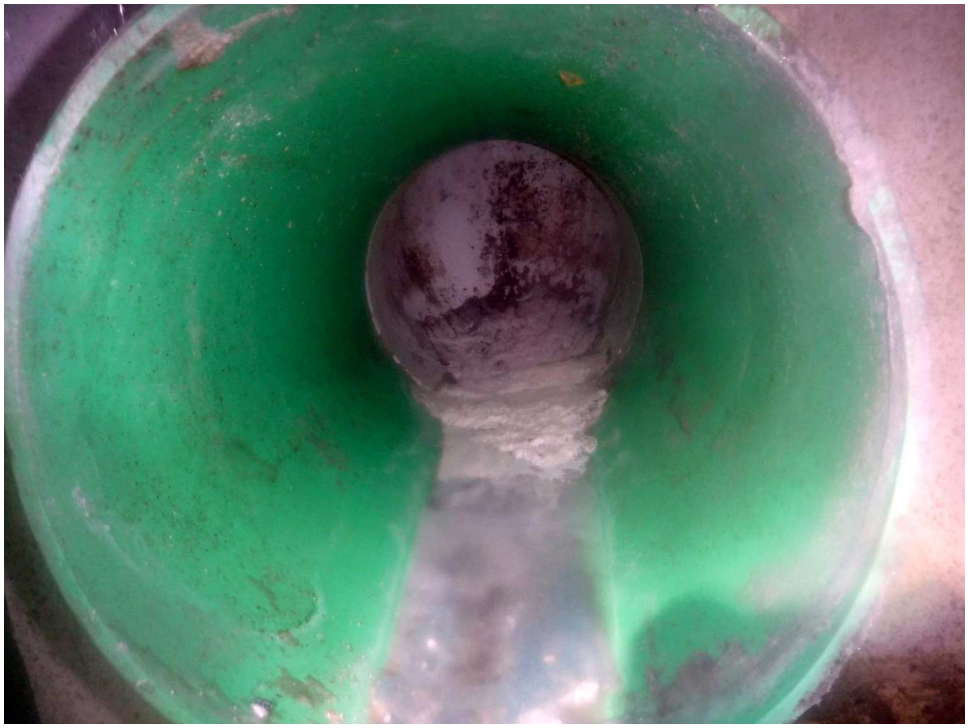
SITE 15

Additional Site Photos

Effluent Pipe



West Influent Pipe (Lower)

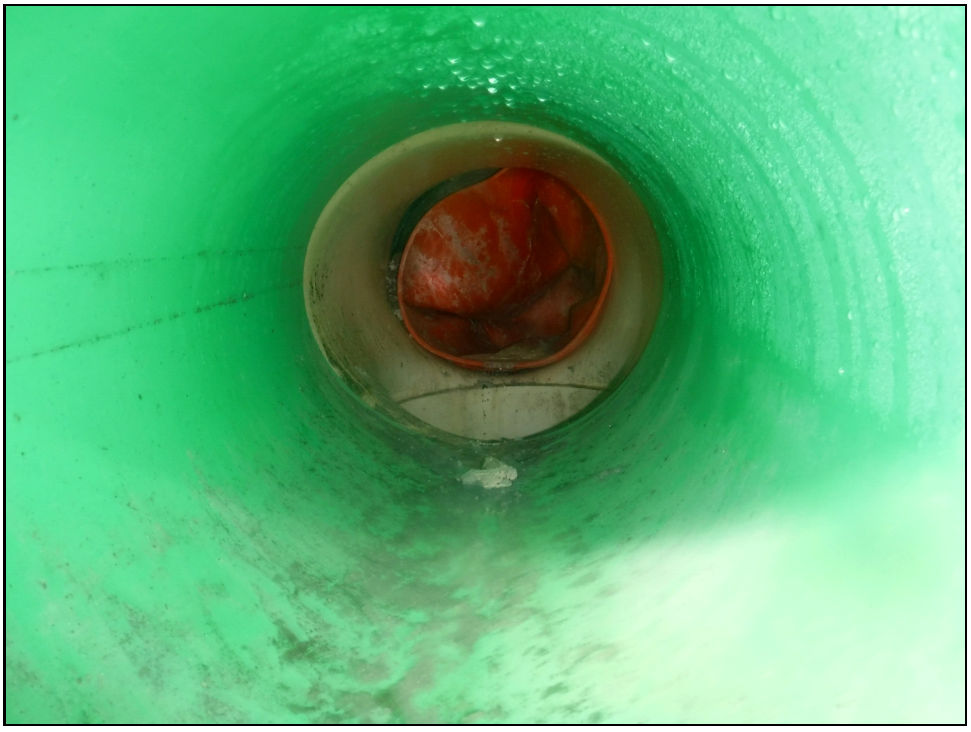


SITE 15

Additional Site Photos

Monitored North Influent Pipe

East Influent Pipe (Lower)

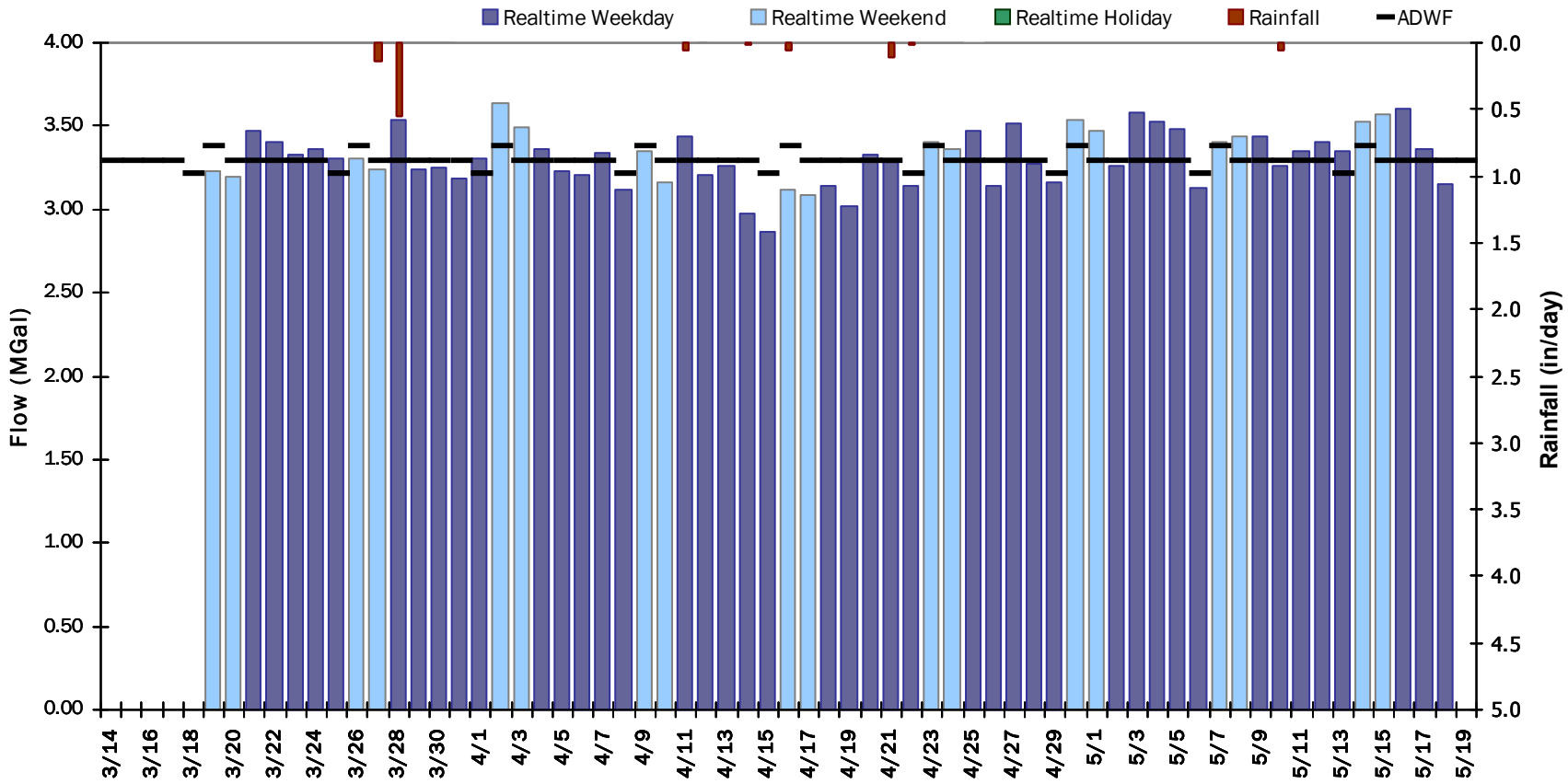


SITE 15

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 3.316 MGal Peak Daily Flow: 3.642 MGal Min Daily Flow: 2.870 MGal

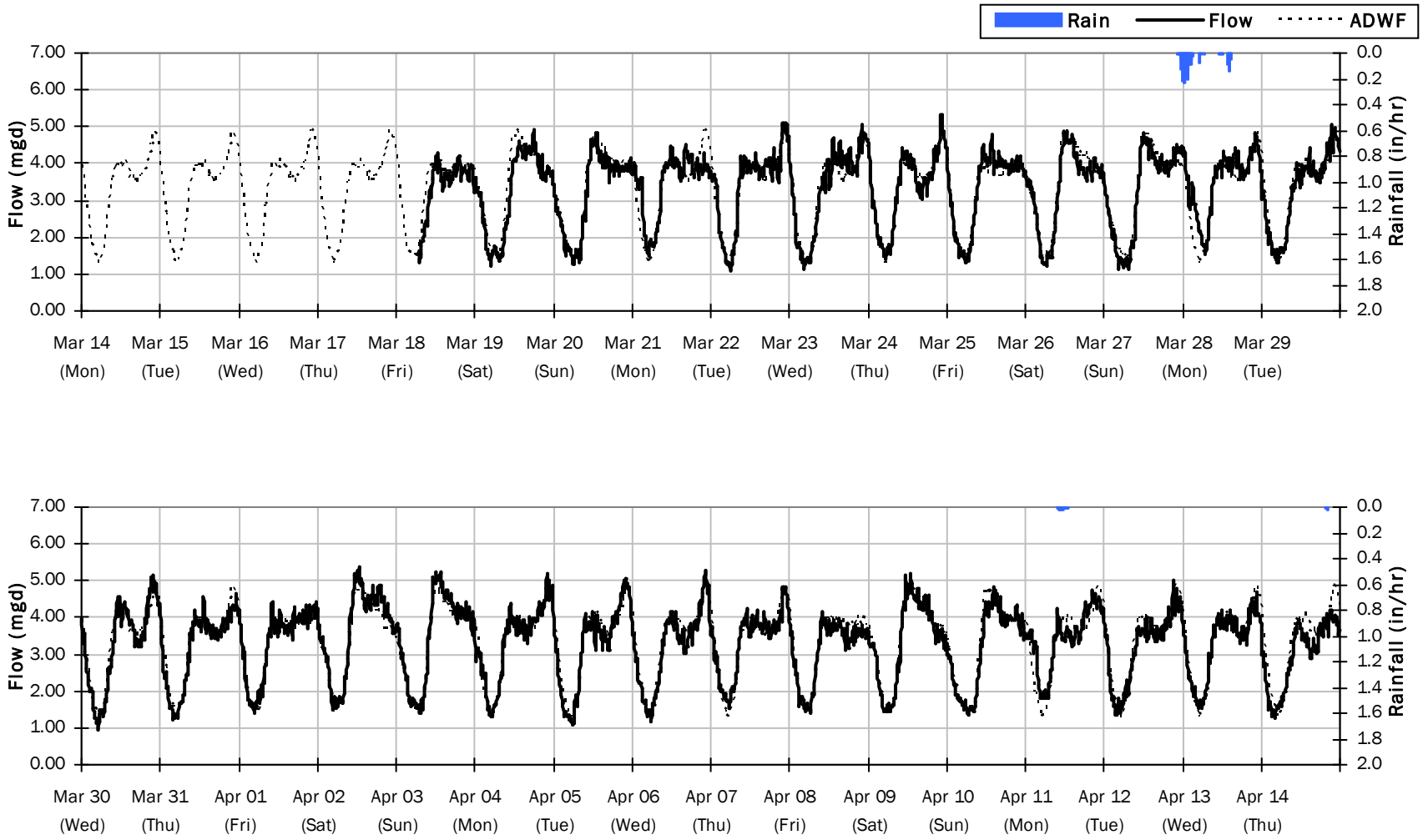
Total Rainfall: 0.99 inches



SITE 15

Flow Summary: 3/14/2022 to 4/14/2022

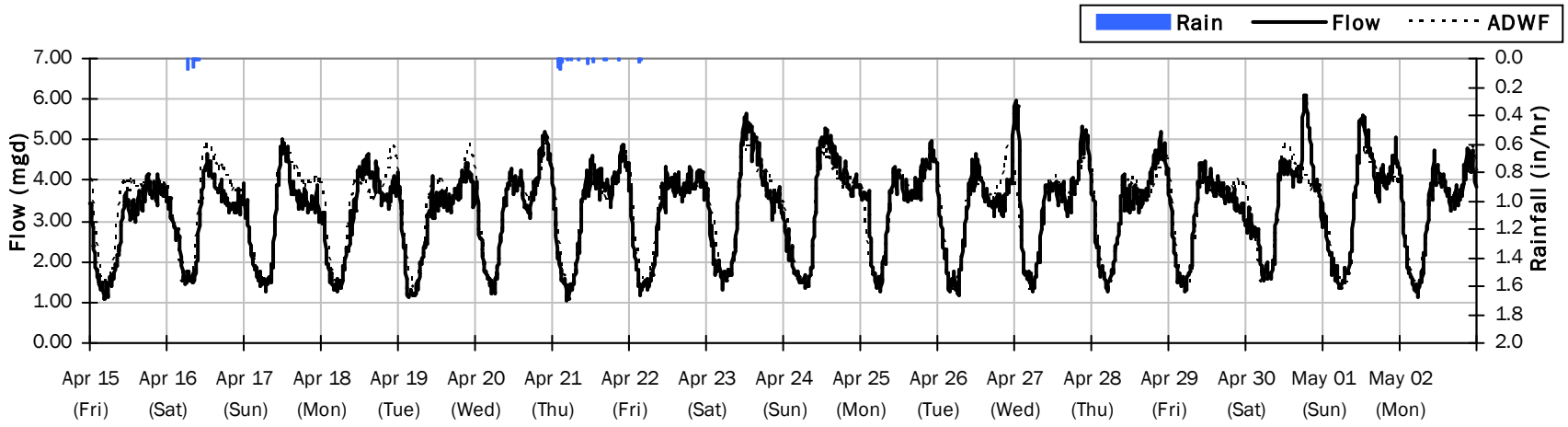
Period Rainfall: 0.75 inches Period Avg Flow: 3.304 mgd Period Peak Flow: 5.380 mgd Period Min Flow: 0.950 mgd

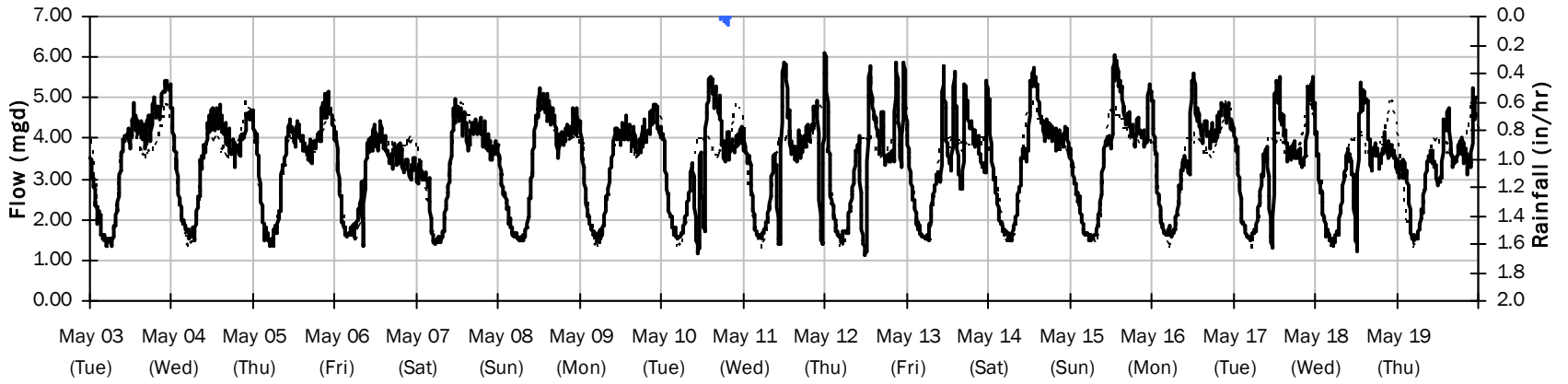


SITE 15

Flow Summary: 4/15/2022 to 5/19/2022

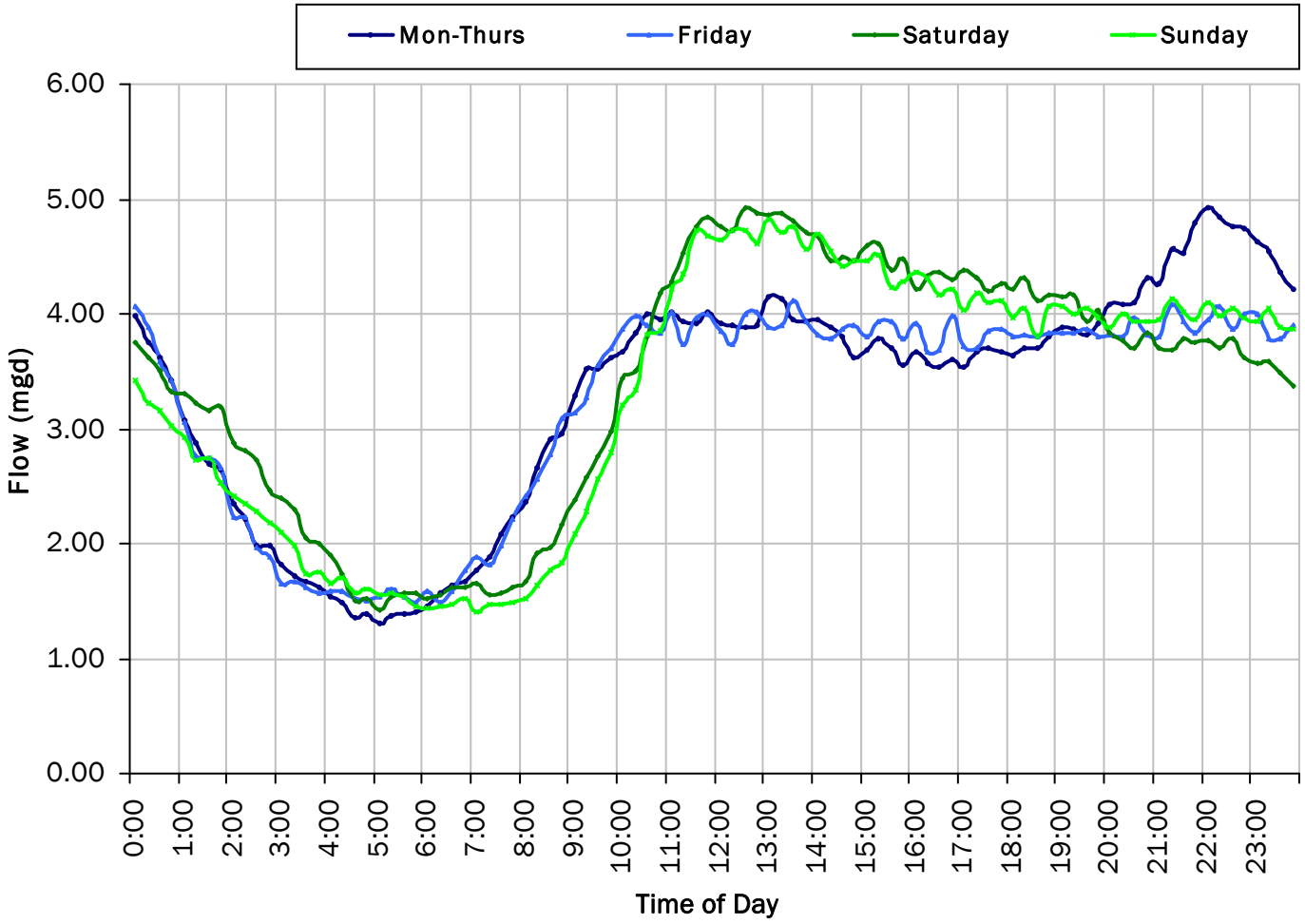
Period Rainfall: 0.24 inches Period Avg Flow: 3.325 mgd Period Peak Flow: 6.108 mgd Period Min Flow: 1.032 mgd





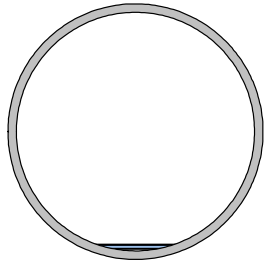
SITE 15

Average Dry Weather Flow Hydrographs



ADWF:

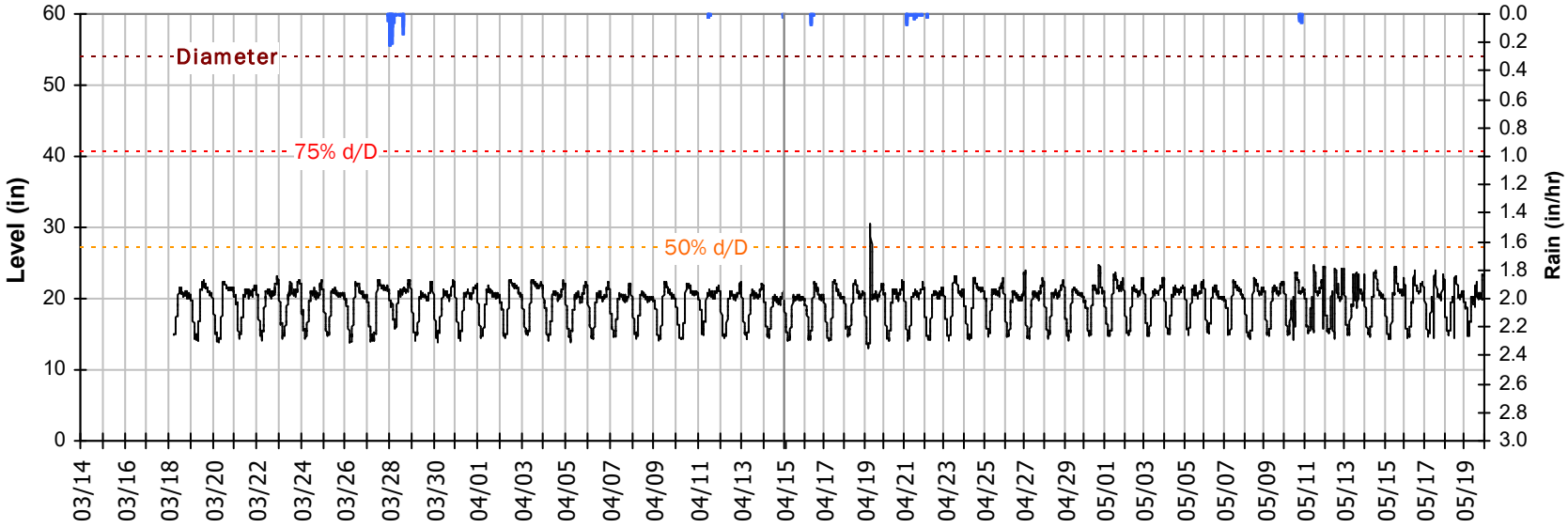
3.294 *mgd*

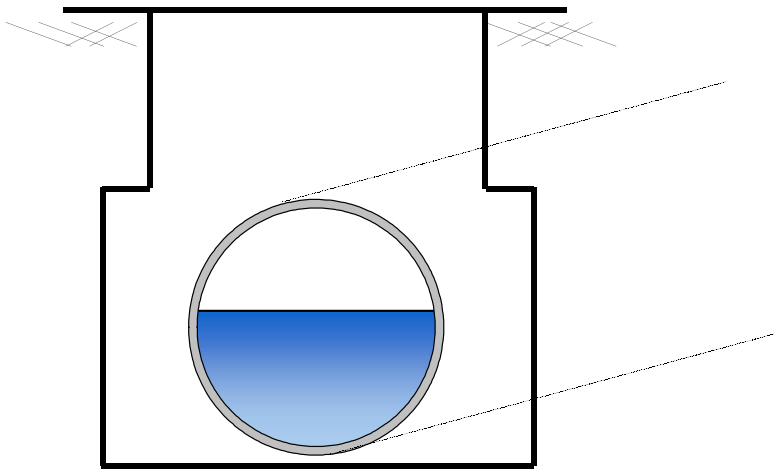


SITE 15

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

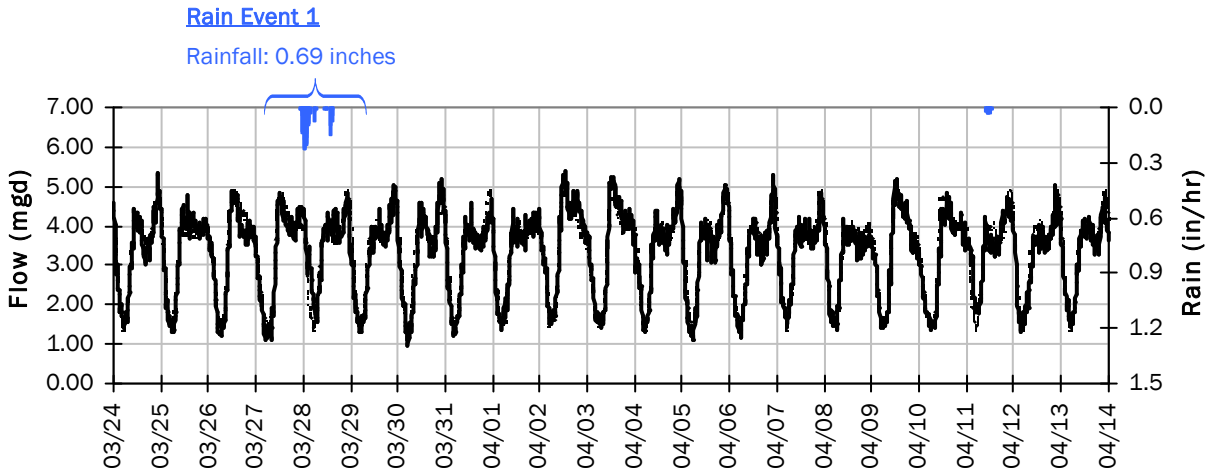




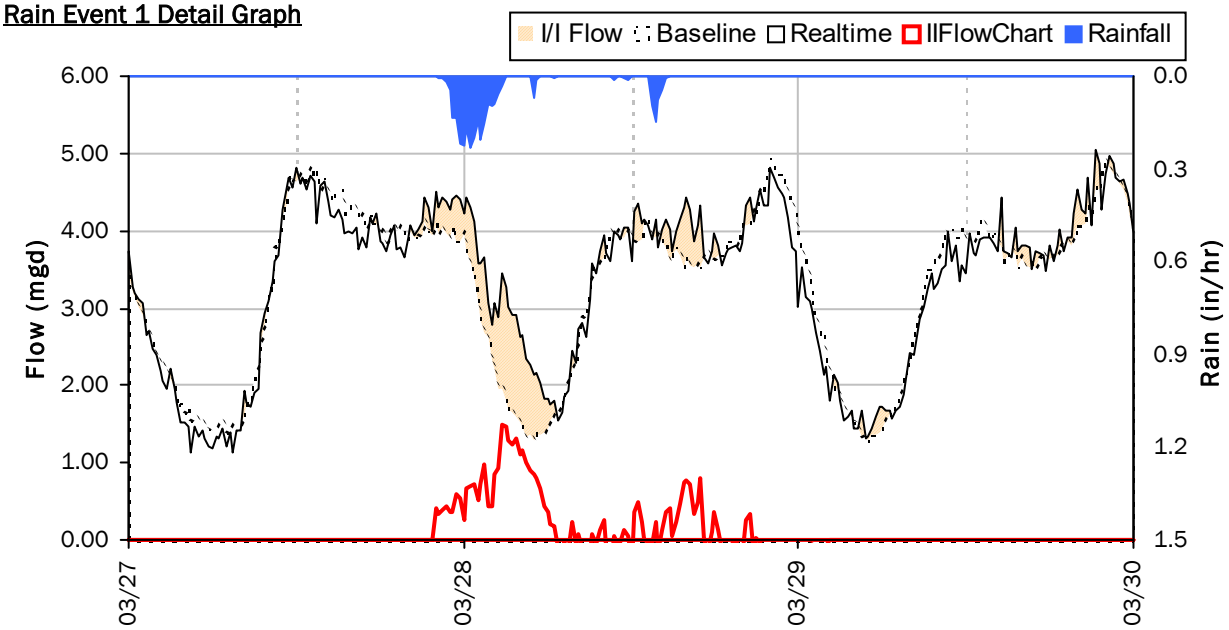
Pipe Diameter:	54	*inches*
Peak Measured Level:	30.6	*inches*
Peak d/D Ratio:	0.57	

SITE 15
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



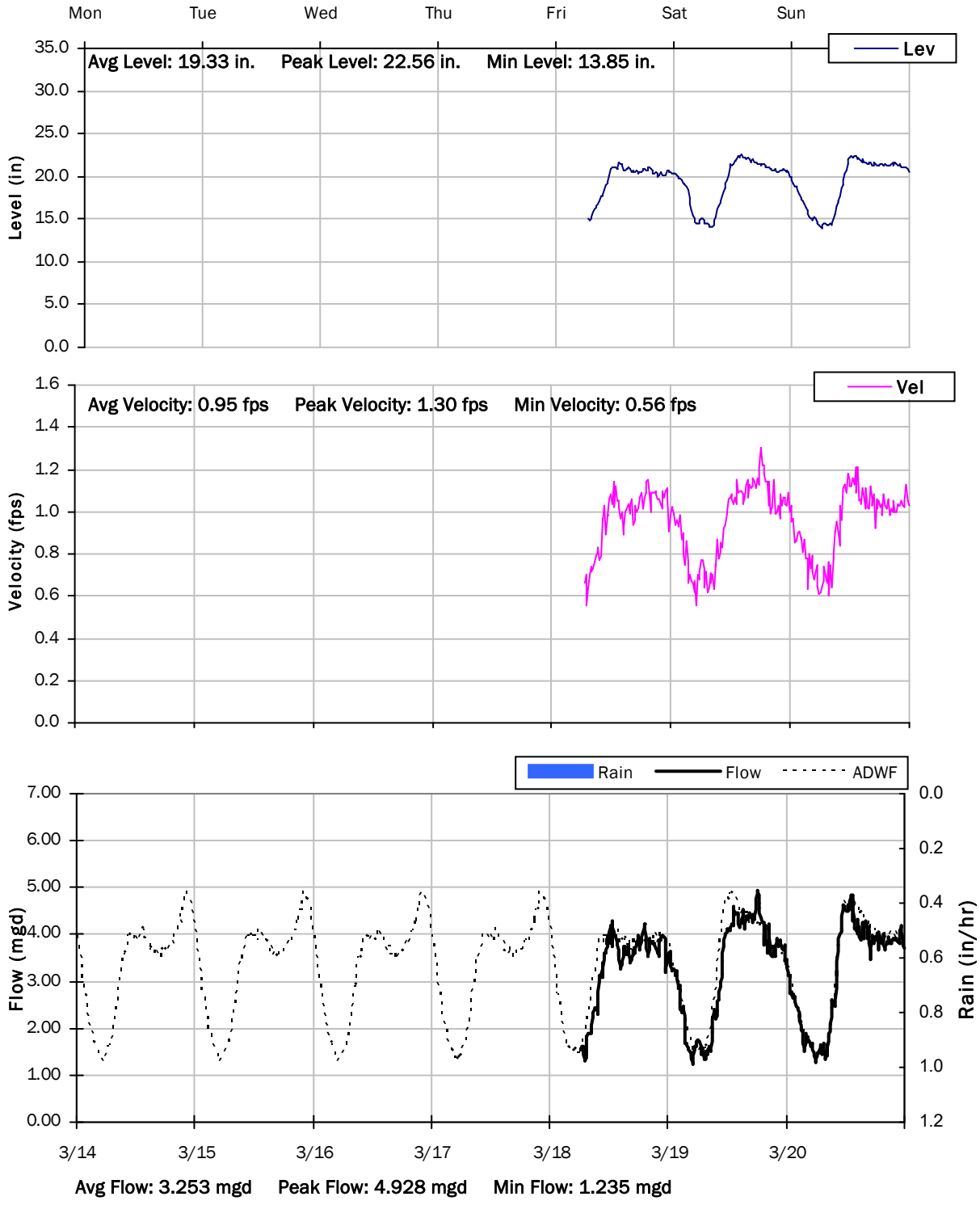
Storm Event I/I Analysis (Rain = 0.69 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	4.825 *mgd*	**Peak I/I Rate:**	1.493 *mgd*
PF:	1.46	**Total I/I:**	261,000 *gallons*
Peak Level:	22.68 *in*		
d/D Ratio:	0.42		

SITE 15

Weekly Level, Velocity and Flow Hydrographs

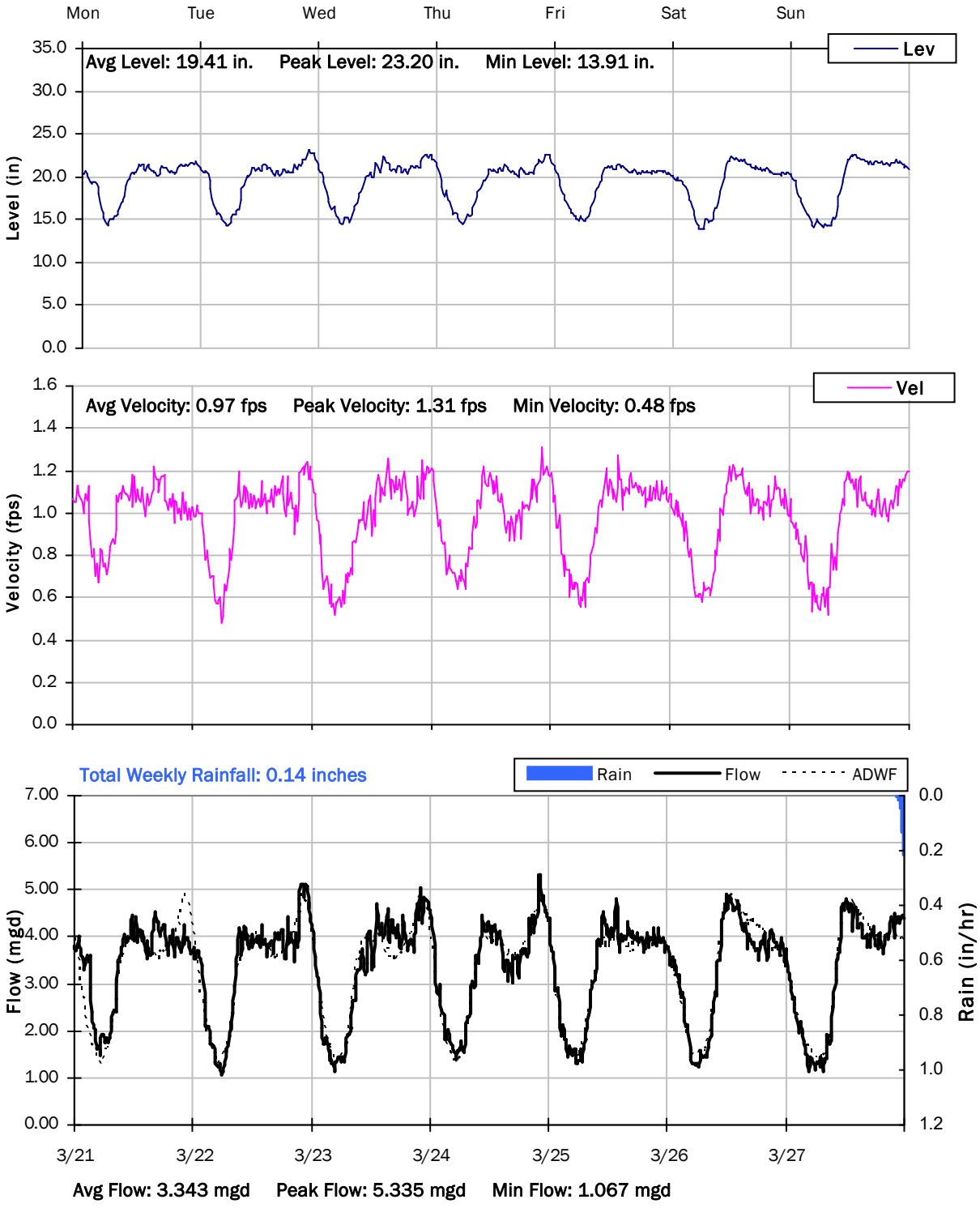
3/14/2022 to 3/21/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

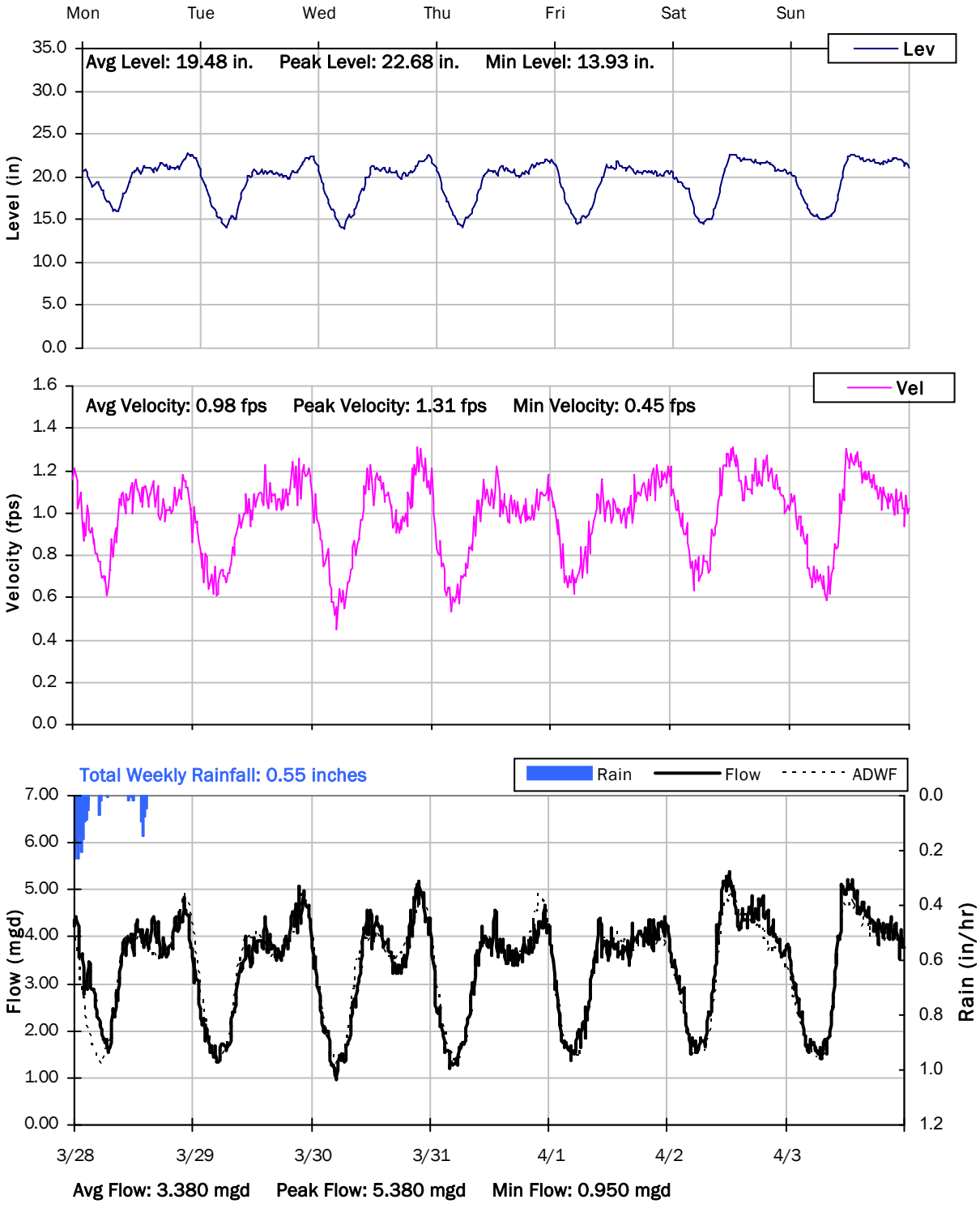
3/21/2022 to 3/28/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

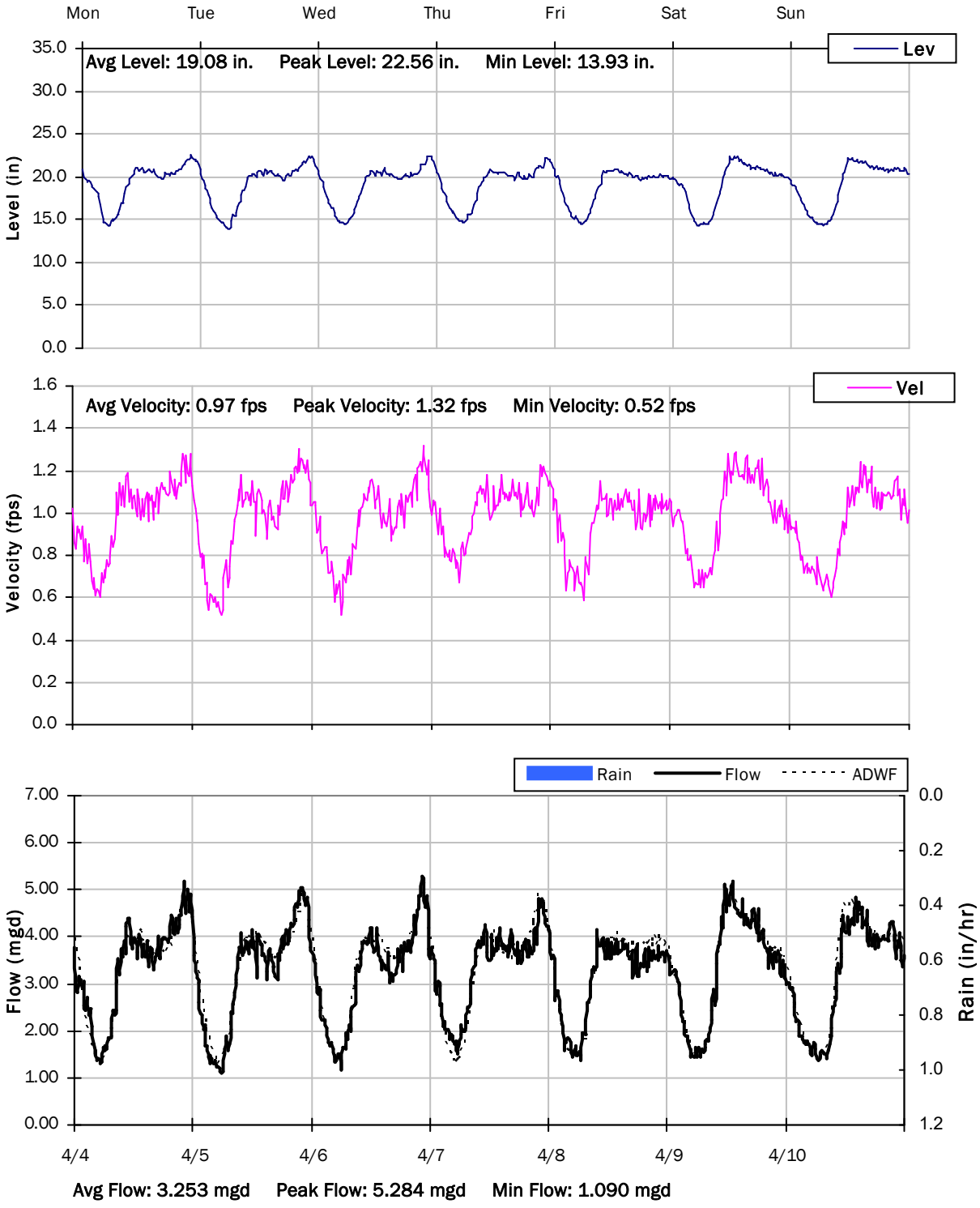
3/28/2022 to 4/4/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

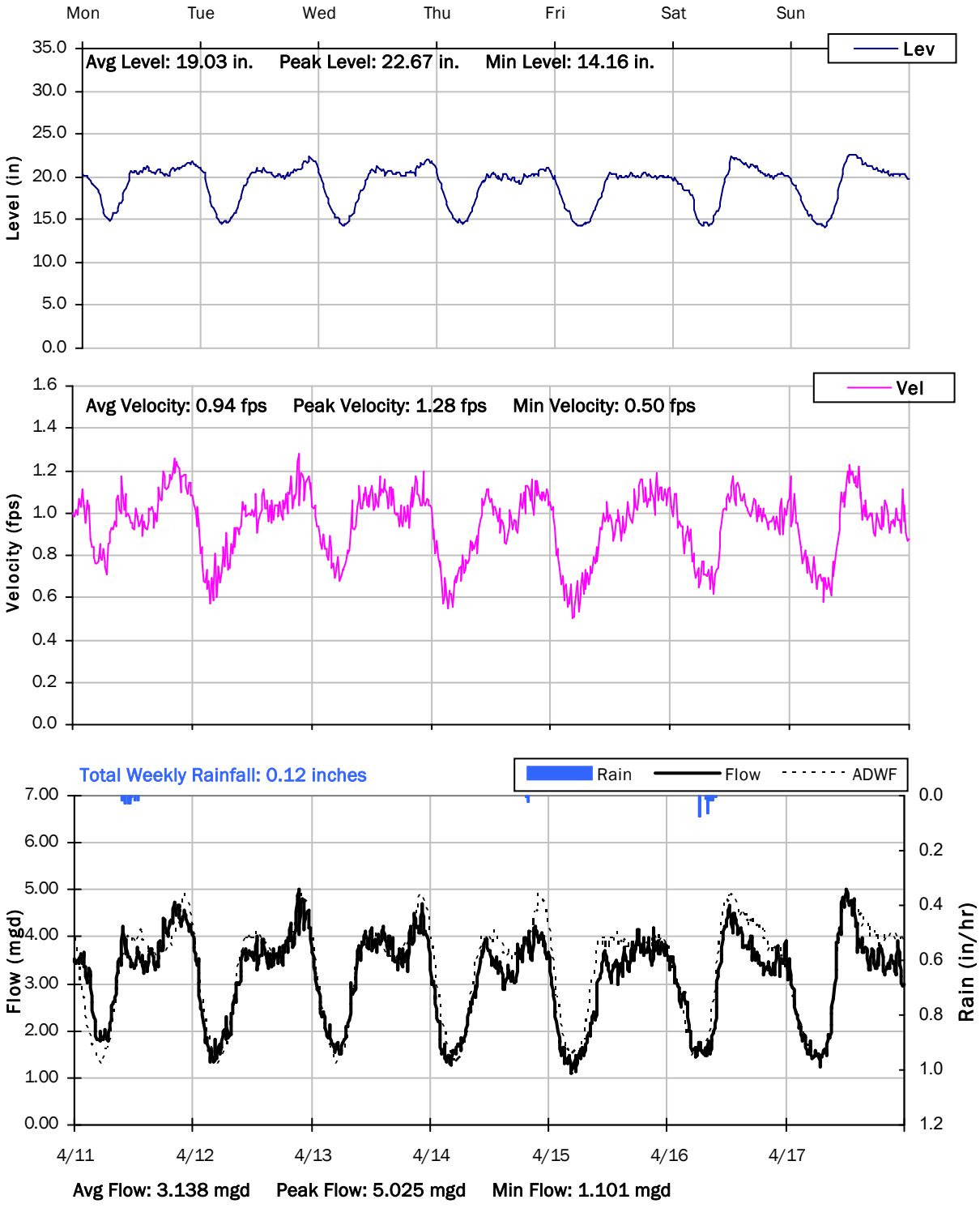
4/4/2022 to 4/11/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

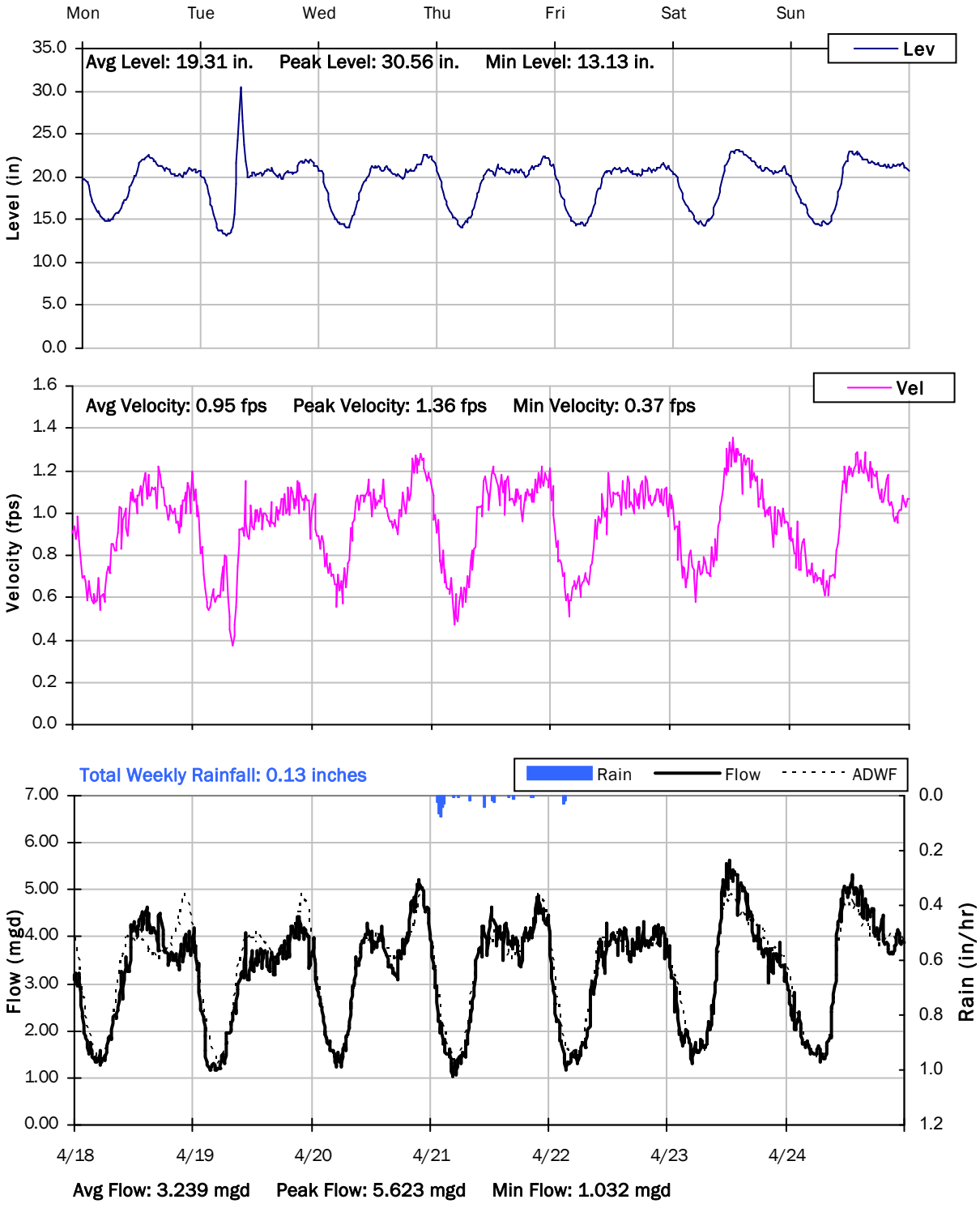
4/11/2022 to 4/18/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

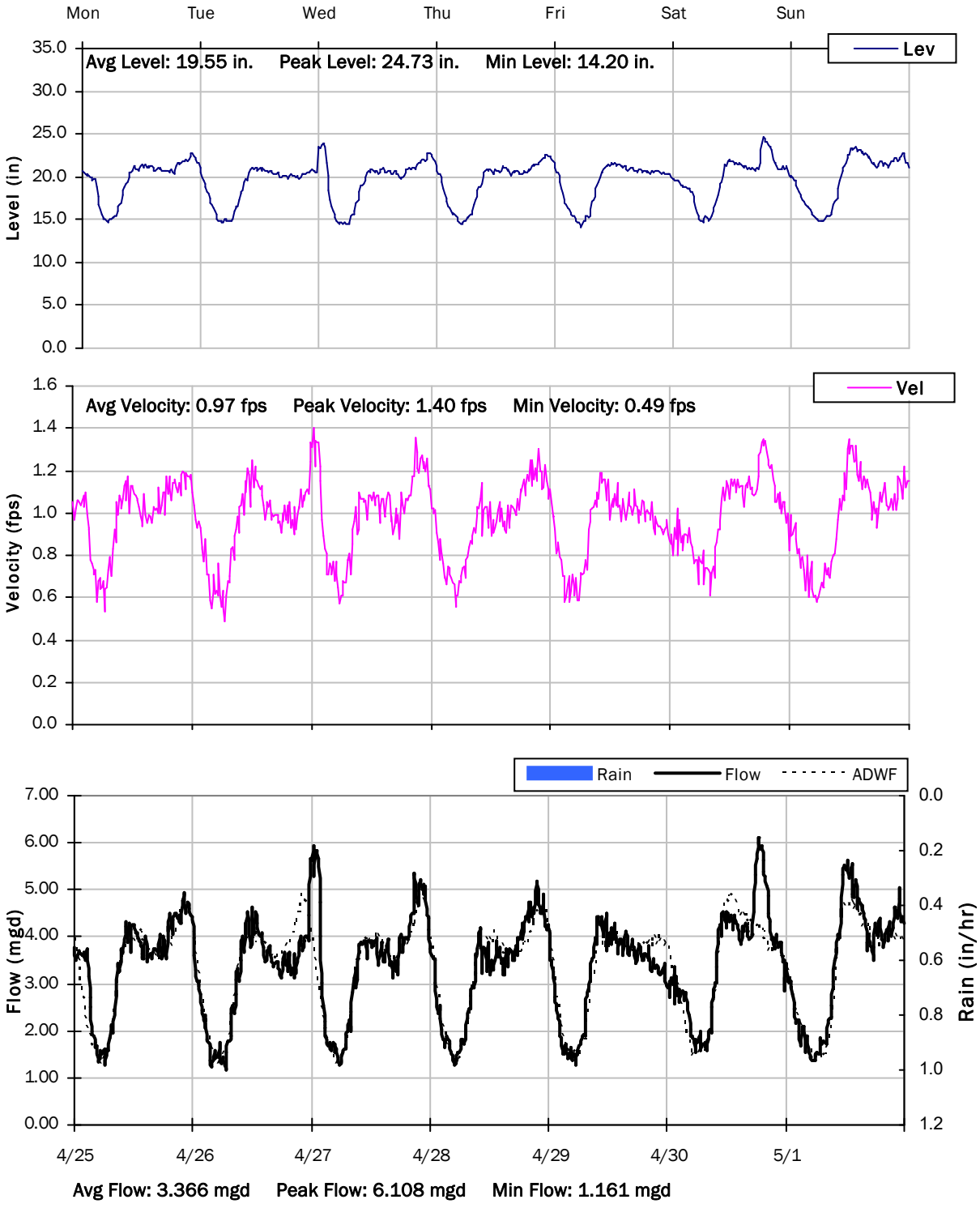
4/18/2022 to 4/25/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

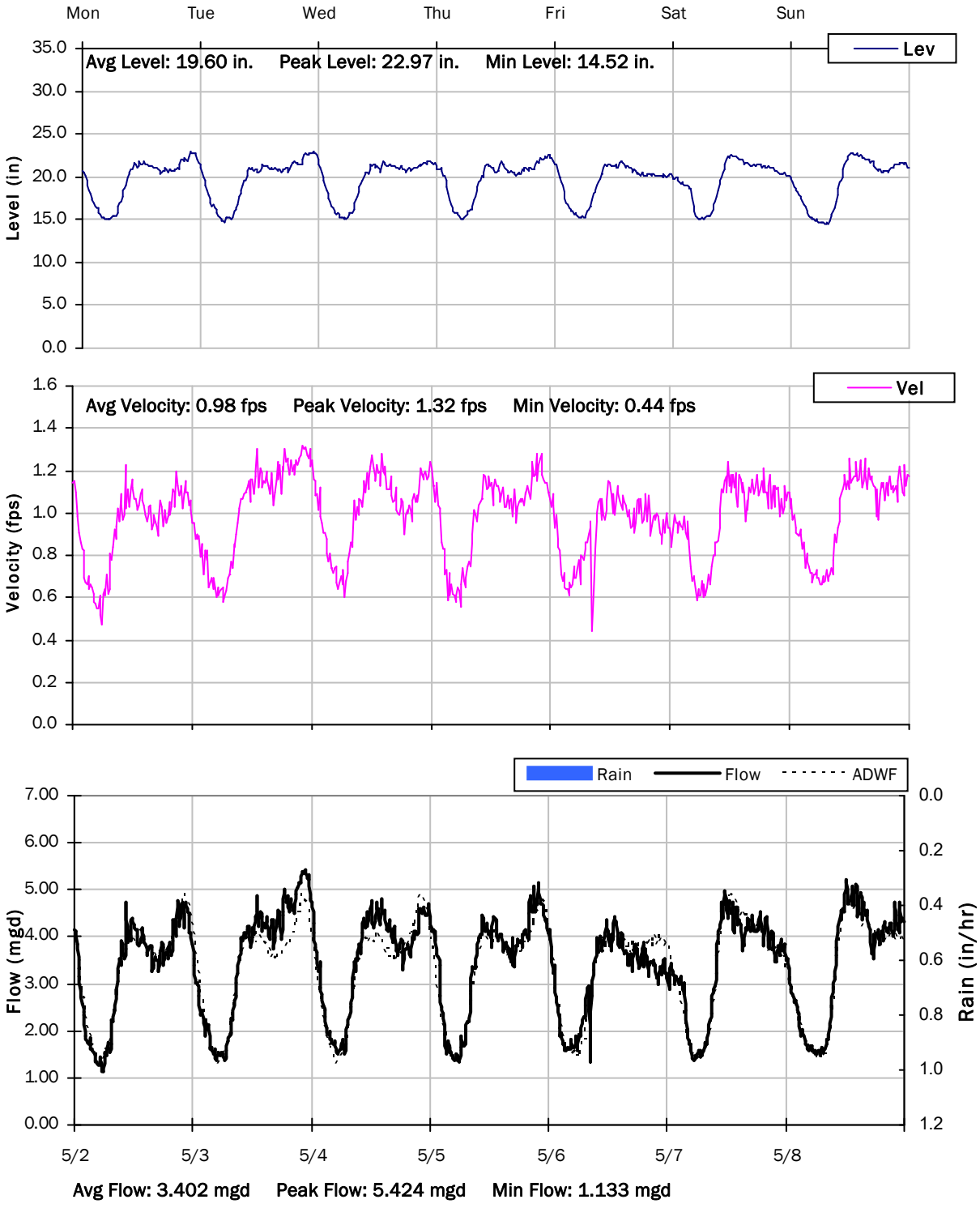
4/25/2022 to 5/2/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

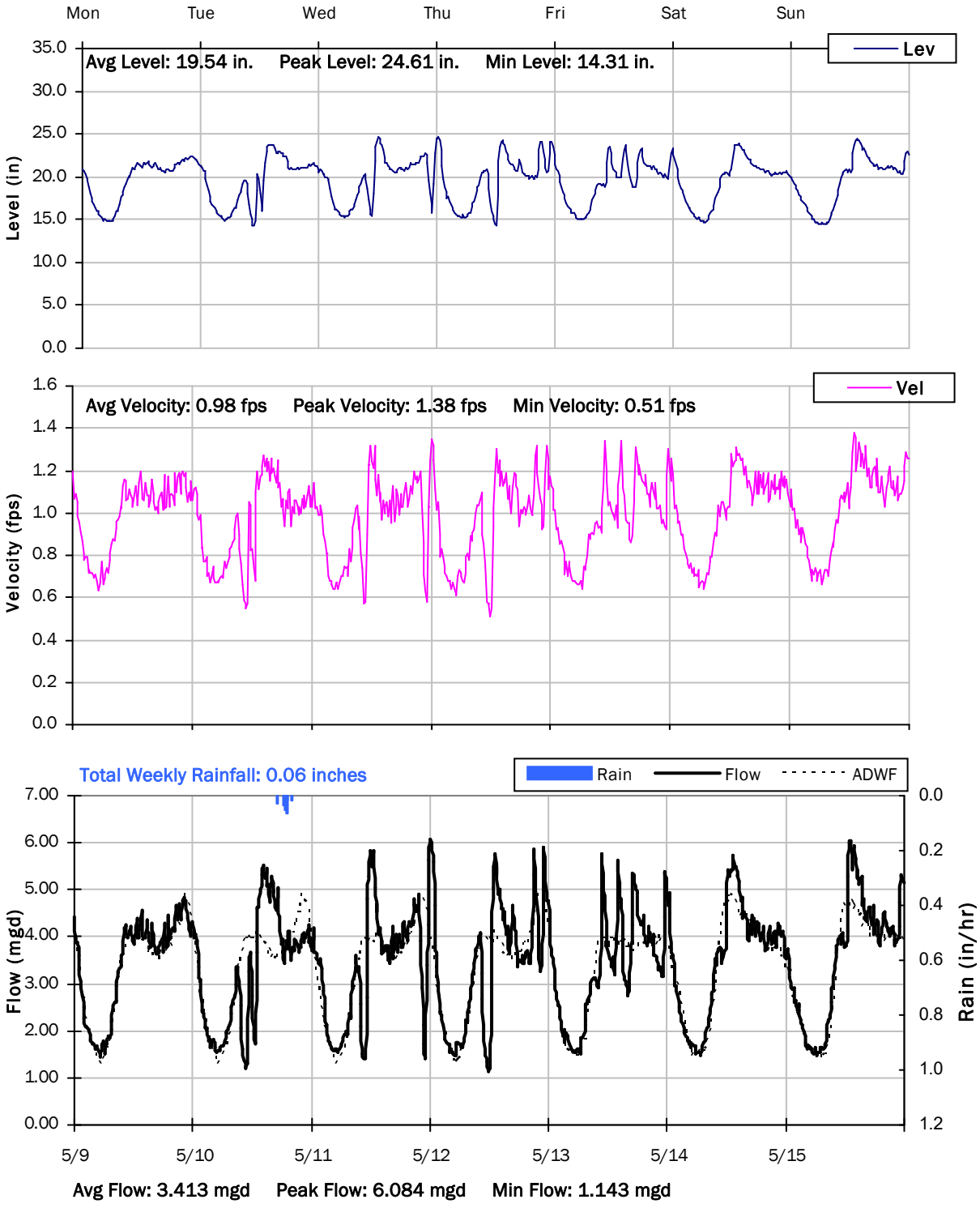
5/2/2022 to 5/9/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

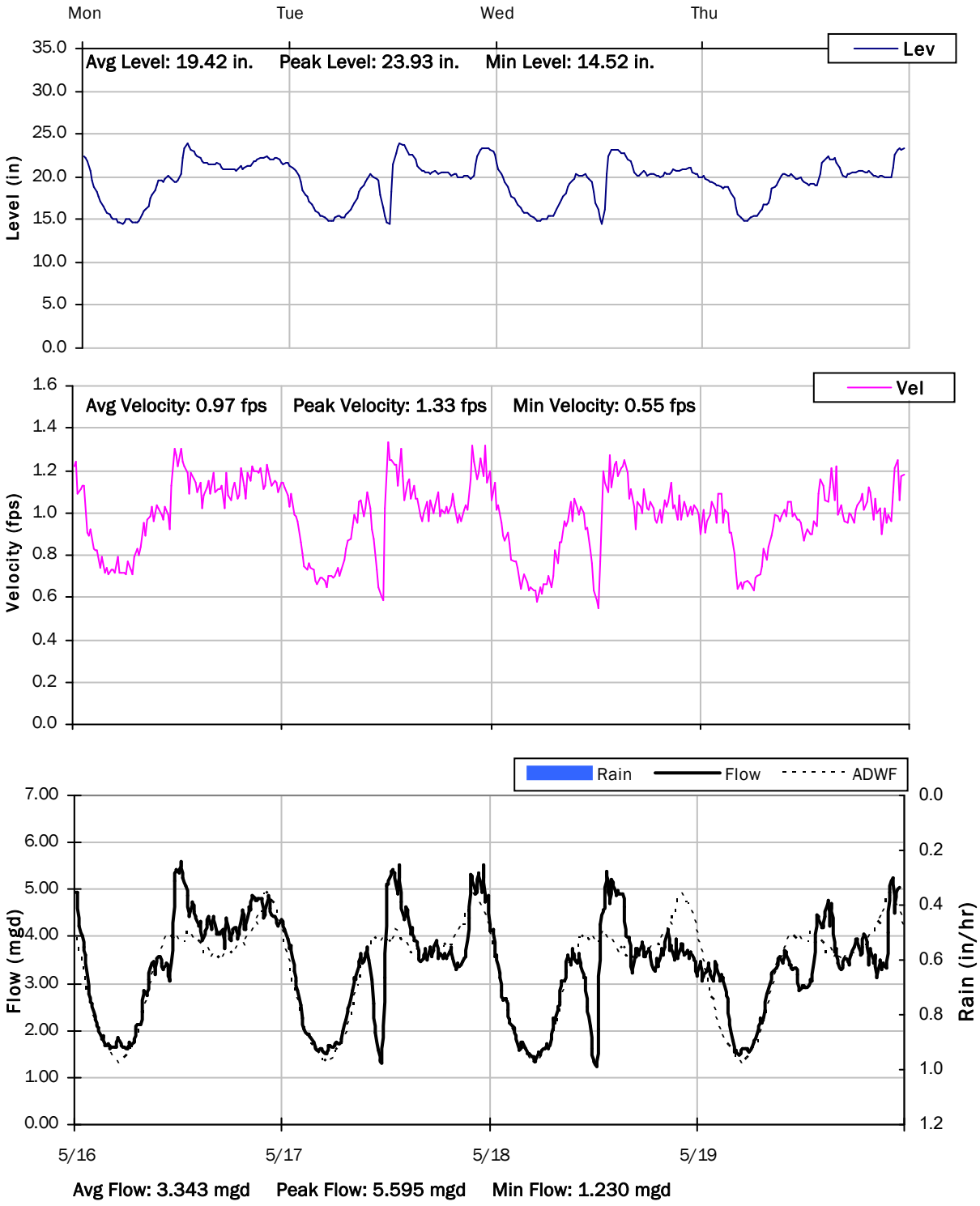
5/9/2022 to 5/16/2022



SITE 15

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 16

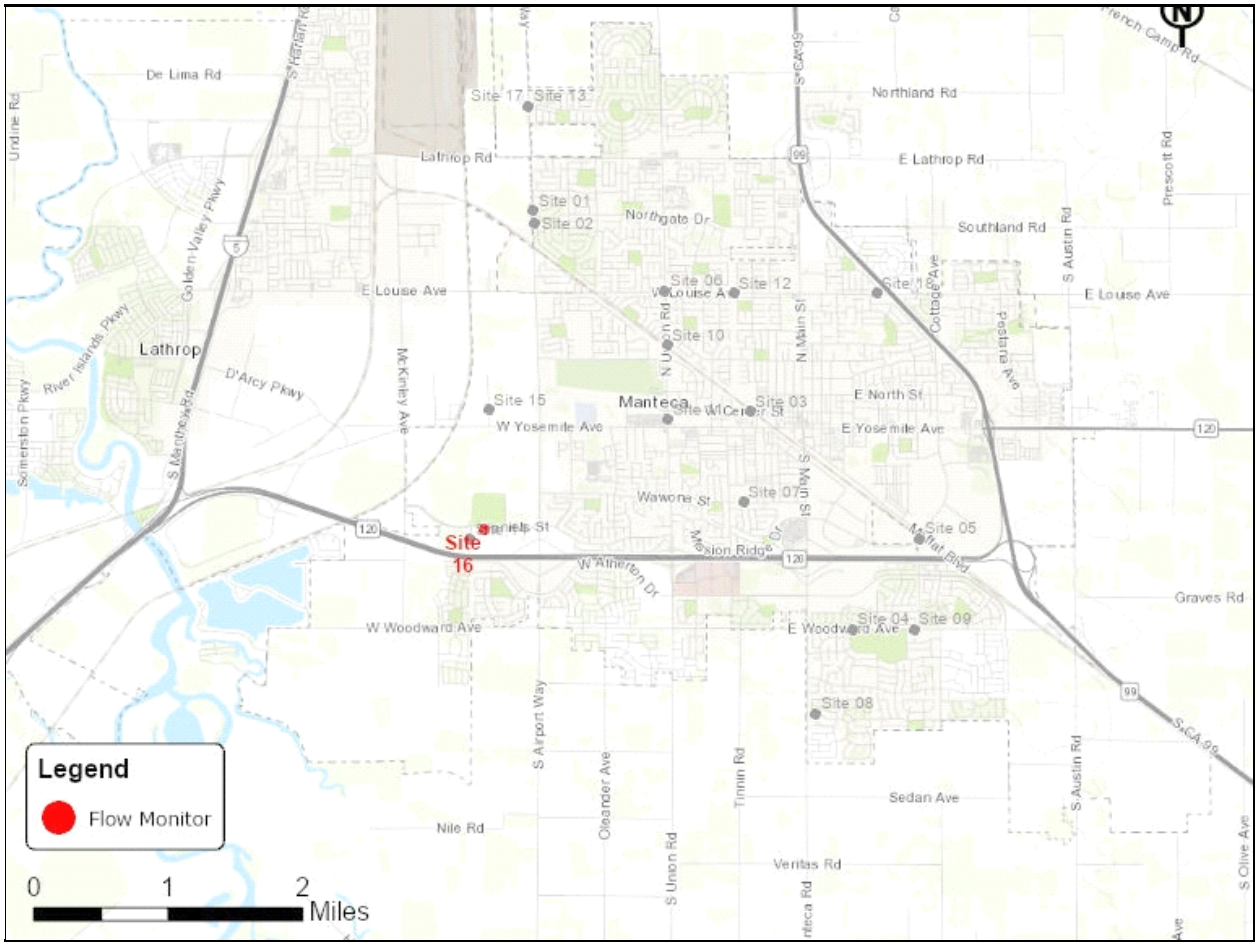
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Daniels Street East of Entertainment Way

Data Summary Report



Vicinity Map: Site 16

SITE 16

Additional Site Photos

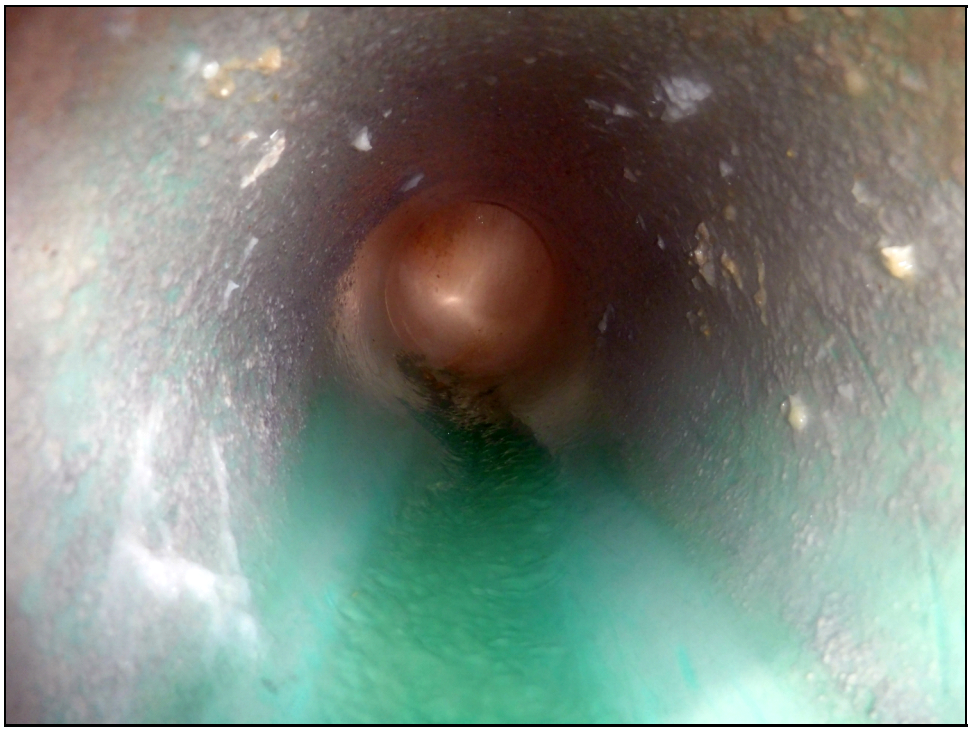
Effluent Pipe

Monitored East Influent Pipe

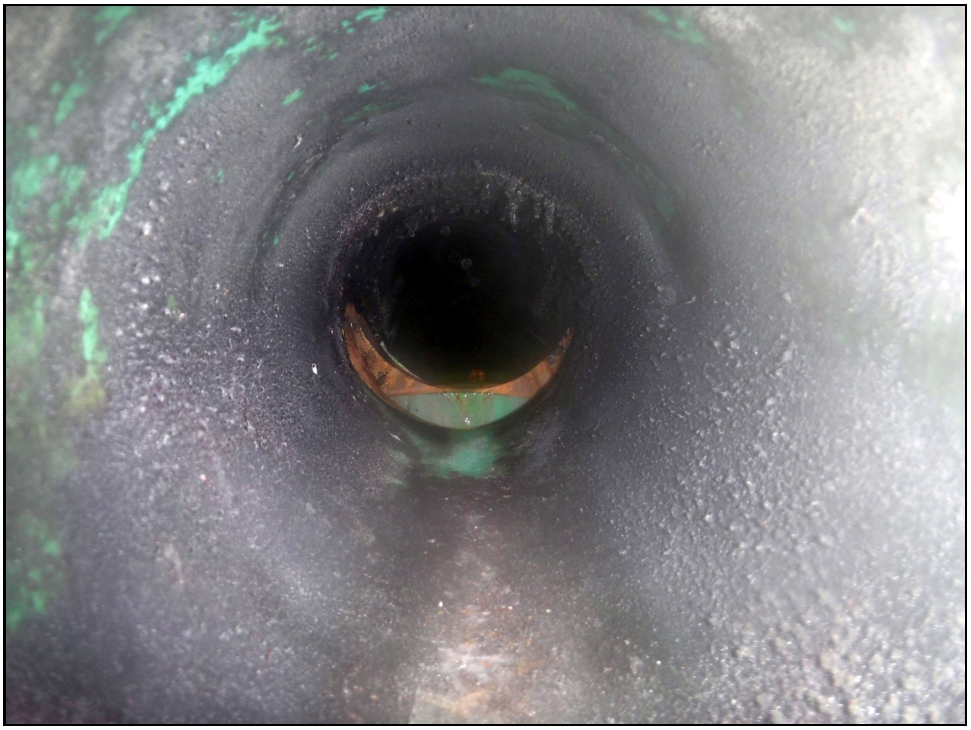
SITE 16

Additional Site Photos

South Influent Pipe (Lower)



South Influent Pipe (Upper)

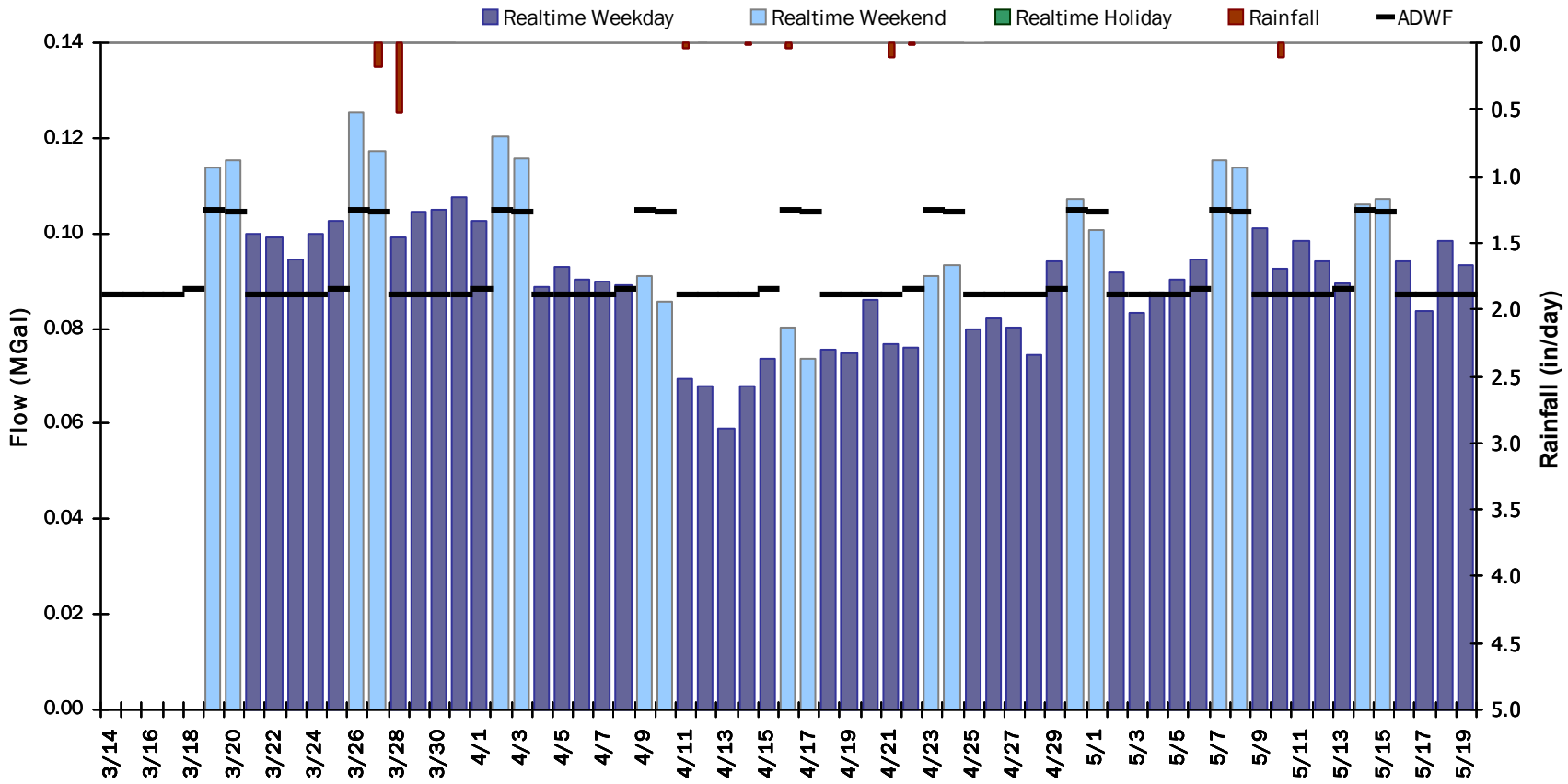


SITE 16

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.094 MGal Peak Daily Flow: 0.127 MGal Min Daily Flow: 0.059 MGal

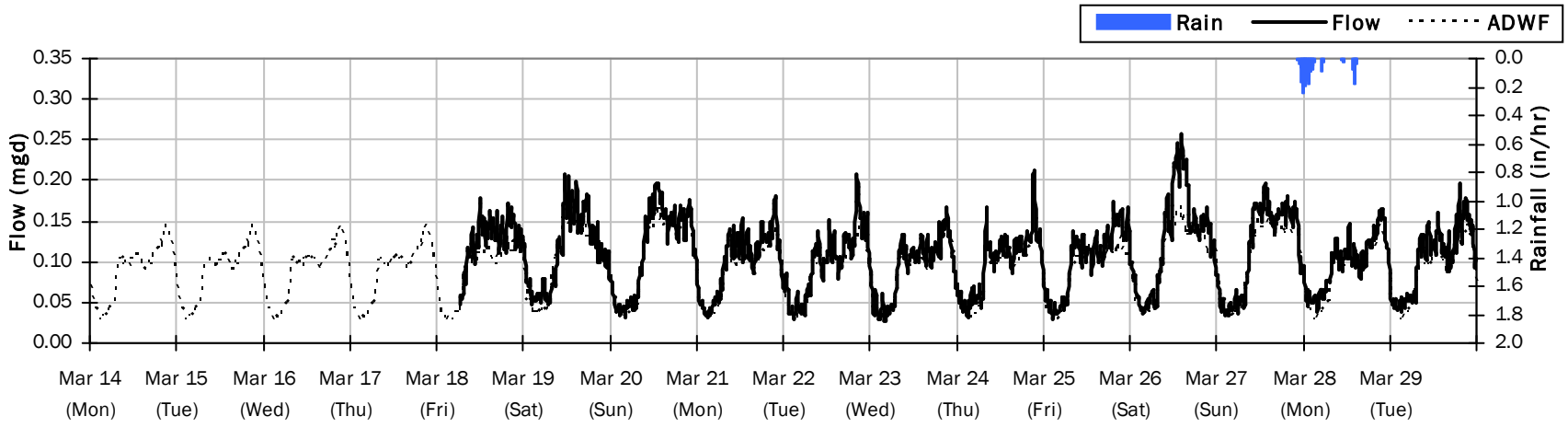
Total Rainfall: 1.04 inches

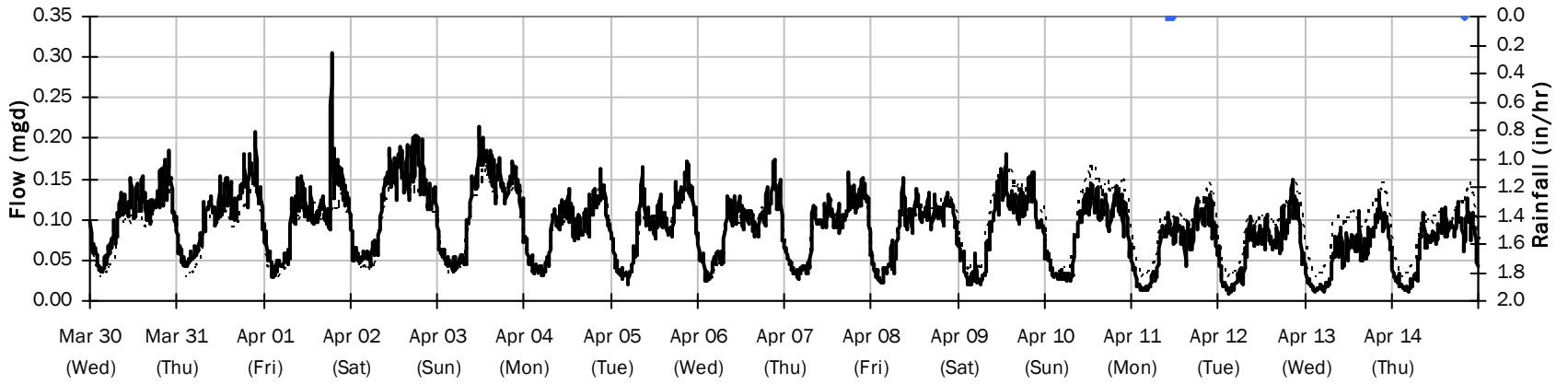


SITE 16

Flow Summary: 3/14/2022 to 4/14/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.098 mgd Period Peak Flow: 0.305 mgd Period Min Flow: 0.009 mgd

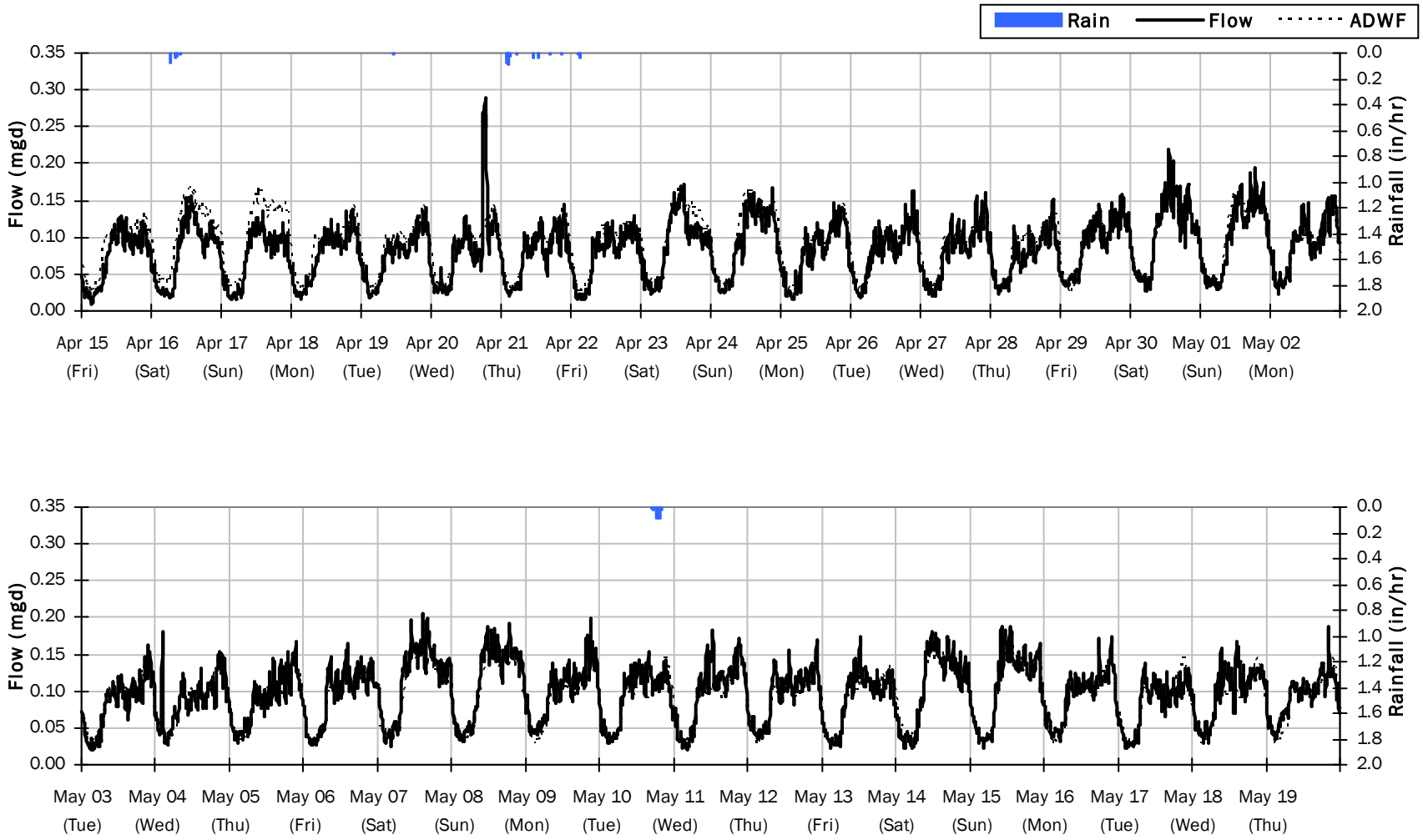




SITE 16

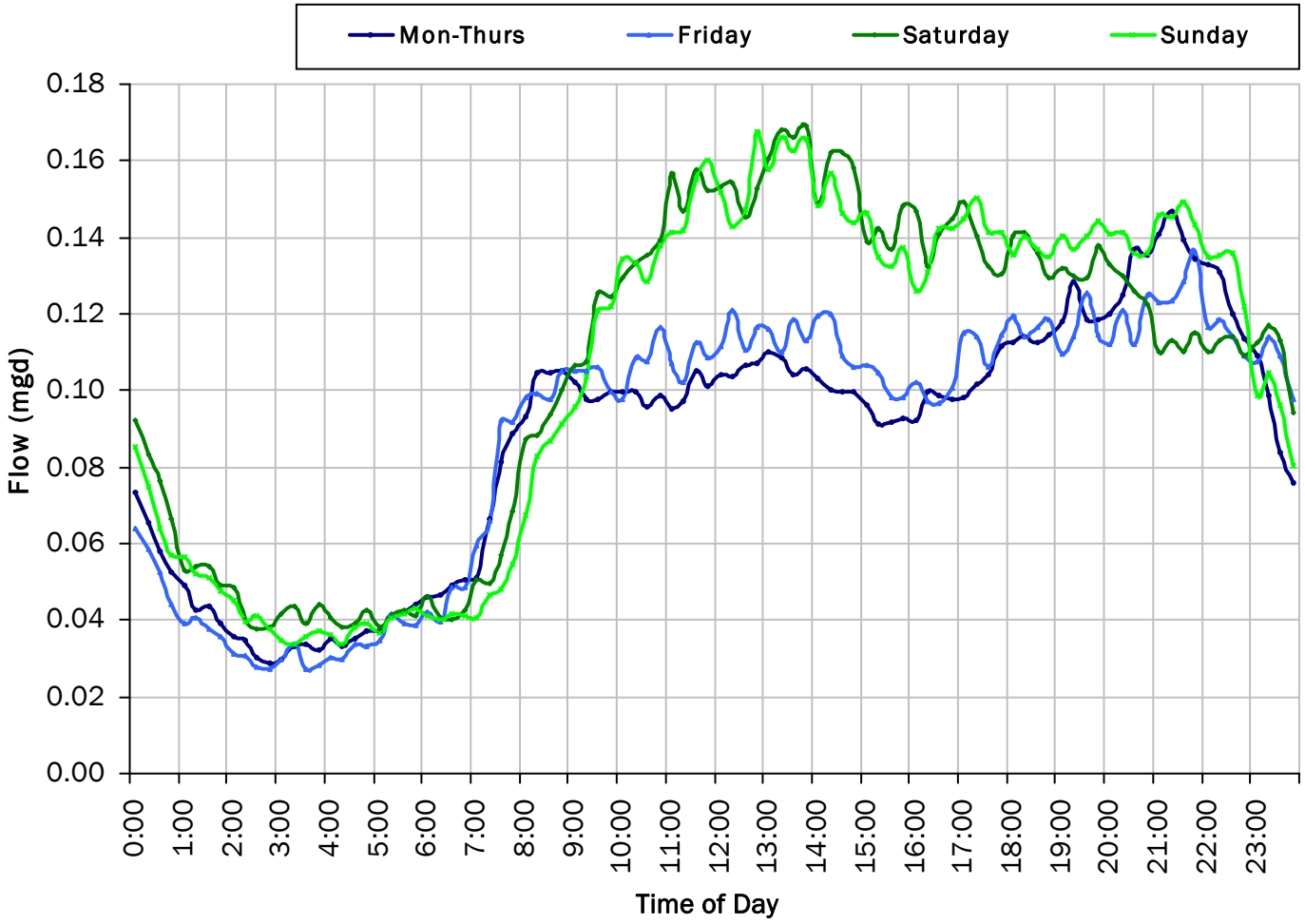
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.28 inches Period Avg Flow: 0.090 mgd Period Peak Flow: 0.290 mgd Period Min Flow: 0.009 mgd



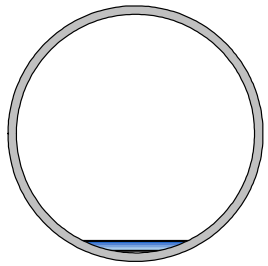
SITE 16

Average Dry Weather Flow Hydrographs



ADWF:

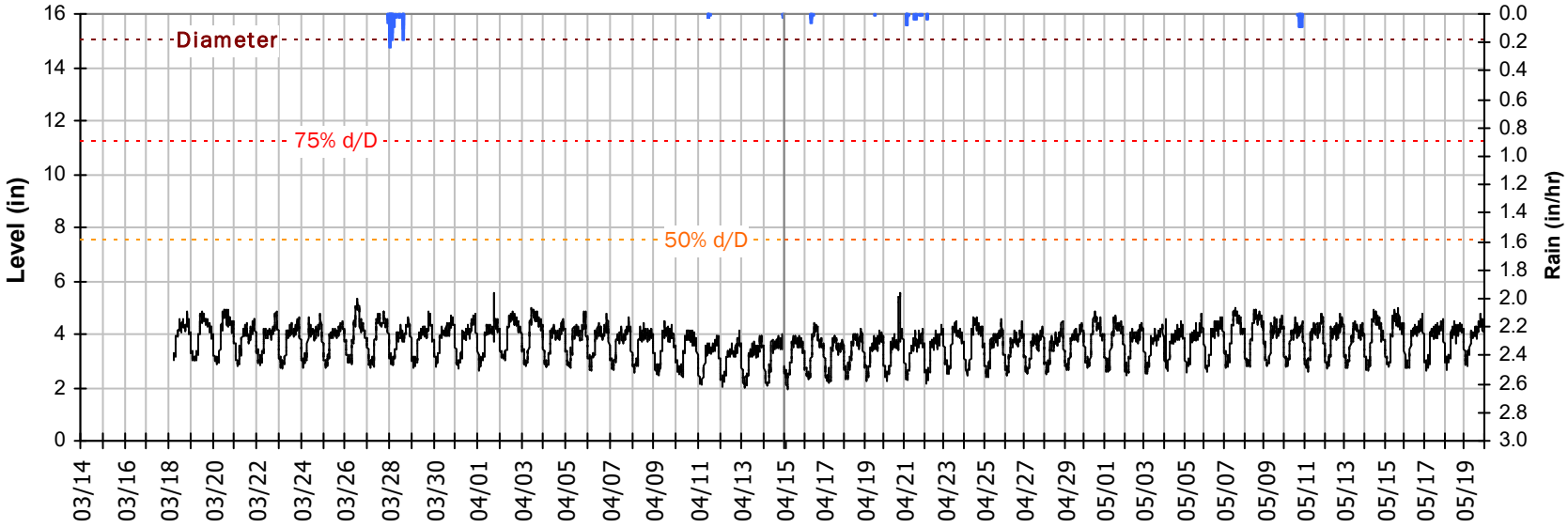
0.092 *mgd*

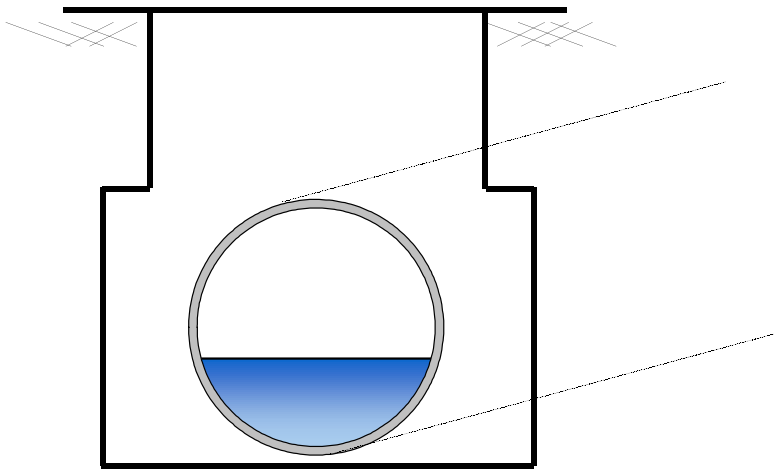


SITE 16

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

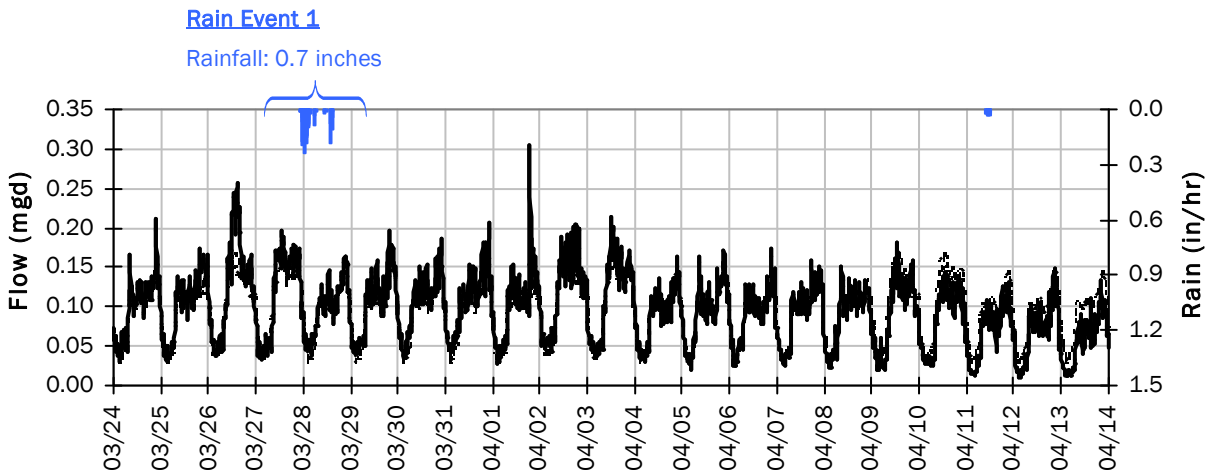




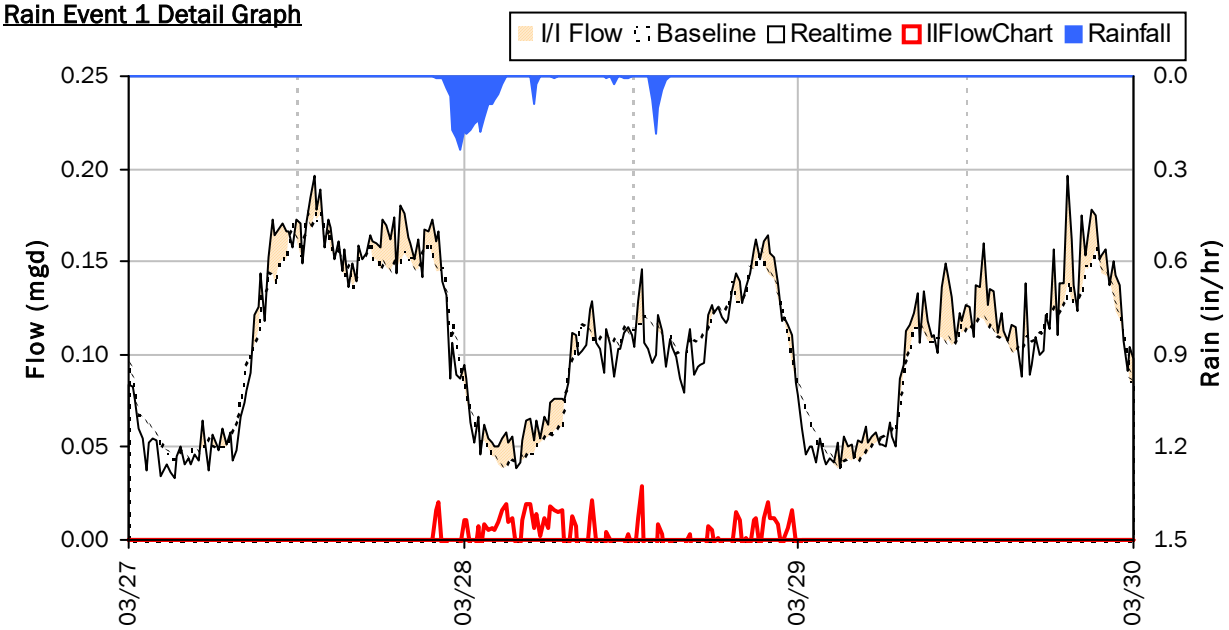
Pipe Diameter:	15	*inches*
Peak Measured Level:	5.57	*inches*
Peak d/D Ratio:	0.37	

SITE 16
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



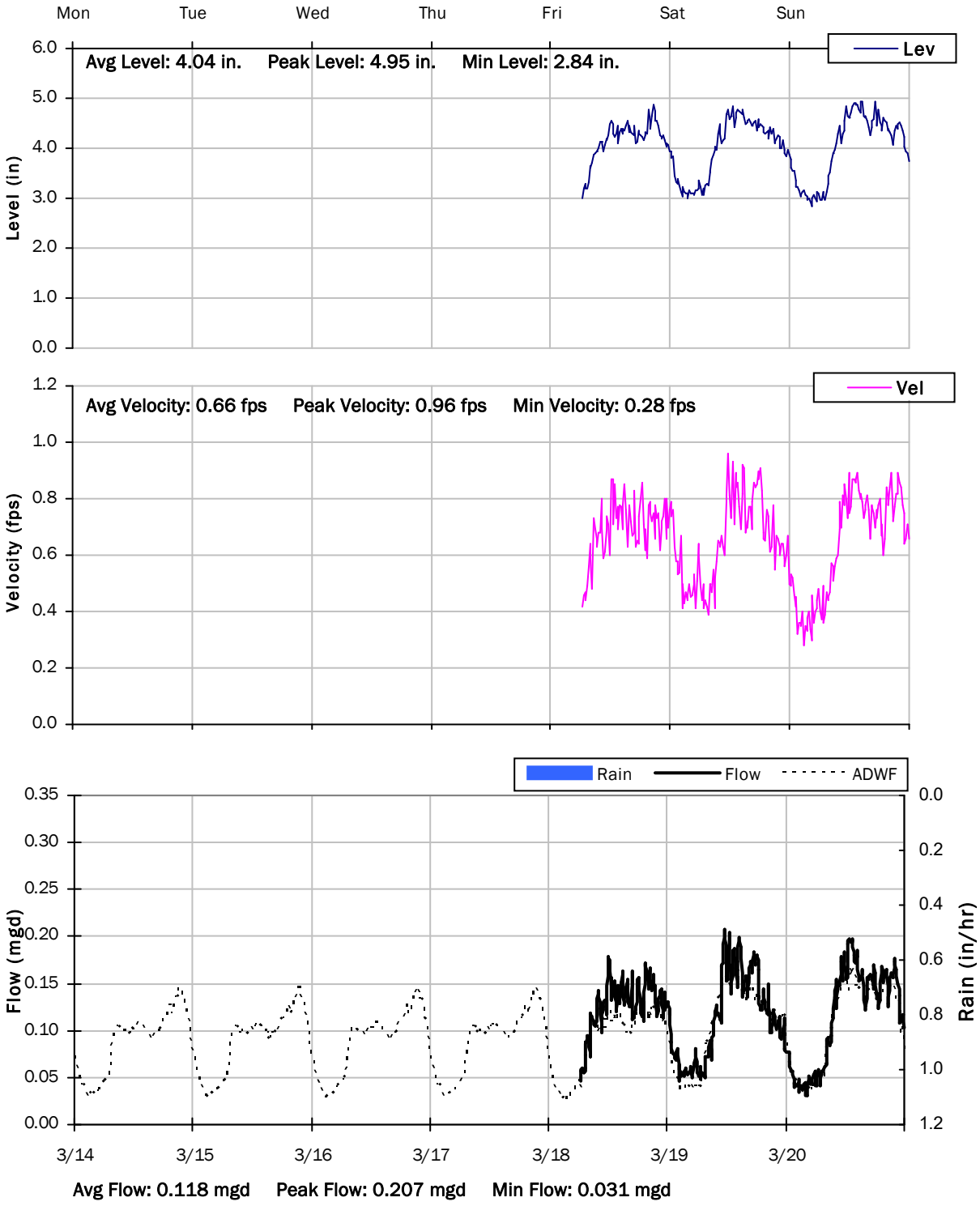
Storm Event I/I Analysis (Rain = 0.70 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.166 *mgd*	**Peak I/I Rate:**	0.029 *mgd*
PF:	1.80	**Total I/I:**	2,000 *gallons*
Peak Level:	4.65 *in*		
d/D Ratio:	0.31		

SITE 16

Weekly Level, Velocity and Flow Hydrographs

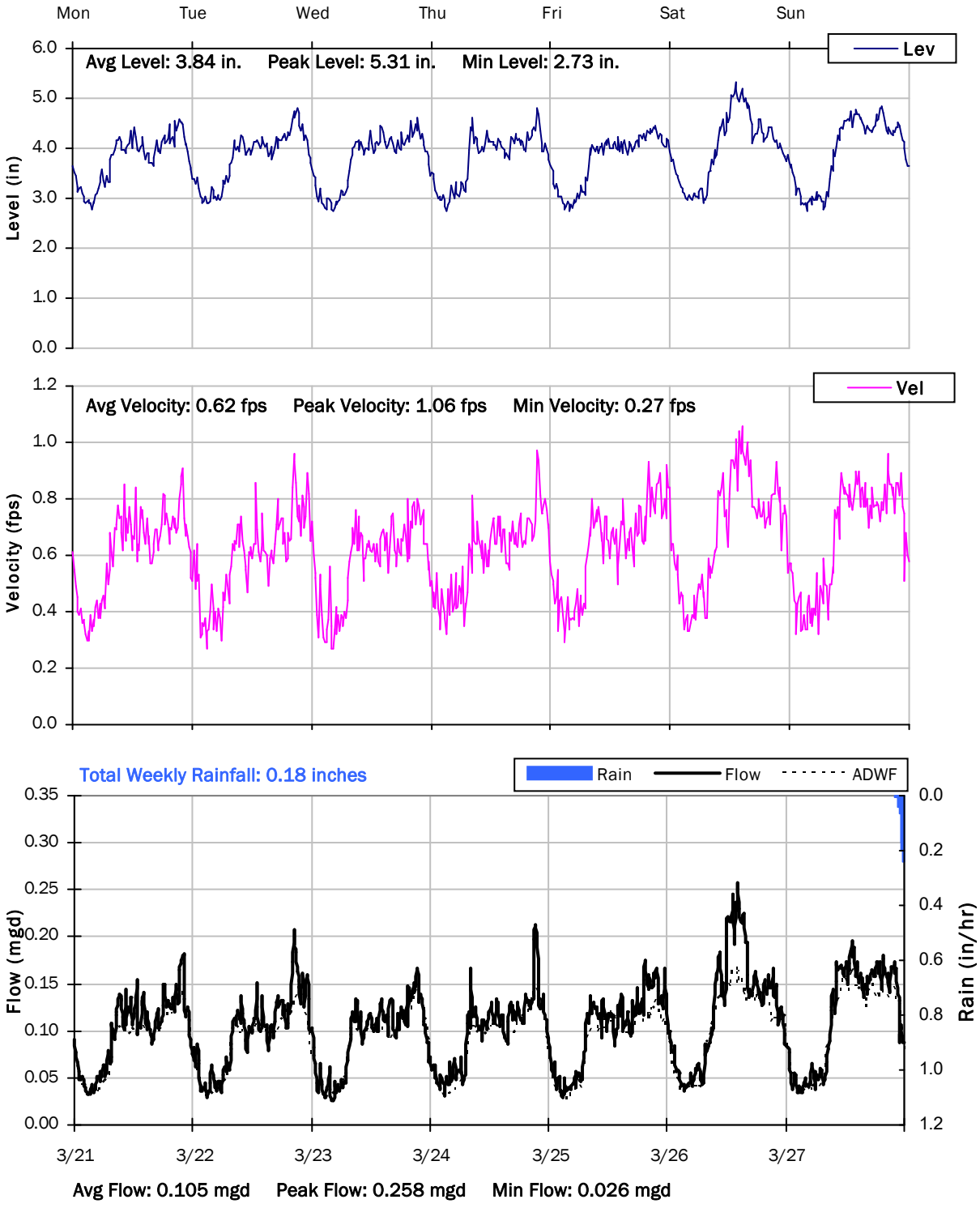
3/14/2022 to 3/21/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

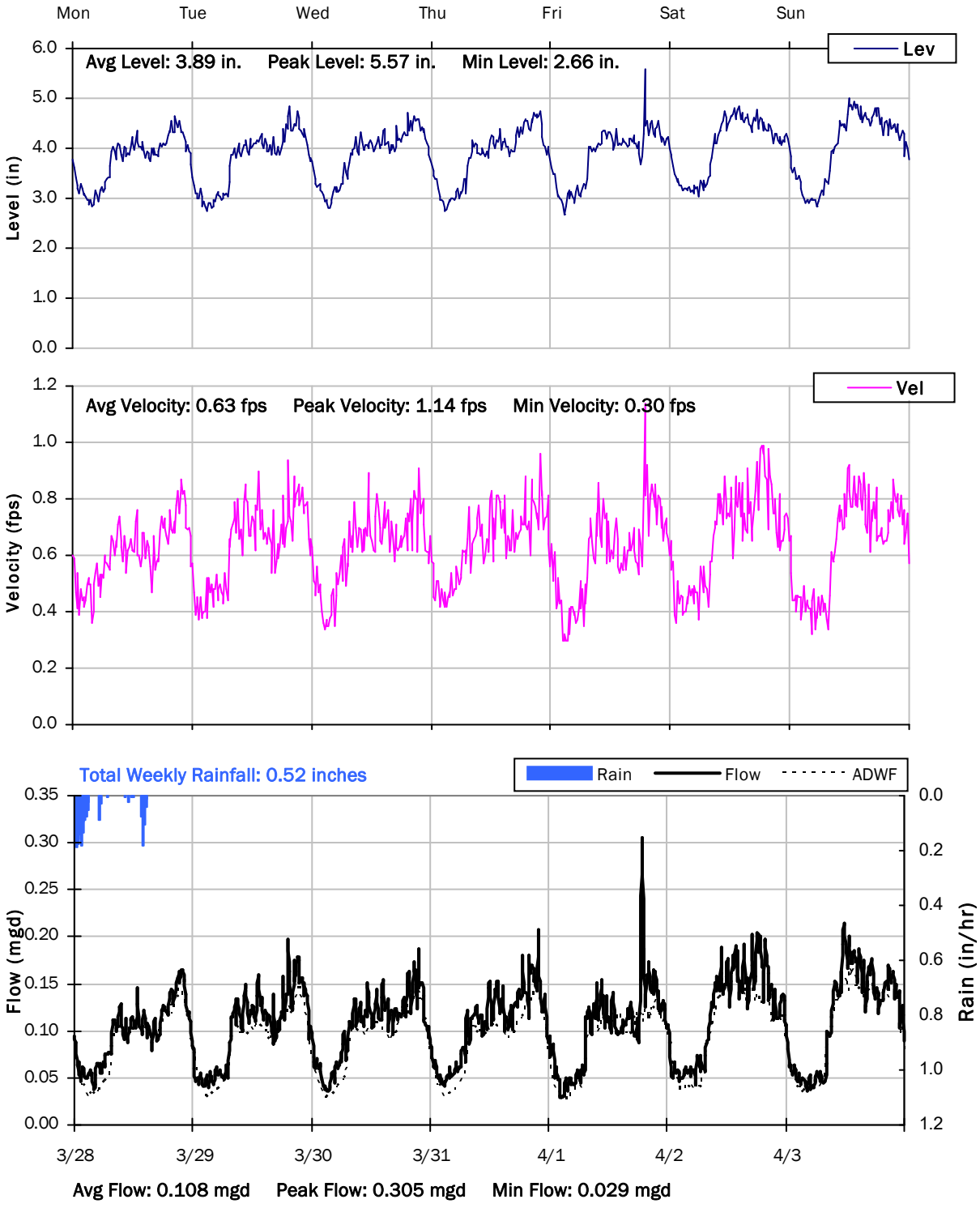
3/21/2022 to 3/28/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

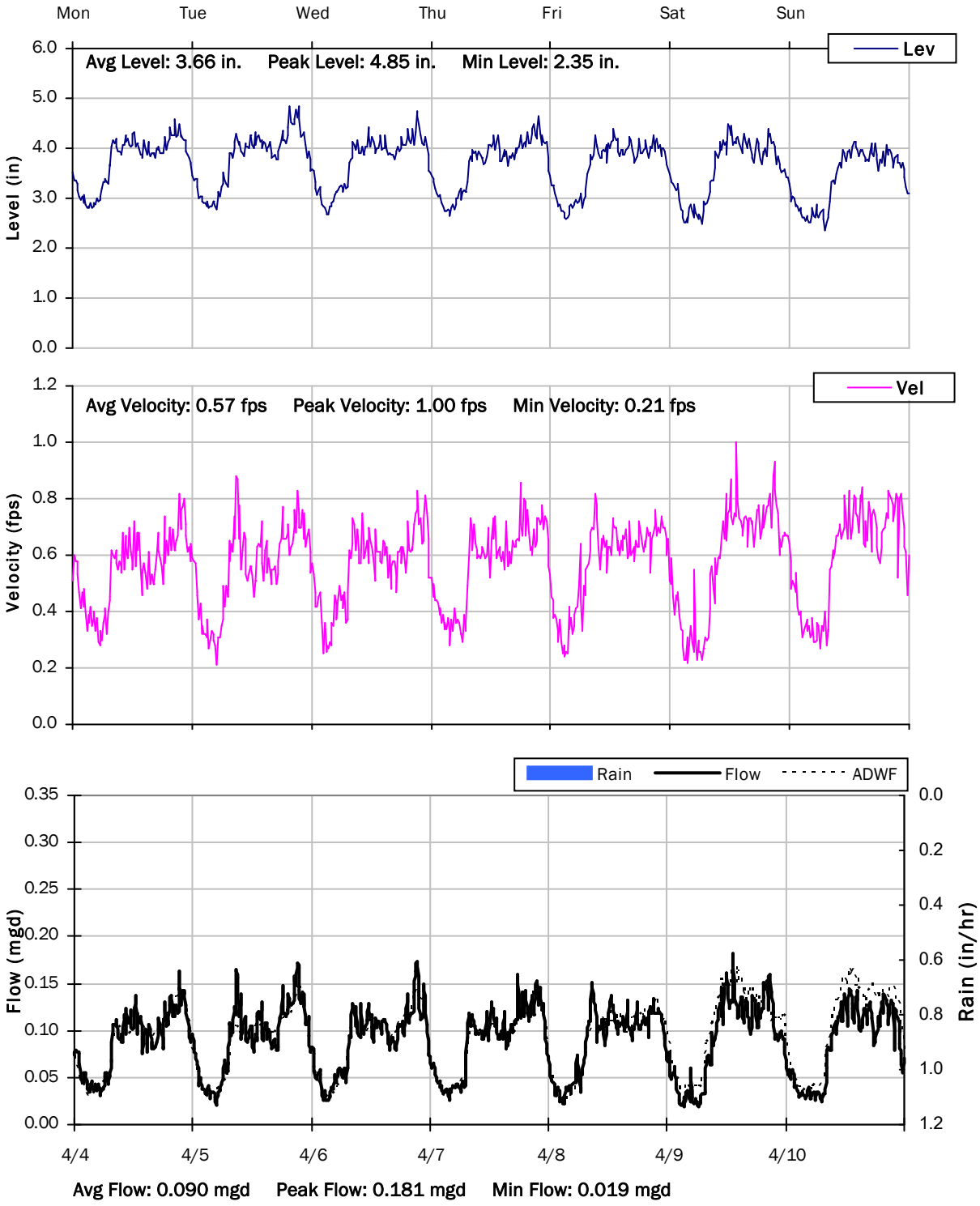
3/28/2022 to 4/4/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

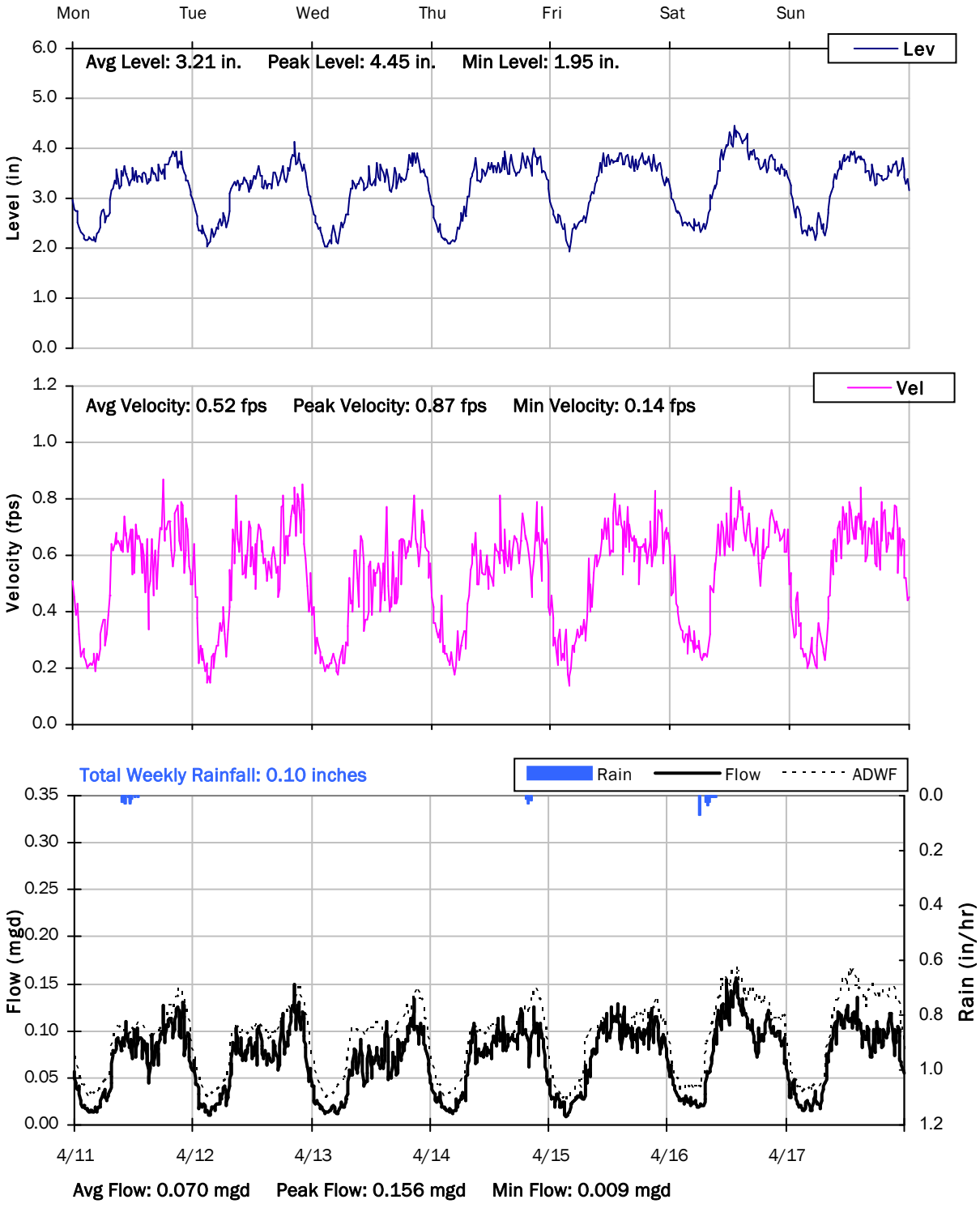
4/4/2022 to 4/11/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

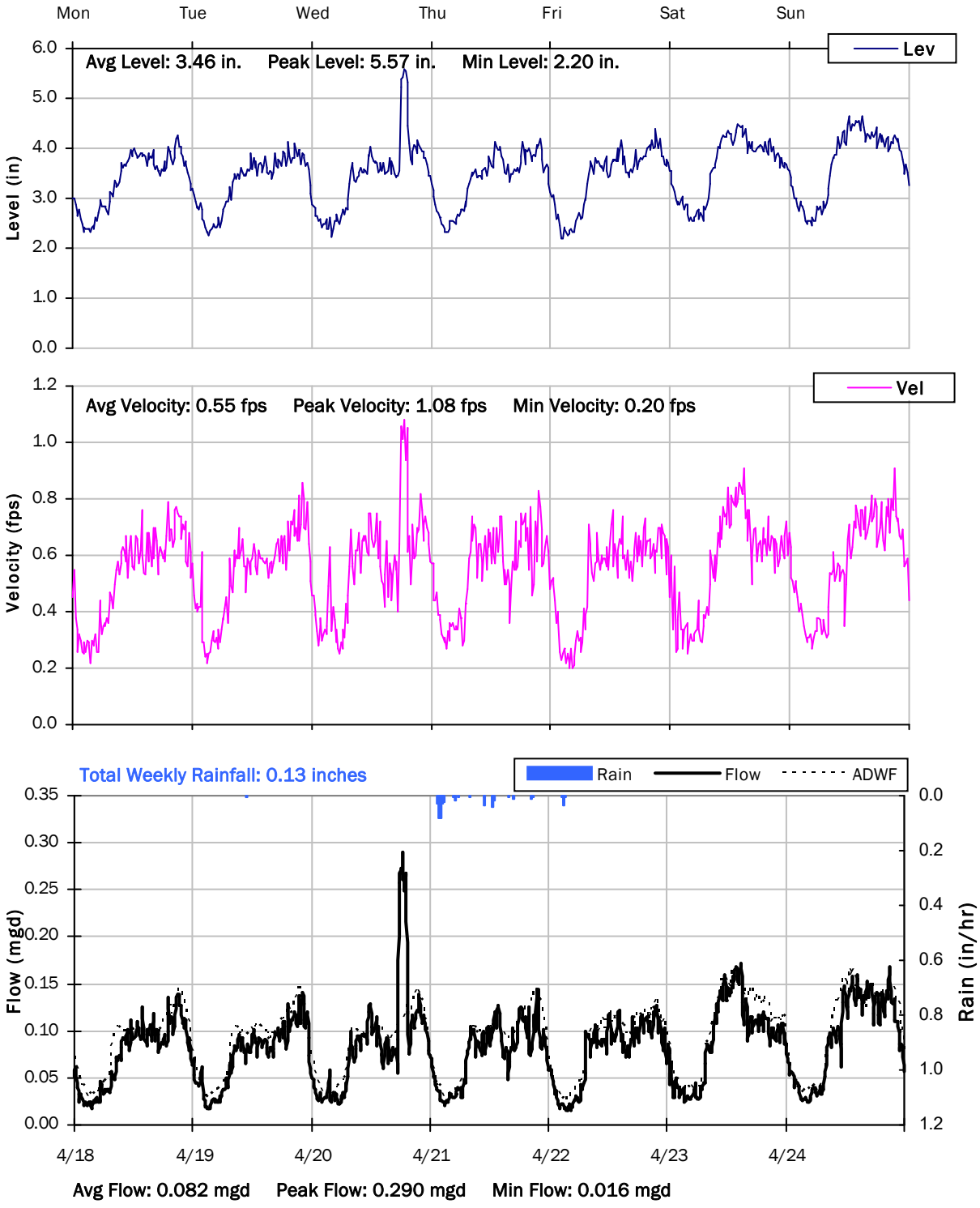
4/11/2022 to 4/18/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

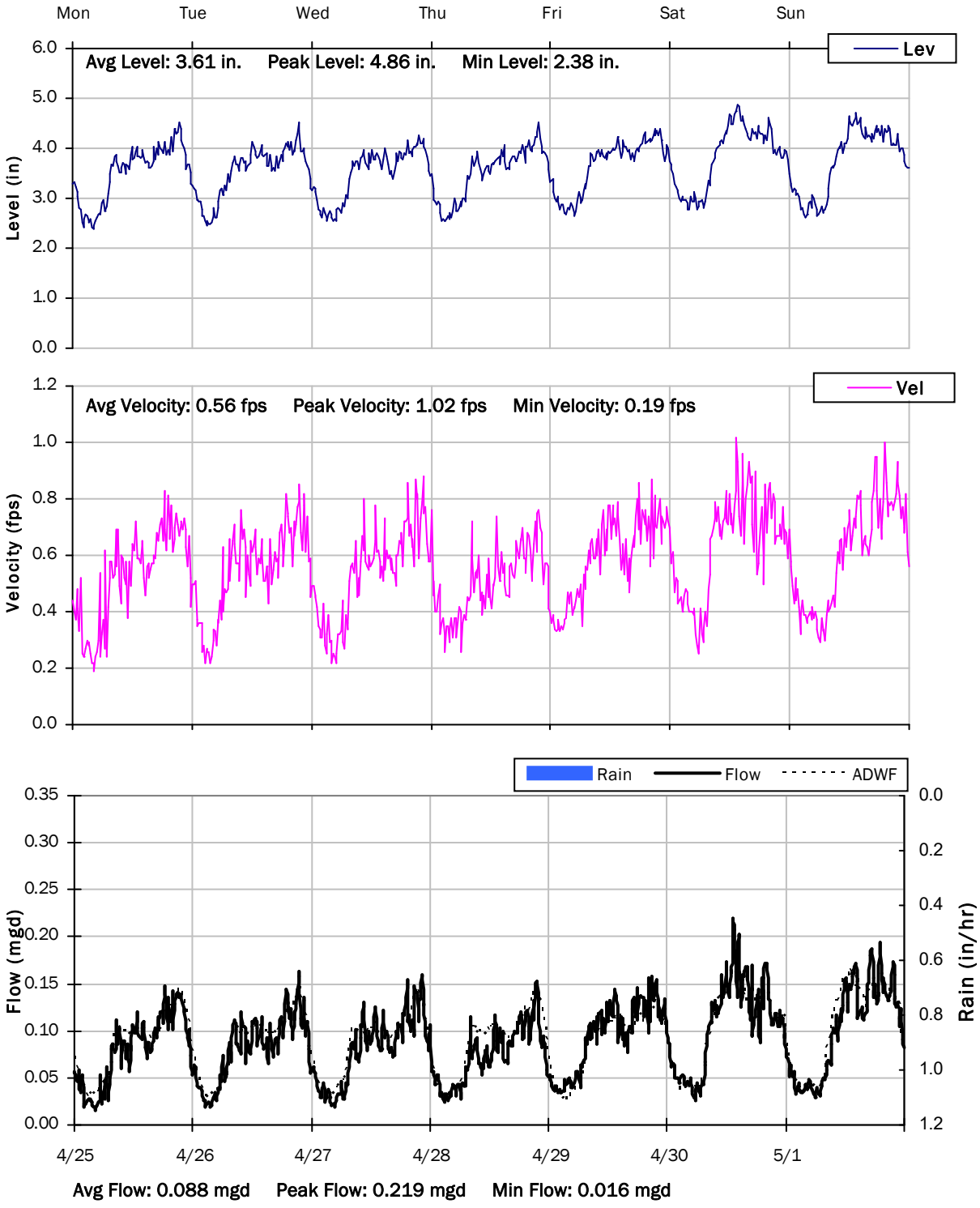
4/18/2022 to 4/25/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

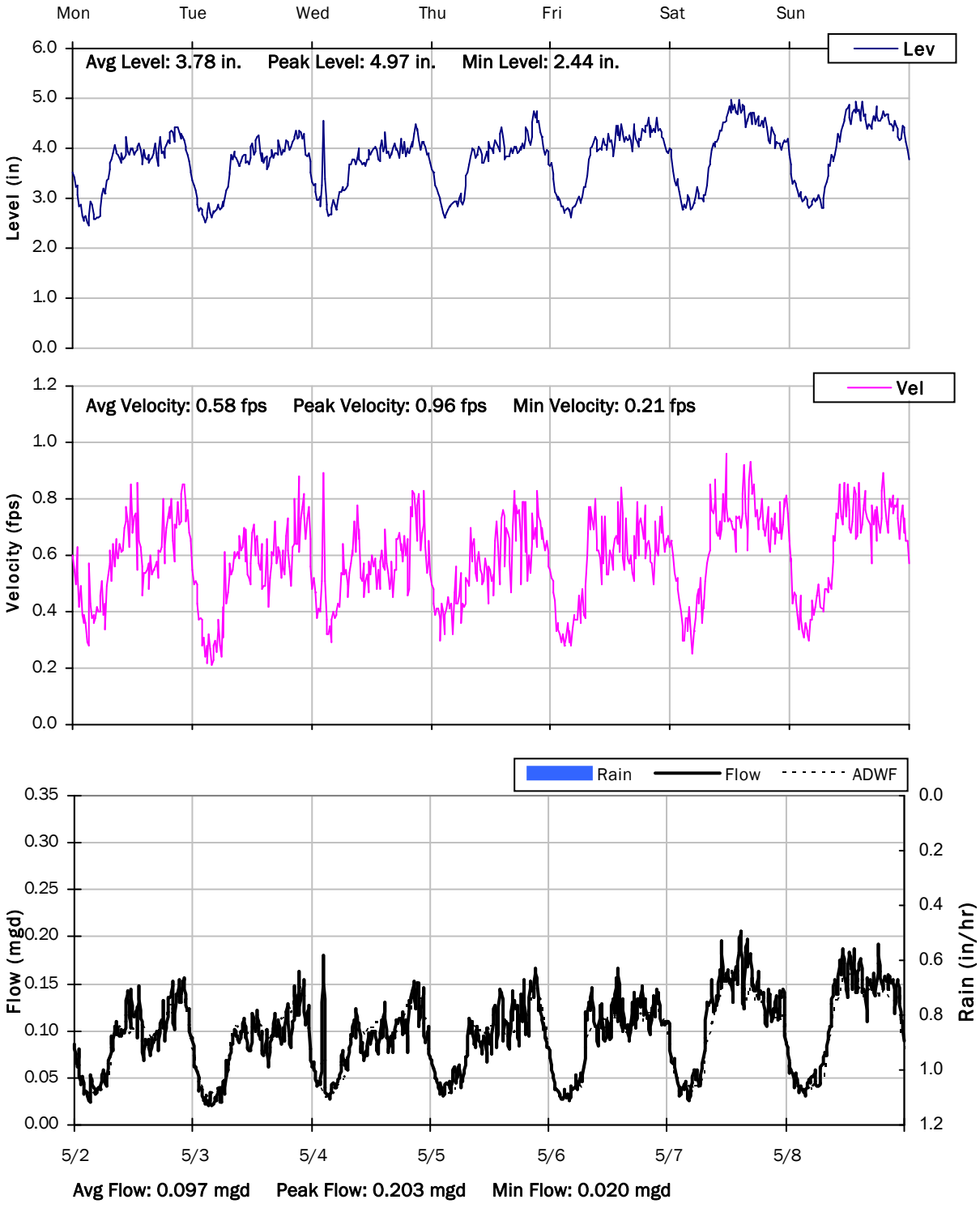
4/25/2022 to 5/2/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

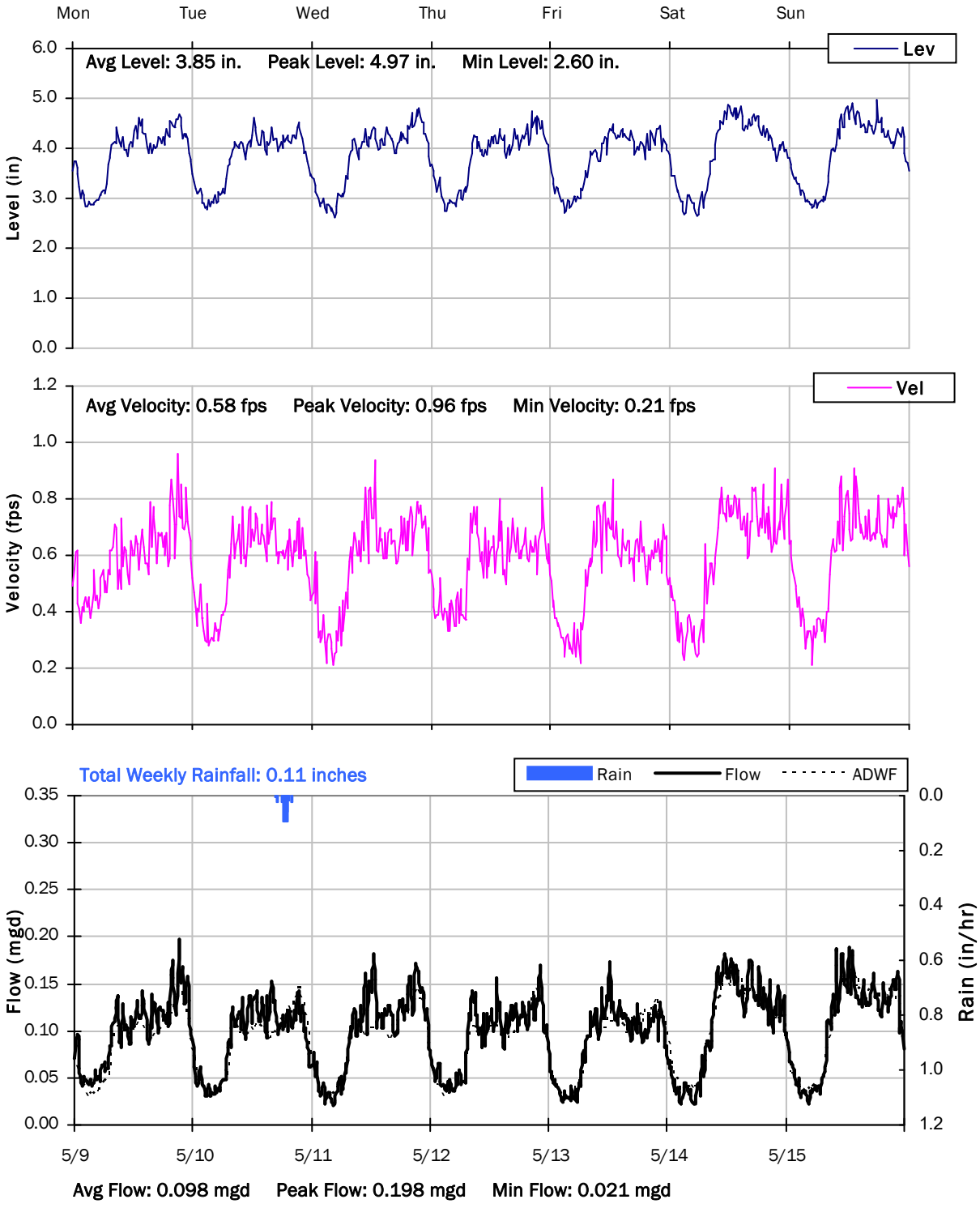
5/2/2022 to 5/9/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

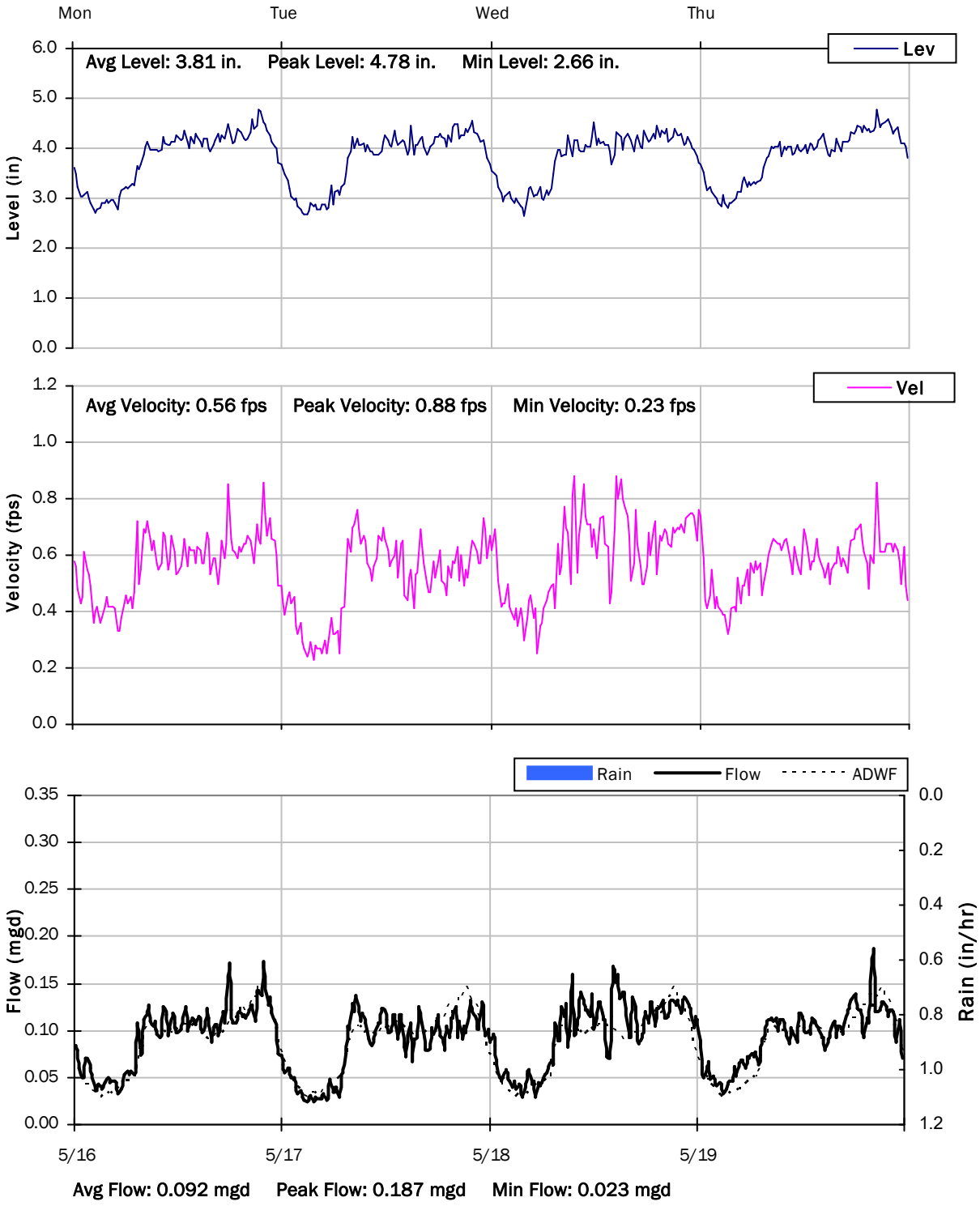
5/9/2022 to 5/16/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 17

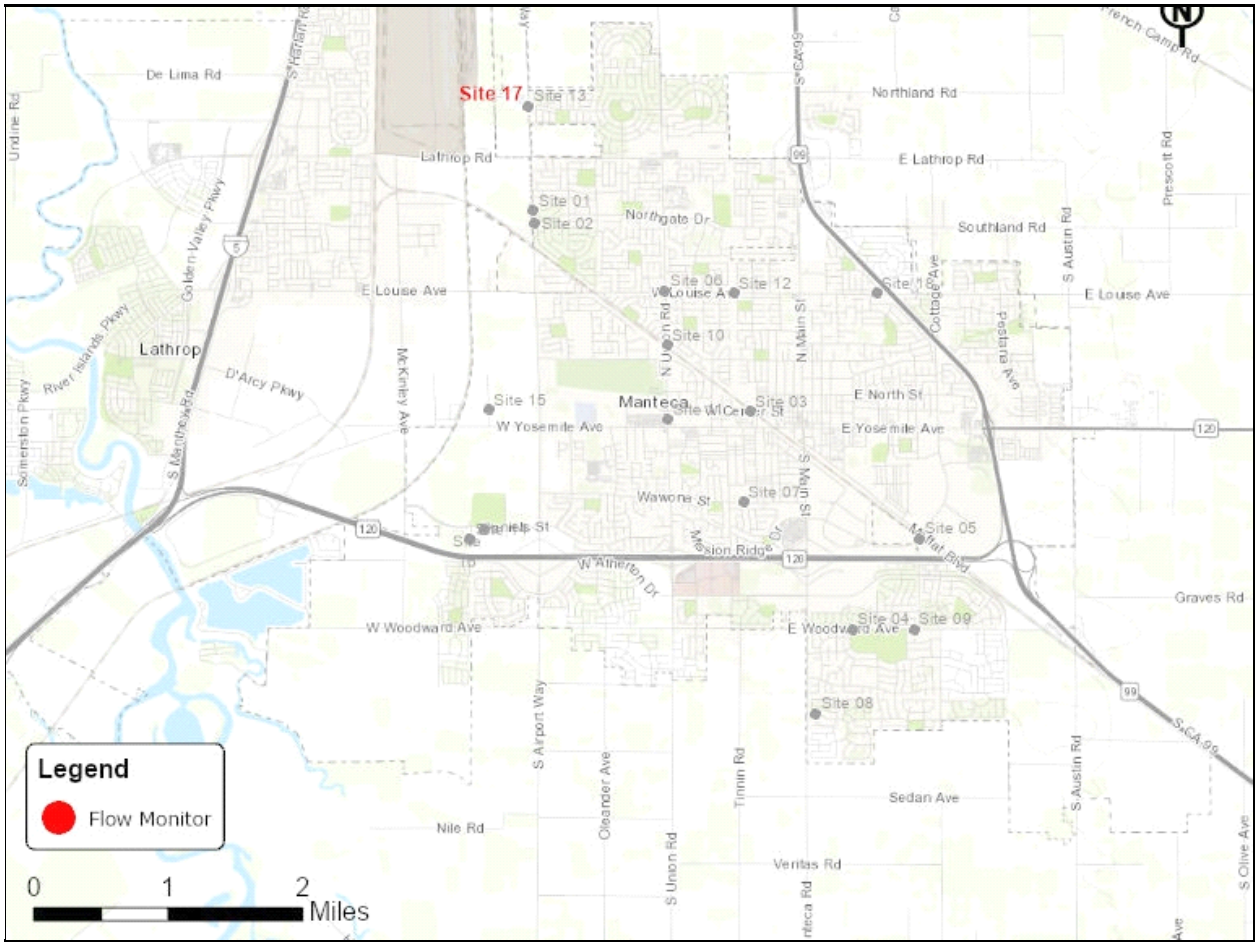
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: Airport Way at Daisywood Drive

Data Summary Report



Vicinity Map: Site 17

SITE 17

Additional Site Photos

Effluent Pipe

Northwest Influent Pipe

SITE 17

Additional Site Photos

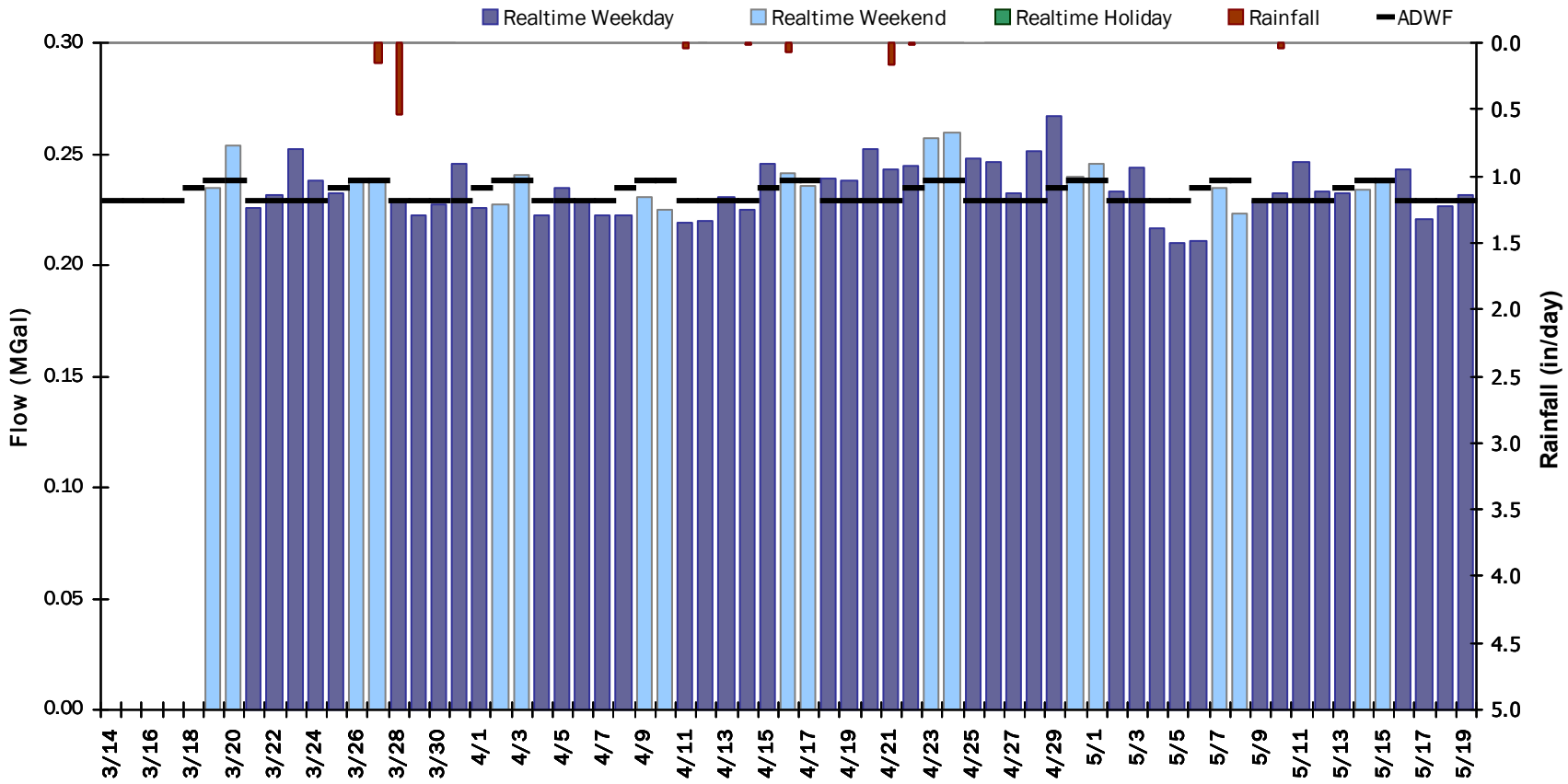
Monitored East Influent Pipe

SITE 17

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.235 MGal Peak Daily Flow: 0.267 MGal Min Daily Flow: 0.210 MGal

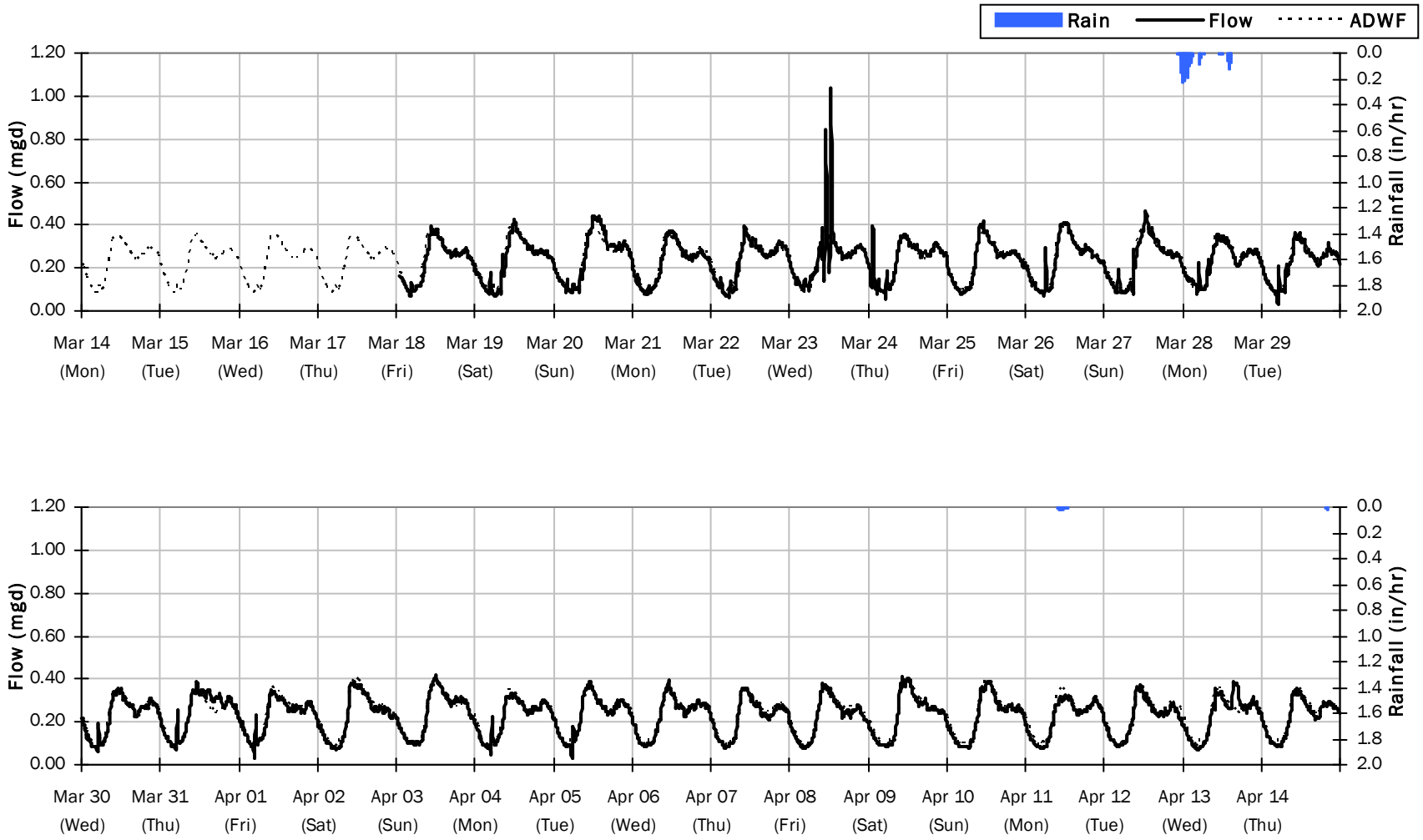
Total Rainfall: 1.04 inches



SITE 17

Flow Summary: 3/14/2022 to 4/14/2022

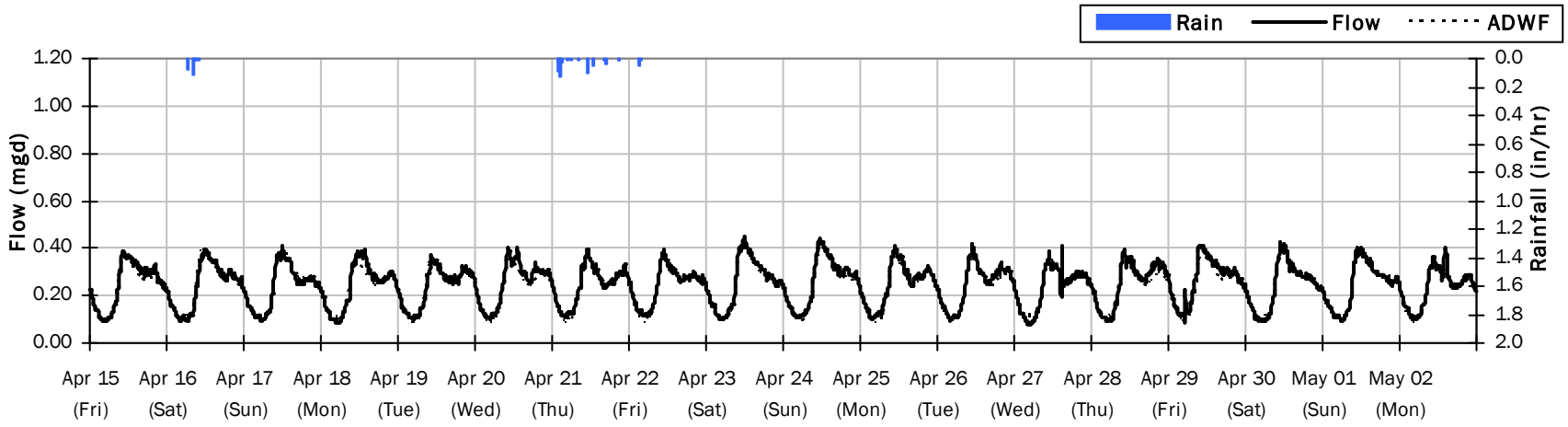
Period Rainfall: 0.75 inches Period Avg Flow: 0.231 mgd Period Peak Flow: 1.034 mgd Period Min Flow: 0.029 mgd

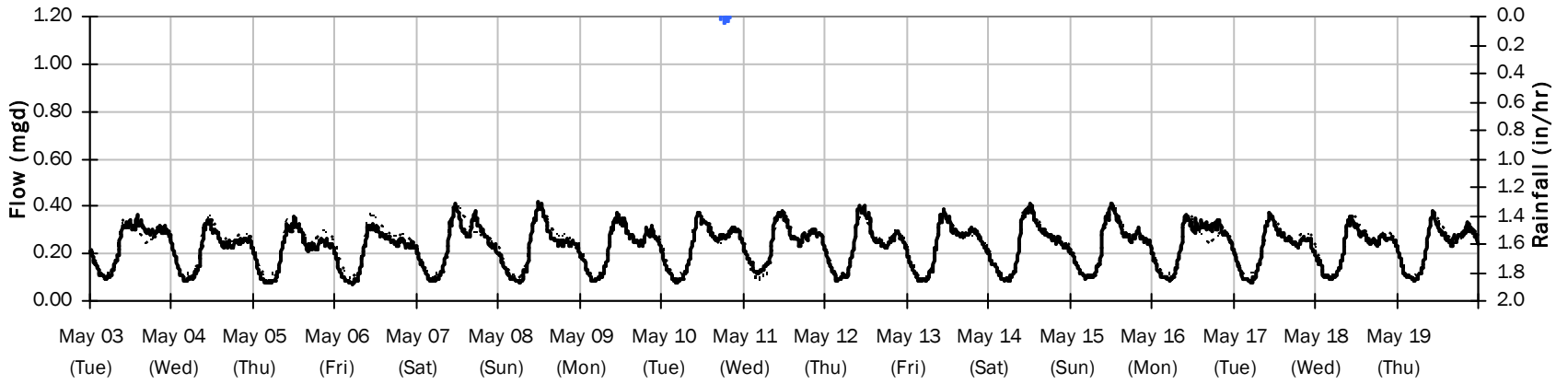


SITE 17

Flow Summary: 4/15/2022 to 5/19/2022

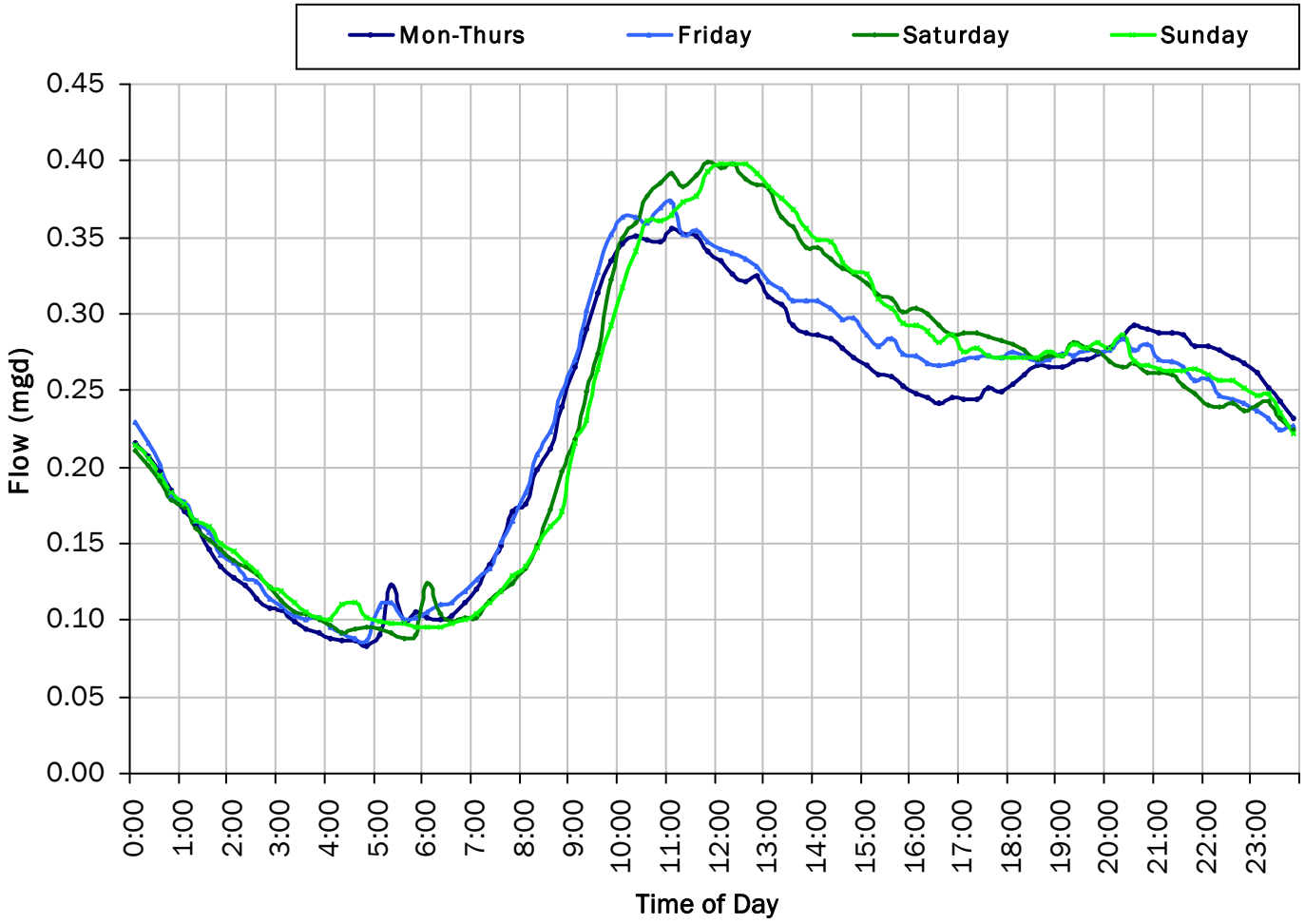
Period Rainfall: 0.29 inches Period Avg Flow: 0.238 mgd Period Peak Flow: 0.449 mgd Period Min Flow: 0.073 mgd





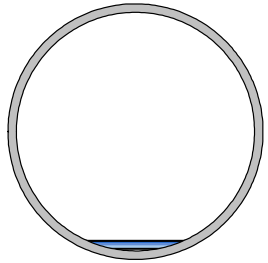
SITE 17

Average Dry Weather Flow Hydrographs



ADWF:

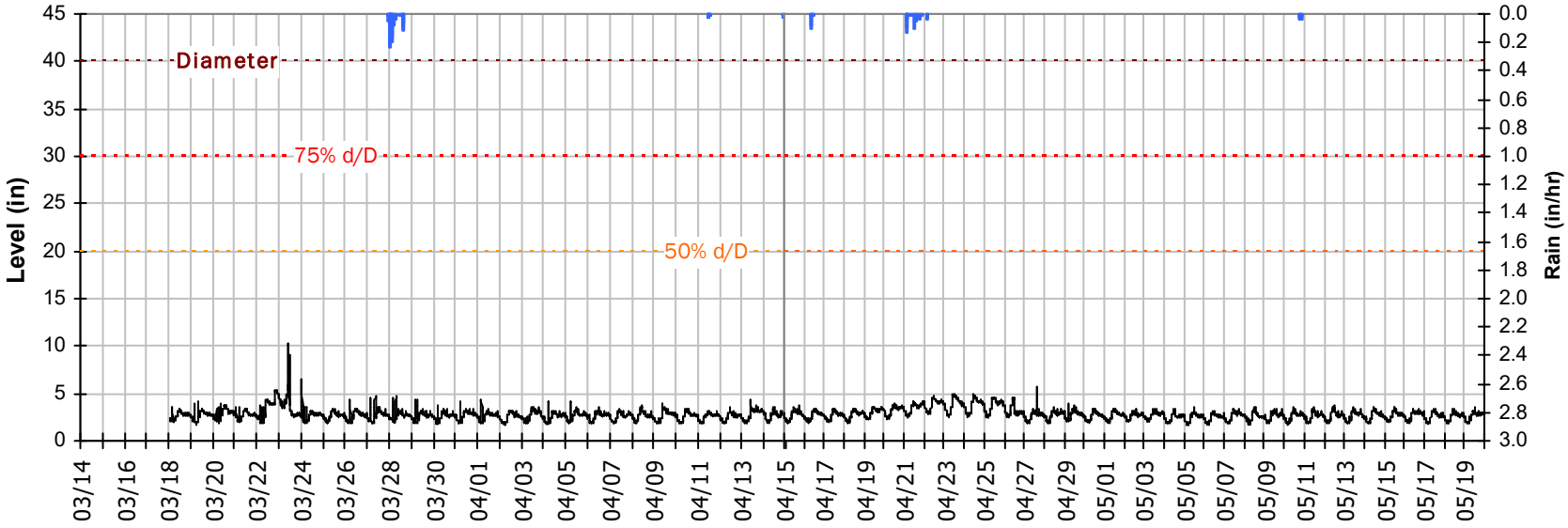
0.232 *mgd*

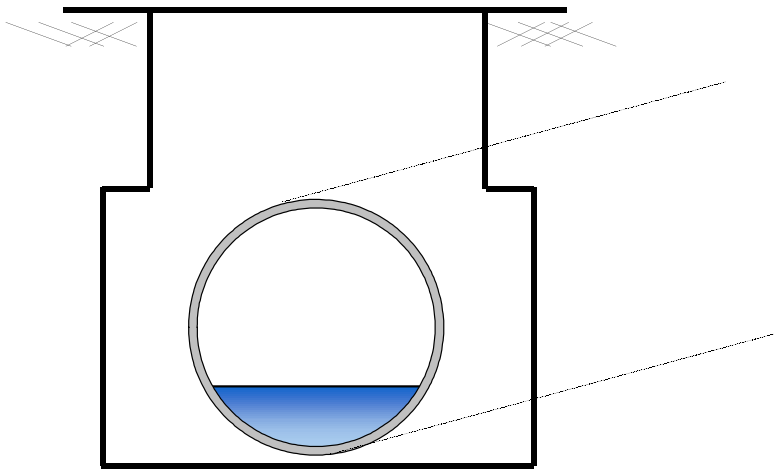


SITE 17

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

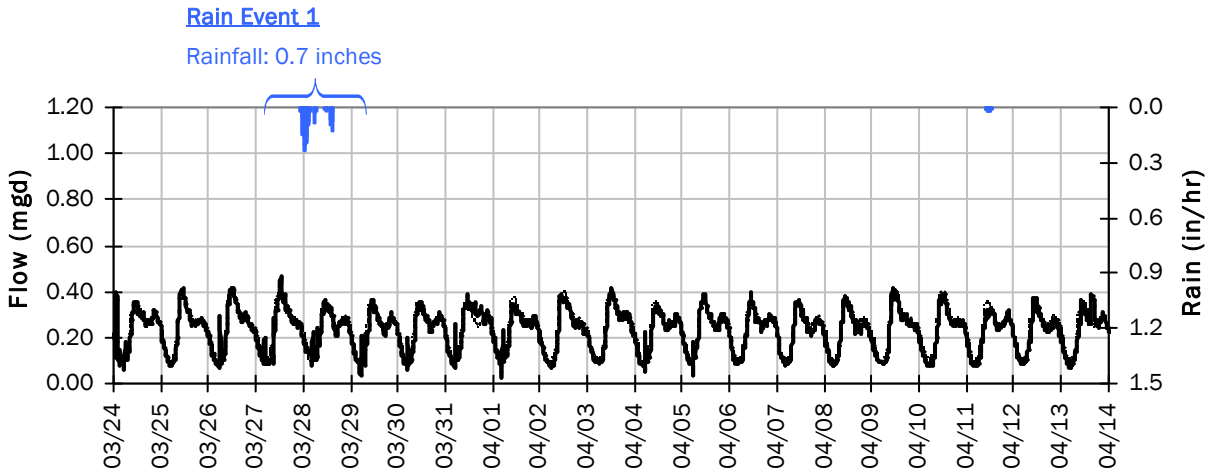




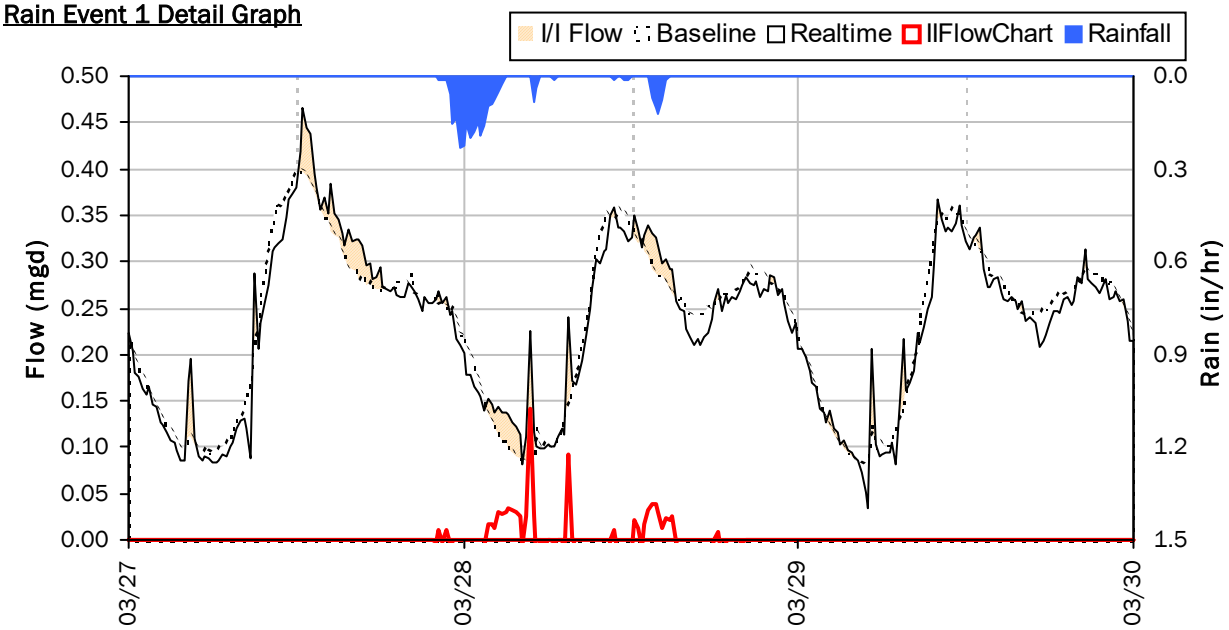
Pipe Diameter:	40	*inches*
Peak Measured Level:	10.1	*inches*
Peak d/D Ratio:	0.25	

SITE 17
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



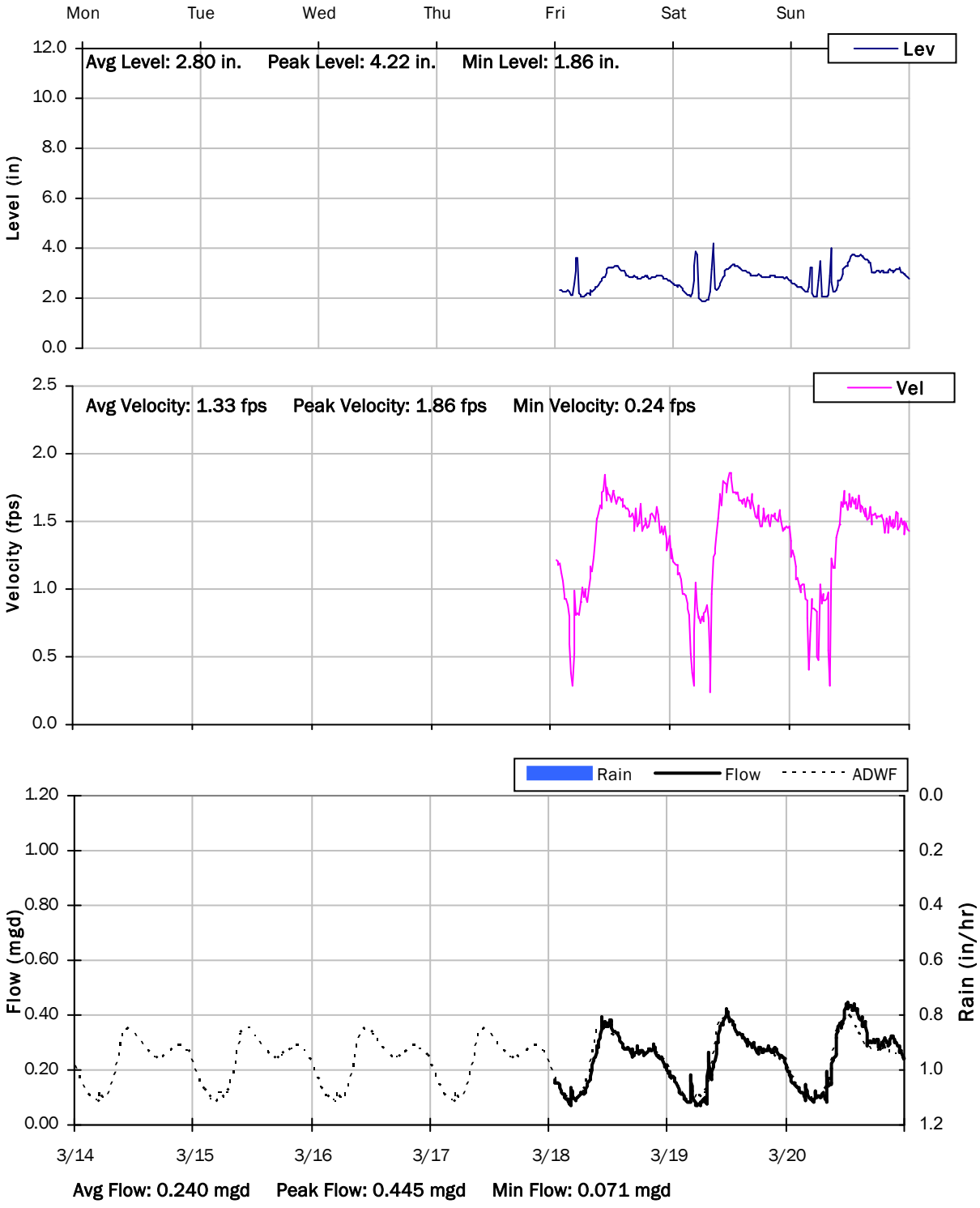
Storm Event I/I Analysis (Rain = 0.70 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.358 *mgd*	**Peak I/I Rate:**	0.143 *mgd*
PF:	1.54	**Total I/I:**	1,000 *gallons*
Peak Level:	4.65 *in*		
d/D Ratio:	0.12		

SITE 17

Weekly Level, Velocity and Flow Hydrographs

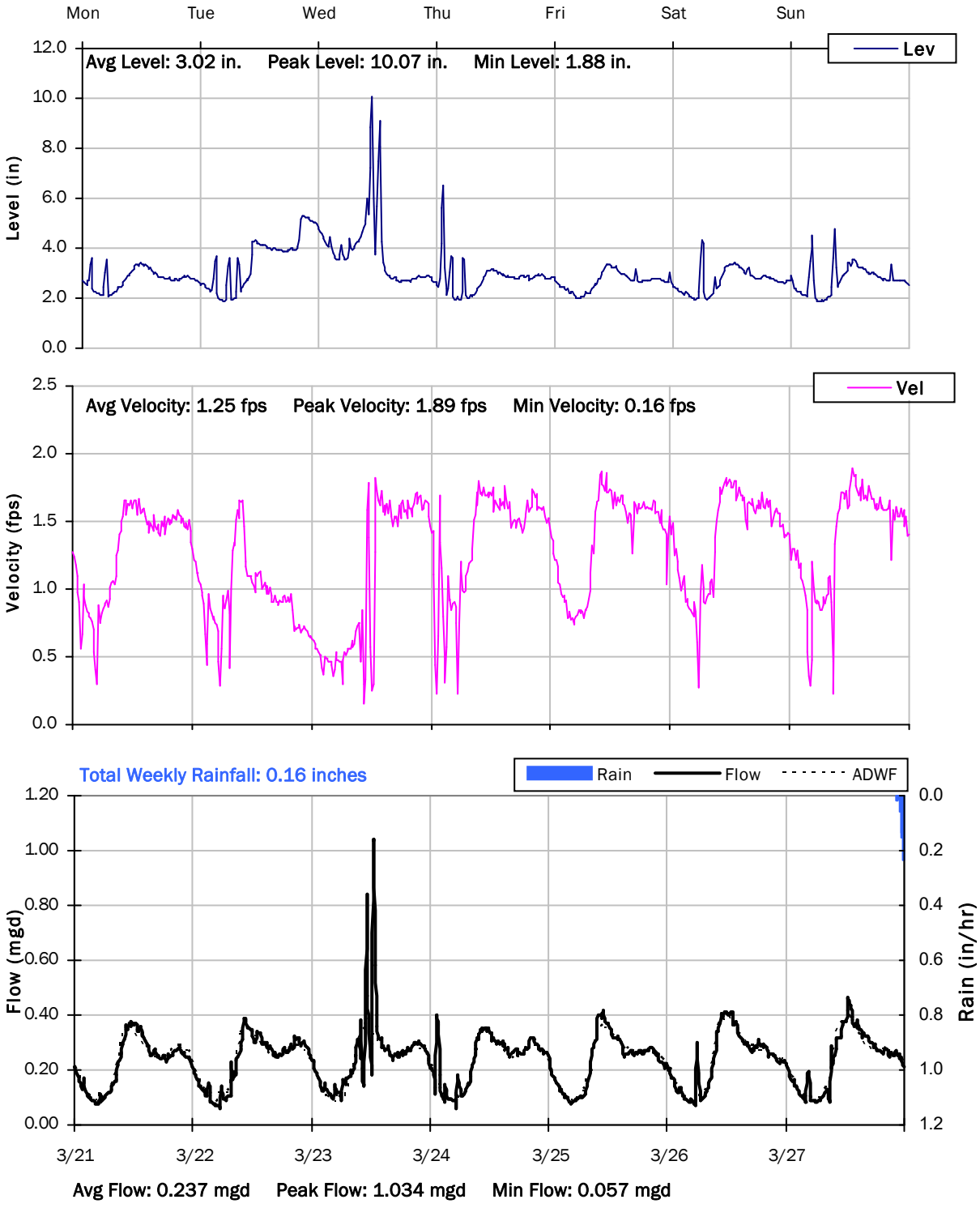
3/14/2022 to 3/21/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

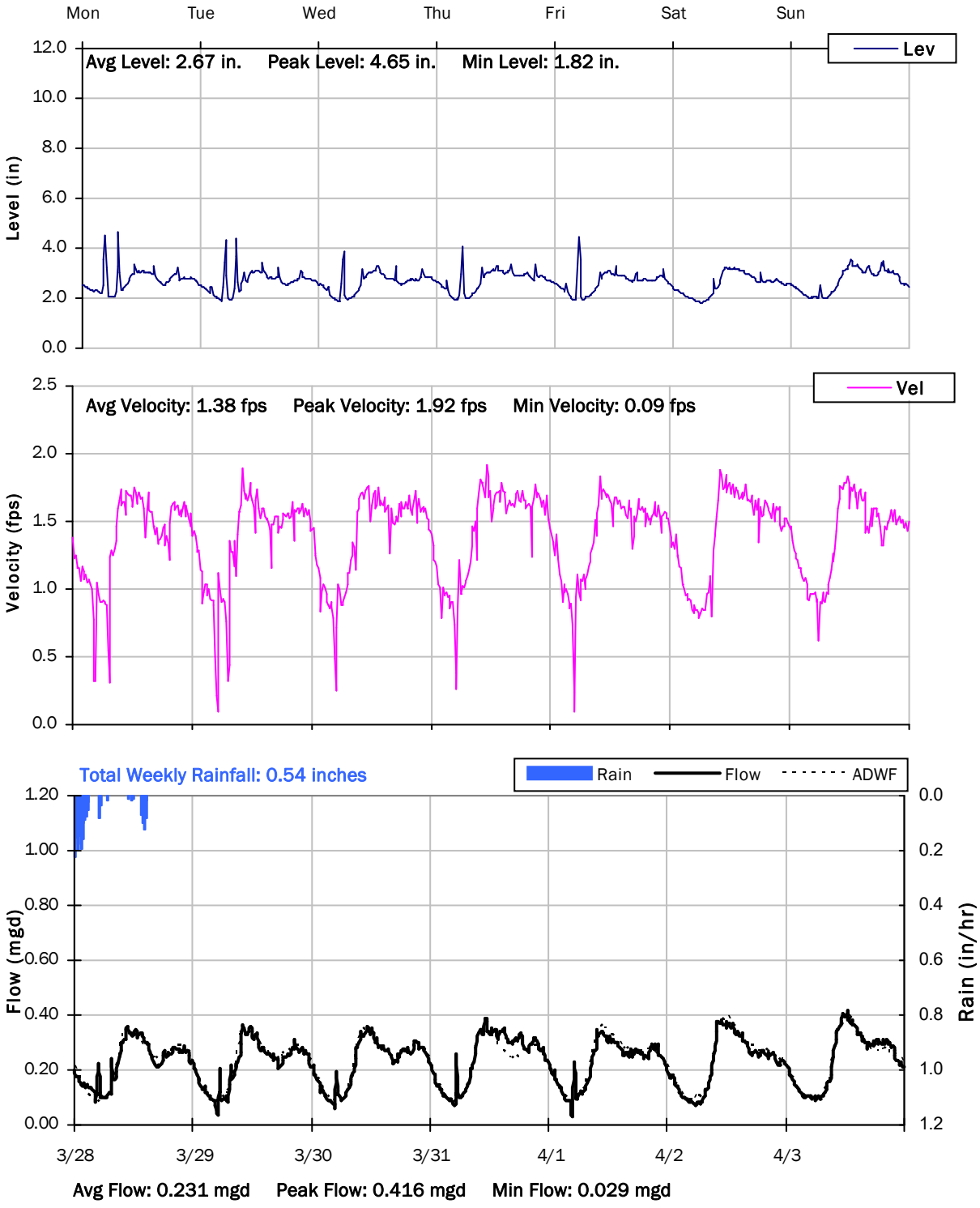
3/21/2022 to 3/28/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

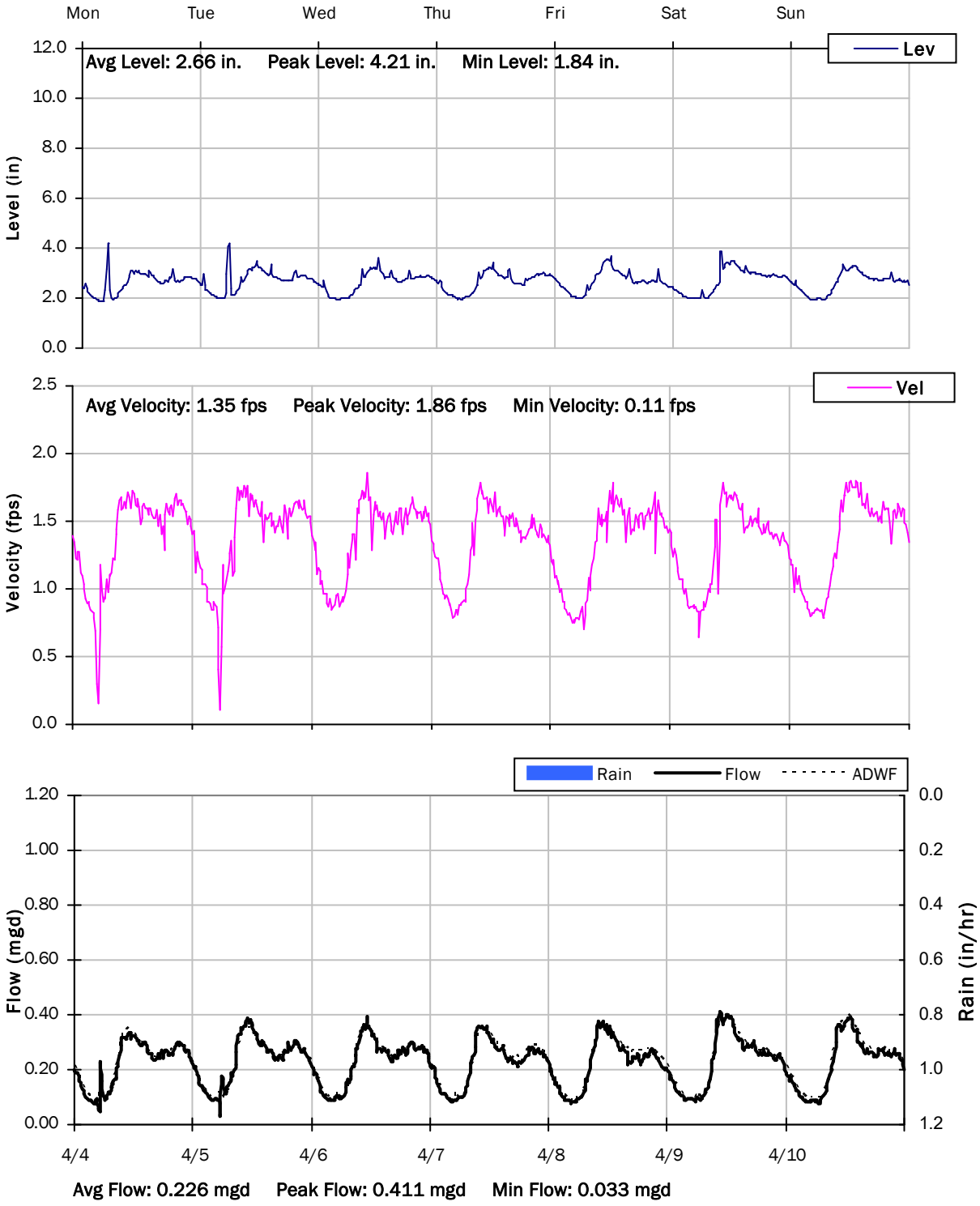
3/28/2022 to 4/4/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

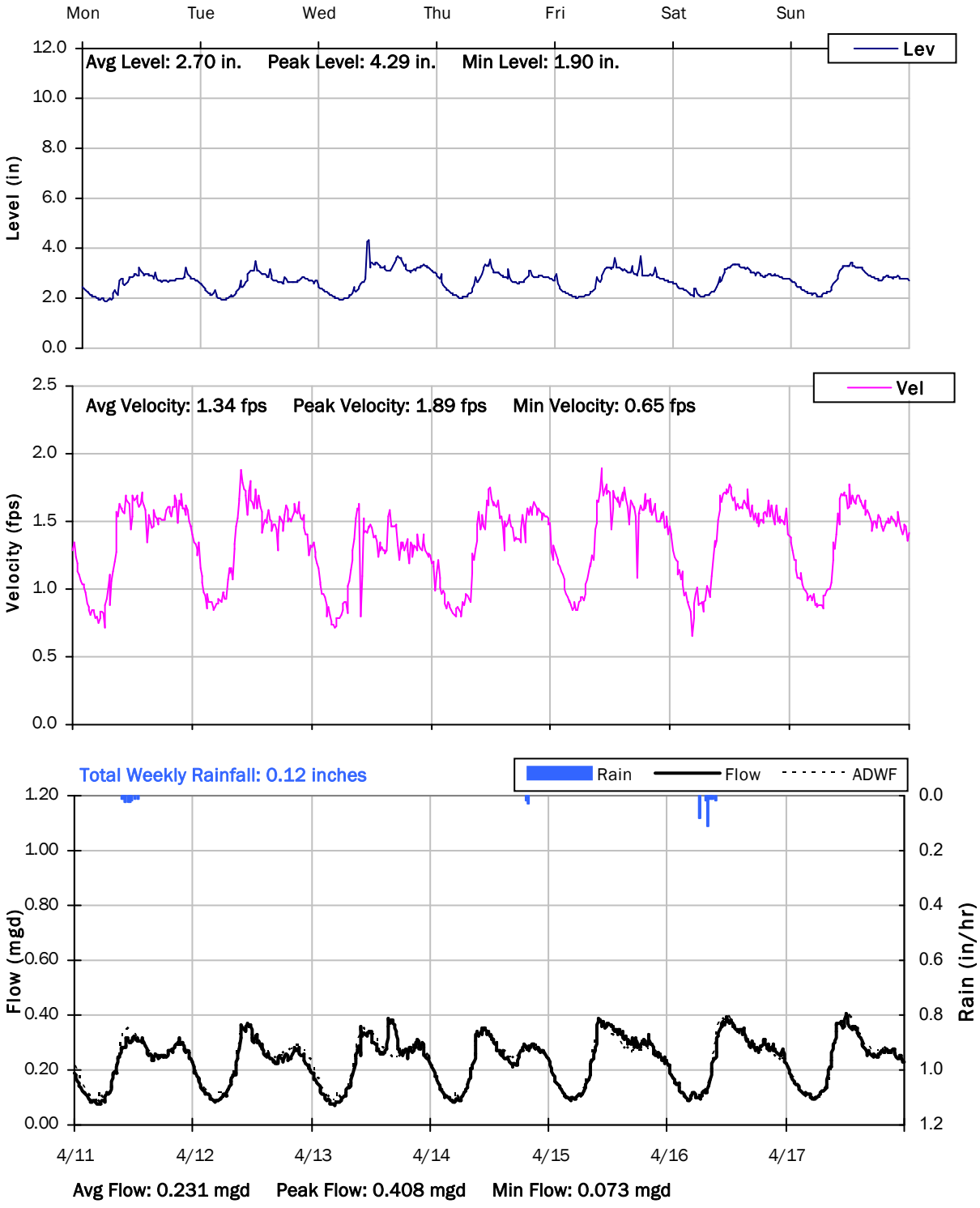
4/4/2022 to 4/11/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

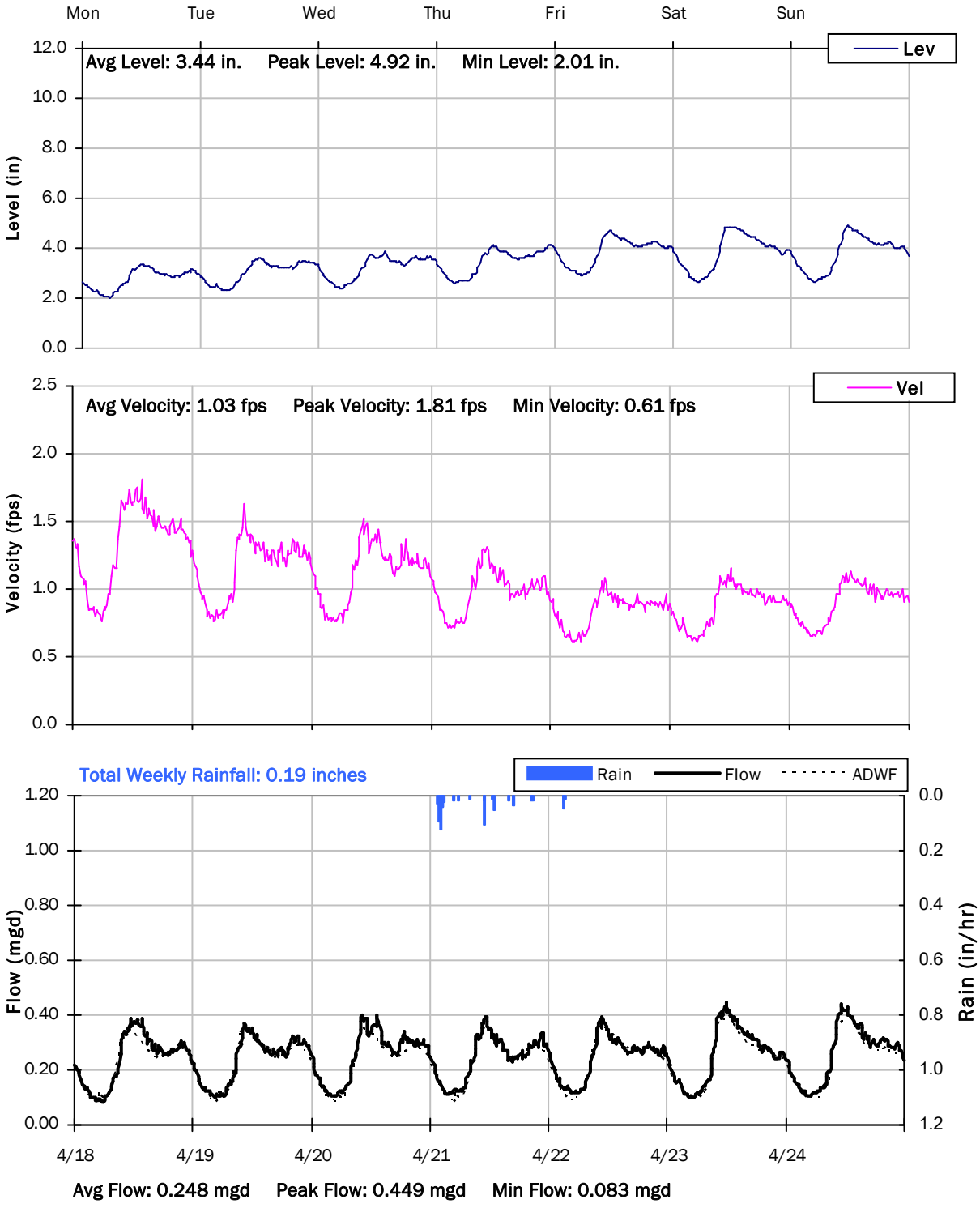
4/11/2022 to 4/18/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

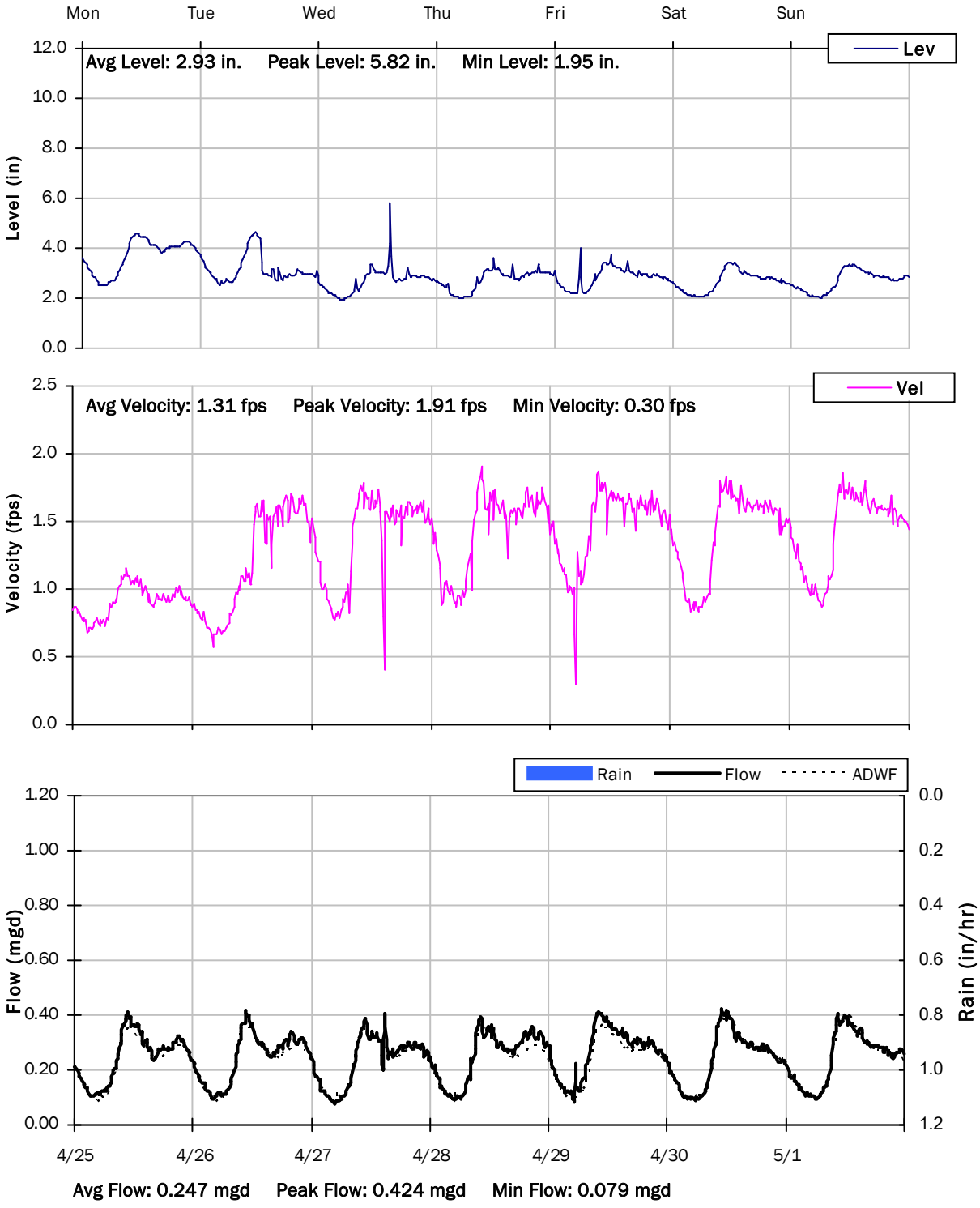
4/18/2022 to 4/25/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

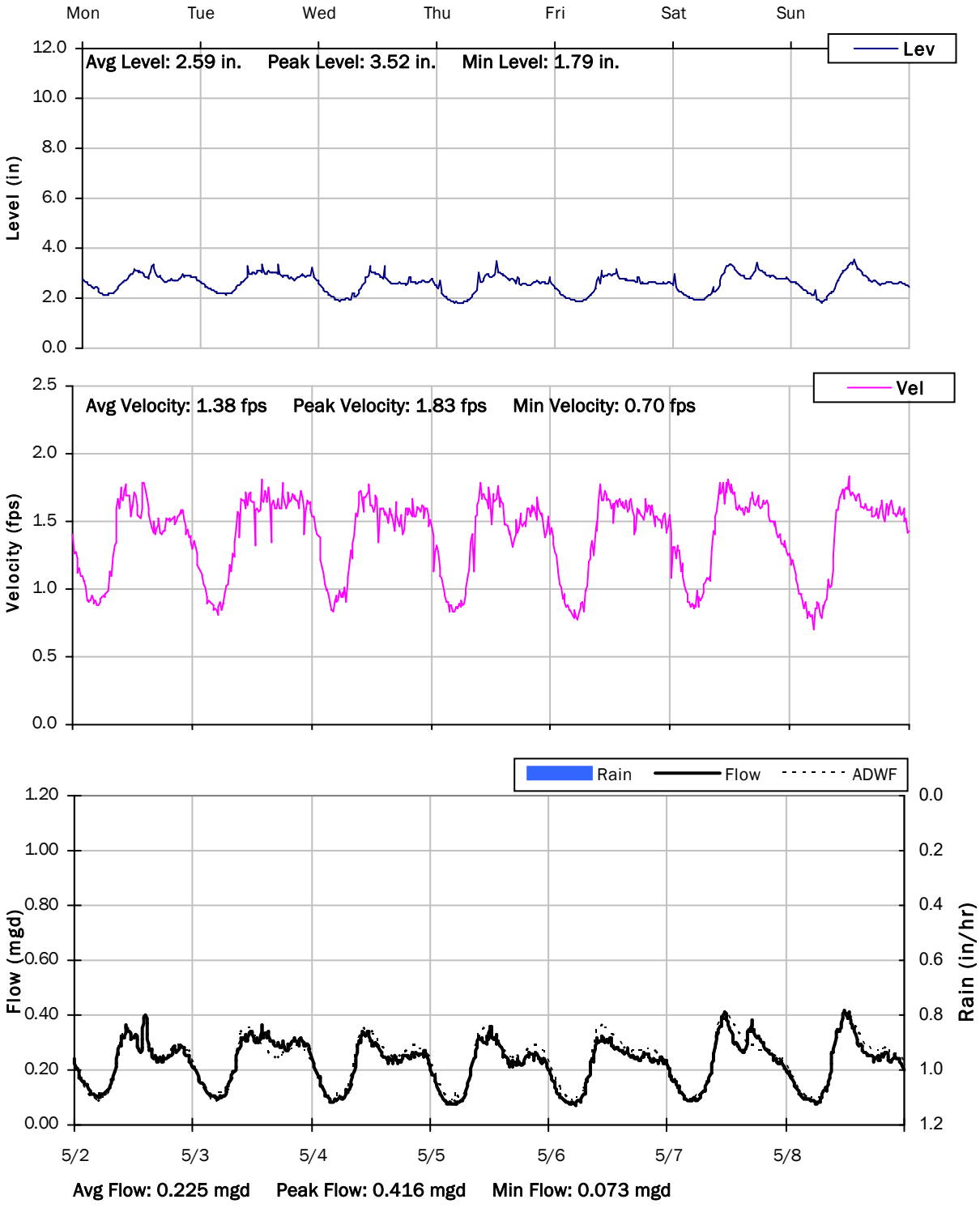
4/25/2022 to 5/2/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

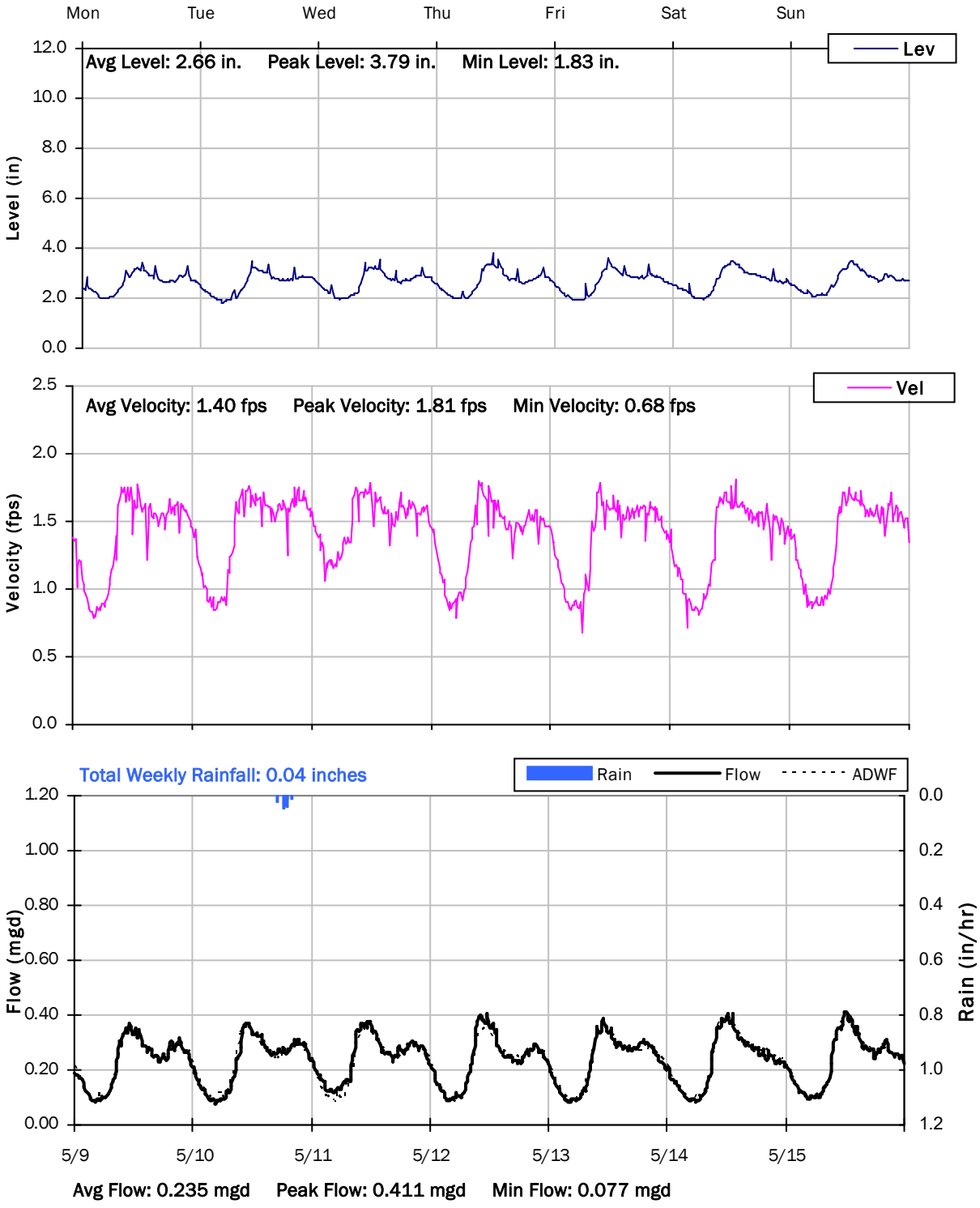
5/2/2022 to 5/9/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

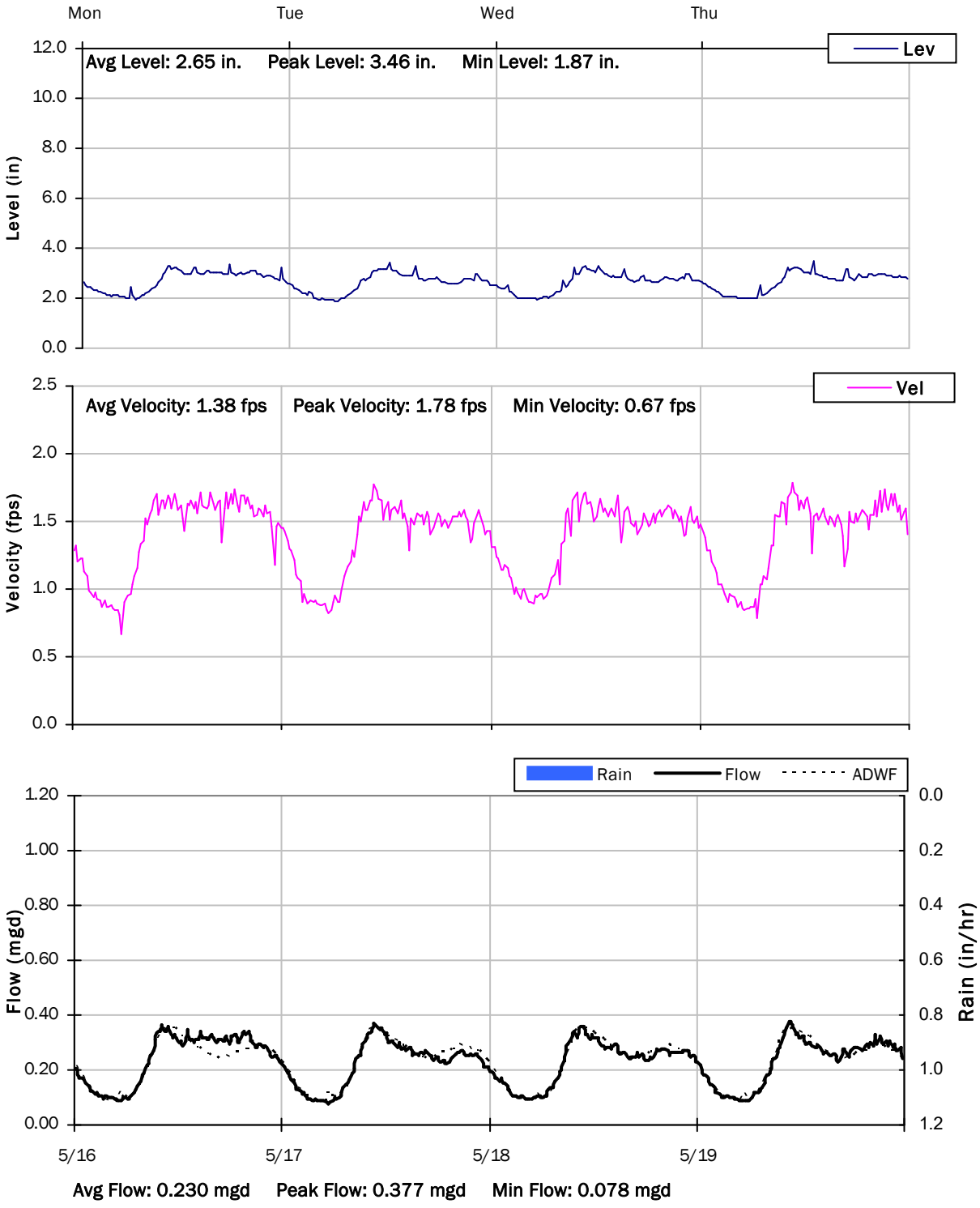
5/9/2022 to 5/16/2022



SITE 17

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



Monitoring Site: Site 18

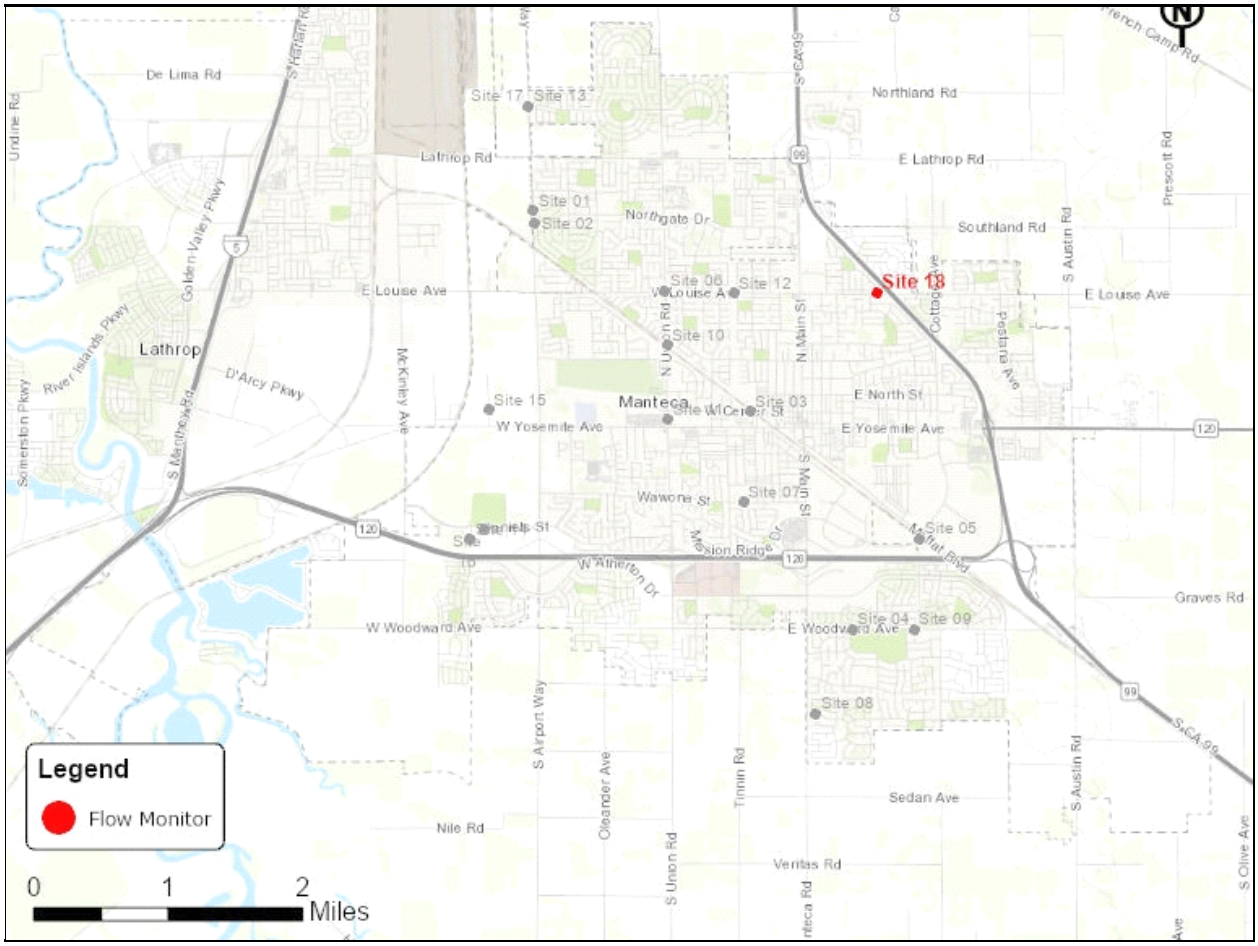
Stantec | City of Manteca, California

Sanitary Sewer Flow Monitoring

March 14, 2022 - May 19, 2022

Location: E. Louise Avenue East of Souza Boulevard

Data Summary Report



Vicinity Map: Site 18

SITE 18

Additional Site Photos

Effluent Pipe

Monitored East Influent Pipe

SITE 18

Additional Site Photos

South Influent Pipe (Lower)

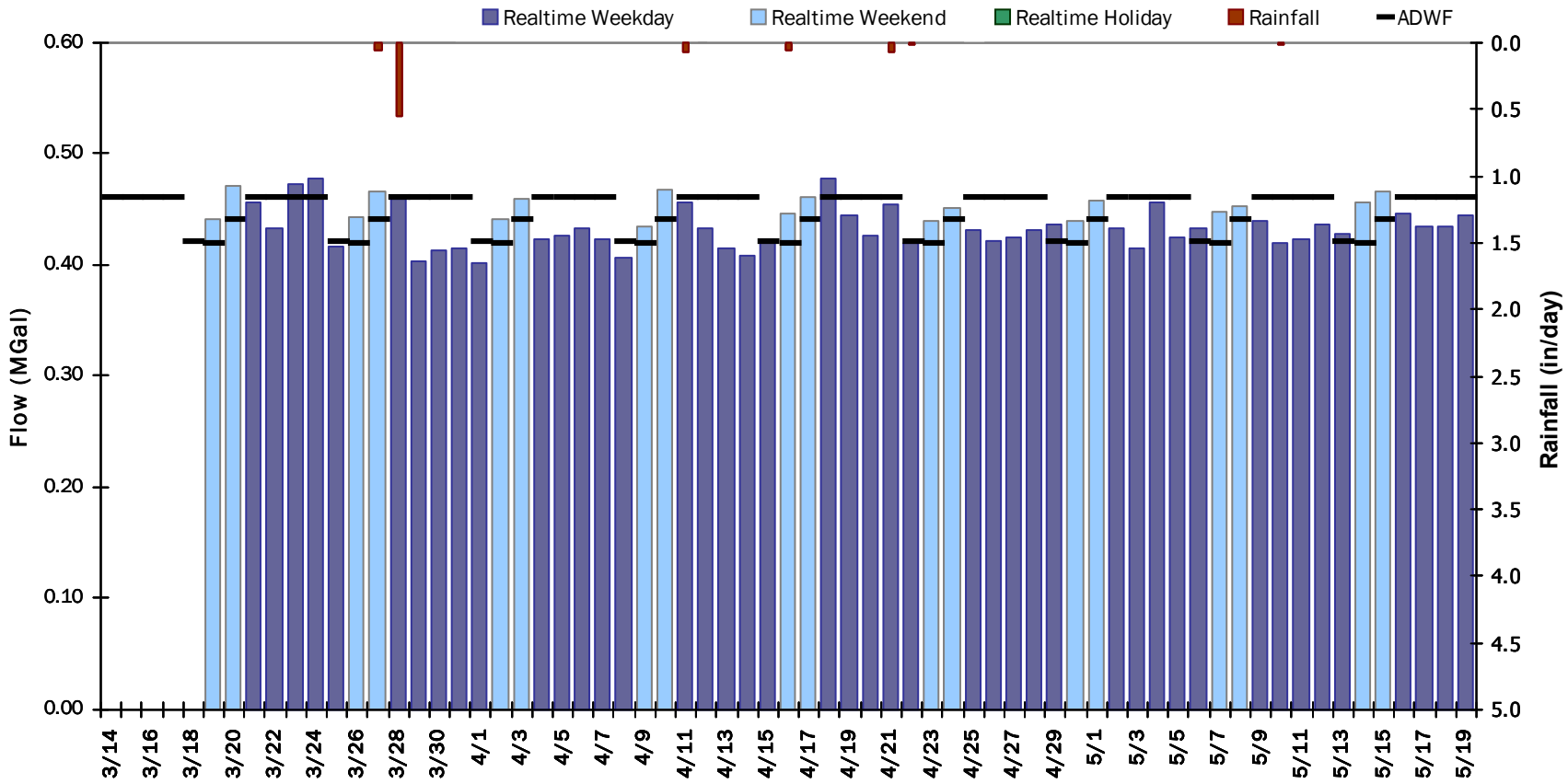
South Influent Pipe (Upper)

SITE 18

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.438 MGal Peak Daily Flow: 0.478 MGal Min Daily Flow: 0.402 MGal

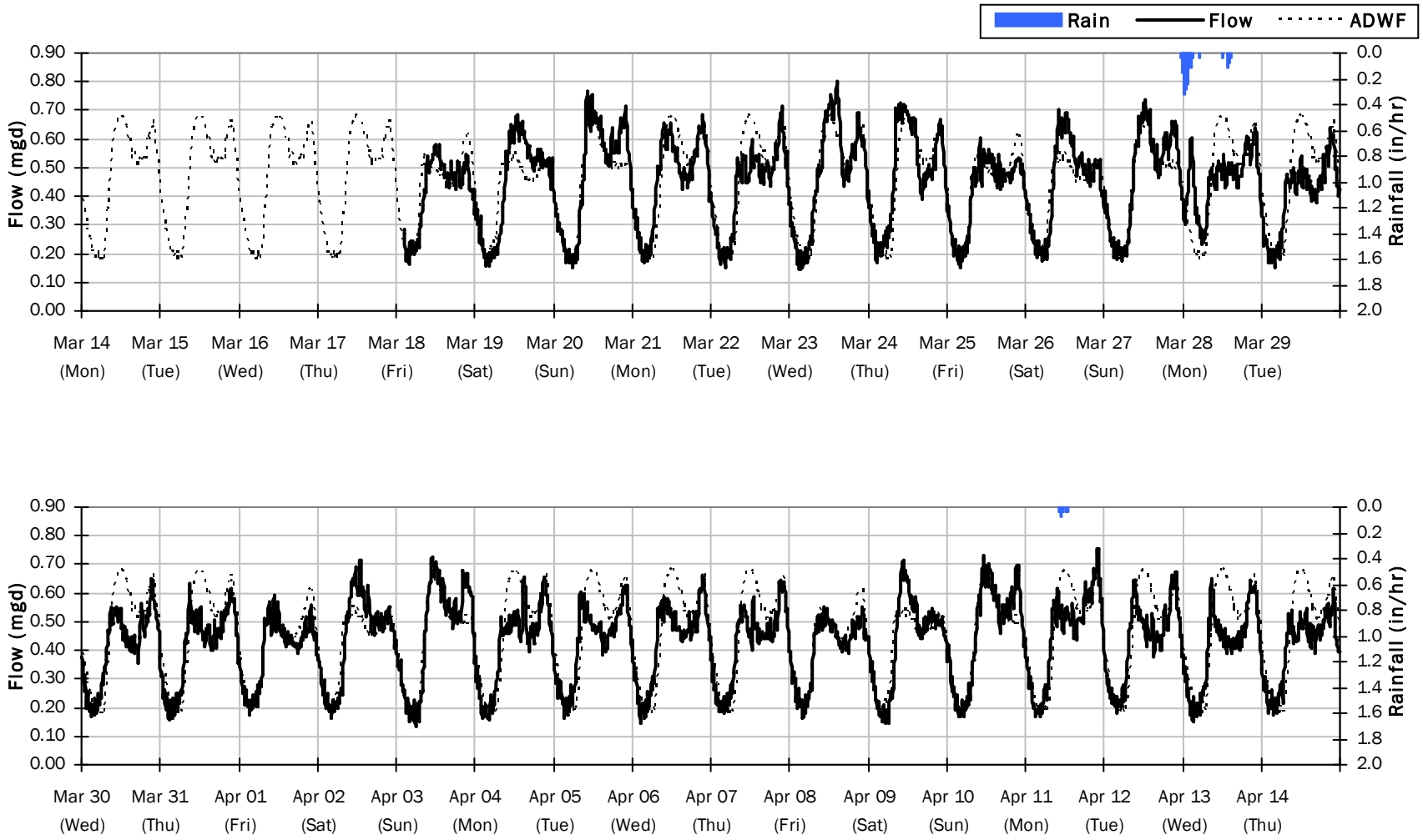
Total Rainfall: 0.84 inches



SITE 18

Flow Summary: 3/14/2022 to 4/14/2022

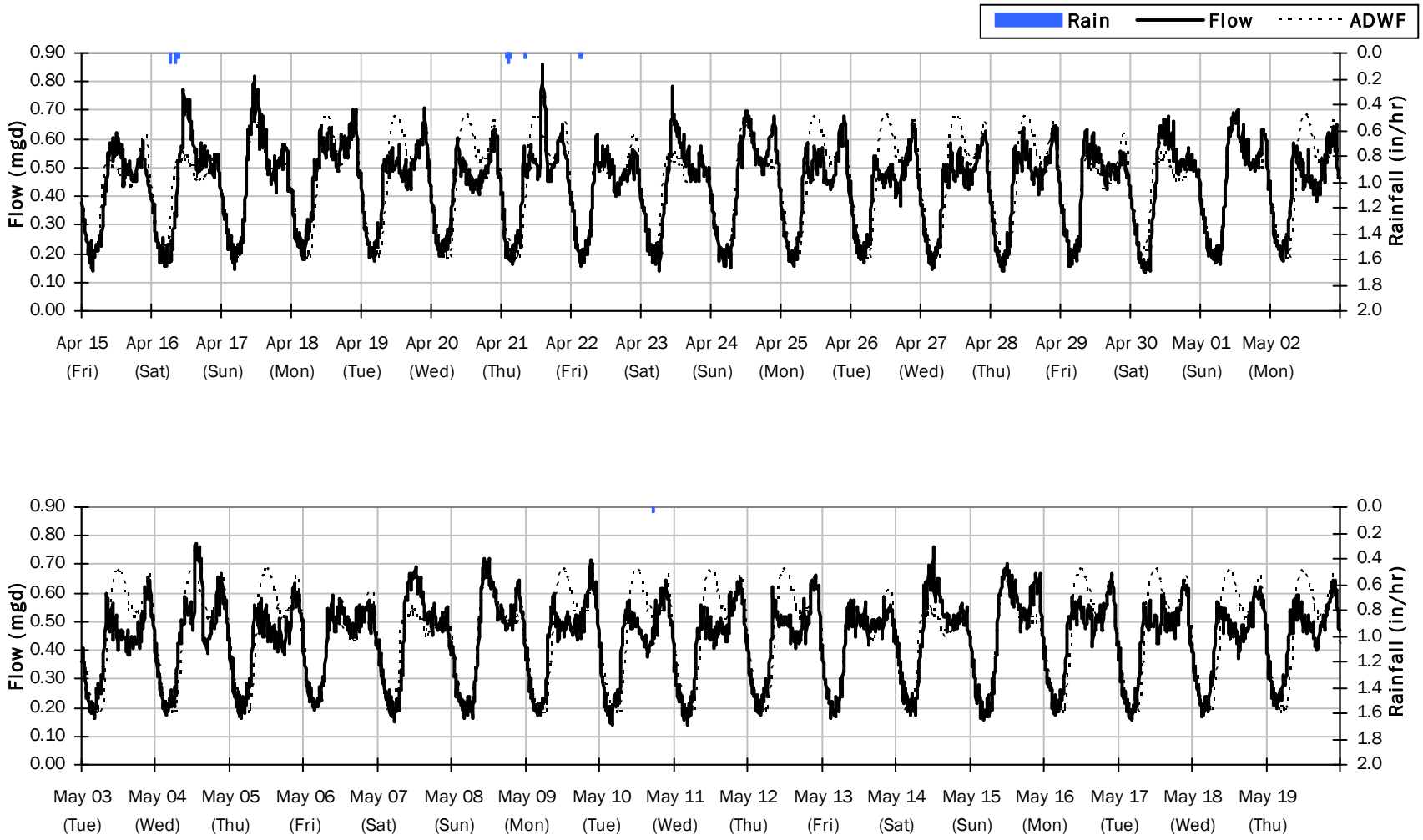
Period Rainfall: 0.68 inches Period Avg Flow: 0.436 mgd Period Peak Flow: 0.804 mgd Period Min Flow: 0.134 mgd



SITE 18

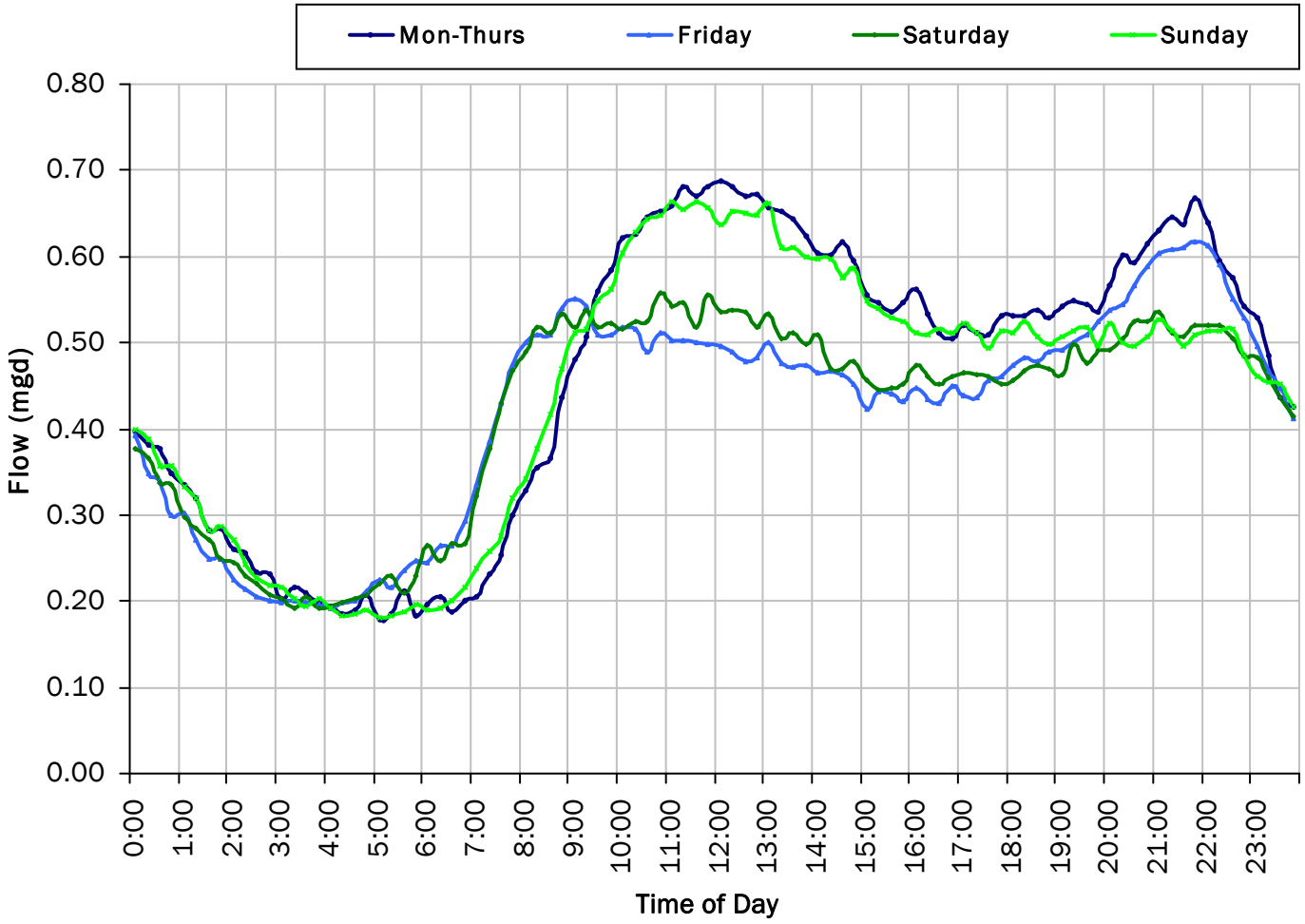
Flow Summary: 4/15/2022 to 5/19/2022

Period Rainfall: 0.16 inches Period Avg Flow: 0.440 mgd Period Peak Flow: 0.856 mgd Period Min Flow: 0.134 mgd



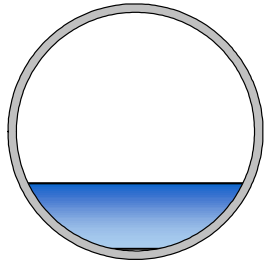
SITE 18

Average Dry Weather Flow Hydrographs



ADWF:

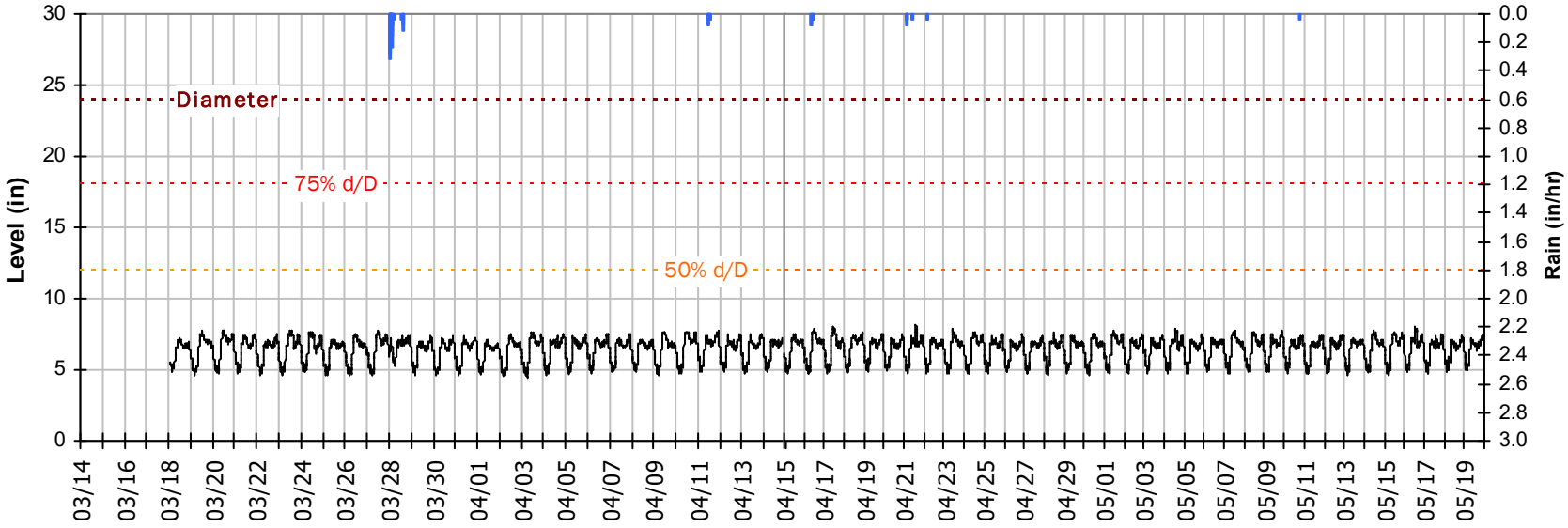
0.448 *mgd*

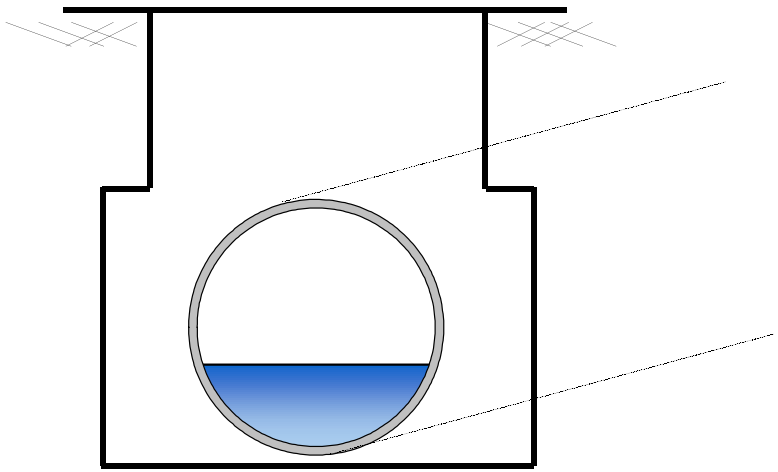


SITE 18

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

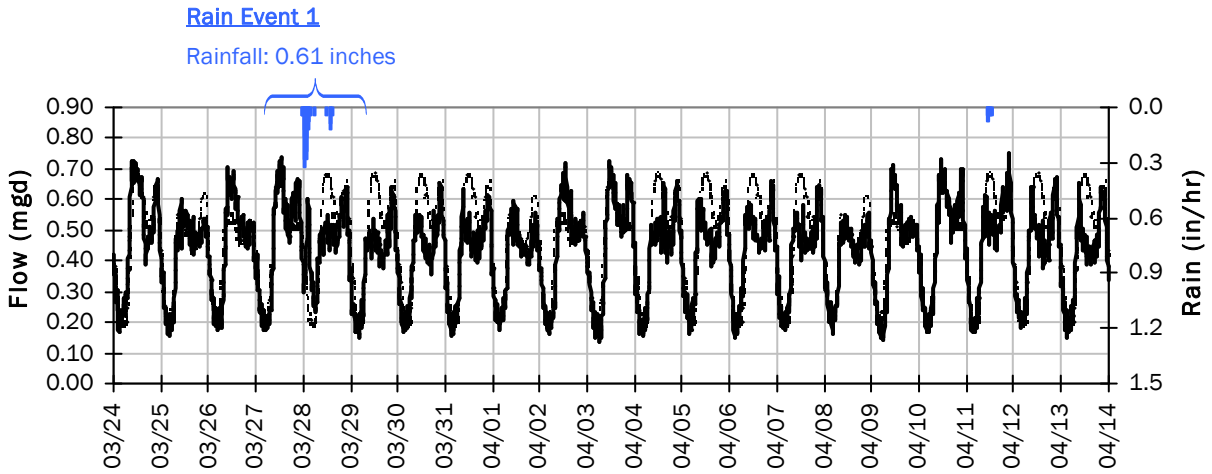




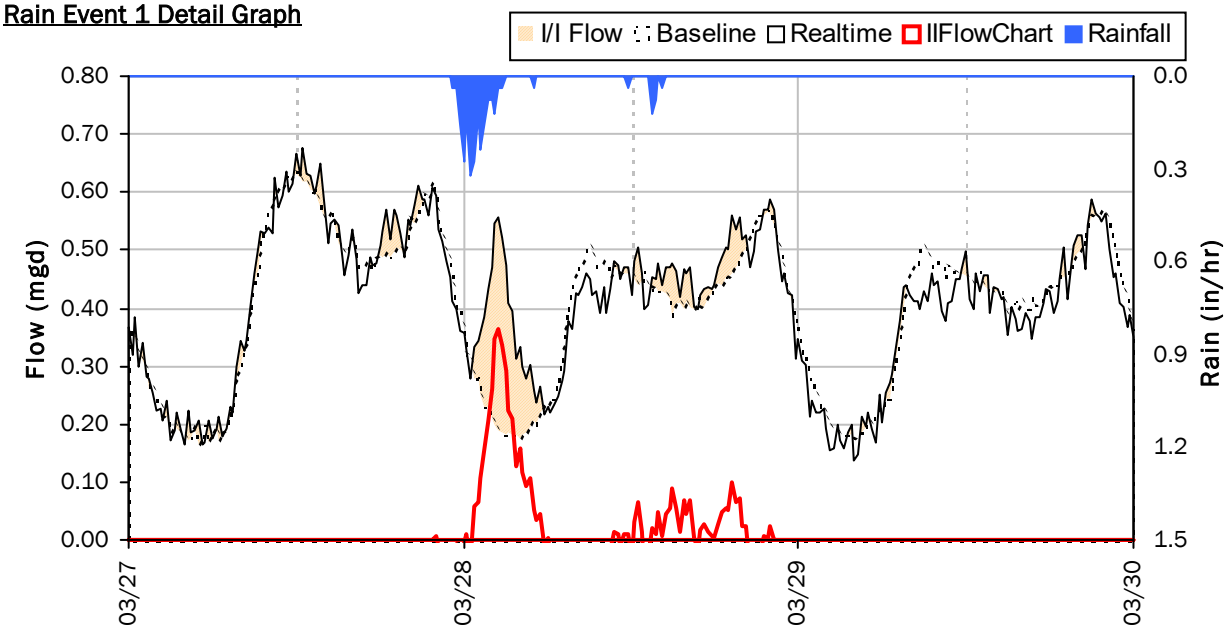
Pipe Diameter:	24	*inches*
Peak Measured Level:	8.18	*inches*
Peak d/D Ratio:	0.34	

SITE 18
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph



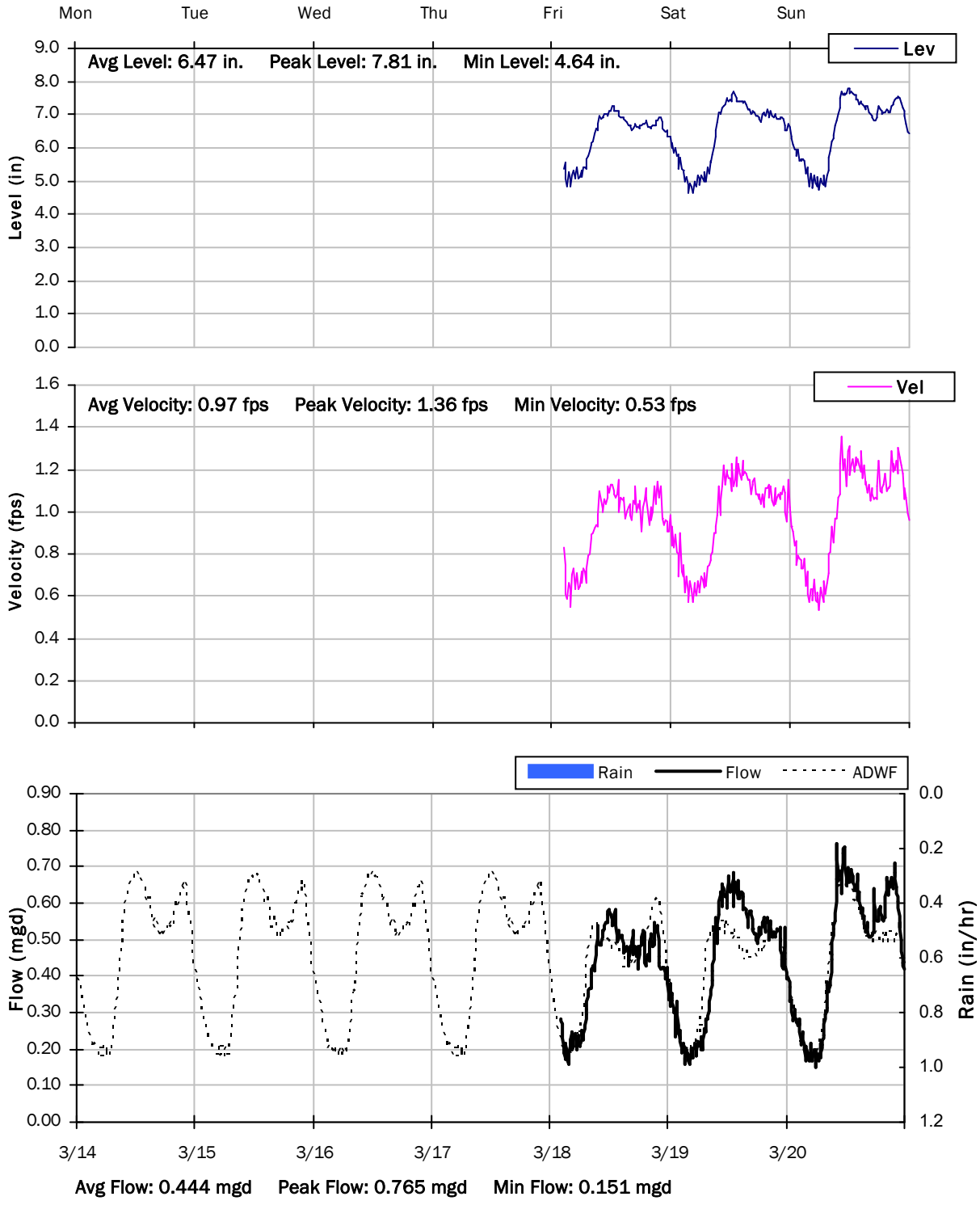
Storm Event I/I Analysis (Rain = 0.61 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.593 *mgd*	**Peak I/I Rate:**	0.365 *mgd*
PF:	1.32	**Total I/I:**	35,000 *gallons*
Peak Level:	7.39 *in*		
d/D Ratio:	0.31		

SITE 18

Weekly Level, Velocity and Flow Hydrographs

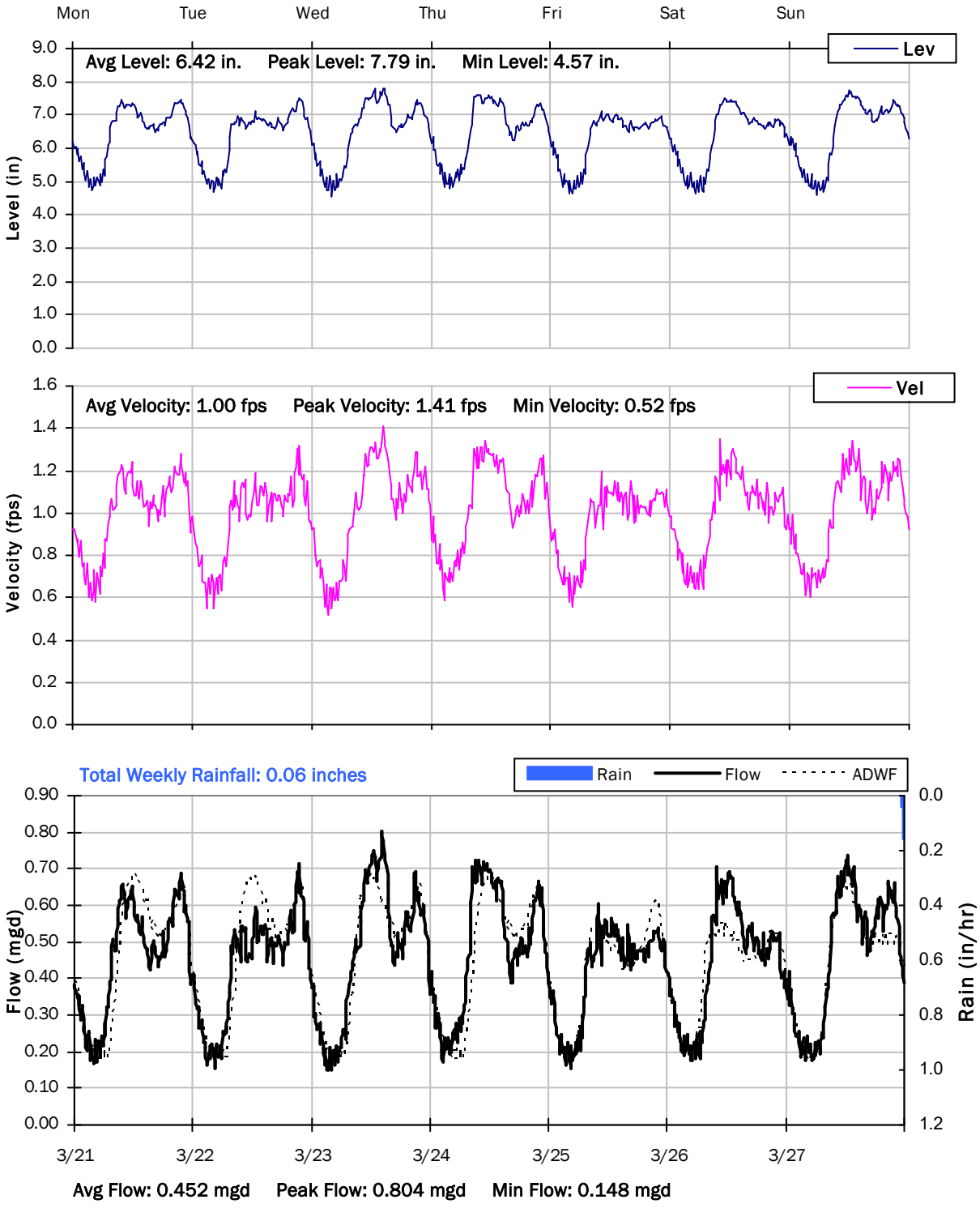
3/14/2022 to 3/21/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

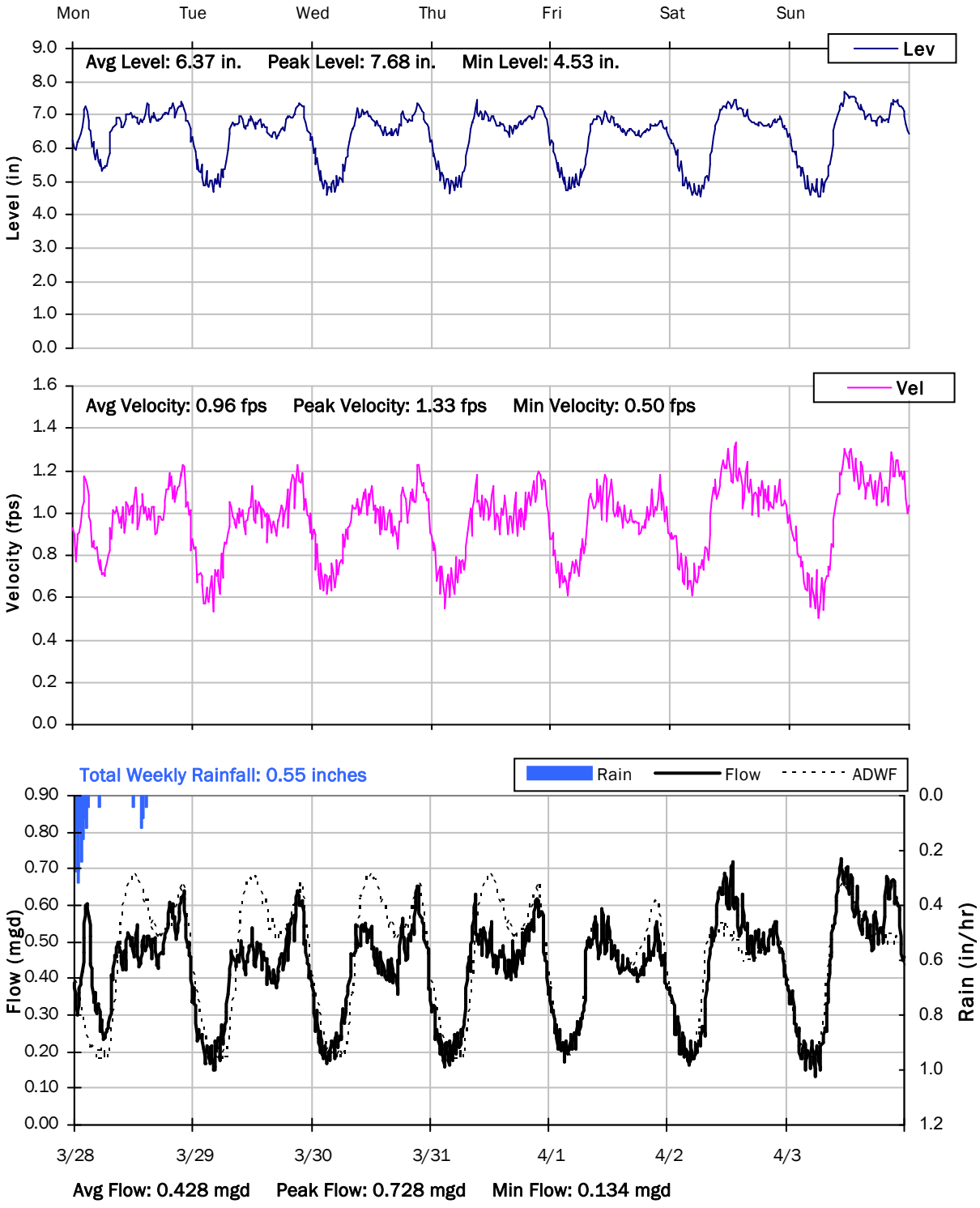
3/21/2022 to 3/28/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022



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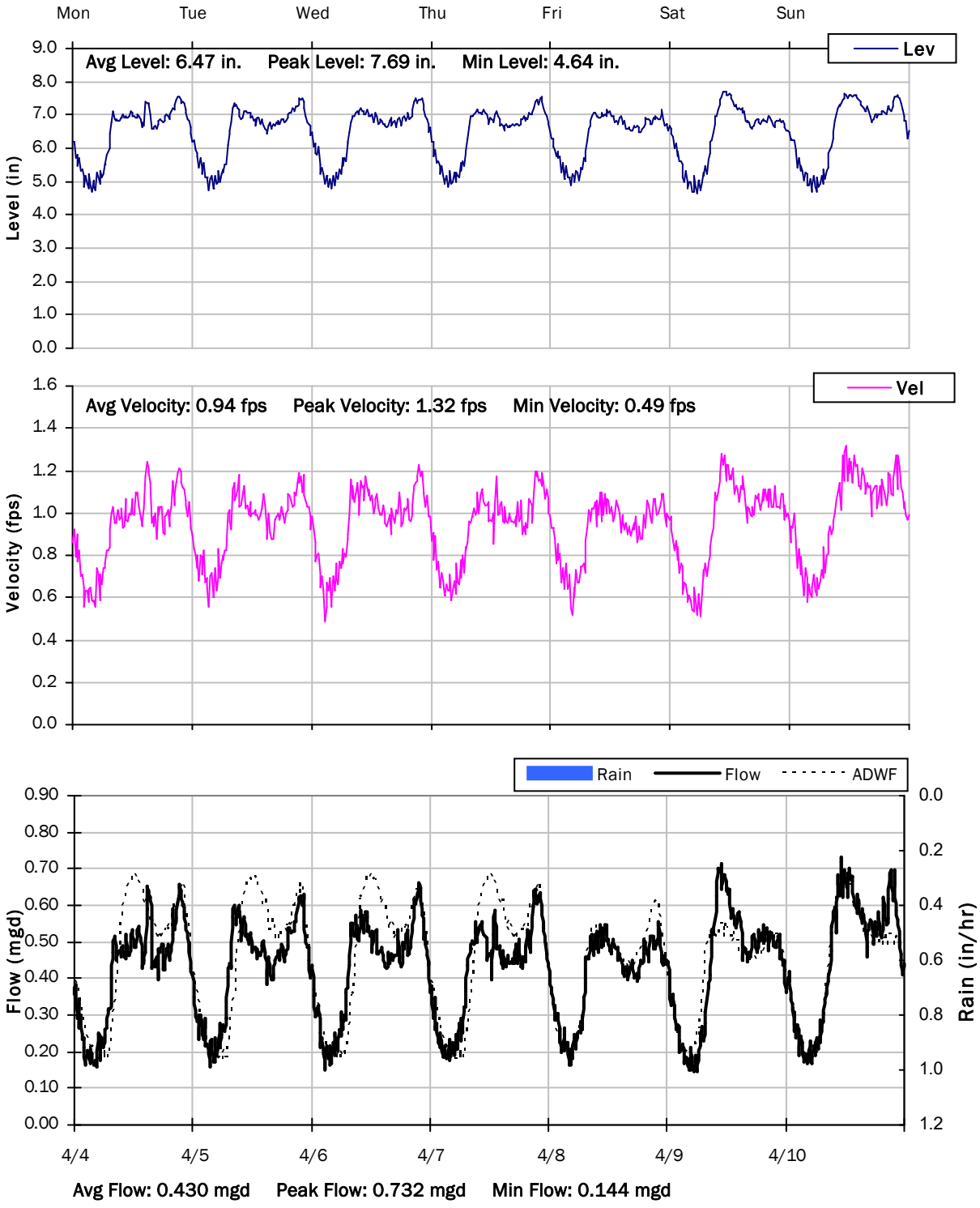
Weekly Level, Velocity and Flow Hydrographs

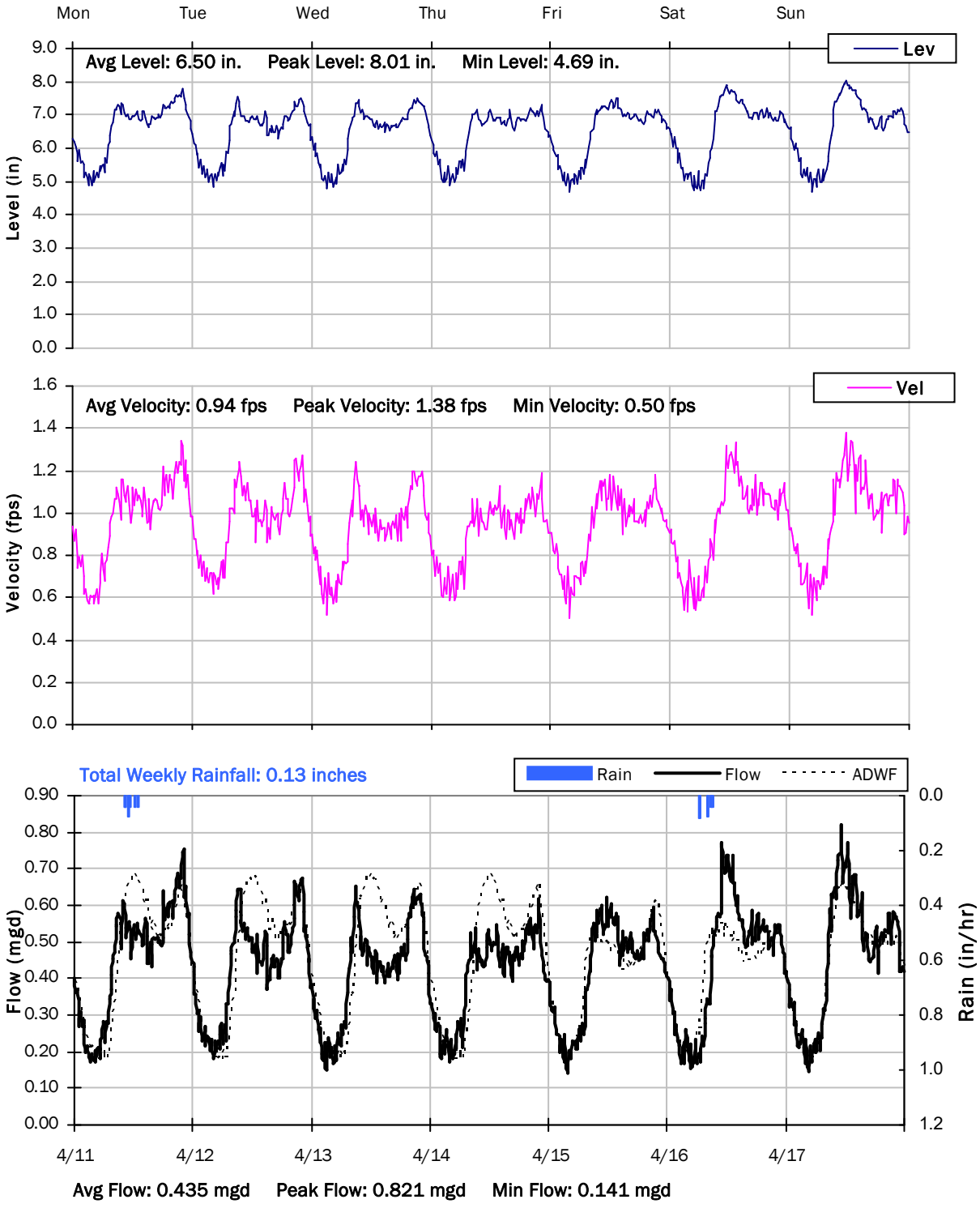
4/4/2022 to 4/11/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

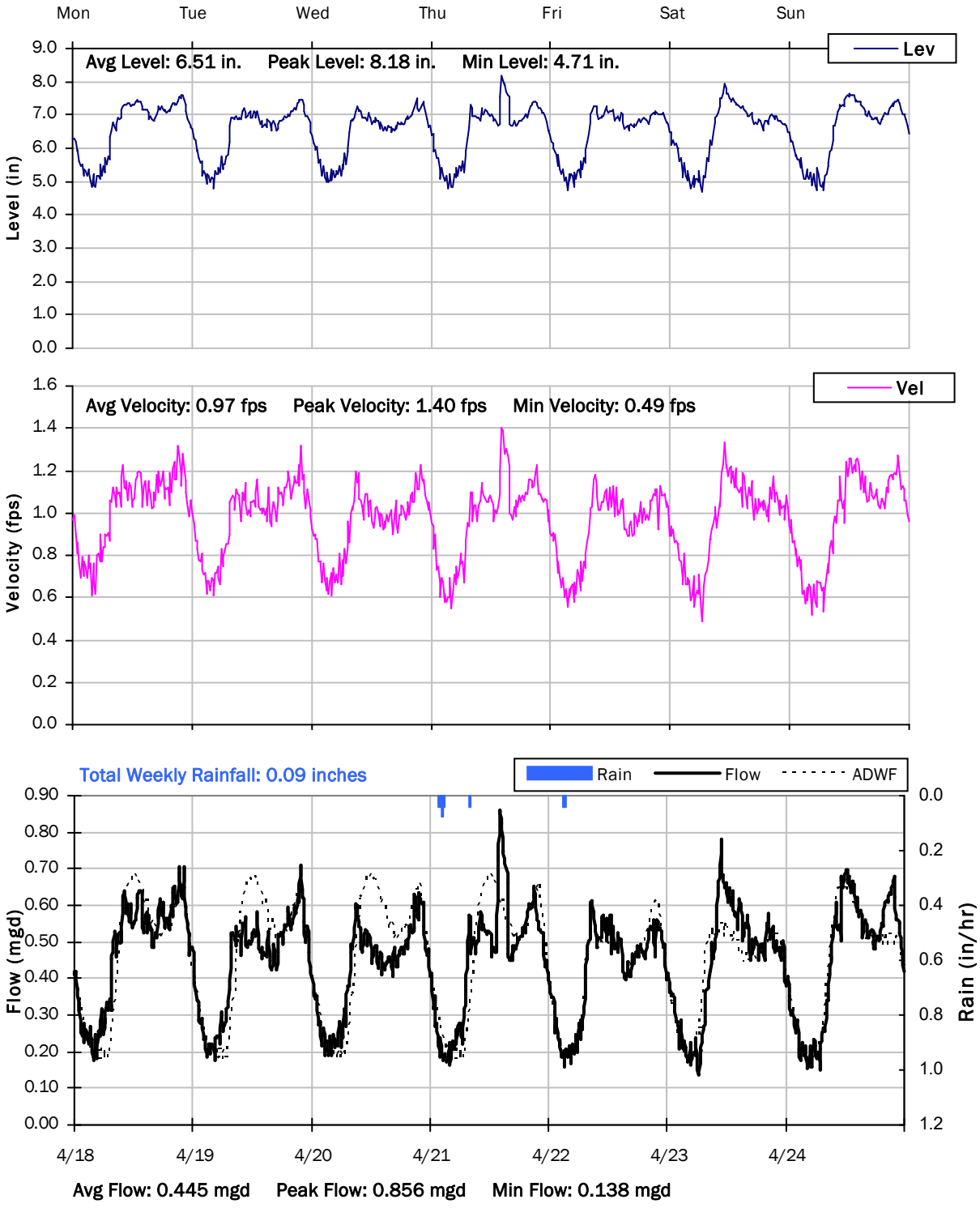
4/11/2022 to 4/18/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

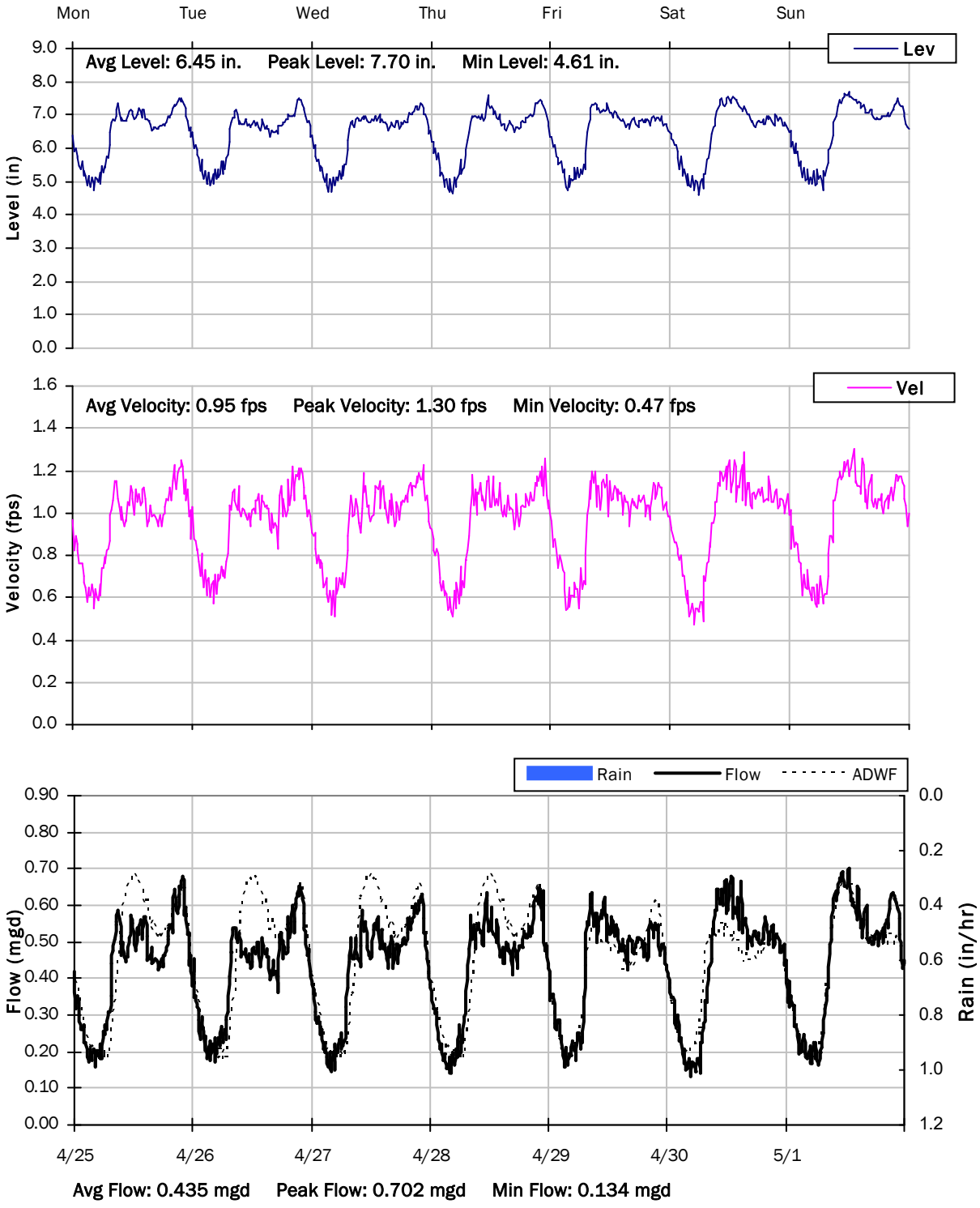
4/18/2022 to 4/25/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

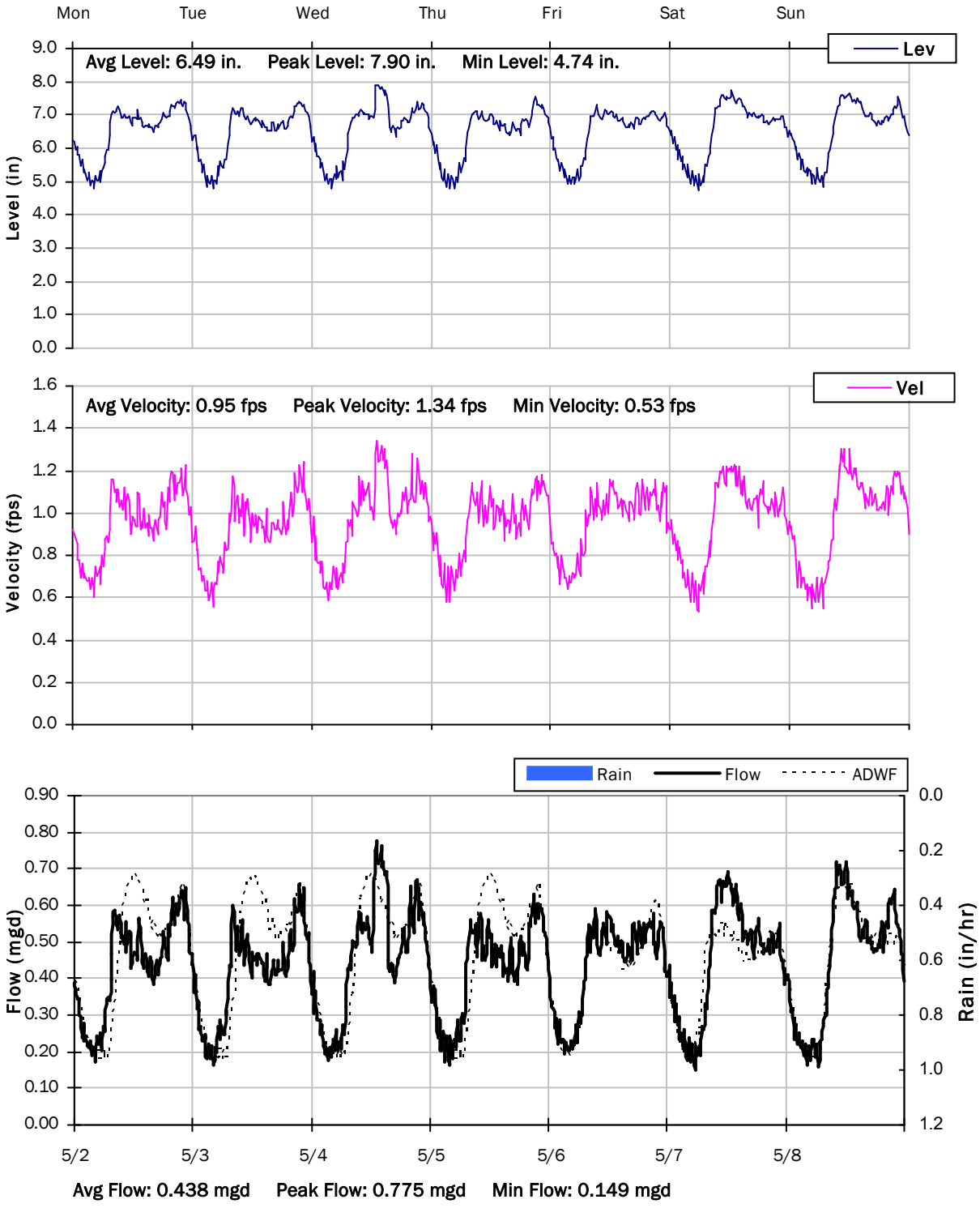
4/25/2022 to 5/2/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

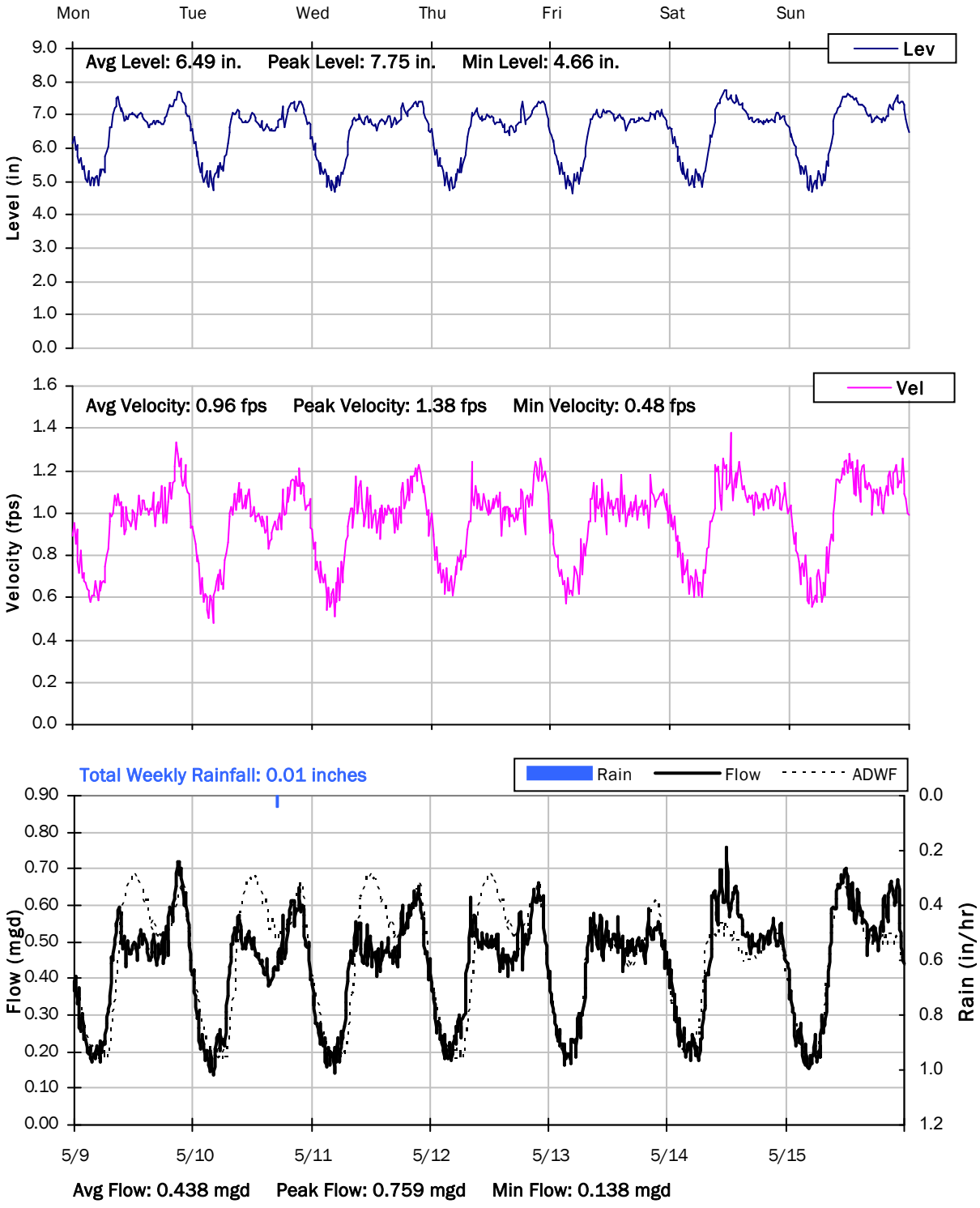
5/2/2022 to 5/9/2022



SITE 18

Weekly Level, Velocity and Flow Hydrographs

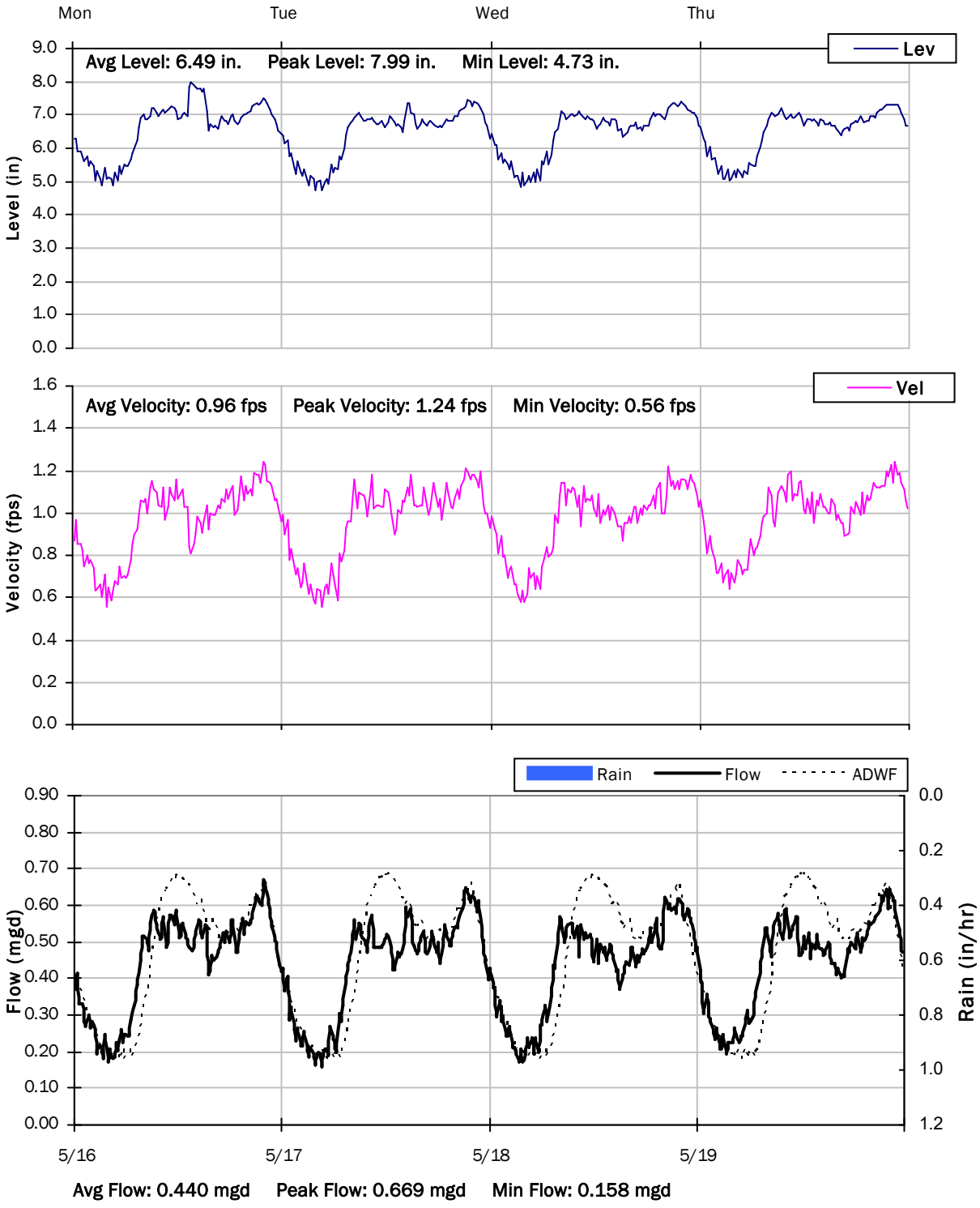
5/9/2022 to 5/16/2022



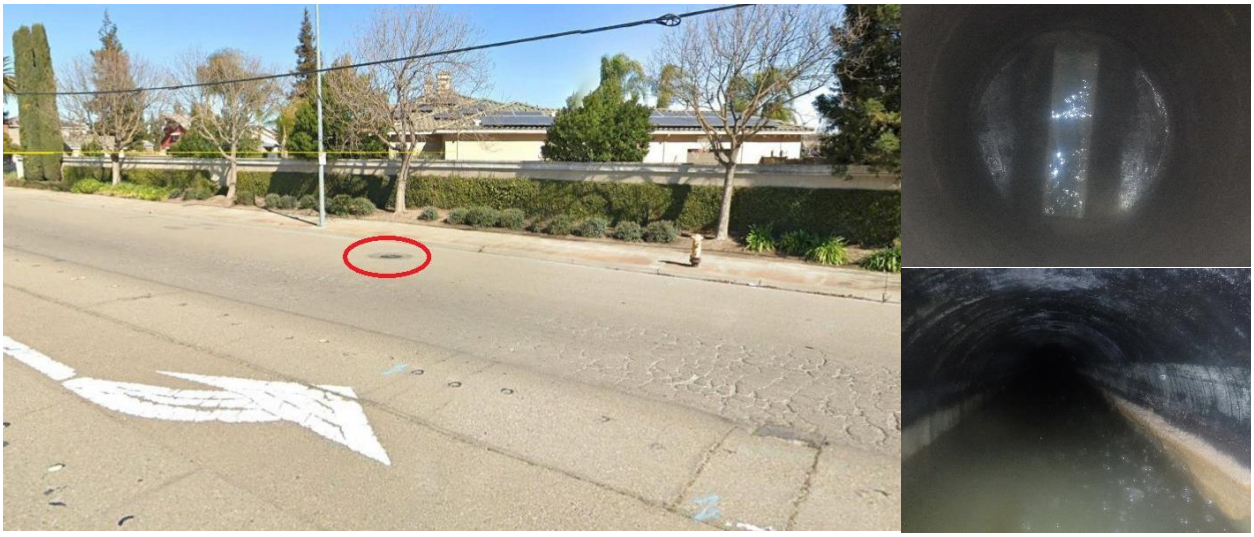
SITE 18

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/20/2022



V&A Project No. 21-0295



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APPENDIX C

Model Selection TM

Stantec

CITY OF MANTECA
WASTEWATER MASTER PLAN

TECHNICAL MEMORANDUM NO. 1:

HYDRAULIC MODEL SOFTWARE SELECTION

February 2, 2022

Prepared for:
City of Manteca, CA

Prepared by:
Mike Van Doorn

Project Number:
Manteca Wastewater Master Plan / 184031535

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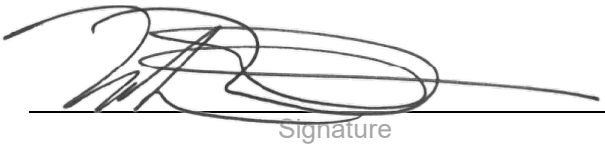
Prepared by: 

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Mike Van Doorn

Printed Name

Reviewed by: _____

Signature

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Printed Name

Approved by: _____

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_____

Printed Name

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ACRONYMS / ABBREVIATIONS II

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Appendix A – Software Comparison Matrix

Acronyms / Abbreviations

1D	One Dimensional
2D	Two Dimensional
CAD	Computer Aided Drafting
CHI	Computational Hydraulics International
DHI	Danish Hydraulic Institute
DWF	Dry Weather Flow
EPA	Environmental Protection Agency
ICM	Integrated Catchment Modeling (Innovyze Infoworks ICM)
RDII	Rainfall Dependent Inflow and Infiltration
RTC	Real-Time Control
RTK	RTK is a method of estimating RDII response used primarily by SWMM-variant models
SWMM	Stormwater Management Model
WWF	Wet Weather Flow

1 Introduction

The City of Manteca's Wastewater Master Plan and Sewer Rate Study will focus on the sustainability of the City's capability and capacity to convey and treat incoming wastewater flows.

In order to meet the goals of the Wastewater Master Plan, and in absence of an existing hydraulic model of the City's existing collection system, one of the first steps of this plan is to select an analysis tool that best suits the objectives of this study and to support ongoing monitoring and assessment of the City wastewater infrastructure. The selection of hydraulic modeling software is an important long-term decision / investment to support these needs.

This memo summarizes a review of commercially available open-channel flow hydraulic models for the purposes of efficiently executing the Collection System components of the Wastewater Master Plan. This includes a high-level comparative review of the potential software candidate capabilities, licensing requirements, training needs, and costs, and to select the best fit for Manteca's needs.

The potential software candidates that we have identified in this memo have varying strengths and limitations, and the selection of a particular software is often based on a combination of long-term modeling objectives, software capabilities and features, integration with other system software (CAD / GIS / Asset Management), end-user capabilities, software sustainability, and cost (to name a few). Note that the cost of most software packages is subscription-based and carry an annual fee, but in some cases can also vary in cost by model size (# of pipes) and software extension modules.

Manteca's existing sewer collection system includes more than 5,000 GIS pipe links, with varying data completeness for physical attributes (invert elevations, etc). While it has not been decided if the model will be "full-pipe" or consolidated as a trunk model (i.e. 8" or 10" and larger sewers only), which will be further confirmed during the model development phase, the comparison of software costs will evaluate only software capable of modeling more than 5,000 pipes.

Stantec has a specialized, integrated team of hydraulic modelers with experience in developing, calibrating, testing, and analyzing computer models that simulate the hydraulics of wastewater collection systems. Our team has experience in the development, calibration and use of several different modeling platforms, including (but not limited to): DHI Mike+ (i.e., MikeUrban); Innovyze InfoSWMM & Infoworks ICM; CHI PCSWMM and other potential model platforms. Our team does not have commercial interests in any of the software candidates and have the capabilities to use any of the software reviewed.

There are several software developers for wastewater collection system models, including, but not limited to, Innovyze, Bentley, Danish Hydraulic Institute (DHI), Computational Hydraulics International (CHI), and the Environmental Protection Agency (EPA). Of this list, Innovyze, Bentley, and DHI offer multiple software platforms with varying capabilities, user interfaces, and computation engines. The following commentary provides a brief summary of each software - with the header providing a hyperlink to the developer website and developer sourced excerpts noted in *"quoted italics"*.

A detailed comparison matrix is included in **Appendix A**.

2 Software Candidates

2.1 EPA SWMM 5

EPA Stormwater Management Model (SWMM) 5

"EPA's Storm Water Management Model (SWMM) is used throughout the world for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems. It can be used to evaluate gray infrastructure stormwater control strategies, such as pipes and storm drains, and is a useful tool for creating cost-effective green/gray hybrid stormwater control solutions. SWMM was developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention, and help to reduce discharges that cause impairment of waterbodies.

SWMM is a Windows-based desktop program. It is open source public software and is free for use worldwide. SWMM contains a flexible set of hydraulic modeling capabilities used to route runoff and external inflows through the drainage system network of pipes, channels, storage/treatment units and diversion structures. These include the ability to do the following:

- *Handle drainage networks of unlimited size.*
- *Use a wide variety of standard closed and open conduit shapes as well as natural channels.*
- *Model special elements, such as storage/treatment units, flow dividers, pumps, weirs, and orifices.*
- *Apply external flows and water quality inputs from surface runoff, groundwater interflow, rainfall-dependent infiltration/inflow, dry weather sanitary flow, and user-defined inflows.*
- *Utilize either kinematic wave or full dynamic wave flow routing methods.*
- *Model various flow regimes, such as backwater, surcharging, reverse flow, and surface ponding. apply user-defined dynamic control rules to simulate the operation of pumps, orifice openings, and weir crest levels.*
- *Percolation of infiltrated water into groundwater layers.*
- *Interflow between groundwater and the drainage system.*
- *Nonlinear reservoir routing of overland flow. Runoff reduction via LID controls.*

SWMM accounts for various hydrologic processes that produce runoff from urban areas, which include the following:

- *Runoff reduction via green infrastructure practices.*
- *Time-varying rainfall (precipitation) and evaporation of standing surface water.*
- *Snow accumulation and melting.*
- *Rainfall interception from depression storage.*
- *Infiltration of rainfall into unsaturated soil layers.*
- *Percolation of infiltrated water into groundwater layers Interflow between groundwater and the drainage system.*
- *Nonlinear reservoir routing of overland flow."*

The EPA SWMM5 software includes a very basic interface, without built-in GIS capabilities and does not have sophisticated model development and output tools. The EPA SWMM5 computational engine, however, as an open source code, is used by other software developers (xxxSWMM variants) that have developed integrated GIS-based interfaces with numerous capabilities and user tools to streamline model development, calibration, and output analysis of 1-D stormwater and wastewater collection system models.

The SWMM5 engine uses the RTK method to model rainfall dependent inflow and infiltration (RDII), by applying up to three (3) overlapping triangular unit-hydrographs against time that combine to simulate the short-term, medium-term, and long-term response of RDII entering the sewer system based on a rainfall timeseries. R represents a fraction of rainfall that enters the sewer system, T is the time from the onset of rain until the peak, and K is the ratio of the time to recession from the peak of the hydrograph to zero. The RTK is a widely used method of simulating the RDII response in sewer collection systems and is used by all models evaluated in this memo, with the exception of Mike+ that when additional modules are purchased can also model physical hydrologic and subsurface parameters for the same purpose. Hyperlink to more information on the RTK Method.

While the software is used extensively worldwide, and technical resources are available on-line, there is no developer support or training available for new users unfamiliar with the software.

2.2 Innovyze:

"Innovyze provides the industry's largest global offering of stormwater, sewer network, and flood modeling solutions – designed to meet the needs of your project and organization."

Our evaluation of potential candidates from Innovyze include only InfoSWMM and Infoworks ICM as they are the most prevalent options from this developer. Innovyze is also the vendor for the InfoSewer* and XPSWMM* software however were excluded as they may be phased out by Innovyze within the next 5 years or so.

2.2.1 INFOSWMM

InfoSWMM (Innovyze)

InfoSWMM is a *"static 1D modeling within ArcGIS for capacity analysis and planning of gravity sewer systems*" and largely an integrated front-end interface and GIS-based application with numerous capabilities and user tools to streamline model development, calibration, and output analysis for EPA's SWMM5 computational engine (capabilities noted above under EPA SWMM5). The model can import and export to/from EPA SWMM 5, and does not limit model size to a fixed number of links (pipes). The developer interface and tools significantly improve efficiency and accuracy in model development, error checking, calibration, and output analysis.

The developer offers different "packages" (at varying price points) that *"Tailor[s] InfoSWMM to your requirements with Modules, Suite Extensions, or the standalone version:*

InfoSWMM Suite package:

- *Calibrator: Automate model calibration*
- *DWF Allocator (Dry Weather Flow): Apportion dry weather flow from GIS elements*
- *Designer: Optimize system design and costs*
- *Conduit Storage Synthesizer: Capture system storage for simpler forcemain models*
- *Subcatchment Manager: Automate runoff models directly from terrain*
- *Risk Assessment Manager: Compute flood risk and damage*

InfoSWMM Executive Suite package:

- *Pond Design Manager: Extract and design storage systems*
- *RDII Analyst (Rainfall-Derived Inflow and Infiltration): Decompose measure flow into model RTK inputs (R, T, K parameters for RDII prediction)*
- *NetVIEW (exporting to GIS / Google Earth)"*

The InfoSWMM software is popular among other large municipal agencies throughout the US, and the developer offers extensive support and training opportunities. The pricing of this software is moving to an annual fee subscription service, and is anticipated to cost upwards of $10,000/year (*awaiting developer quote, to be confirmed…*).

2.2.2 INFOWORKS ICM

Infoworks ICM (Innovyze)

Infoworks ICM is Innovyze's flagship hydraulic modeling platform, based on a proprietary computational engine, that integrates 1D collection system modeling with 2D surface modeling - typically found in a combined sewer system that is heavily impacted by direct surface inflows, ponding and CSOs. Infoworks offers a 1-D only Sewer Edition (SE), specifically for wastewater collection systems that do not require the integration and conveyance of surface flows.

This software includes very sophisticated GIS-based model development and analysis tools, including notable advanced hydrologic parameters and response models for rainfall dependent inflow and infiltration (RDII) simulation, real-time control, calibration and visualization and output capabilities. It is used by many large municipal agencies throughout the US, but due to its advanced capabilities is also one of the most complicated commercial models and most expensive on the market. The pricing of this software is moving to an annual fee subscription service, and is anticipated to cost upwards of $15,000/year (*awaiting developer quote, to be confirmed…*).

2.3 Bentley: SewerGEMS

SewerGEMS (Bentley)

SewerGEMS is a versatile software from Bentley that uses a proprietary computational engine that has the ability to use kinematic wave (steady state and extended period simulations with no surcharging or backflow), gradually varied flow solver, or the dynamic wave 1-D St. Venant equations using either an implicit dynamic solution or an explicit dynamic solution (SWMM5 engine). The model interface can be used in several ways, either as a stand-alone interface, or integrated within ArcGIS, AutoCAD, MicroStation, or OpenRoads Designer (Civil license). It includes many useful model development tools including a sewage (load) allocation module, calibration modules, and offers one of the most robust scenario management capabilities of any commercially available software. The output result visualization capabilities of SewerGEMS are not as sophisticated when compared to other software (InfoWorks, InfoSWMM, PCSWMM), and the model cannot be exported to a SWMM5 file for use in other platforms, requiring model users to have a subscription to the software.

Pricing for Bentley's OpenFlows SewerGEMS software is based on an annual subscription, with a starting fee for a 5,000 pipe model is $7,638/year increasing to over $10,000/year for a 10,000 pipe limit.

2.4 DHI: Mike+

Mike+ (DHI)

Mike+ is a very sophisticated hydraulic modeling software that has the ability to integrate both water distribution system modeling and open-channel flow modeling (sanitary and storm) within the same platform. This software is the successor to MikeUrban, its predecessor, used by many large municipal agencies throughout the world. It is a GIS-based program that activates various software modules that hosts and pulls physical model attributes and input parameters from a detailed structure of related geodatabases and solution engines. The software has ability to model complex systems using dynamic wave computations with real-time control (RTC) capabilities and using either the RTK RDII models or a more complex simulation that models physical hydrologic and subsurface parameters to derive RDII responses. Mike+ is meant for use by expert-level users and extensive software documentation and developer support is available.

The cost of the Mike+ base license that includes only the SWMM module for open channel flow is approximately $3,000/year (the base license does not integrate with ArcGIS), and approximately $10,400/year if the Collection System Modules (includes ArcGIS, SWMM+Mike1D Pipeflow, and Rainfall Runoff, Control and Transport extensions).

2.5 CHI: PCSWMM

PCWMM (CHI)

PCSWMM is a complete interface and suite of analysis tools for the SWMM5 engine. It is a stand-alone GIS interface that offers support for over 50 GIS/Shapefile formats, importing / exporting functions for excel, topological tools for model development, digital elevation models, automatic watershed delineation, and access to map services from Microsoft and other web map services. PCSWMM offers unlimited model size and complexity, and can use distributed computing systems to solve large model computations if necessary. It includes very sophisticated model development and error checking routines, time series management and output visualization tools and other analysis tools that streamline the analysis of collection system performance. It is also one of the most user-friendly software available, offers extensive training and support, as well as access to widely used open-source codes, peer-reviewed journals and OpenSWMM community posts.

PCSWMM also has 1D and 2D modeling capabilities (to model surface flows in either combined sanitary or stormwater networks), and also can be used as an interface for water distribution modeling using the EPANET hydraulic model engine. PCSWMM's scenario management tools are extensive and useful in managing multiple scenarios, but considered rudimentary and not as transparent when compared to SewerGEMS.

The PCSWMM is priced at approximately $1,200/year for the Professional 1D version and approximately $1,800/year for the Professional 2D version.

3 Software Pricing Summary:

Table 1 – Cost Summary

Software	Annual Cost
SWMM 5	$0
InfoSWMM	Approximately $10,000+ *(Awaiting developer quote)*
InfoWorks ICM	Approximately $15,000+ *(Awaiting developer quote)*
SewerGEMS	$7,600 (5,000 pipes) - $10,000 (10,000 pipes)
Mike+	$3,000 (base) - $10,400 (with Collection System extensions)
PCSWMM	$1,200 (1D) - $1,800 (2D)

4 Comparison and Ranking Matrix

A simple comparison matrix was developed to rank each of the software against each other using a relative weighting system that attempts to consider our knowledge of Manteca's needs for this project and for the sustainability of managing the ongoing and future performance of the collection system. Many criteria were evaluated, including several criteria under 5 main performance areas including:

- GIS interaction Criteria
- Modeling Capabilities
- Engineering Criteria
- User Interfacing Criteria
- Commercial Criteria

The weighting value (importance to Manteca) of each Technical Criteria was based on the following:

Table 2 – Criteria Weightings

Weight	Descriptions
4	Critical Needs
3	Priority Needs
2	Needs
1	Desired but not a need, yet

The scoring value of each Technical Criteria was based on the following:

Table 3 – Criteria Scoring

Score	Description
4	Fully satisfy the criteria.
3	Almost satisfy the criteria.
2	Partly satisfy the criteria, more to be desired.
1	Satisfy a small portion of the criteria.
0	Do not satisfy the criteria.

The detailed criteria, weighting and evaluation and ranking results of the comparison is provided in **Appendix A**.

5 Conclusion

Based on this analysis, the highest rank (yet lowest cost at $1,200/year) software is PCSWMM.

The 2nd highest ranked software is InfoWorks ICM, however the costs are significantly higher for this and the remaining candidates.

Based on our previous experience in completing similar projects in central California (Concord, Merced, Grass Valley, Lincoln, etc) and throughout North America, we can confidently recommend the use of PCSWMM to the City of Manteca as a cost-effective, user friendly, yet very powerful modeling software that uses based on the EPA SWMM engine. We are very confident in the PCSWMM model software as it will save significant time and effort in the model development and future system analysis for this study.

We trust this memo provides the City with an objective review of available hydraulic models available for use on the Manteca Wastewater Master Plan, and if you have any questions or concerns, we are available at your convenience to discuss.

APPENDIX A – SOFTWARE COMPARISON MATRIX

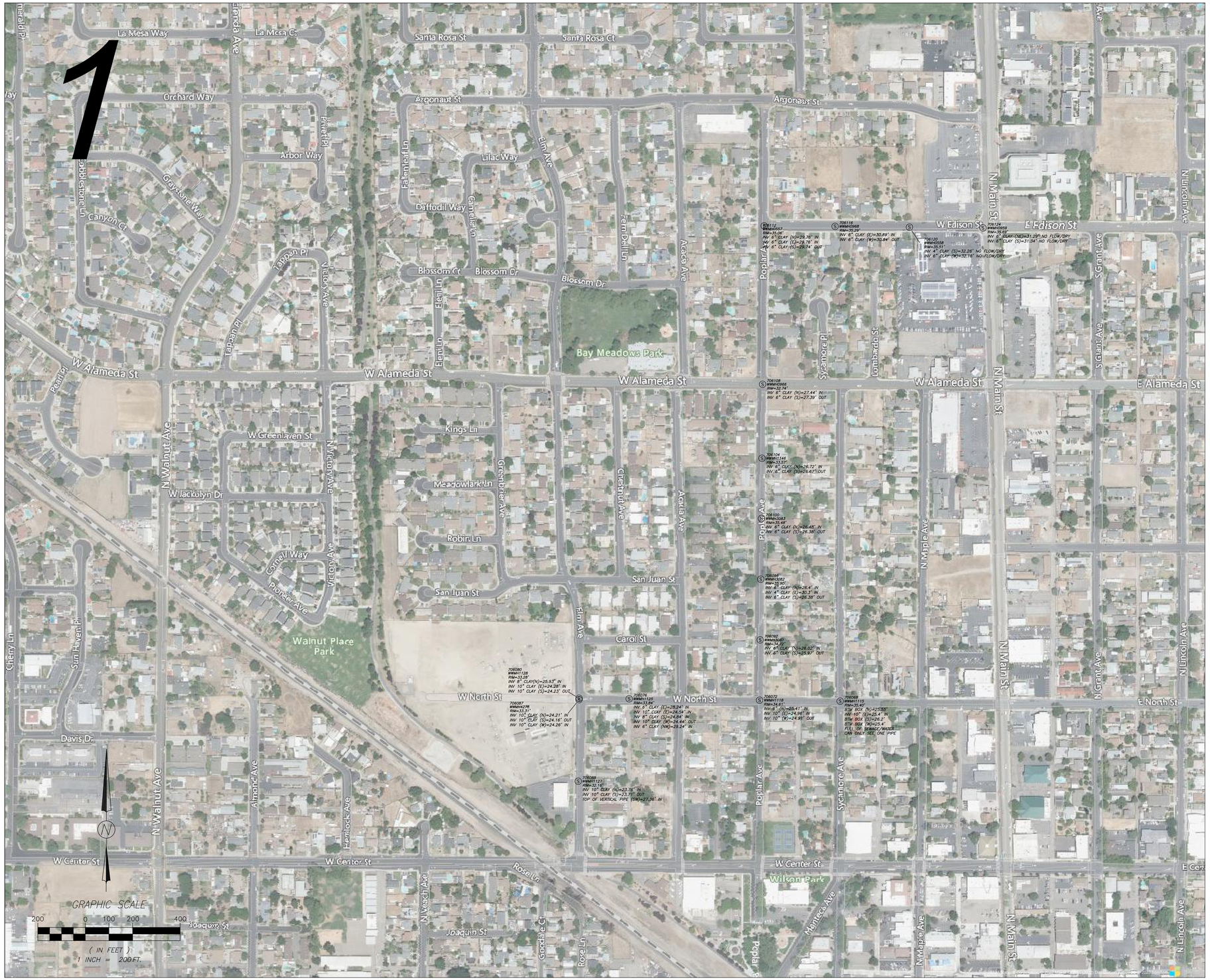
APPENDIX A – SOFTWARE COMPARISON MATRIX

Performance Area	Technical Criteria	Weight (1-4)	Software Score (0, 1, 2, 3, 4)						Software Screening (Weight x Score)					
			Innovyze		DHI	CHI	Bentley	EPA	Innovyze		DHI	CHI	Bentley	EPA
			InfoSWMM	InfoWorks ICM	MikeURBAN	PCSWMM	SewerGEMS	EPA SWMM	InfoSWMM	InfoWorks ICM	Mike URBAN	PCSWMM	SewerGEMS	EPA SWMM
GIS Interaction Criteria	Data exchange between model and GIS	**4**	3	3	3	3	3	0	12	12	12	12	12	0
	Compare updated GIS with model data	**2**	3	2	4	3	3	0	6	4	8	6	6	0
	Model results / GIS mapping capabilities	**4**	4	3	4	4	4	0	16	12	16	16	16	0
	Generate catchment data	**2**	4	2	4	3	3	0	8	4	8	6	6	0
Modeling Capabilities	Merging network models	**1**	2	4	2	4	2	0	2	4	2	4	2	0
	Create sub models	**1**	4	4	4	4	4	0	4	4	4	4	4	0
	Compare two models	**1**	4	4	4	4	0	0	4	4	4	4	0	0
	Input field data flag	**1**	0	4	0	0	0	0	0	4	0	0	0	0
	Version Control	**1**	0	4	1	0	1	0	0	4	1	0	1	0
	SCADA Integration	**1**	2	2	0	0	2	0	2	2	0	0	2	0
	Asset management integration	**1**	4	2	0	0	0	0	4	2	0	0	0	0
	Scenario Management	**3**	1	4	2	1	4	0	3	12	6	3	12	0
	Comparing Scenarios	**3**	1	4	4	4	4	0	3	12	12	12	12	0
	HGL Comparison	**4**	3	3	4	4	2	0	12	12	16	16	8	0
	Data exchange between model and EXCEL	**4**	3	4	3	4	3	0	12	16	12	16	12	0
	Rainfall and Flow Data Analysis	**3**	4	0	0	4	0	0	12	0	0	12	0	0
	Model Validation and Error Check	**4**	4	4	4	4	4	0	16	16	16	16	16	0
	Group Editing	**4**	4	4	4	4	4	1	16	16	16	16	16	4
	Data exchange between model and CAD	**1**	0	4	0	0	4	0	0	4	0	0	4	0
	LID Modeling	**0**	4	4	4	4	4	4	0	0	0	0	0	0
Engineering Criteria	SCS Runoff	**4**	0	3	0	4	4	0	0	12	0	16	16	0
	Modified Rational Method	**3**	0	3	0	4	4	0	0	9	0	12	12	0
	RTC Compatibility	**1**	3	4	3	3	3	2	3	4	3	3	3	2
User Interfacing Criteria	Workspace Display	**3**	4	4	3	4	3	1	12	12	9	12	9	3
	User Friendly	**2**	3	3	2	4	3	1	6	6	4	8	6	2
Commercial Criteria	Software Support	**4**	4	4	4	4	2	0	16	16	16	16	8	0
	Software Sustainability	**1**	4	4	4	4	3	2	4	4	4	4	3	2
	Applicable for smaller systems (<100,000 people)	**4**	4	2	2	4	3	2	16	8	8	16	12	8
	Affordability (1 = High Cost; 4 = Low Cost)	**4**	1	1	1	3	2	4	4	4	4	12	8	16
								SCORE	**193**	**219**	**181**	**242**	**206**	**37**
								RANK	**4**	**2**	**5**	**1**	**3**	**6**

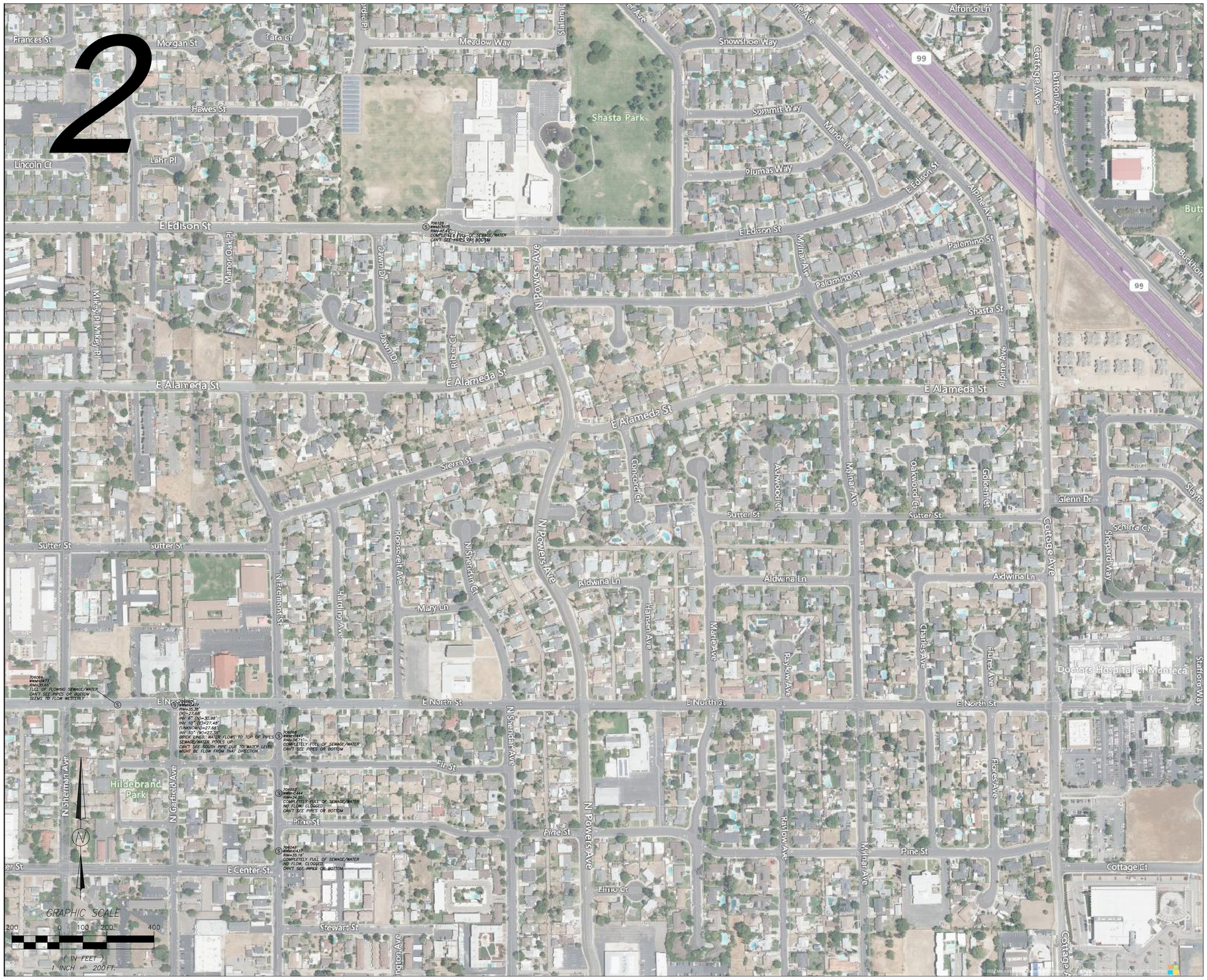
APPENDIX D

F3 Survey Results

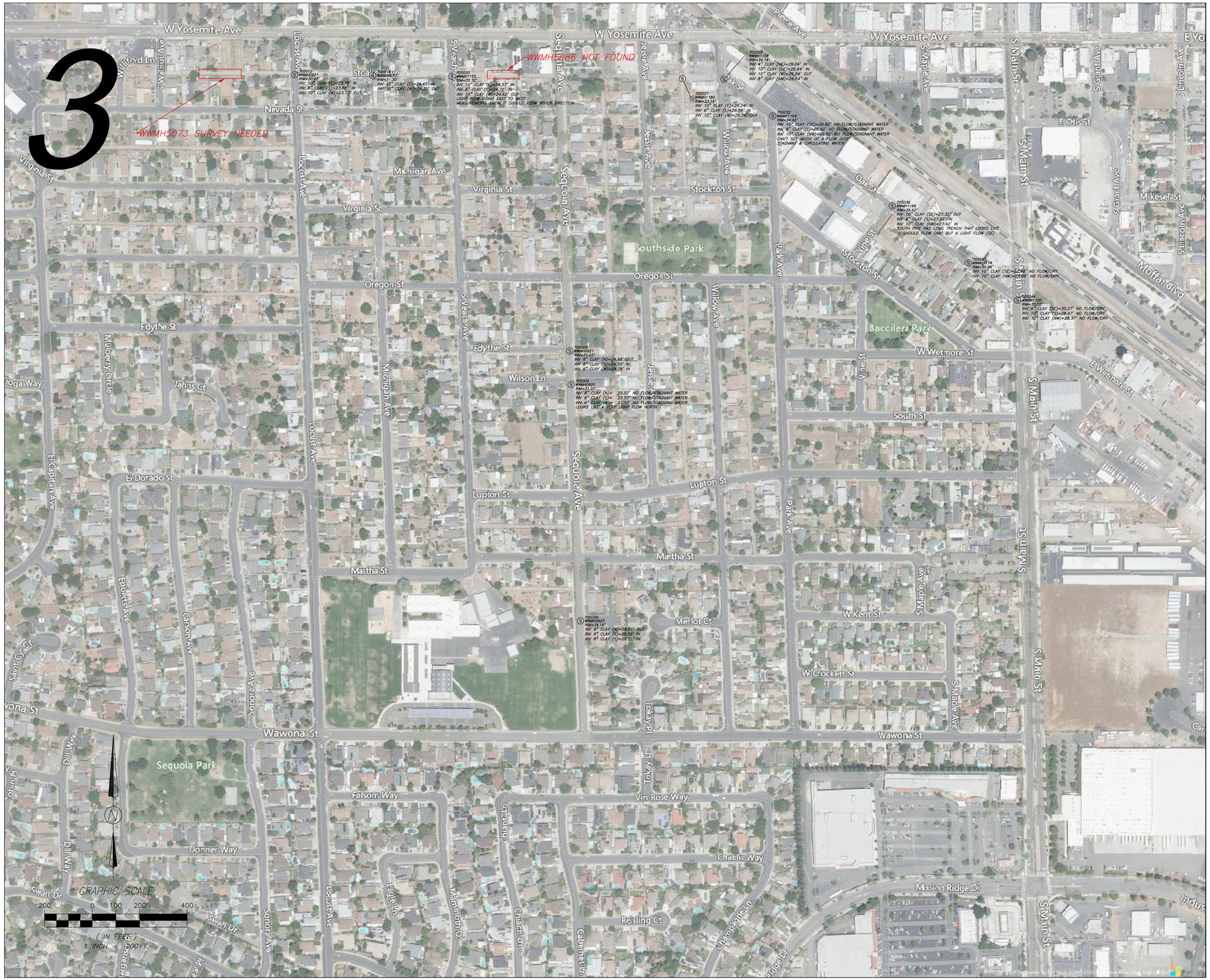
1


La Mesa Way
La Mesa Ct
Santa Rosa St
Santa Rosa Ct
Orchard Way
Argonaut St
Arbor Way
Lilac Way
Daffodil Way
Blossom Ct
Blossom Dr
W Edison St
E Edison St
N Main St
W Alameda St
E Alameda St
Bay Meadows Park
W Greenhaven St
Kings Ln
W Jackolyn Dr
Meadowlark Ln
Robin Ln
San Juan St
Carol St
Walnut Place Park
W North St
E North St
Davis Dr
W Center St
Wilson Park
Joaquin St
Rose Ln
Pioneer Ave
Conrol Way
Victor Ave
N Walnut Ave
N Maple Ave
N Lincoln Ave
N Grant Ave
Poplar Ave
Sycamore Ave
Acacia Ave
Chestnut Ave
Elm Ave
Fern Dell Ln
Fern Ln
Elena Ln
Camellia Ln
Tappan Pl
Canyon Ct
Graystone Way
Cobblestone Ln
Pearl Pl
Cherry Ln
Sun Haven Pl
Almond Ave
Hemlock Ave
Meadowlark Dr
Mantes Ave
Graddale Ct
GRAPHIC SCALE
200 0 100 200 400
(IN FEET)
1 INCH = 200 FT.

2


Frances St
Morgan St
Tara Ct
Meadow Way
Snowshoe Way
Alfonso Ln
Hawes St
Shasta Park
Summit Way
Manor Ln
Lincoln Ct
Lahr Pl
Plumas Way
E Edison St
Alpine Ave
Cottage Ave
Button Ave
99
Palomino St
Manor Oak Pl
Dawn Dr
N Powers Ave
Mylnar Ave
Shasta St
Mikey Pl
Ribor Ct
E Alameda St
Sierra St
Concord Ct
Ashwood Ct
Oakwood Ct
Galen Ct
Glenn Dr
Sutter St
N Richmond St
Harding Ave
Roosevelt Ave
N Sheridan Ct
Aldwina Ln
Hansen Ave
Marie Ave
Rayow Ave
Charles Ave
Hures Ave
Doctors Hospital of Manteca
Shepard Way
Scissta Ct
Stafford Way
E North St
Fir St
Pine St
Elmo Ct
Cottage Ct
Hildebrand Park
N Sherman Ave
N Garfield Ave
E Center St
Stewart St
Lexington Ave
GRAPHIC SCALE
200 0 100 200 400
(IN FEET)
1 INCH = 200 FT.

3


WWMH5073 SURVEY NEEDED
WWMH5086 NOT FOUND
W Yosemite Ave
Nevada St
Virginia St
Michigan Ave
Oregon St
Edythe St
Wilson Ln
Jahns Ct
El Dorado St
Lupton St
Martha St
Wawona St
Sequoia Park
Southside Park
Baccileri Park
Stockton St
W Wetmore St
South St
E Otis St
Mikesell St
Moffat Blvd
Folsom Way
Vin Rose Way
Donner Way
Chablis Way
Mission Ridge Dr
Riesling Ct
Merlot Ct
W Kent St
W Crockett St
Locust Ave
Sequoia Ave
Michigan Ave
Jessie Ave
Willow Ave
Park Ave
Oak St
Vine St
S Main St
S Maple Ave
S Grant Ave
S Lincoln Ave
Pierce Ave
Wilford Ln
Mulberry Circle
El Capitan Ave
Ebbetts Ave
Carson Ave
Sonora Ave
Dill Way
Eagle Ln
Mammoth Dr
Chianti Ln
Cabernet Ln
Champagne Ln
Tokay Pl
Tokay Ln
Swan Dr
GRAPHIC SCALE
200 0 100 200 400
(IN FEET)
1 INCH = 200 FT.

4

E Yosemite Ave
E Yosemite Ave
E Yosemite Ave
S Sherman Ave
S Fremont St
S Washington Ave
Dot Way
Merle Ln
Mikesell Ave
S Griffith Ave
Lincoln Park
Wilson Ln
Marin St
S Powers Ave
Moffat Blvd
E Bristow St
E Lambdin St
S Bertram Way
S Bertram Ave
S McGinnis Ave
S Dyer Ave
E Hutchings St
Schadeck St
E Norman Dr
Spreckels Ave
Phoen
Edgewald Ave
California Ave
Gowell Ave
Unity St
Yolo St
Stevens Ave
Melon Ave
Carnegie St
Dupont Ct
WWMH0504 NOT FOUND
WWMH0404 NOT FOUND
WWMH2961 NOT FOUND
WILL NEED TO REVISIT, NO DIP INFORMATION AT THIS TIME
GRAPHIC SCALE
200 0 100 200 400
(IN FEET)
1 INCH = 200 FT.

ABBREVIATION

BM	BENCHMARK
BTM	BOTTOM
EL	ELEVATION
FL	FLOW
GR	GRATE
SSMH	SANITARY SEWER MANHOLE
W/	WITH

LEGEND

Ⓢ MANHOLE – SANITARY SEWER

NOTES

1) SURVEY DATA BASED UPON THE CONDITION AT THE TIME OF SURVEY PERFORMED BY F3 & ASSOCIATES ON JULY 14, 2022.
2) ALL MEASUREMENTS ARE IN FEET AND DECIMAL THEREOF, UNLESS OTHERWISE NOTED.

GRAPHIC SCALE

400 0 200 400 800

(IN FEET)
1 INCH = 400 FT.

F3 & Associates, Inc.
LAND SURVEYING - 3D INDUSTRIAL LASER SCANNING
701 E. H ST, BENICIA, CA 94510
PHONE(707)748-4300 FAX(707)361-0295
www.F3-Inc.com

CITY OF MANTECA

SANITARY SEWER MASTER PLAN

SAN JOAQUIN COUNTY CALIFORNIA

MANTECA

DESIGN BY:	N/A
DRAWN BY:	STAFF
DATE:	7/20/2022
SCALE:	1"=400'
PAGE OF	1 1
JOB NUMBER:	18181

FILE: P:\PROFESSIONAL\2022\22433-MANTECA SEWER STUDY\AUTOCAD\22433-MANTECA SEWER STUDY.DWG DATE: 7/14/2022

Stantec

PROJECT: Manteca Wastewater Master Plan
Survey Data Summary

DATE: 7/21/2022

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: City of Manteca

CHECKED BY: SLB

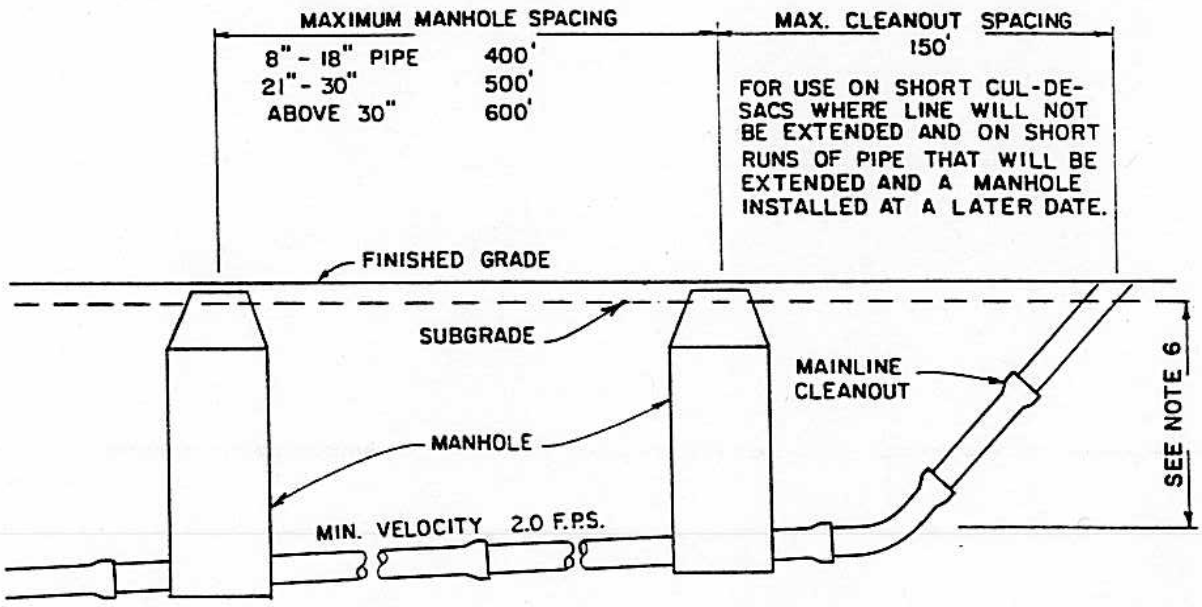
DESCRIPTION: Survey Data Summary

Manhole ID	RIM EL (ft)	OUT EL (ft)	IN EL (ft)	IN EL (ft)	IN EL (ft)	NOTES
WWMH0327	36.21	26.41 SW, 12"	26.41 N, 12"	27.91 SE, 6"	33.81 NW, 6"	
WWMH0328	36.42	29.02 NW, 6"	29.12 SE, 6"	30.52 SW, 4"		
WWMH0330	38.79	31.99 N, 8"	32.04 SW, 8"	31.99 , CAPPED		
WWMH0410	NA	NA	NA	NA	NA	NOT FOUND
WWMH0437	35.16	NA	NA	NA		Completely full of sewage, can't see pipes or bottom.
WWMH0443	34.71	NA	NA	NA		Completely full of sewage, can't see pipes or bottom.
WWMH0444	34.05	NA	NA	NA		Completely full of sewage, can't see pipes or bottom.
WWMH0473	35.65	NA	NA	NA		Full of flowing water/sewage, can't see pipes or bottom, seems to flow westerly.
WWMH0477	35.38	27.38 W, 10"	27.48 E, 10"	27.68 N, ?	30.98 N, 6"	Brick lined, water flows to top of pipes, sewage pools up, cant see south pipe due to water level, flow might be from that direction.
WWMH0502	36.60	31.2 W, 8"	31.2 S, 8"	31.4 SE, 8" X	31.45 NE, 4" X	<Marked X = No flow/clogged
WWMH0504	NA	NA	NA	NA	NA	NOT FOUND
WWMH0521	30.48	23.73 W, 10"	23.78 E, 10"	23.88 S, 8"		
WWMH0557	35.06	29.74 S, 6"	29.76 N, 6"	29.76 E, 6"		
WWMH0558	35.51	32.16 W, 6"	32.16 S, 4"			NO FLOW/DRY
WWMH0920	31.37	25.52 N, 8"	25.57 S, 8"	27.17 W, 6"		No Flow/ Stagnant water, looks like very light flow north.
WWMH0921	31.03	24.68 N, 8"	24.73 S, 8"	24.78 W, 6"		
WWMH0923	34.16	28.51 N, 8"	28.51 S, 8"	28.56 E, 6"		
WWMH0959	35.69	31.29 NE, 6"	31.34 S, 6"			NO FLOW/DRY
WWMH0966	32.74	27.39 S, 6"	27.44 N, 6"			
WWMH0968	35.29	30.84 W, 6"	30.89 E, 6"			
WWMH1115	35.40	25.4 W, ?	25.4 E, 10"	26.2 S, ?	25.55 N, ?	BOX? FULL OF SEWAGE CAN ONLY SEE ONE PIPE
WWMH1118	34.61	24.91 W, 10"	24.96 E, 10"	25.41 N, 6"		
WWMH1125	33.84	24.44 W,10"	24.54 E, 10"	28.24 E, 6"	24.84 S, 8"	29.24, NW, 6"
WWMH1127	32.16	23.71 S, 10"	23.76 N, 10"	27.36 SW, 6"		(top of vertical pipe, SW)
WWMH1128	33.28	24.23 S, 10"	24.28 E, 10"	25.93 N, 8"		
WWMH1146	33.57	26.67 S, 6"	26.72 N, 6"			
WWMH1150	35.52	28.37 NW, 10"	28.47 S, 10"	30.27 SE, 6"		No flow/Dry
WWMH1155	30.32	24.62 W, 10"	24.57 E, 10"	24.72 S, 8"		Light flow going east to west, measurements show it should flow other direction
WWMH1158	34.14	26.54 W, 10"	26.64 SE, 10"	26.64 NW, 8"	29.04 NE, 4"	
WWMH1164	34.42	26.82 NW, 10"	26.82 SE, 10"	26.92 S, 8"		No flow/stagnant water. Can't see much of a flow just stagnant & circulating water
WWMH1166	35.62	27.32 SE, 10"	27.42 NW, 10"	27.62 S, 8"		South pipe has long trench that looks like it should flow NW, but light flow SE.
WWMH1174	35.88	27.88 SE, 10"	27.98 NW, 10"			No flow/Dry
WWMH1180	33.14	26.34 W, 10"	26.24 E, 10"	26.54 S, 6"		
WWMH2961	NA	NA	NA	NA	NA	NOT FOUND
WWMH2978	35.97	33.07 S, 6"	33.17 E, 8"			No Flow/Stagnant
WWMH2986	37.60	32.25 W, 8"	32.3 E, 8"	32.3 S, 8"		
WWMH2988	38.07	32.17 N, 8"	32.22 E, 8"	34.32 W, 6" *		* = Top of 6"
WWMH2991	37.02	32.42 ?, 8"	32.42 ?, 8"	33.42 W, 4"		No Flow/Stagnant Water
WWMH3075	37.49	NA	NA	NA		Completely full of sewage, can't see pipes or bottom.
WWMH3081	34.72	25.97 S, 6"	26.02 N, 6"			
WWMH3082	35.90	26.38 S, 6"	26.4 N, 6"	30.3 E, 4"		
WWMH3083	35.48	26.38 S, 6"	26.48 N, 6"			
WWMH3746	35.73					Survey Needed
WWMH3779	37.54	33.34 S, 6"	33.34 N, 6"			
WWMH3935	38.71	31.86 N, 8"	31.91 S, 8"	31.91 E, 8" X		< X = Clogged w/ sewage
WWMH3937	37.56	32.66 N, 6"	32.71 S, 6"			
WWMH4277	31.30	24.35 W, 10"	24.45 E, 10"			
WWMH4278	33.31	24.16 S, 10"	24.21 N, 10"	24.26 N, 10"		
WWMH5073						Survey Needed
WWMH5086	NA	NA	NA	NA	NA	NOT FOUND

DATA SUMMARY	# of MHs
Invert could not be determined	
Surcharged	5
Behind Fence	1
Not found/ likely paved over	3
Survey crew to follow up	2
Total missing invert data	***11***
Total with data provided	***39***
Total manholes requested for survey	***50***

APPENDIX E

Manteca Design Standards



PIPE SIZE	"n"	MIN. SLOPE
6" DIAM.	0.013	.0040 FT./FT.
8" DIAM.	0.013	.0034 FT./FT.
10" DIAM.	0.013	.0025 FT./FT.
12" DIAM.	0.013	.0020 FT./FT.
15" DIAM.	0.013	.0015 FT./FT.
18" DIAM.	0.013	.0012 FT./FT.

NOTES:

1. THE MINIMUM PIPE SIZE SHALL BE 6 INCHES IN DIAMETER.
2. A MANHOLE SHALL BE INSTALLED AT ALL INTERSECTING LINES AND CHANGES OF GRADE, ALIGNMENT, PIPE SIZES OR MATERIALS.
3. ALL SERVICE CONNECTIONS TO SANITARY SEWERS SHALL BE MADE AT WYES OR BY CUTTING A HOLE AND INSTALLING A COLLAR WYE SADDLE. NO CONNECTIONS WILL BE PERMITTED IN LINES OVER 15 INCHES IN DIAMETER EXCEPT AT MANHOLES.
4. THE MANNING "n" SHALL BE NOT LESS THAN 0.013 FOR ALL PIPES.
5. A SLOPE OF 0.006 FT./FT. MINIMUM ON ENDS OF RUNS UP TO 15 CONNECTIONS. MORE THAN 15 CONNECTIONS, SLOPE SHALL BE AS PER THE ABOVE SCHEDULE.
6. PROVIDE A MINIMUM COVER OF 2.5 FEET TO TOP OF PIPE. WHERE MINIMUM COVER CANNOT BE OBTAINED, DUCTILE IRON CEMENT LINED PIPE SHALL BE USED WHEN APPROVED BY THE CITY ENGINEER.
7. THE CITY ENGINEER WILL REQUIRE DEWATERING FOR ALL CONSTRUCTION BELOW EXISTING WATER TABLE.
8. MINIMUM SEWER LINE SLOPE SHALL BE SUFFICIENT TO MAINTAIN AN EFFLUENT VELOCITY OF 2 FEET PER SECOND OR GREATER.
9. REFER TO SECTION NO. 71 OF THE STANDARD SPECIFICATION FOR ADDITIONAL DESIGN GUIDE CRITERIA.
10. TEMPORARY MANHOLE PUMPING STATION DETAILS SHALL BE SUBMITTED WITH THE IMPROVEMENT PLANS FOR APPROVAL.

NO.	REVISED	BY

DRAWN BY: J. HULSEY
CHECKED BY: J. PODESTA
SCALE: NONE

SANITARY SEWER PROFILE DATA

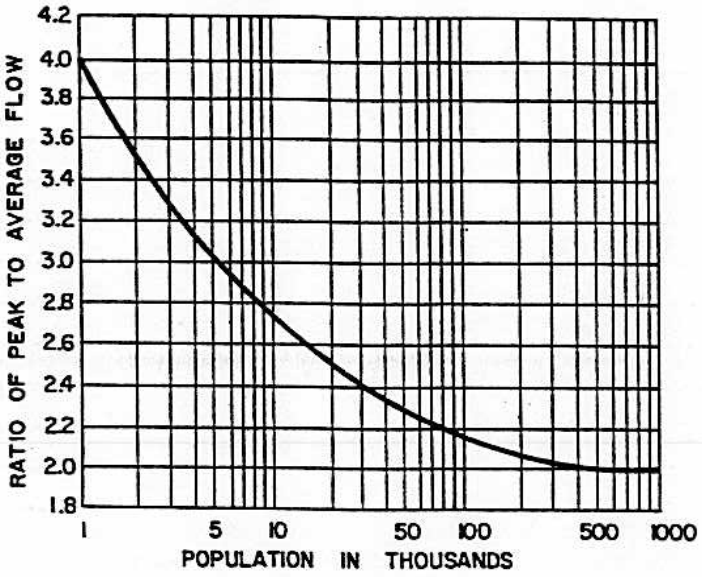
CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M. Bruton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-1
DATE: JAN. 1988

PRINTED ON DIEPO NO 1000H CLEARPRINT

RESIDENTIAL PEAKS



WASTEWATER SEWER SYSTEM DESIGN SHALL BE IN CONFORMANCE WITH THE CITY OF MANTECA'S CURRENT WASTEWATER SEWER SYSTEM MASTER PLAN.

ASSUME SINGLE FAMILY RESIDENCE AVERAGE OF 4.5 LOTS PER ACRE AND 3.3 PERSONS PER LOT OR 14.8 PERSONS PER ACRE.

VOLUME

RESIDENTIAL:

AVERAGE FLOW	100 GAL./PERSON/DAY

COMMERCIAL:

AVERAGE FLOW	3,400 GAL./ACRE/DAY
PEAK FLOW	10,000 GAL./ACRE/DAY

INDUSTRIAL AND INSTITUTIONAL (NON-SEASONAL):

AVERAGE FLOW	4,700 GAL./ACRE/DAY
PEAK FLOW	13,500 GAL./ACRE/DAY

NO.	REVISED	BY

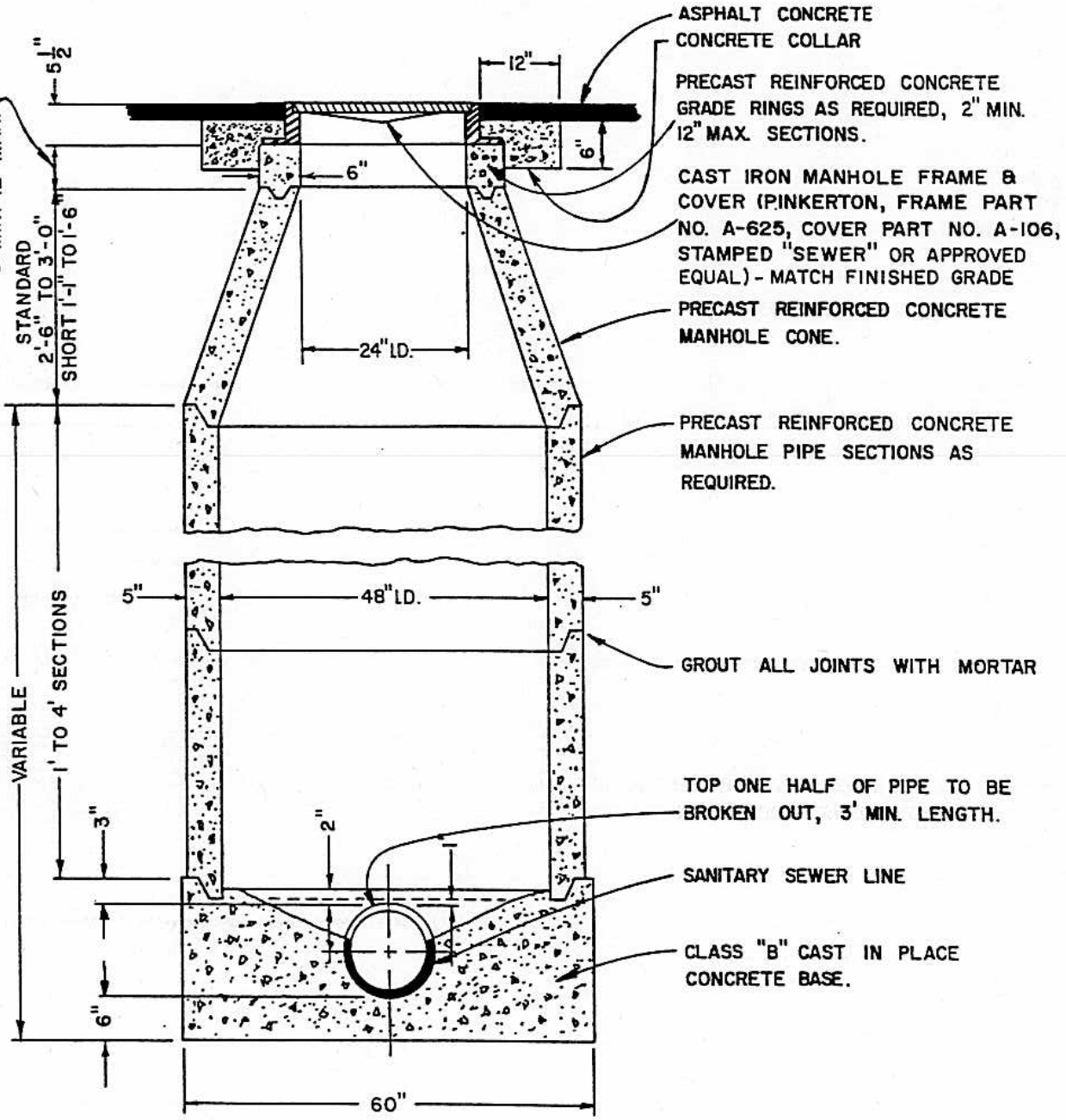
DRAWN BY: C. SABERTON
CHECKED BY: J. PODESTA
SCALE: NONE

SANITARY SEWER DESIGN DATA

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-2
DATE: JAN. 1988



NOTES:

1. PRECAST REINFORCED CONCRETE MANHOLE UNIT SHALL CONFORM TO A.S.T.M. C-478.
2. PIPE JOINT SHALL BE WITHIN 6 INCHES OF OUTER WALLS OF MANHOLE.
3. MANHOLE BASE TO BE TROWELED SMOOTH INSIDE.
4. MANHOLE SHALL BE CLEANED IN ACCORDANCE WITH CITY OF MANTECA SPECIFICATIONS.
5. SHORT CONE TO BE USED ONLY WHEN MANHOLE DEPTH JUSTIFIES.
6. COLLAR SHALL BE CLASS "B" CONCRETE AND CONSTRUCTED 2 1/2 INCHES BELOW FINISHED GRADE.

NO.	REVISED	BY

DRAWN BY: C. SABERTON
CHECKED BY: J. PODESTA
SCALE: NONE

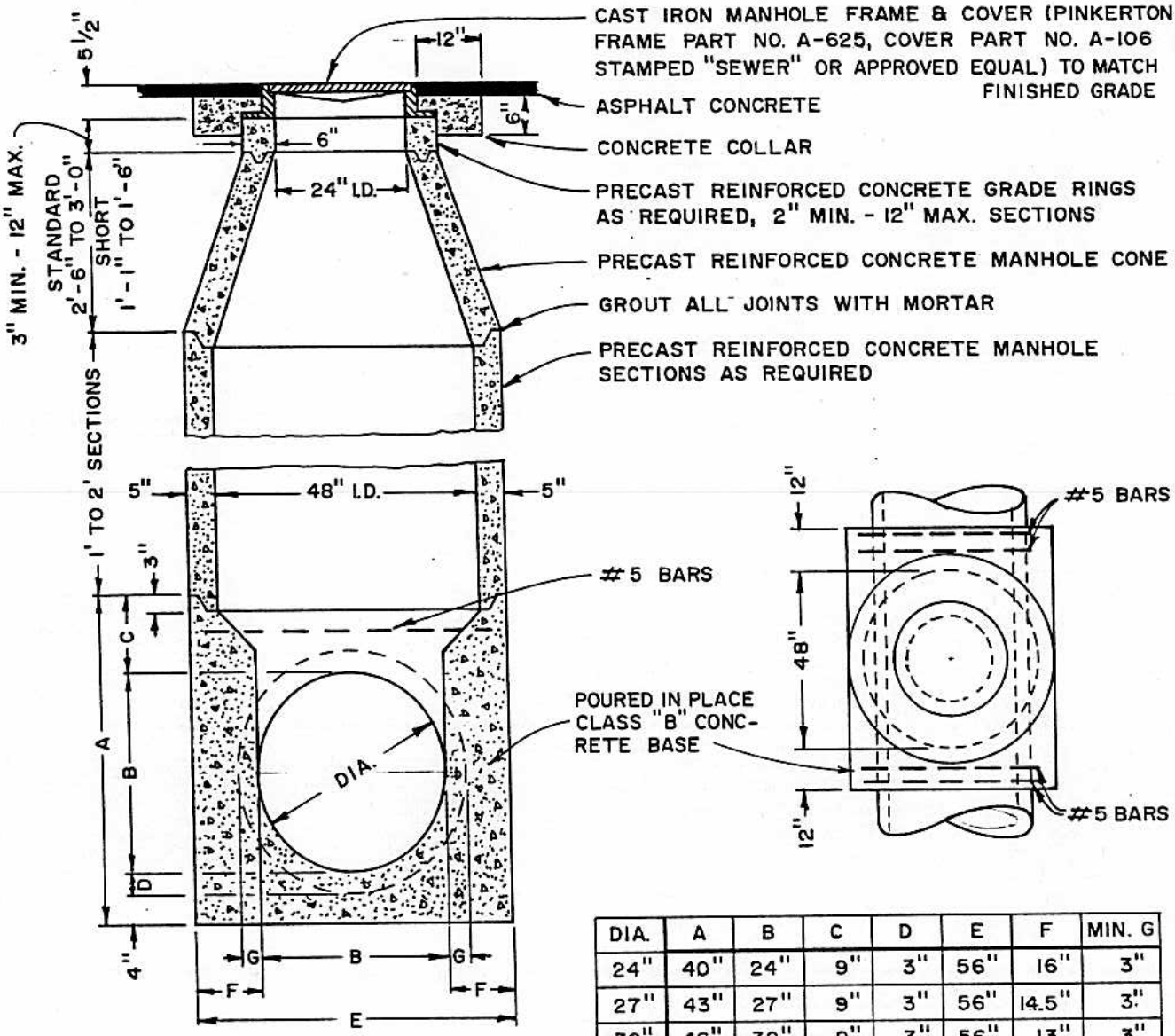
SANITARY SEWER MANHOLE 6" THRU 33" DIA. PIPES

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M. Brinton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-3
DATE: JAN 1988

PRINTED ON DIEPO NO. 1000H CLEARPRINT



DIA.	A	B	C	D	E	F	MIN. G
24"	40"	24"	9"	3"	56"	16"	3"
27"	43"	27"	9"	3"	56"	14.5"	3"
30"	46"	30"	9"	3"	56"	13"	3"
36"	53"	36"	9.5"	3.5"	56"	10"	3.5"
42"	60"	42"	10"	4"	60"	9"	4"

NOTES:

1. PRECAST REINFORCED CONCRETE MANHOLE UNIT SHALL CONFORM TO A.S.T.M. C-478.
2. PIPE JOINT SHALL BE WITHIN 6 INCHES OF OUTER WALLS OF MANHOLE.
3. MANHOLE BASE TO BE TROWELED SMOOTH INSIDE.
4. MANHOLE SHALL BE CLEANED IN ACCORDANCE WITH CITY OF MANTECA SPECIFICATIONS.
5. SHORT CONE TO BE USED ONLY WHEN MANHOLE DEPTH JUSTIFIES.
6. COLLAR SHALL BE CLASS "B" CONCRETE AND CONSTRUCTED 2 1/2 INCHES BELOW FINISHED GRADE.

NO.	REVISED	BY

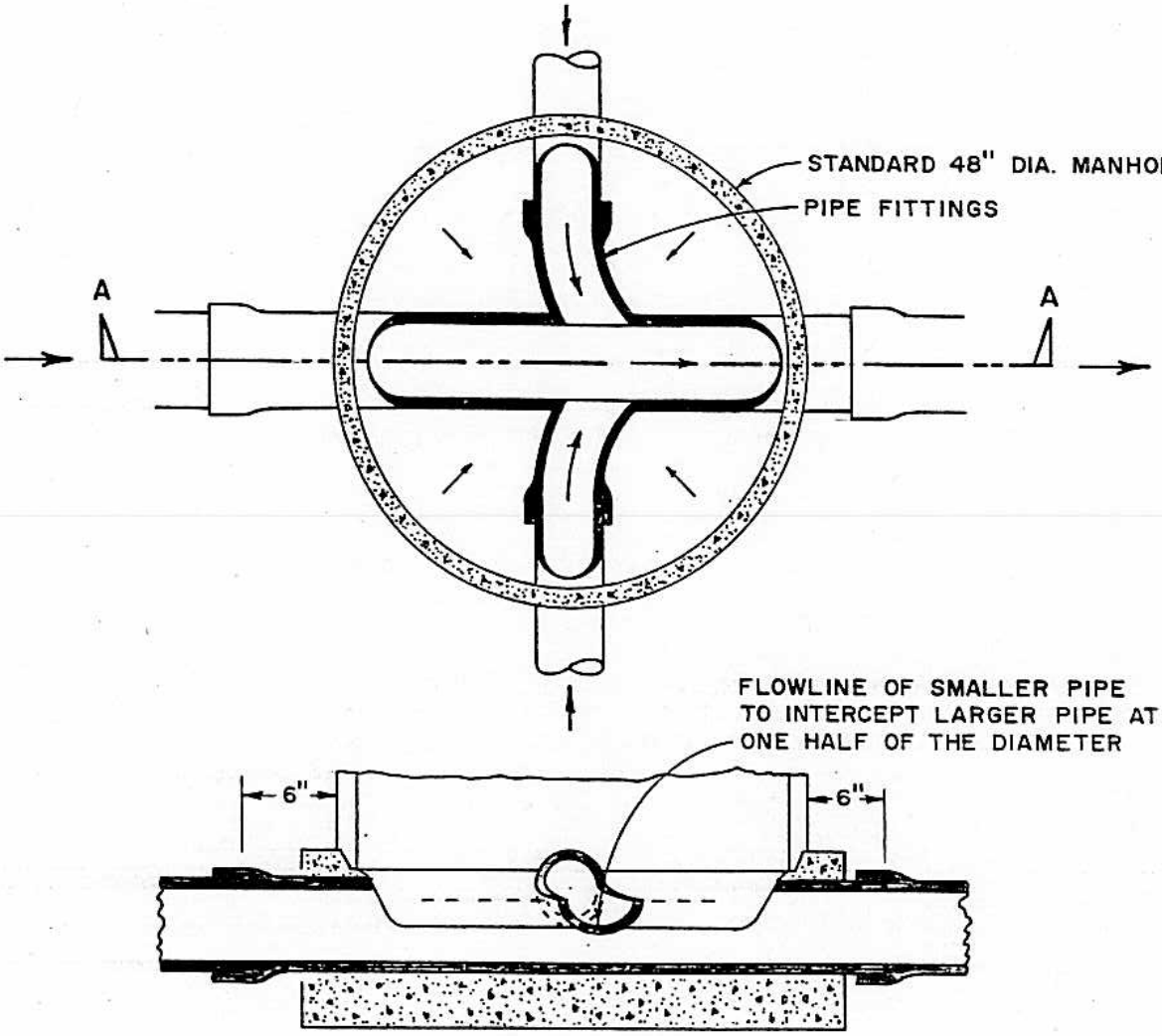
DRAWN BY: J. HULSEY
CHECKED BY: J. PODESTA
SCALE: NONE

SANITARY SEWER MANHOLE 36" THRU 42" DIA. PIPES

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M. A. Brinton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-4
DATE: JAN. 1988



SECTION A-A

NOTES:

1. CLAY PIPE FITTINGS WITH TOP HALF BROKEN OUT IS REQUIRED FOR TROUGH.
2. TROUGHS WITHIN MANHOLE SHALL BE FULLY ACCESSIBLE.
3. MANHOLE SHALL BE CLEANED OF ALL EXCESS MATERIALS.
4. CONCRETE TROUGH CONSTRUCTED INTO BASE OF MANHOLE MAY BE USED WITH THE APPROVAL OF THE CITY ENGINEER.
5. ALL OTHER MANHOLE REQUIREMENTS AS PER STANDARD SANITARY SEWER MANHOLE DETAIL.

NO.	REVISED	BY

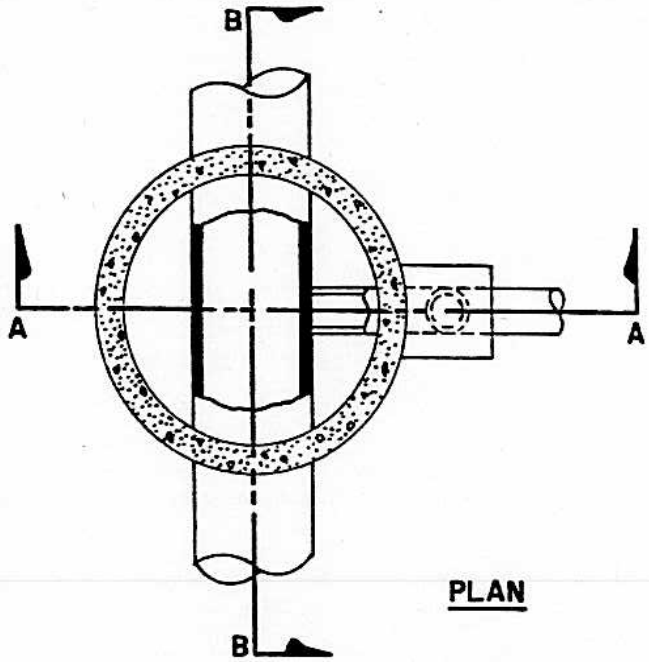
DRAWN BY: J. HULSEY
CHECKED BY: J. PODESTA
SCALE: NONE

INTERSECTION FOR 24" DIA. PIPE & SMALLER

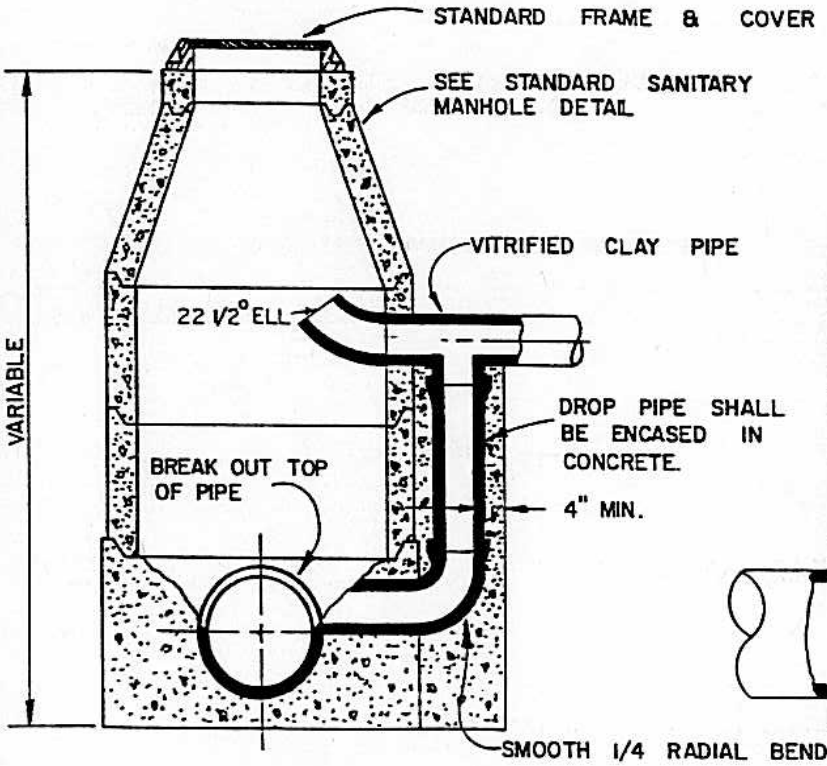
CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M. J. Brunton
DIRECTOR OF PUBLIC WORKS

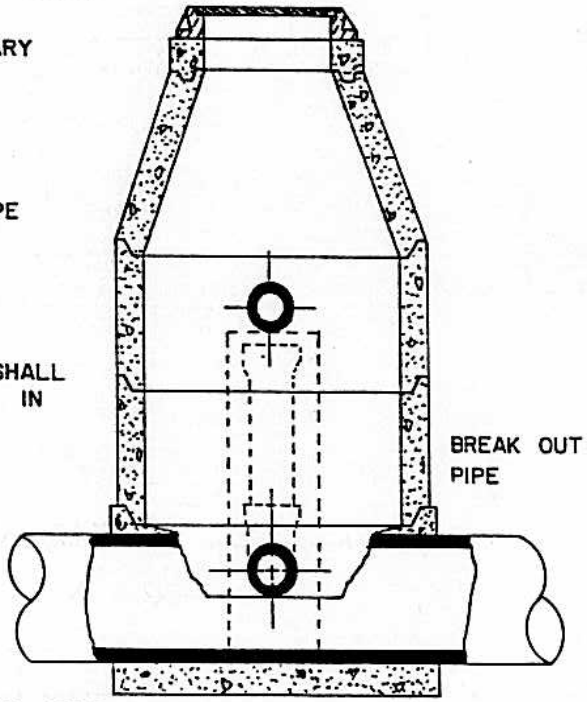
DRAWING NO. S-5
DATE: JAN. 1988



PLAN



SECTION A-A



SECTION B-B

NOTES:

1. THIS TYPE OF MANHOLE SHALL BE USED WHEN THE DIFFERENCE IN ELEVATIONS OF THE FLOW LINE OF UPPER LINE AND CROWN OF LOWER LINE EXCEEDS 24 INCHES.
2. ALL OTHER CONDITIONS AS NOTED ON STANDARD SANITARY SEWER MANHOLE DETAIL SHALL APPLY.

NO.	REVISED	BY

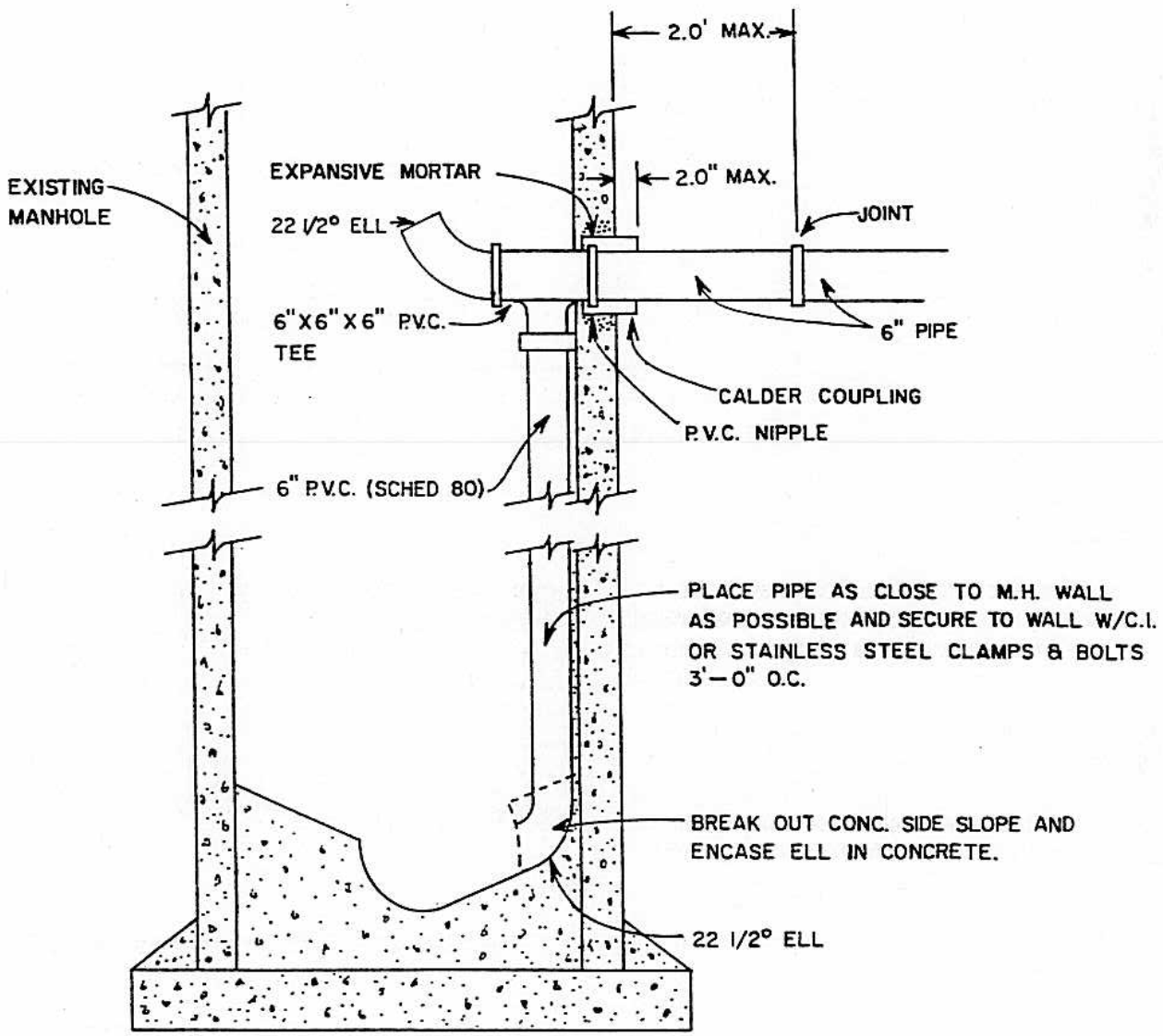
DRAWN BY: C. SABERTON
CHECKED BY: J. PODESTA
SCALE: NONE

OUTSIDE SEWER DROP MANHOLE

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-6
DATE: JAN. 1988



NOTES:

1. THIS TYPE OF MANHOLE SHALL BE USED ONLY WHEN TIEING INTO AN EXISTING MANHOLE.
2. THIS TYPE OF MANHOLE SHALL BE USED WHEN THE DIFFERENCE IN ELEVATION OF THE FLOW LINE OF THE UPPER LINE AND THE CROWN OF THE LOWER LINE EXCEEDS 24 INCHES.
3. ALL OTHER CONDITIONS AS NOTED ON STANDARD SANITARY SEWER MANHOLE DETAIL SHALL APPLY.

NO.	REVISED	BY

DRAWN BY: A. MENOR
CHECKED BY: J. PODESTA
SCALE: NONE

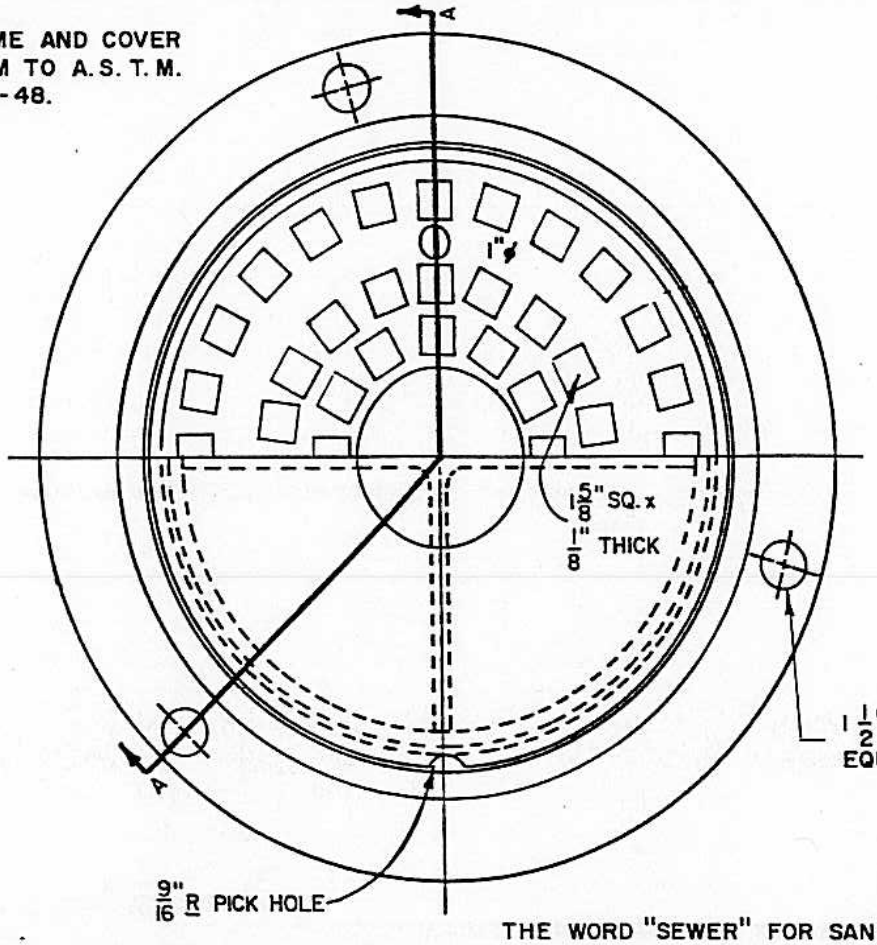
INSIDE SEWER DROP MANHOLE

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:
DIRECTOR OF PUBLIC WORKS

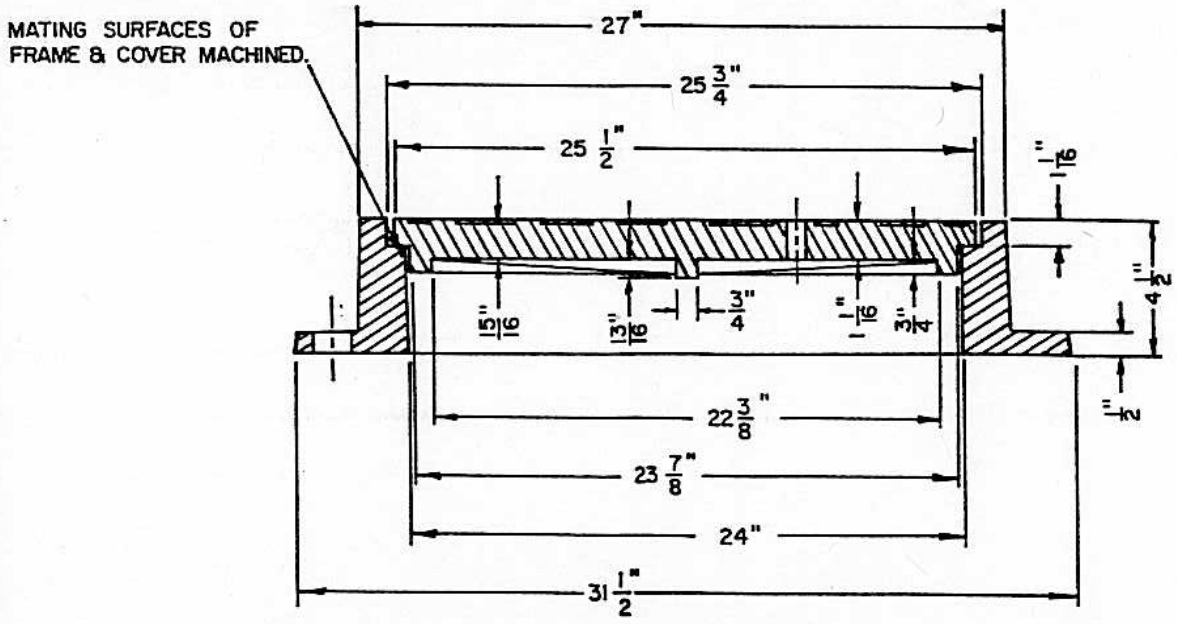
DRAWING NO. S-7
DATE: JAN. 1988

CAST IRON FRAME AND COVER SHALL CONFORM TO A.S.T.M. DESIGNATION A-48.



PINKERTON
FRAME PART NO. A-625 APPROX. WT. 140 LBS.
COVER PART NO. A-106 APPROX. WT. 163 LBS.
OR APPROVED EQUAL FRAME AND COVER

THE WORD "SEWER" FOR SANITARY SEWER OR THE WORD "STORM" FOR STORM DRAIN AS APPROPRIATE SHALL BE EMBOSSED ON CENTER DISC.



SECTION A-A

NO.	REVISED	BY
1	MANHOLE FRAME	DRK

DRAWN BY: C. SABERTON
CHECKED BY: J. PODESTA
SCALE: NONE

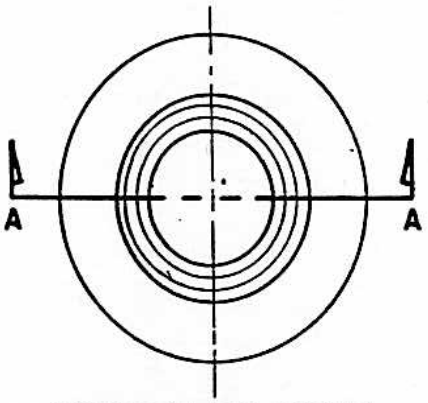
MANHOLE FRAME AND COVER ASSEMBLY

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

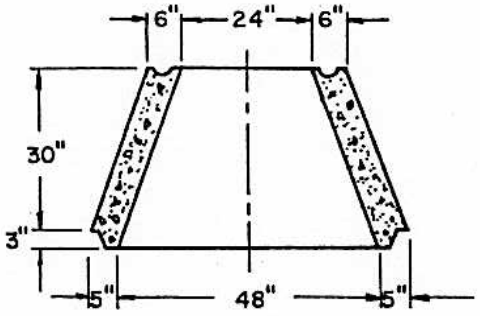
APPROVED BY: M. Brinton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-8
DATE: JAN 1988

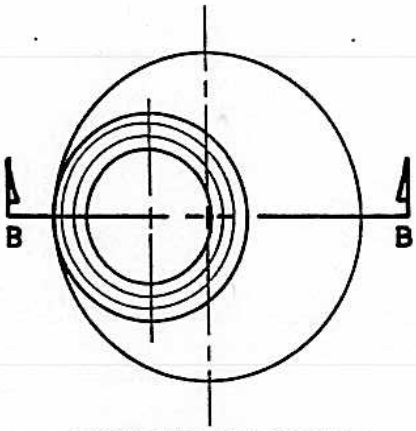
PRINTED ON DIEPO NO. 1000H CLEARPRINT



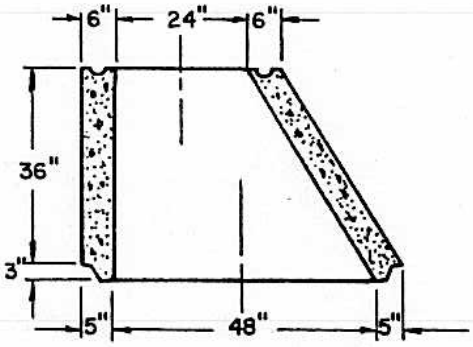
CONCENTRIC CONE



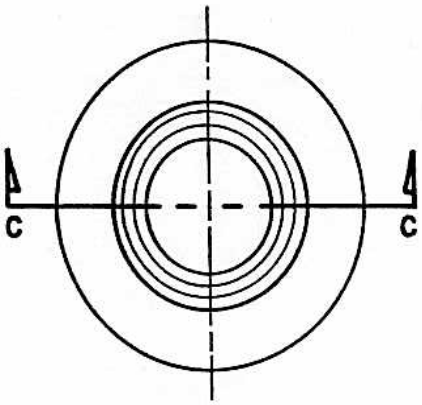
SECTION A-A



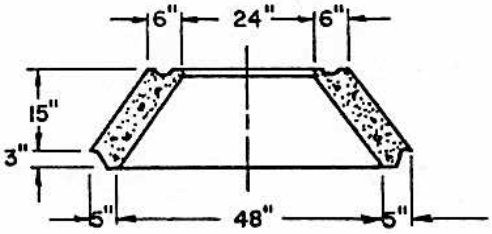
ECCENTRIC CONE



SECTION B-B



CONCENTRIC SHORT CONE



SECTION C-C

NOTES:

1. PRECAST REINFORCED CONCRETE MANHOLE CONE SHALL CONFORM TO A.S.T.M. C-478.
2. ECCENTRIC CONE TO BE USED ONLY WITH THE APPROVAL OF THE CITY ENGINEER.

NO.	REVISED	BY

DRAWN BY: C. SABERTON

CHECKED BY: J. PODESTA

SCALE: NONE

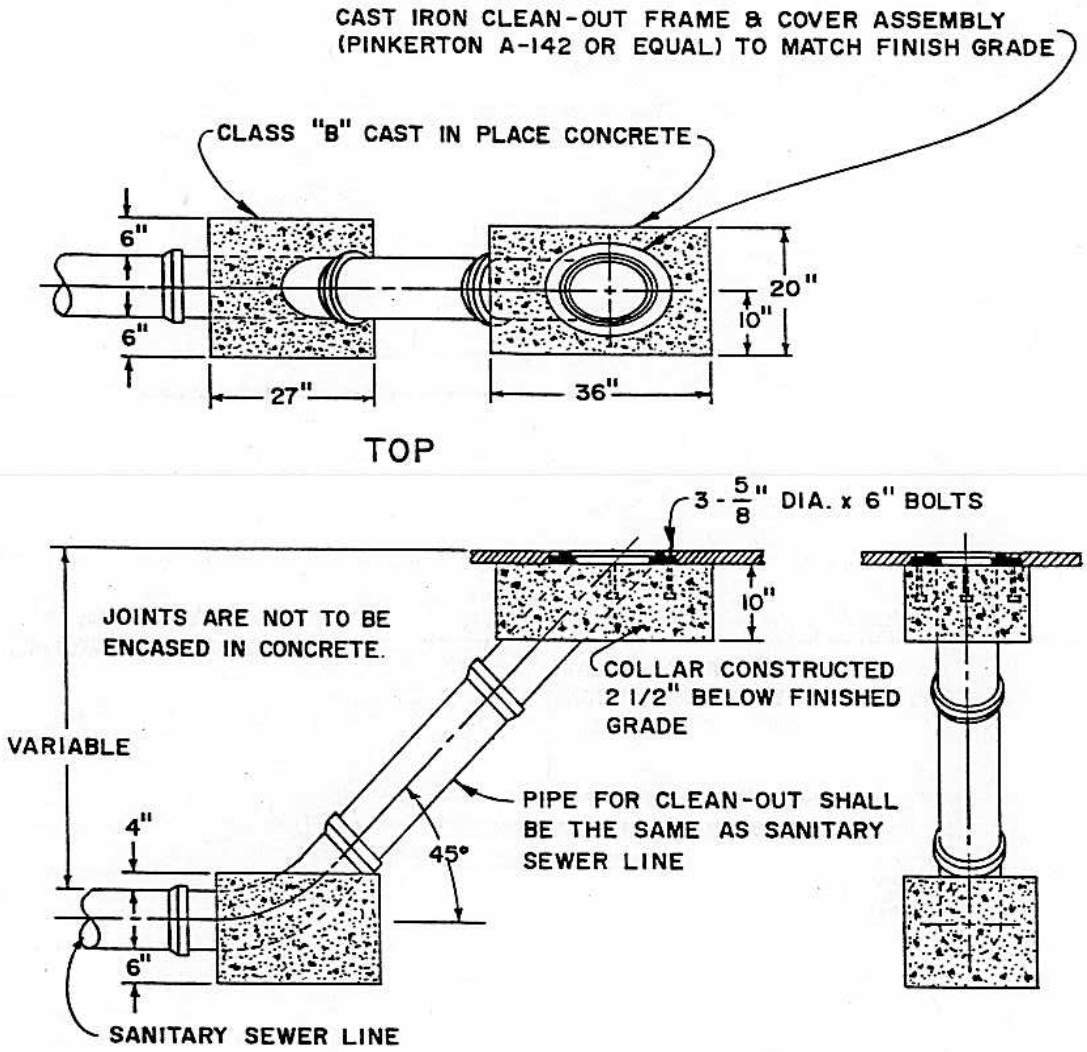
PRECAST REINFORCED CONCRETE MANHOLE CONE

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M.G. Brinton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-9

DATE: JAN. 1988



NO.	REVISED	BY

DRAWN BY: B. CANTU

CHECKED BY: J. PODESTA

SCALE: NONE

MAIN LINE CLEAN-OUT

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-10

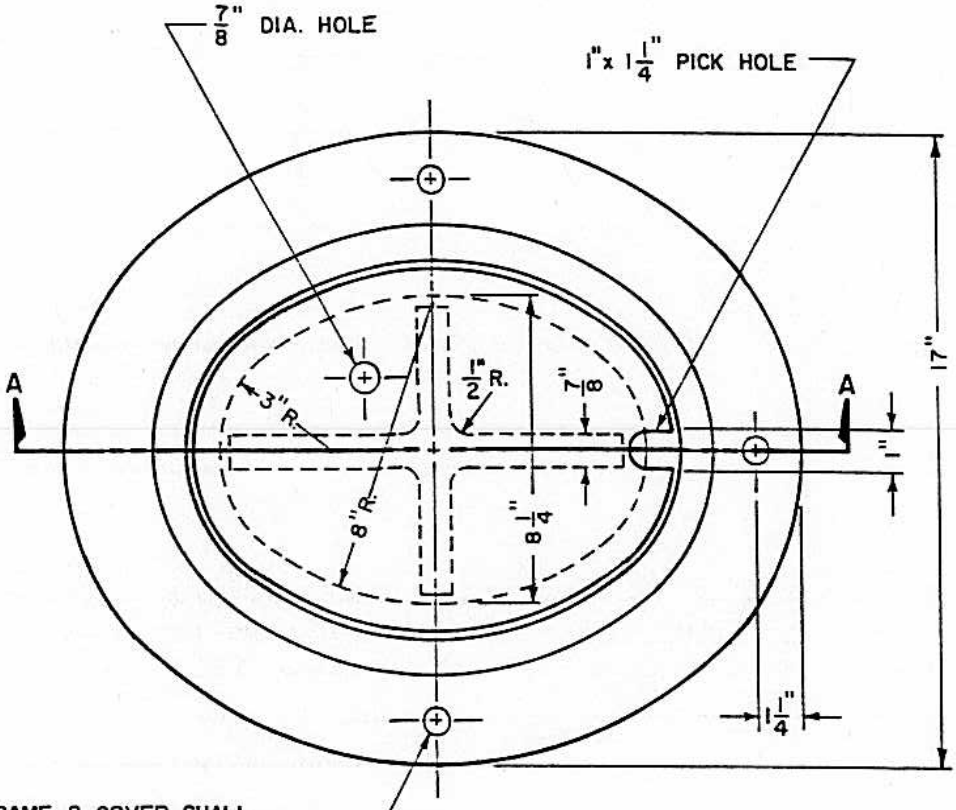
DATE: JAN. 1988

PINKERTON:

FRAME PART NO. A-144 APPROX. WT. 45 LBS.

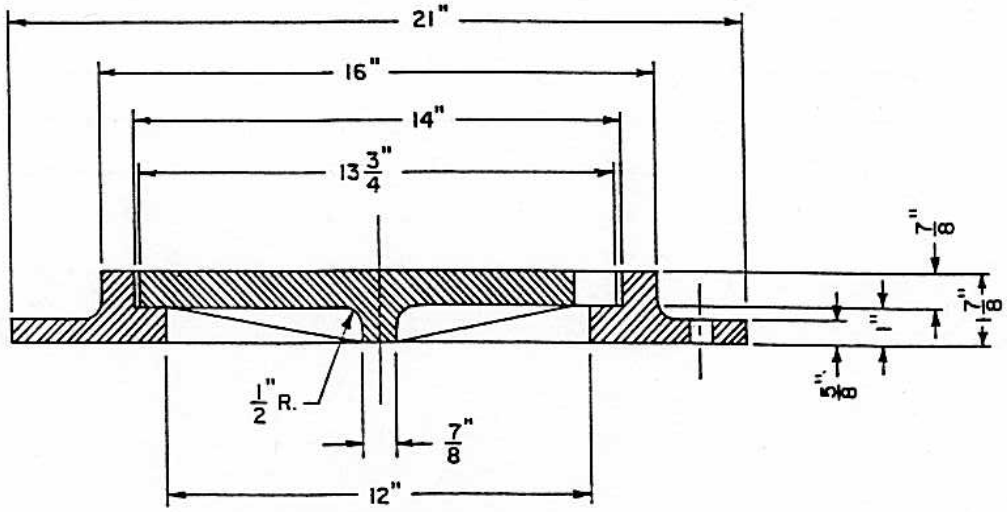
COVER PART NO. A-144 APPROX. WT. 25 LBS.

OR APPROVED EQUAL



CAST IRON FRAME & COVER SHALL CONFORM TO A.S.T.M. DESIGNATION A-48.

5/8" DIA. – 3 HOLES



SECTION A-A

NO.	REVISED	BY

DRAWN BY: B. CANTU

CHECKED BY: J. PODESTA

SCALE: NONE

MAIN CLEAN-OUT FRAME AND COVER ASSEMBLY

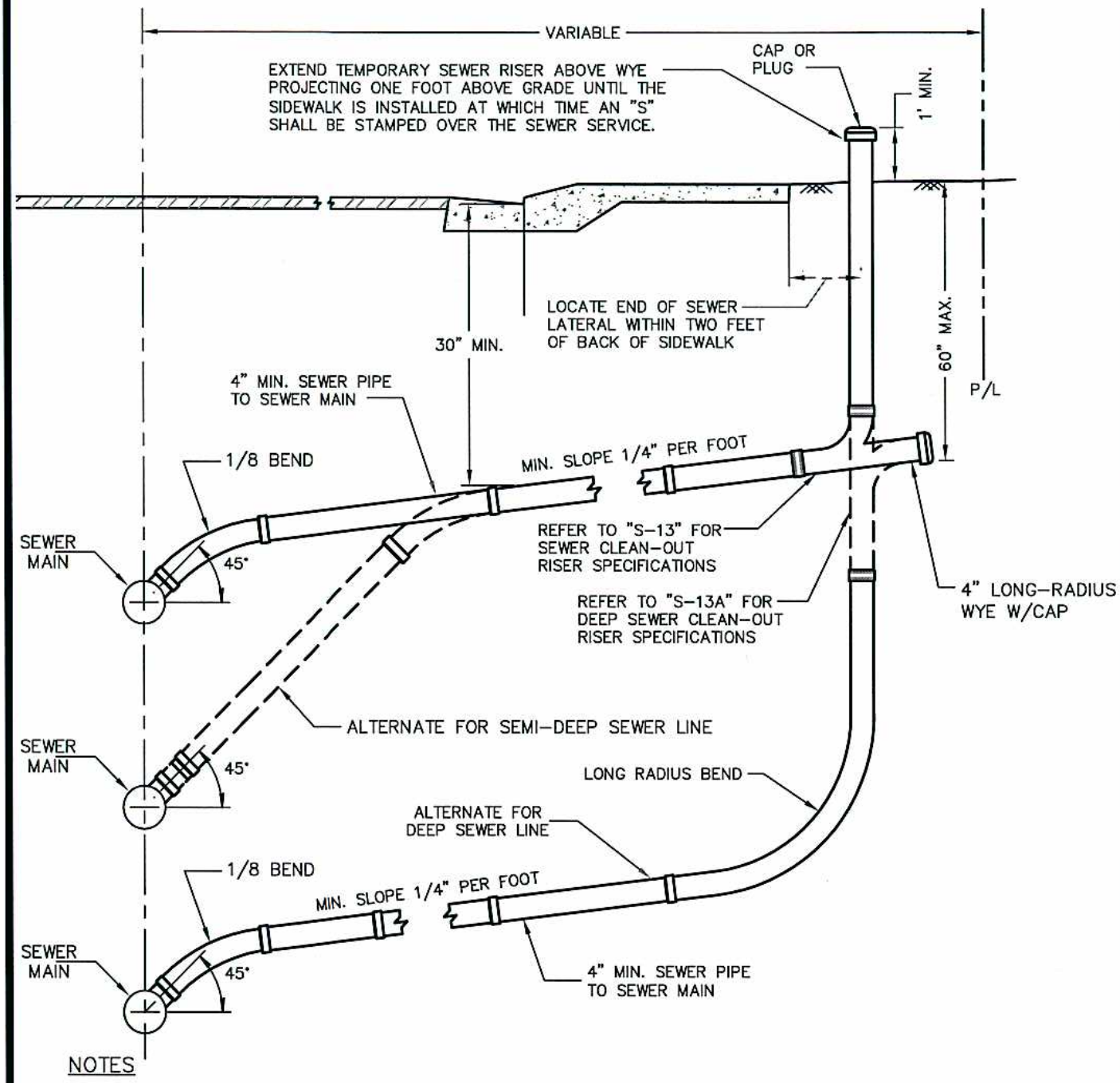
CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: W. Bruton
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-11

DATE: JAN 1988

PRINTED ON DIEPO NO. 1000H CLEARPRINT



NOTES

1. ANY SANITARY SEWER LATERAL THAT CROSSES A WATER MAIN SHALL BE DUCTILE IRON CEMENT-LINED OR P.V.C. (C-900) FOR TEN FEET IN EACH DIRECTION FROM THE CROSSING, UNLESS THE WATER MAIN IS ONE FOOT OR GREATER ABOVE THE SANITARY SEWER LATERAL.
2. FITTINGS, WYE BRANCH, RISER AND LATERALS SHALL BE OF THE SAME DIAMETER.
3. CLEAN-OUT MAY BE CAST IRON, PLASTIC, OR VITRIFIED CLAY PIPE.
4. SEWER LATERALS WITH COVER LESS THAN 30 INCHES SHALL BE DUCTILE IRON CEMENT-LINED PIPE.
5. 4" LONG RADIUS WYE WITH CAP AND TEMPORARY 4" CLEAN-OUT RISER WITH CAP TO BE CONSTRUCTED & TESTED WITH SEWER LATERAL.
6. PERMANENT CLEANOUT RISER SHALL BE ADJUSTED TO FINAL GRADE WITH INSTALLATION OF THREADED CLEAN-OUT PLUG & BOX BY BUILDING CONTRACTOR. REFER TO CITY STANDARD S-13 AND S-13A FOR CLEAN-OUT RISER SPECIFICATIONS.

NO.	REVISED	BY
2	NOV. 2006	J.R.
DRAWN BY:	J. ROSS	
CHECKED BY:	J. PODESTA	
SCALE:	NONE	

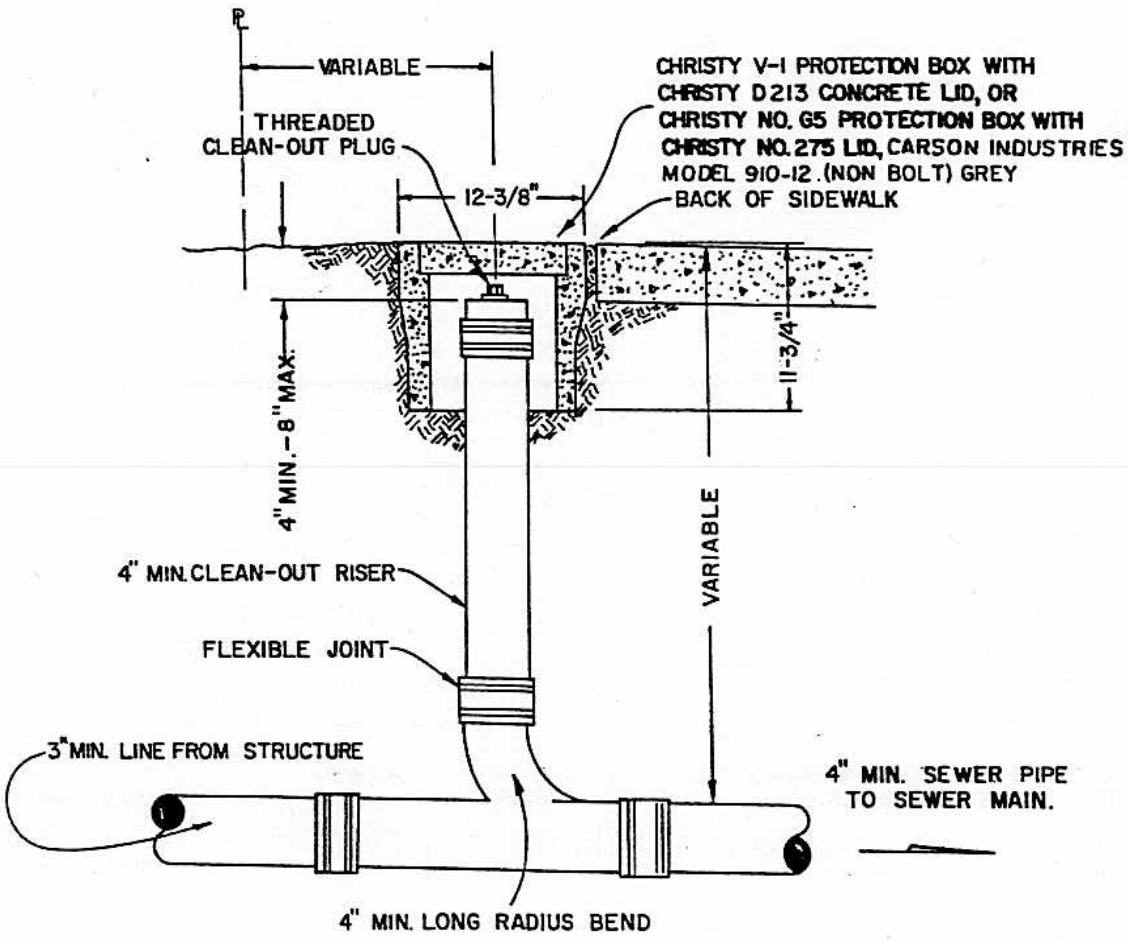
SEWER LATERAL

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: Michael G. Brintnall
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-12

DATE: JAN. 1988



NOTES:

1. CLEAN-OUT RISER SHALL BE THE SAME SIZE AS THE SEWER LATERAL.
2. CLEAN-OUT SHALL BE LOCATED AT BACK OF SIDEWALK.
3. ANY DEVIATION FROM THIS STANDARD MUST HAVE THE APPROVAL OF THE CITY ENGINEER.
4. CLEAN-OUT RISER COMBINATION MAY BE CAST IRON, PLASTIC, OR VITRIFIED CLAY PIPE.

NO.	REVISED	BY

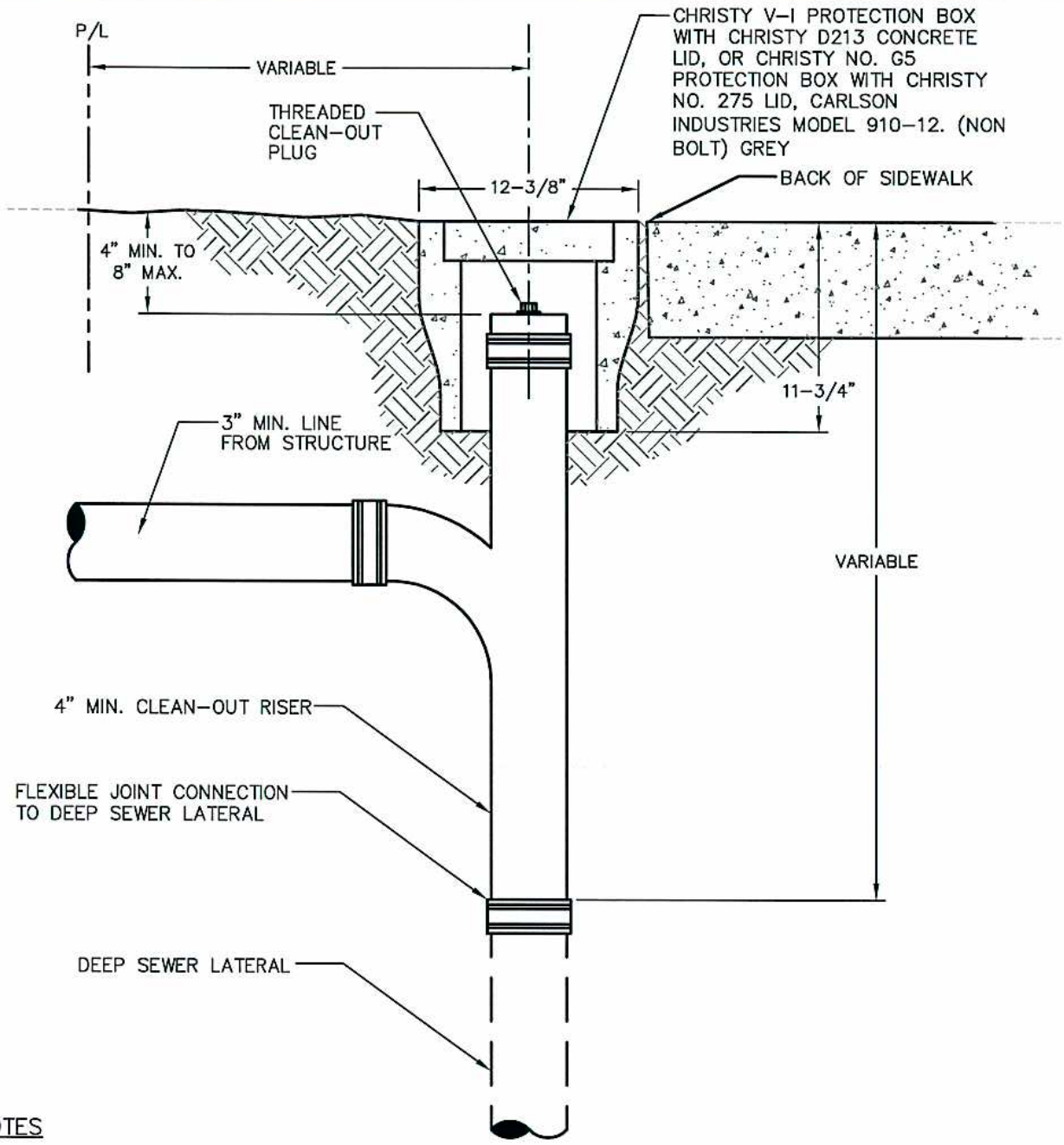
DRAWN BY: C. SABERTON
CHECKED BY: J. PODESTA
SCALE: NONE

CLEAN-OUT RISER

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-13
DATE: JAN. 1988



NOTES

1. CLEAN–OUT RISER SHALL BE THE SAME SIZE AS THE SEWER LATERAL.
2. CLEAN–OUT SHALL NOT BE LOCATED MORE THAN 24" FROM THE BACK OF SIDEWALK.
3. CLEAN–OUT RISER MAY BE DUCTILE IRON, A.B.S. (S.D.R. 35) SOLID WALL PIPE, P.V.C. (S.D.R. 23.5), OR VITRIFIED CLAY PIPE.
4. PRIOR TO INSTALLATION, INSTALLER MUST OBTAIN AN ENCROACHMENT PERMIT FROM THE CITY OF MANTECA PUBLIC WORKS DEPARTMENT.
5. CLEAN–OUTS WITHIN THE STREET RIGHT OF WAY MUST BE INSTALLED BY A LICENSED CONTRACTOR.
6. THE CITY MAINTAINS SEWER LATERALS DOWNSTREAM FROM CLEAN–OUTS LOCATED WITHIN 24" FROM THE BACK OF SIDEWALK. PROPERTY OWNERS MUST MAINTAIN SEWER LATERALS UPSTREAM FROM THE CLEAN–OUT. SEWER LATERALS WITHOUT CLEAN–OUTS, OR WITH CLEAN–OUTS LOCATED GREATER THAN 24" FROM THE BACK OF SIDEWALK MUST BE MAINTAINED THEIR FULL LENGTH BY THE PROPERTY OWNER.

NO.	REVISED	BY

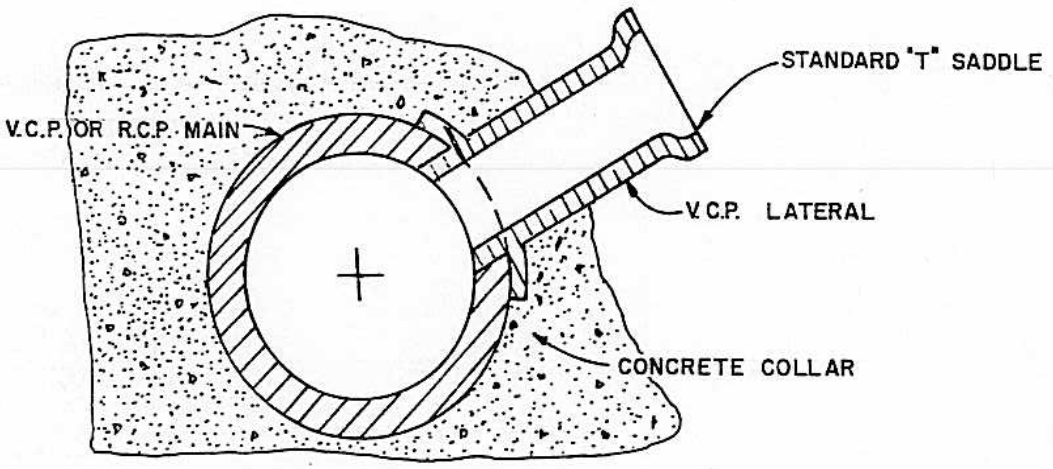
DRAWN BY: J. ROSS
CHECKED BY: J. PODESTA
SCALE: NONE

CLEAN–OUT RISER FOR DEEP SEWER LATERAL

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: Michael L. Brizio
DIRECTOR OF PUBLIC WORKS

DRAWING NO. S-13A
DATE: AUG. 1999



SANITARY SEWER

NOTES:

1. BREAK OUT PORTION OF MAIN TO FIT LATERAL.

NO.	REVISED	BY

DRAWN BY: C. SABERTON

CHECKED BY: J. PODESTA

SCALE: NONE

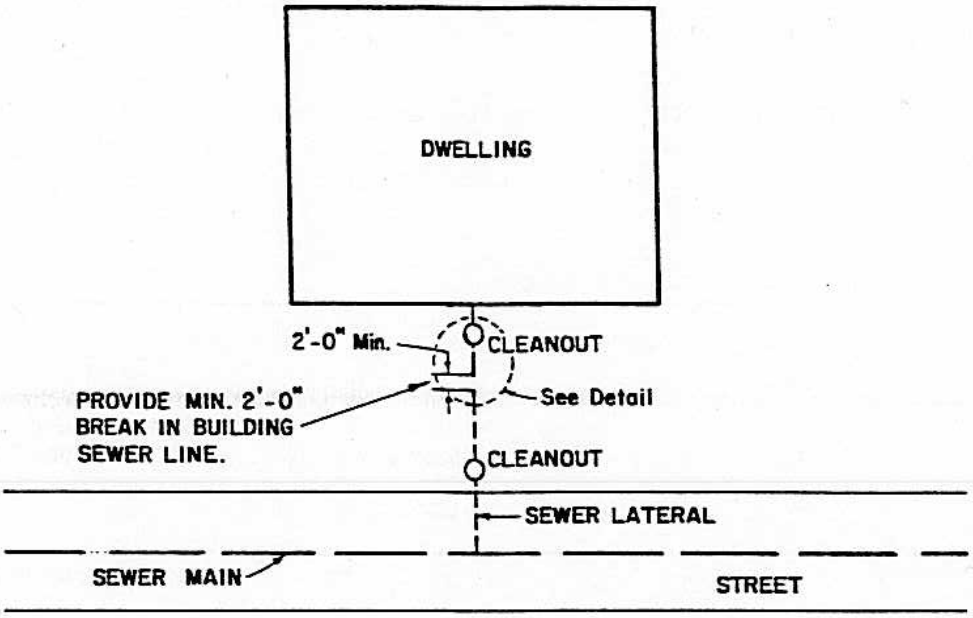
TAPPING FOR SEWER MAINS

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M.K. Brinton
DIRECTOR OF PUBLIC WORKS

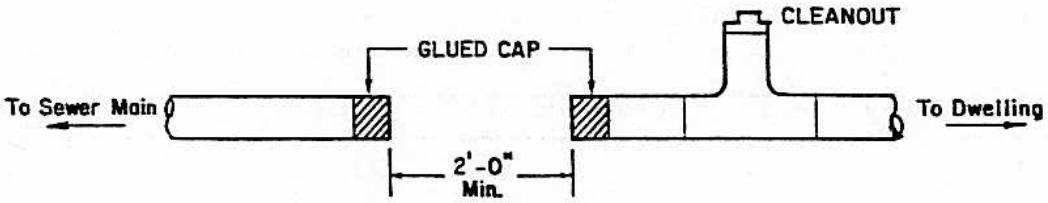
DRAWING NO. S-14

DATE: JAN. 1988



PLAN

N.T.S.



SEWER LINE DETAIL

N.T.S.

NOTES:

1. TWO FOOT BREAK IN BUILDING SEWER LINE SHALL BE LEFT UNCOVERED UNTIL SEWER ALLOCATION IS GRANTED.
2. FINAL CONNECTION SHALL NOT BE MADE UNTIL SEWER ALLOCATION IS GRANTED. A FINAL INSPECTION WILL BE PERFORMED AT THAT TIME.

NO.	REVISED	BY

DRAWN BY: J. KOESTER
CHECKED BY: J. PODESTA
SCALE: NONE

SEWER CONNECTION

CITY OF MANTECA
DEPARTMENT OF PUBLIC WORKS

APPROVED BY: M. Brinton
DIRECTOR OF PUBLIC WORKS

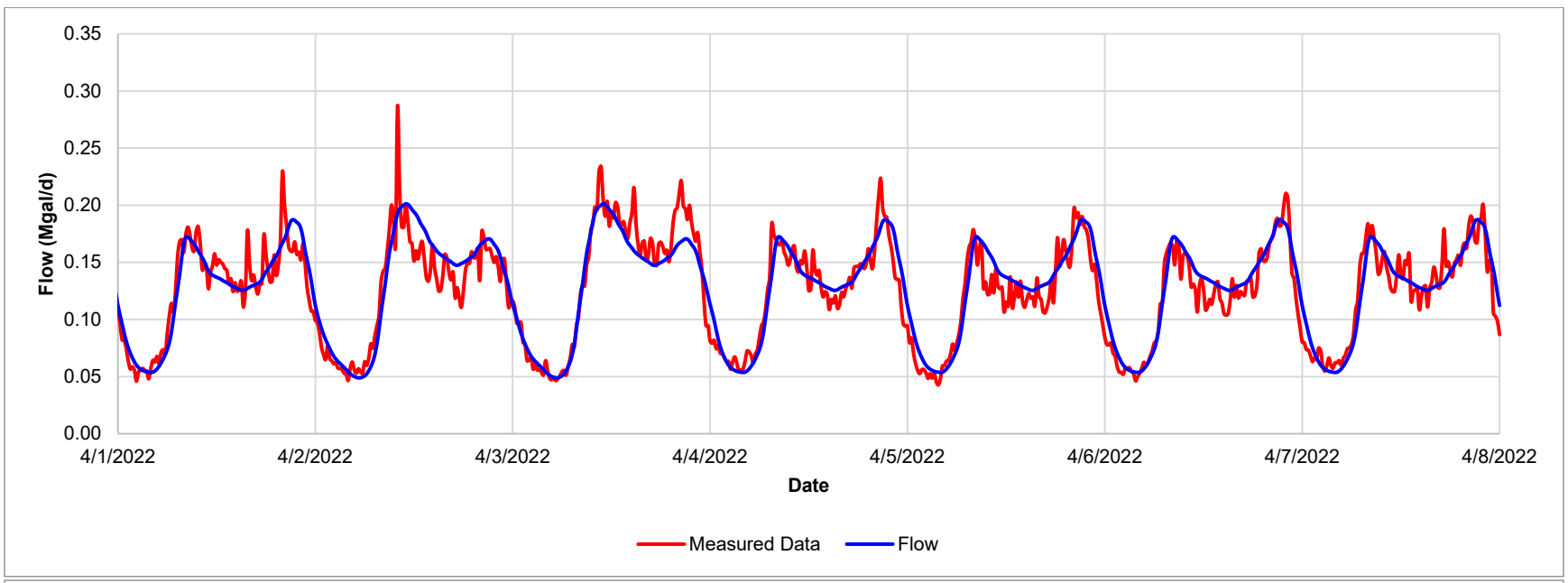
DRAWING NO. S-15
DATE: JAN. 1988

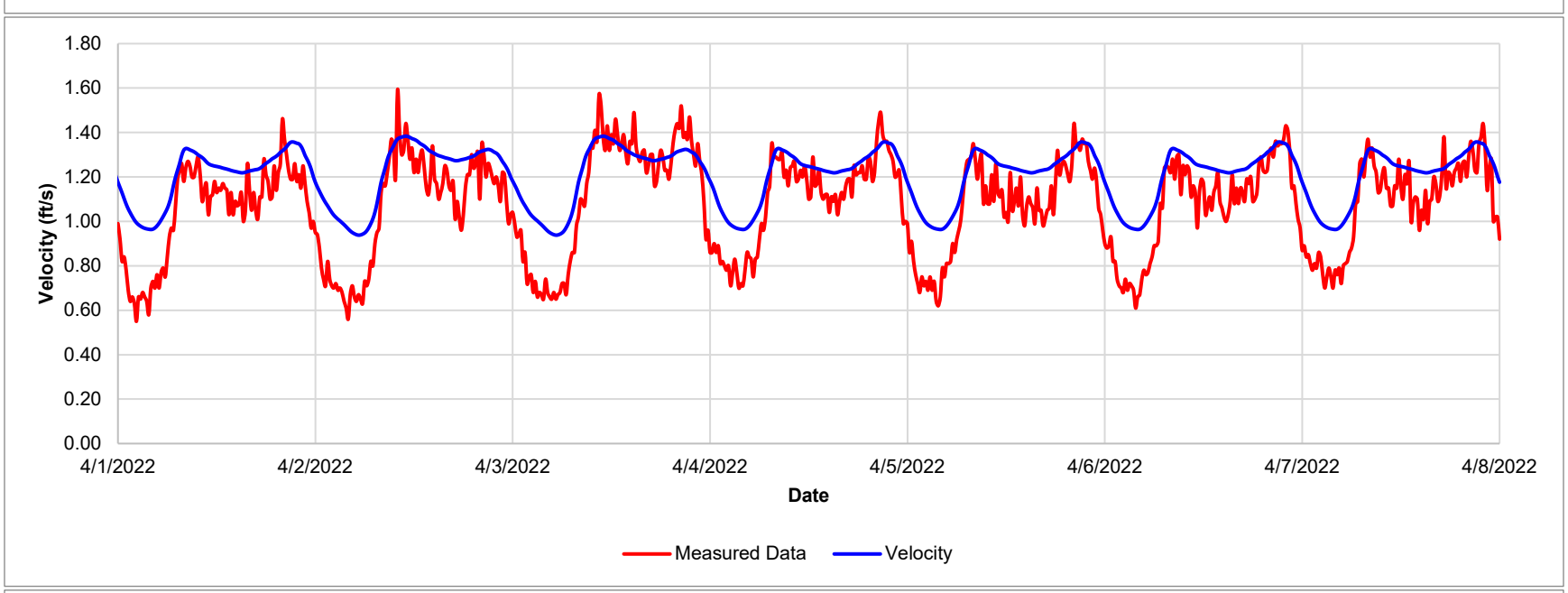
APPENDIX F

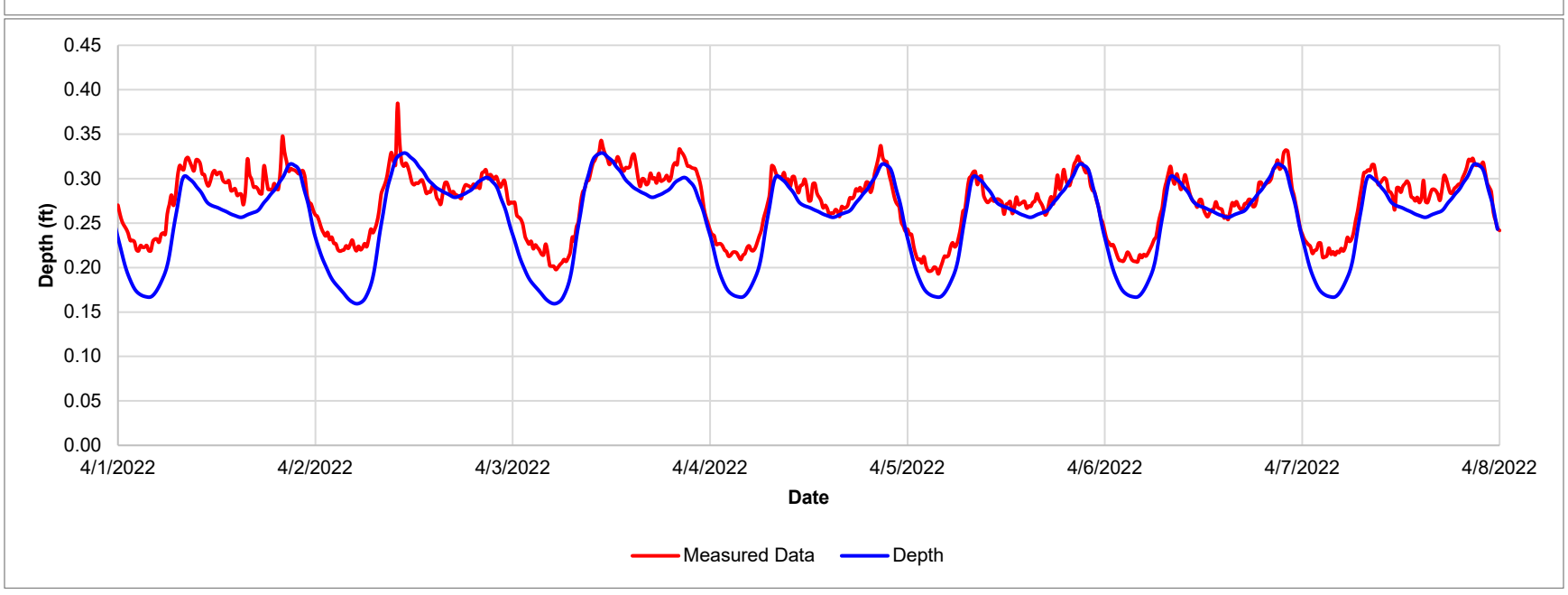
Hydraulic Model Calibration & Scenario Results

Appendix F – Calibration

1.1 SITE 1 - DWF

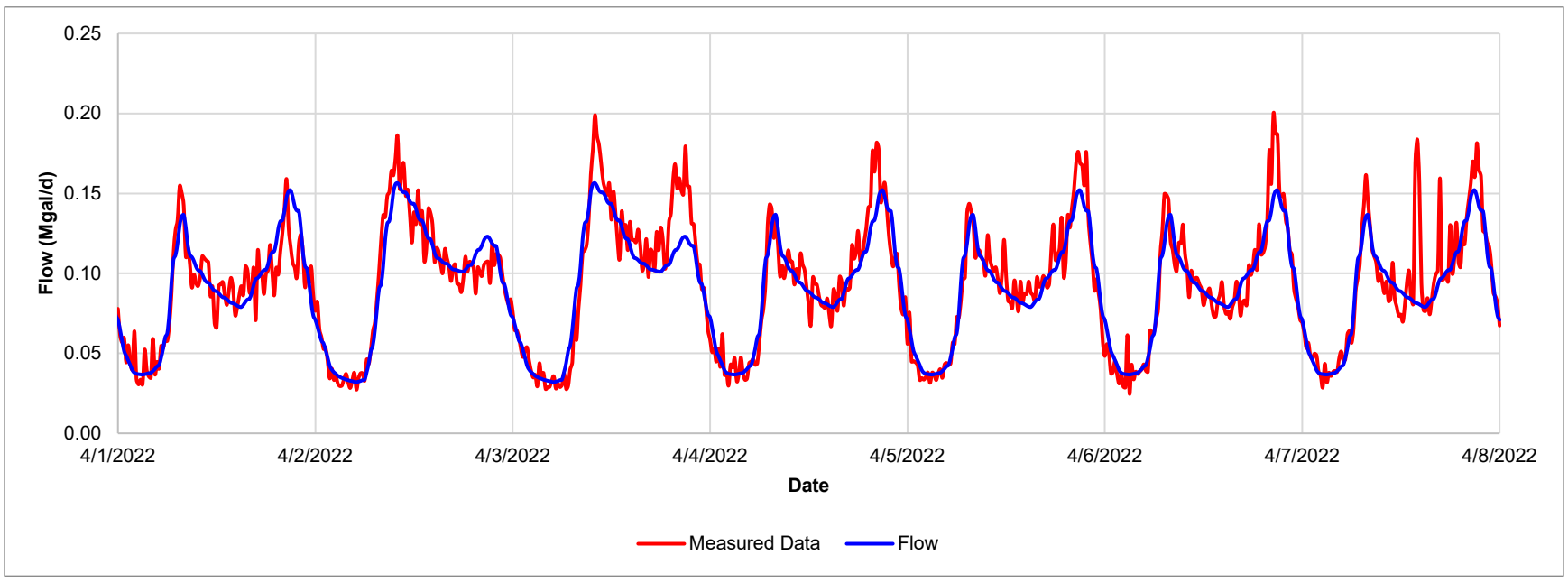


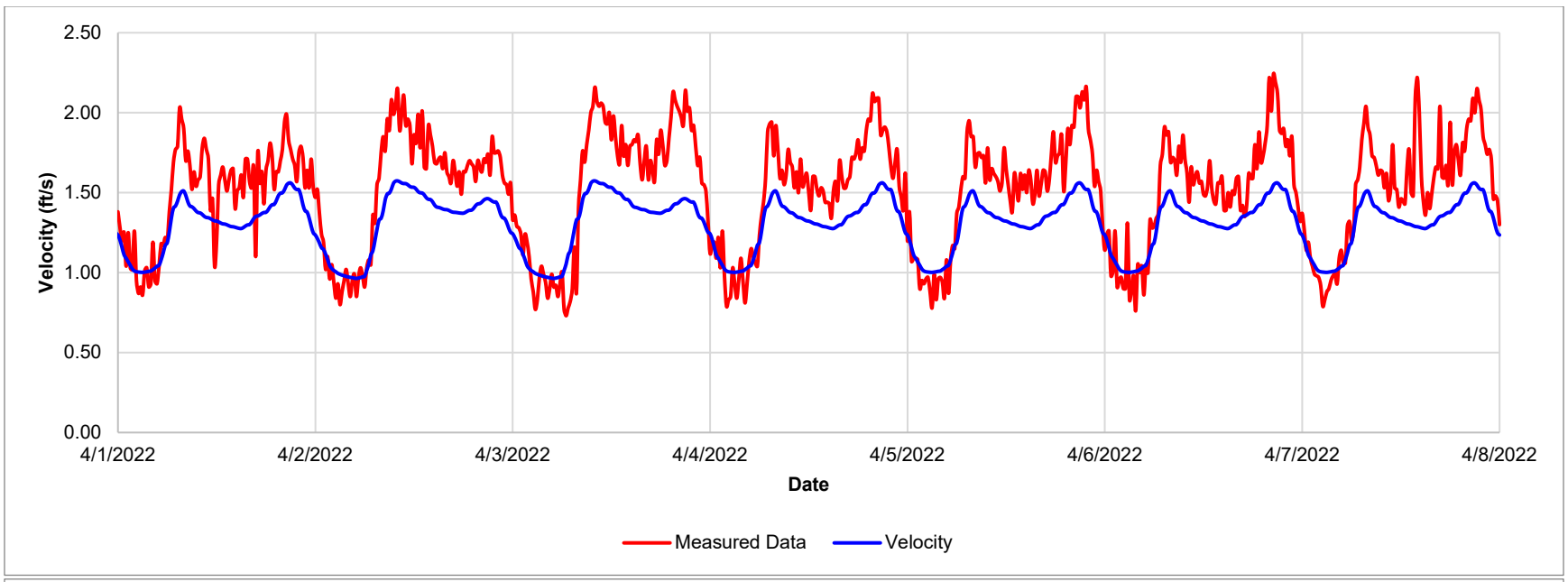


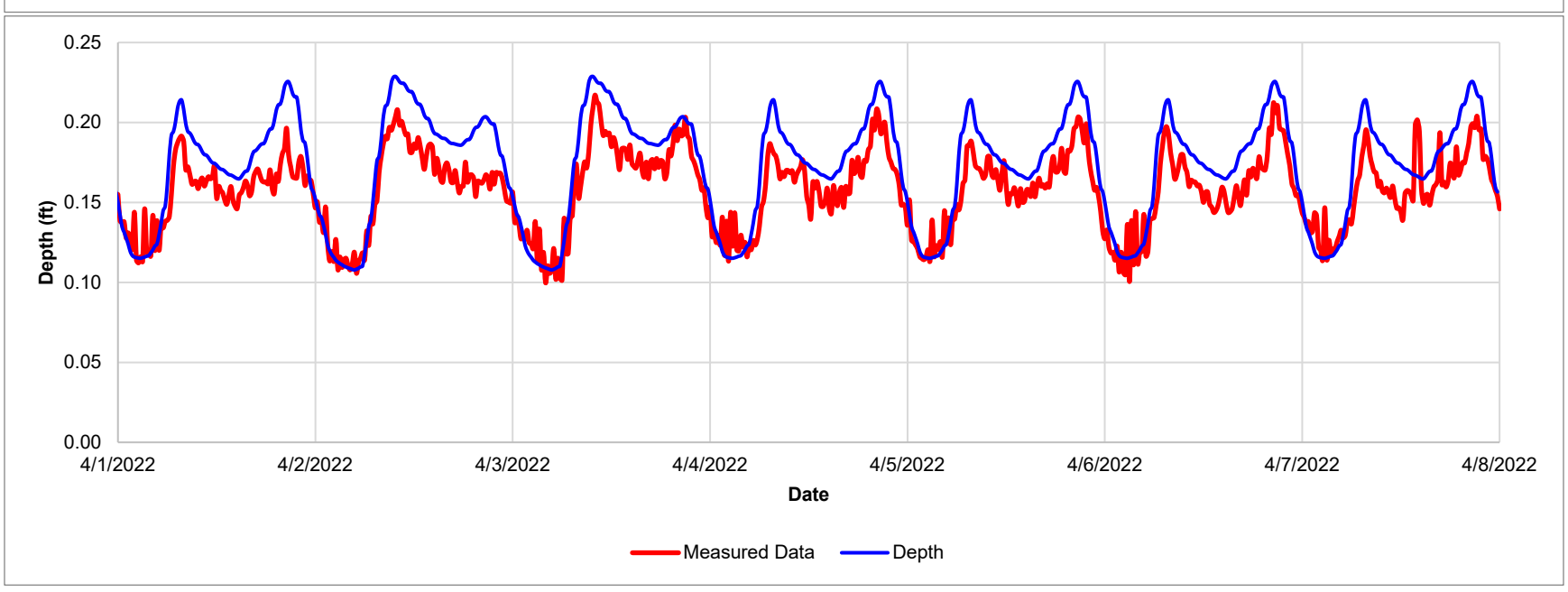


Site 1	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.38	1.59	0.29	0.22	0.33	1.38	0.20	-14.5%	-13.0%	-29.8%	-6.9%
Min	0.19	0.55	0.04	0.05	0.16	0.94	0.05				
Avg	0.27	1.08	0.13	0.13	0.25	1.21	0.13	-6.7%	12.1%	1.5%	1.5%
Volume			250,615	250,662			254,360			1.5%	1.5%

1.2 SITE 2 – DWF

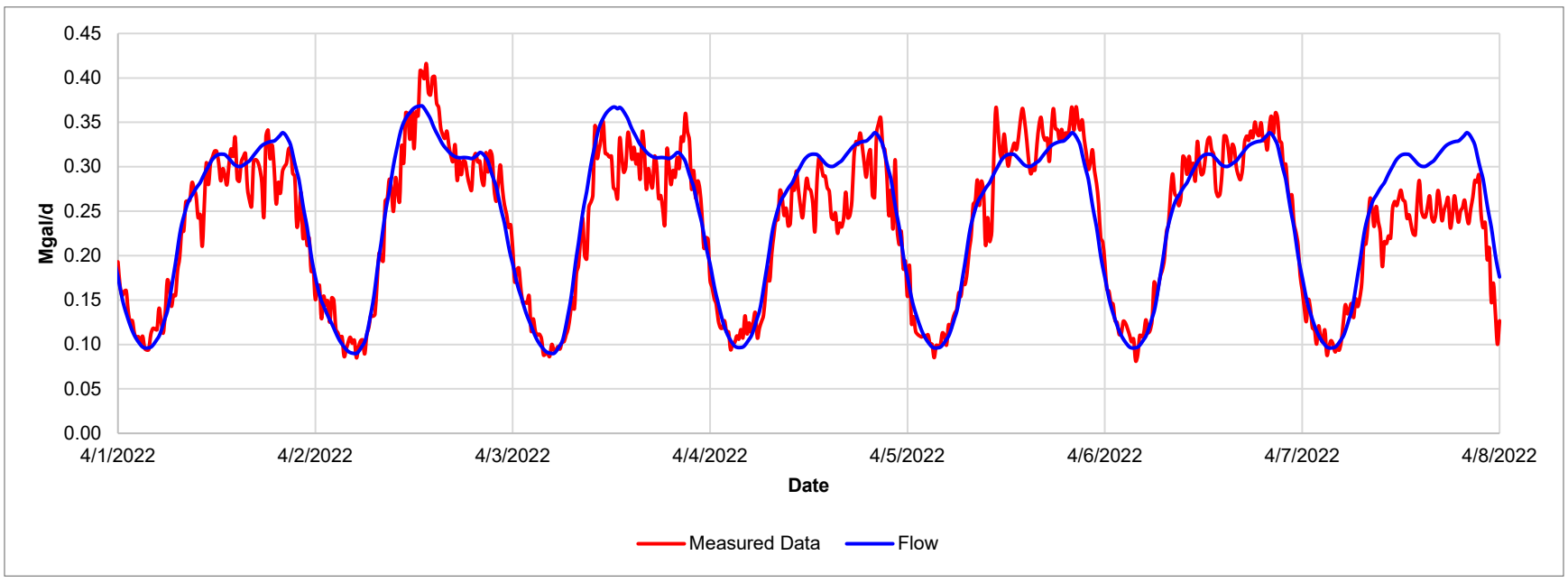


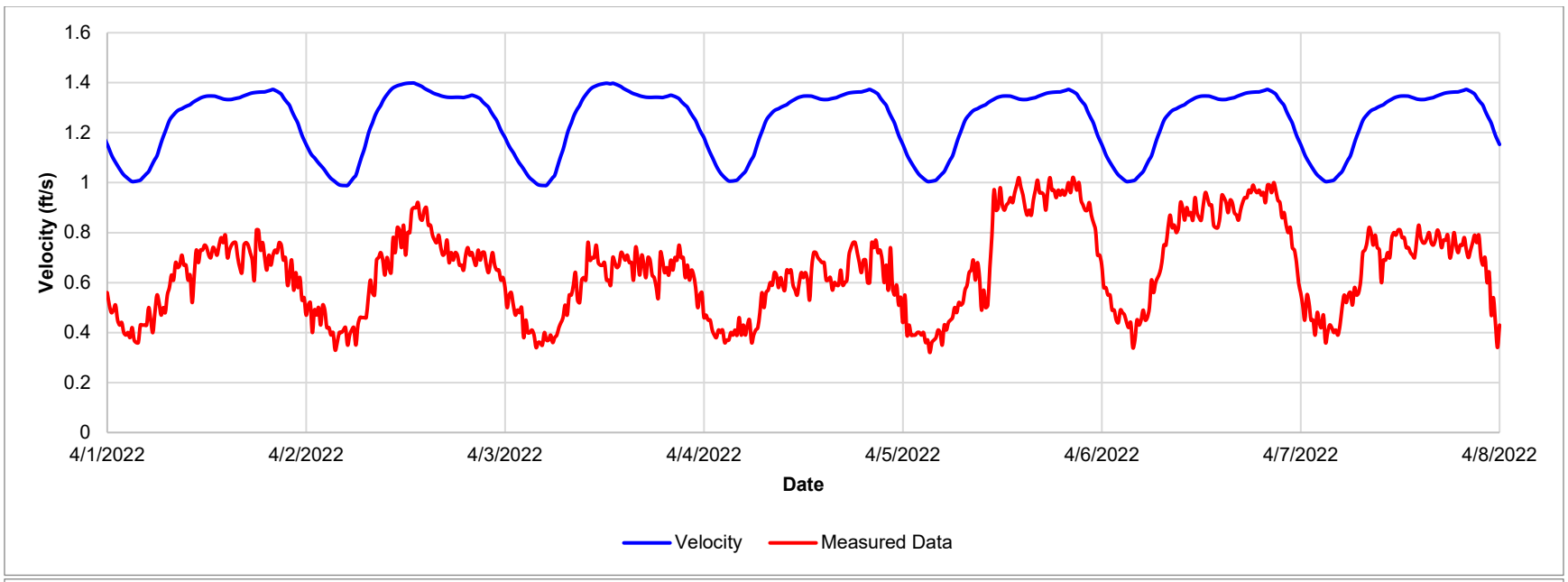


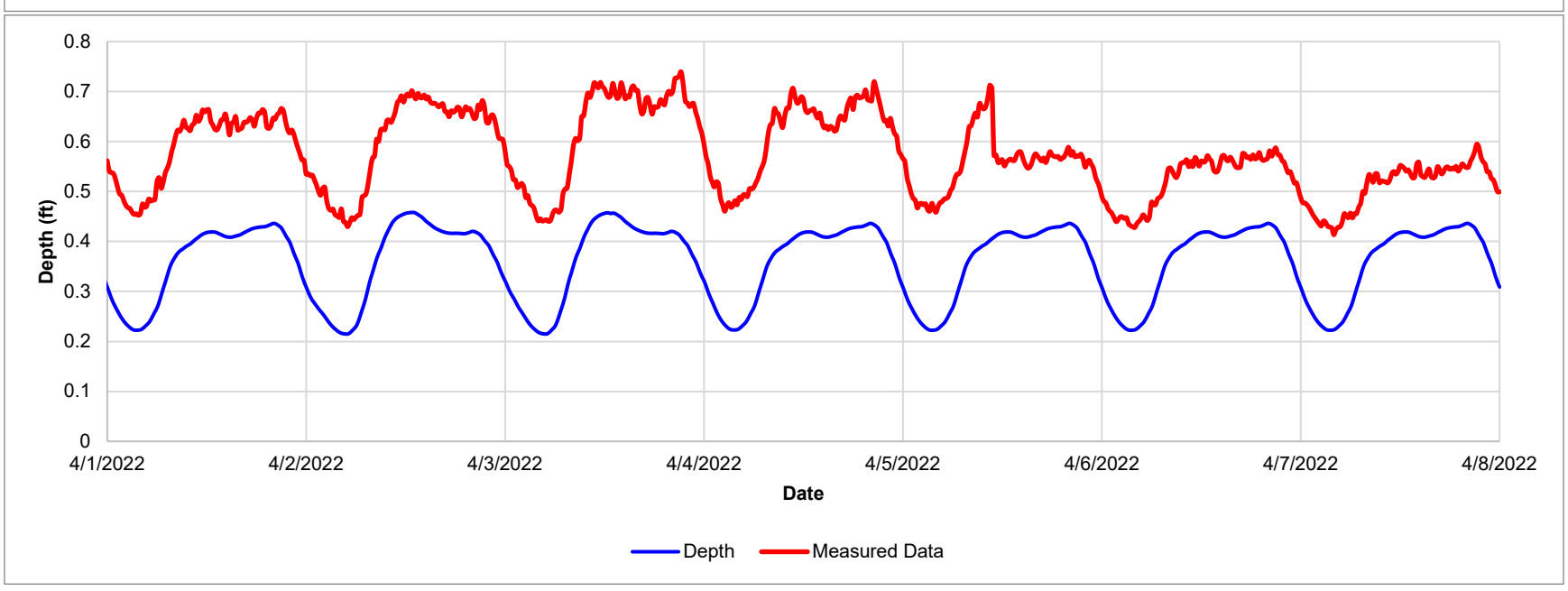


Site 2	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.22	2.24	0.20	0.19	0.23	1.57	0.16	5.4%	-29.8%	-21.6%	-15.7%
Min	0.10	0.73	0.02	0.03	0.11	0.96	0.03				
Avg	0.16	1.52	0.09	0.09	0.17	1.31	0.09	9.4%	-13.9%	-2.4%	-2.4%
Volume			186,015	186,038			181,625			-2.4%	-2.4%

1.3 SITE 3 – DWF

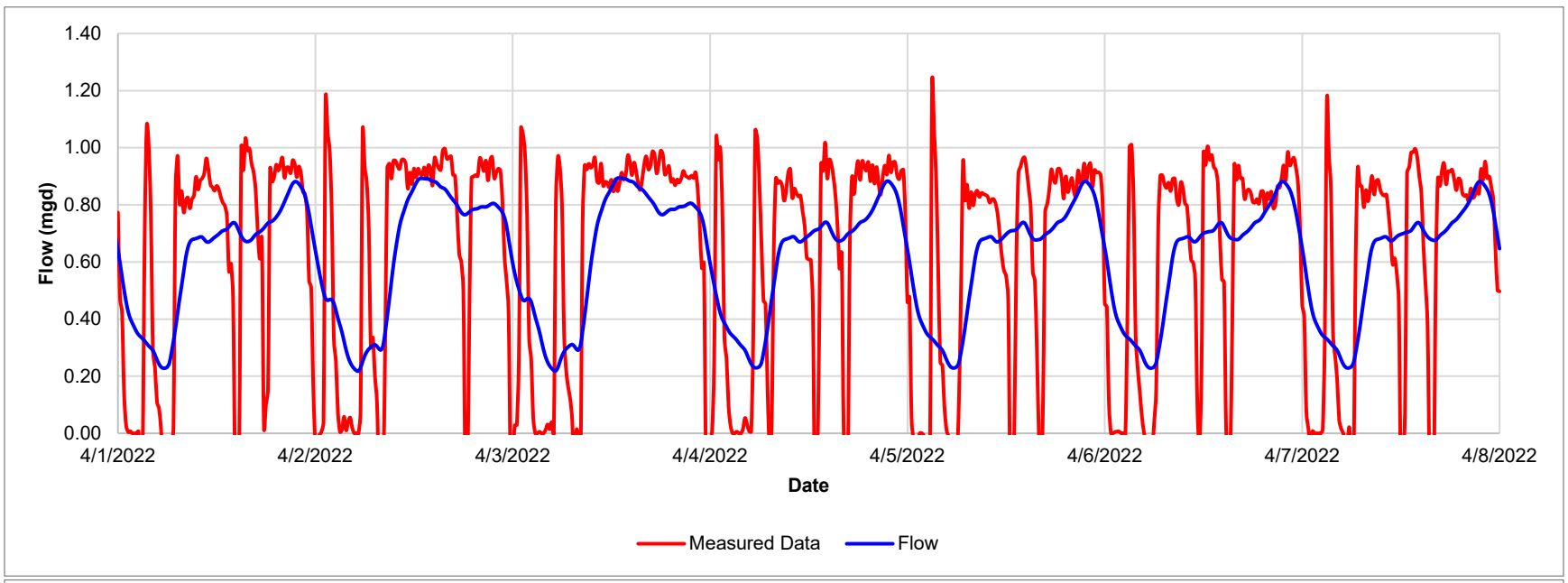


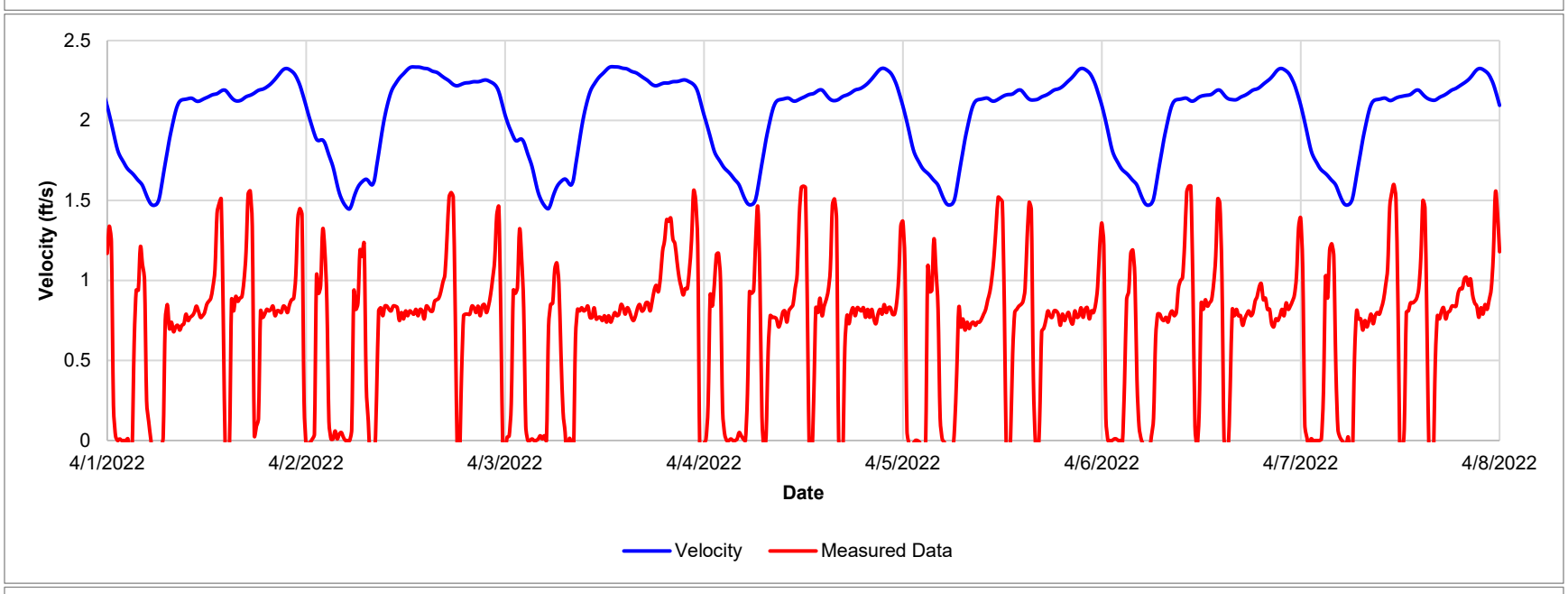


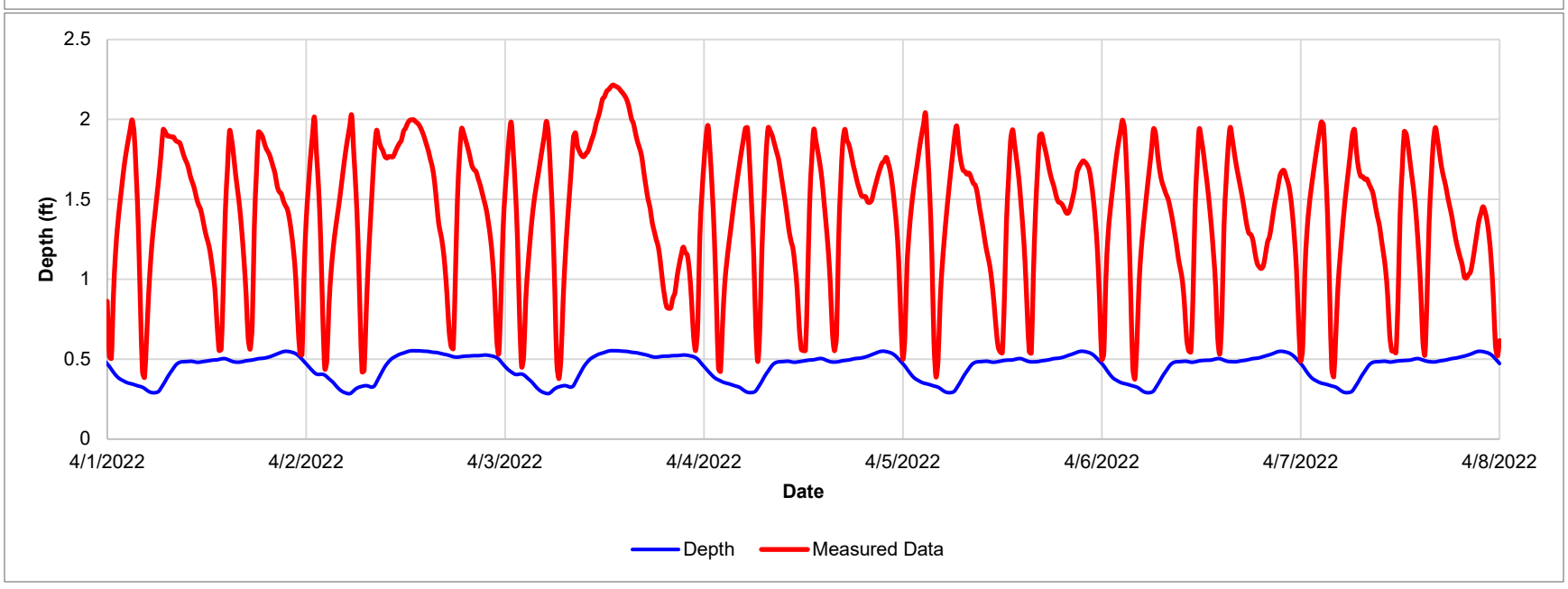


Site 3	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.74	1.02	0.42	0.41	0.46	1.40	0.37	-38.0%	37.1%	-11.4%	-9.6%
Min	0.41	0.32	0.08	0.09	0.21	0.99	0.09				
Avg	0.57	0.65	0.24	0.24	0.36	1.25	0.24	-37.2%	92.2%	4.1%	4.1%
Volume			470,307	470,476			489,773			4.1%	4.1%

1.4 SITE 4 – DWF

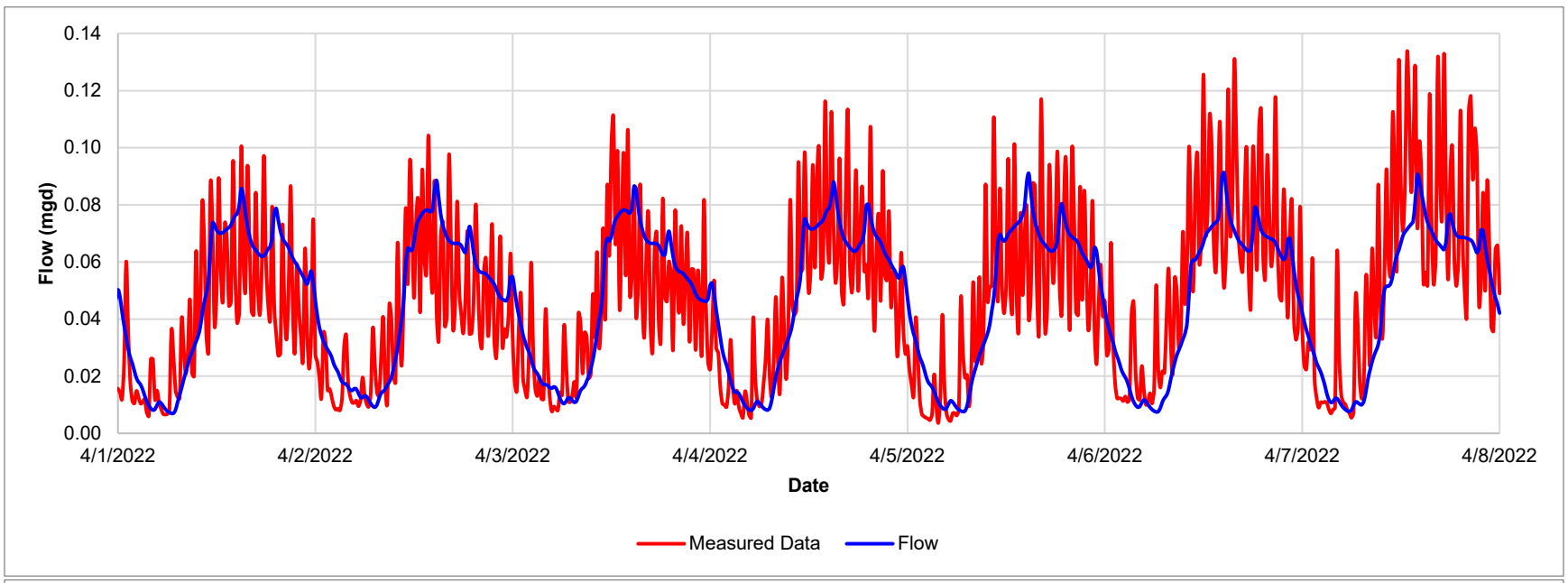


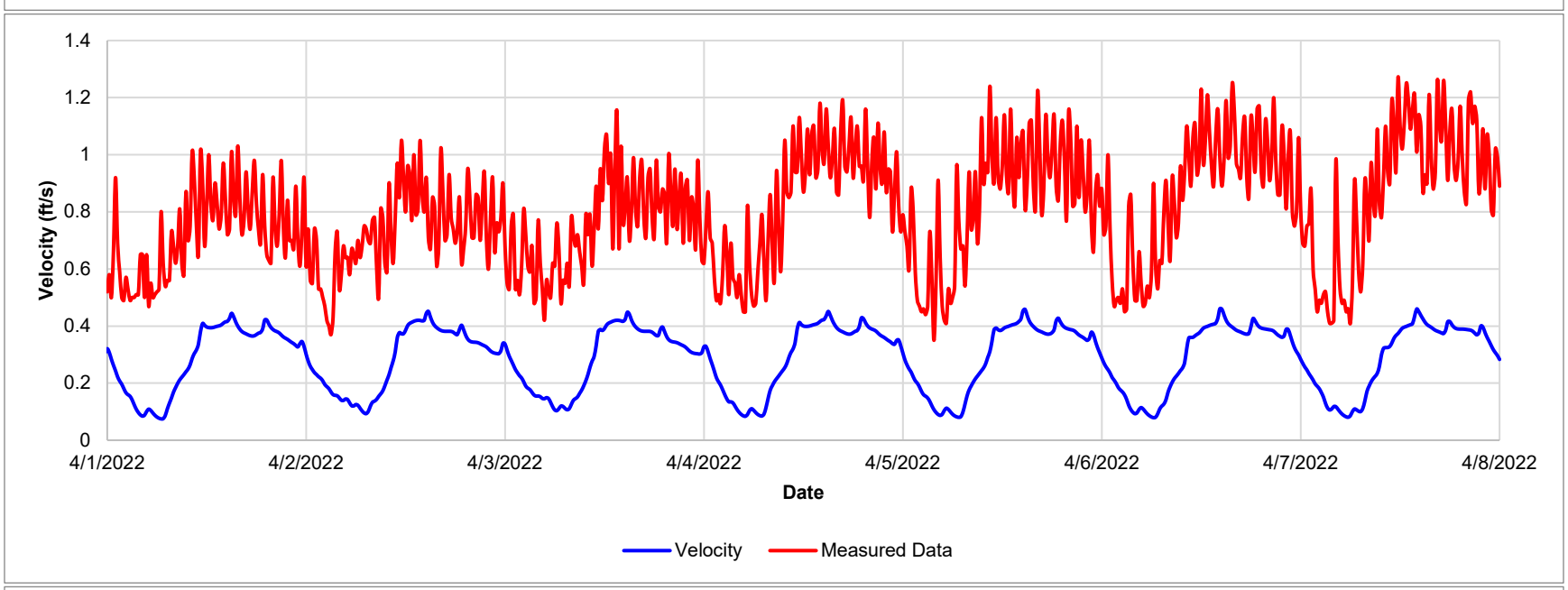


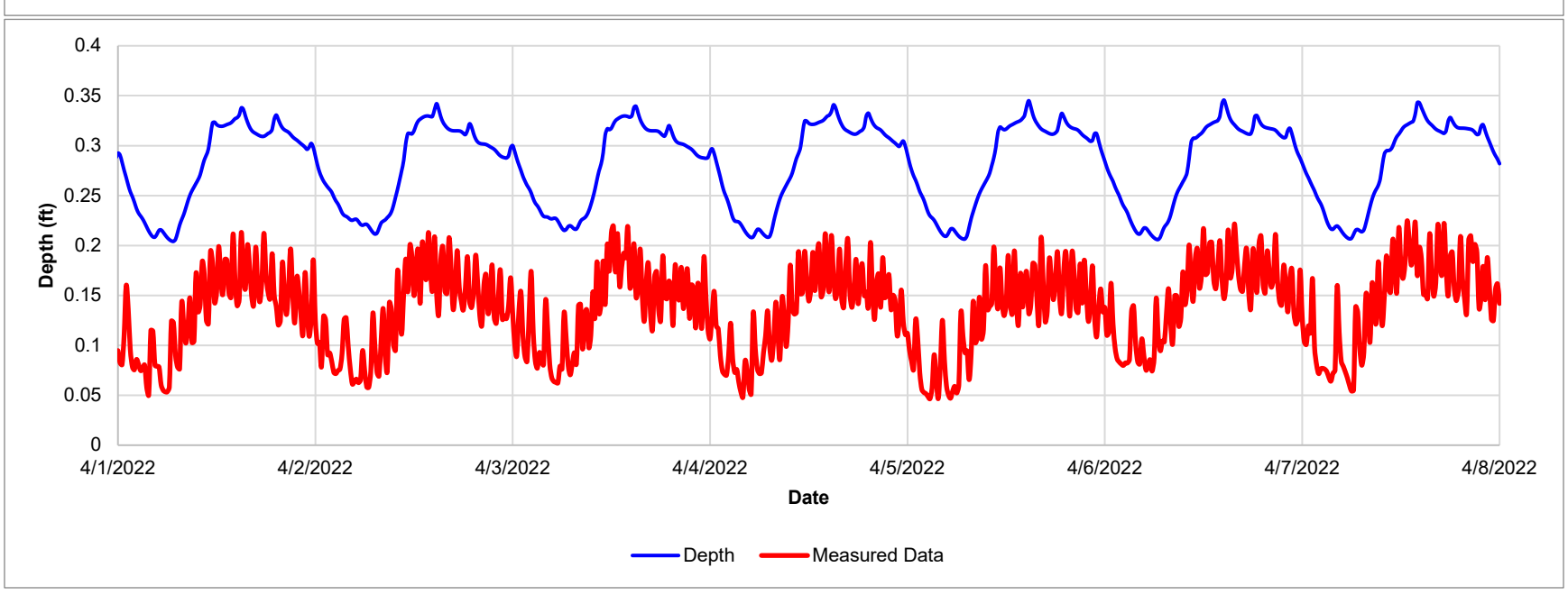


Site 4	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	2.22	1.60	1.23	1.00	0.55	2.34	0.89	-75.0%	46.0%	-27.2%	-10.3%
Min	0.38	-0.20	-0.23	-0.09	0.28	1.45	0.22				
Avg	1.41	0.69	0.61	0.61	0.45	2.03	0.61	-67.8%	194.3%	0.4%	0.4%
Volume			1,223,326	1,223,577			1,228,243			0.4%	0.4%

1.5 SITE 5 – DWF

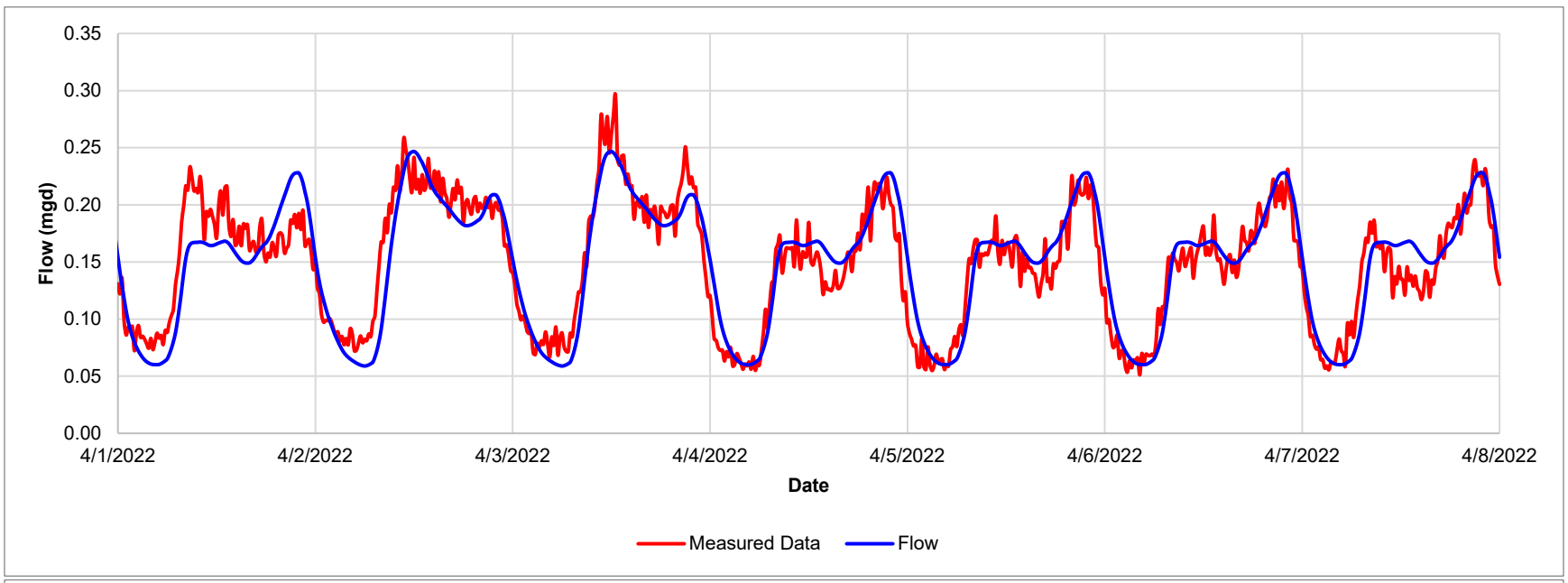


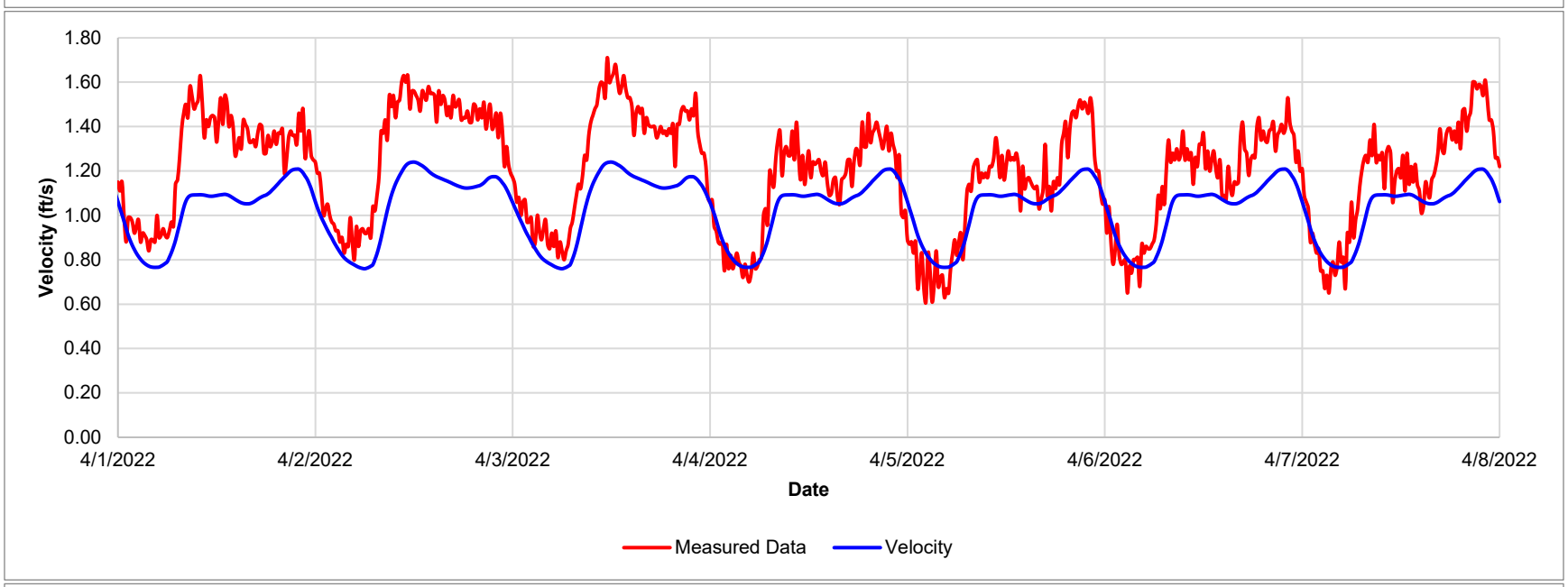


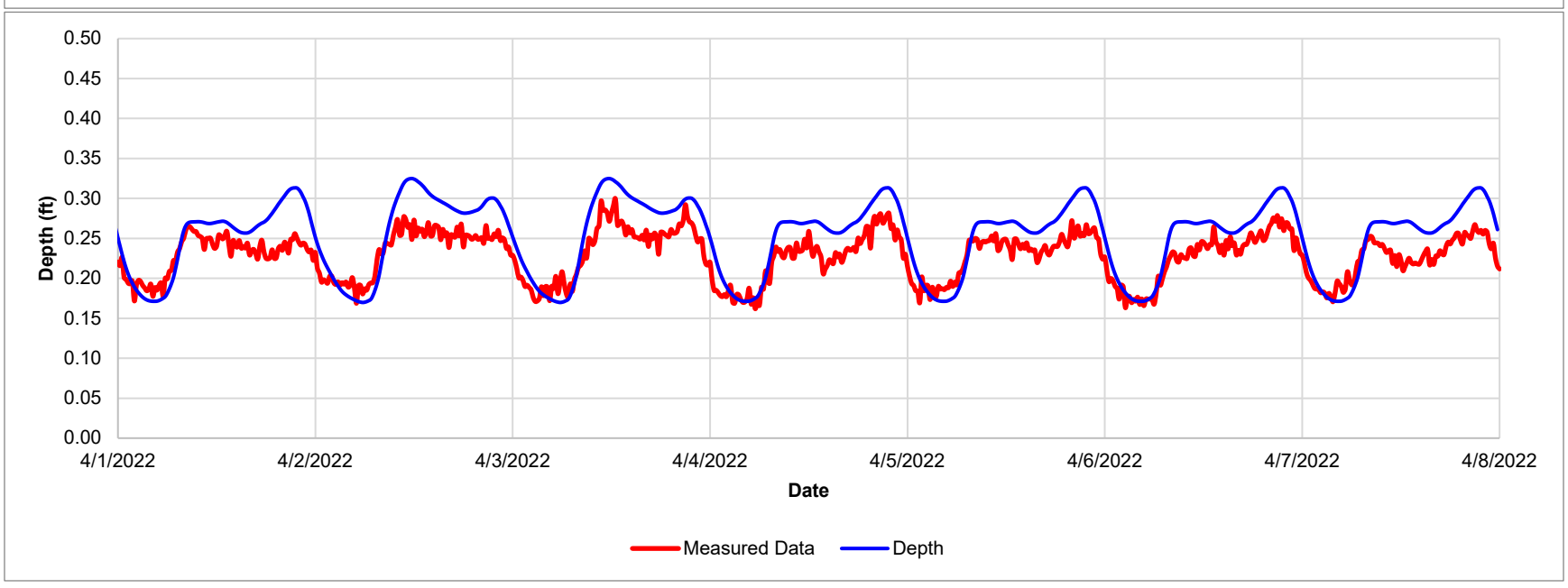


Site 5	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.22	1.27	0.13	0.11	0.35	0.46	0.09	54.2%	-63.8%	-31.5%	-15.3%
Min	0.05	0.35	0.00	0.00	0.20	0.07	0.01				
Avg	0.14	0.80	0.05	0.05	0.28	0.29	0.05	106.4%	-64.0%	-0.9%	-0.9%
Volume			94,259	94,236			93,387			-0.9%	-0.9%

1.6 SITE 6 – DWF

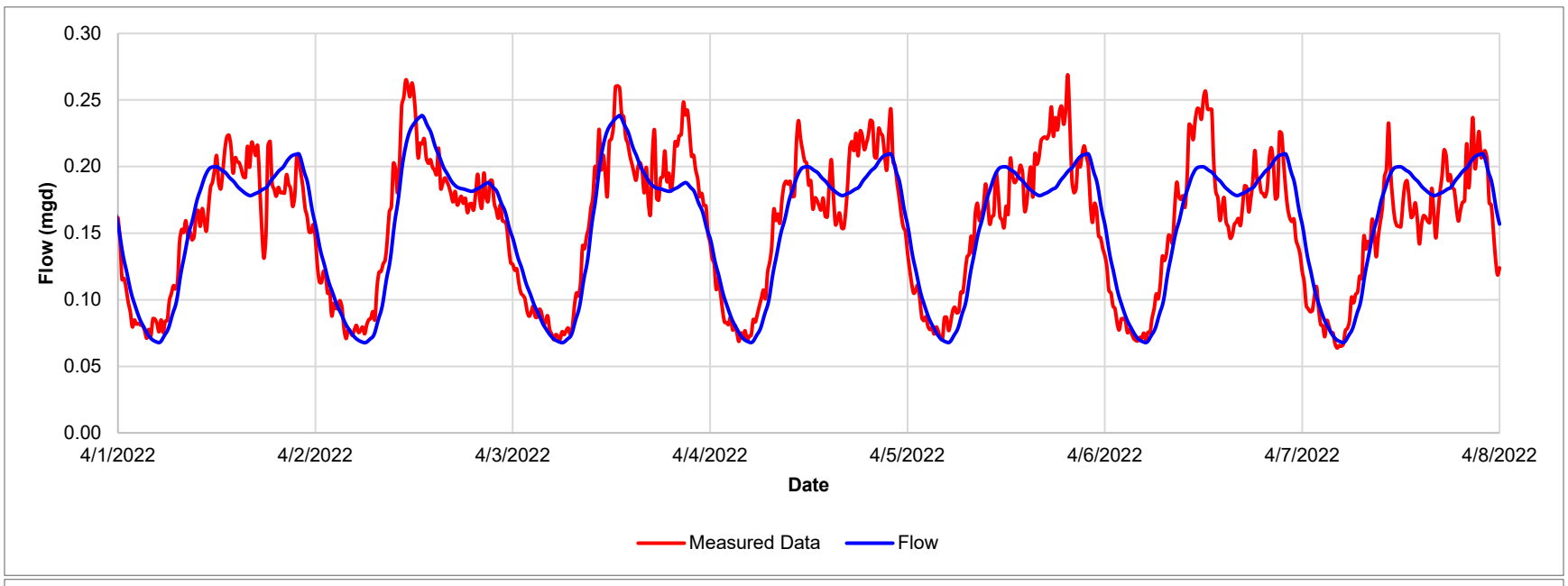


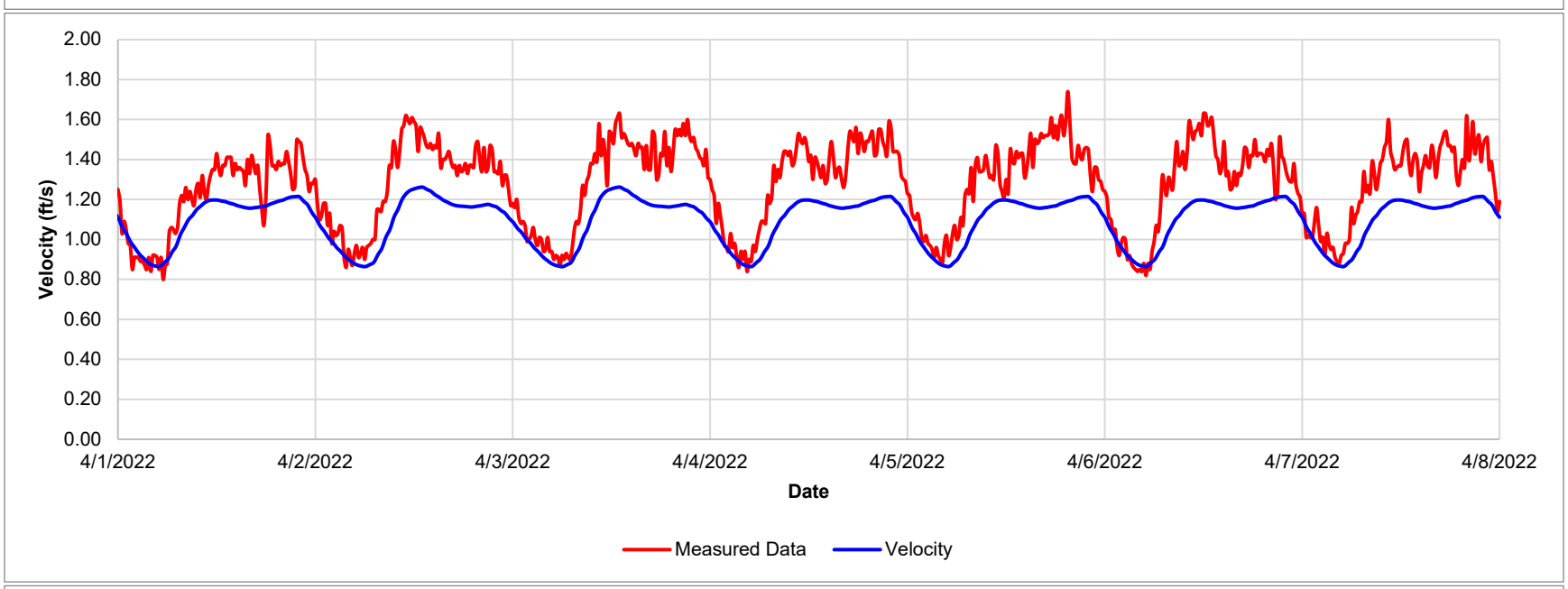


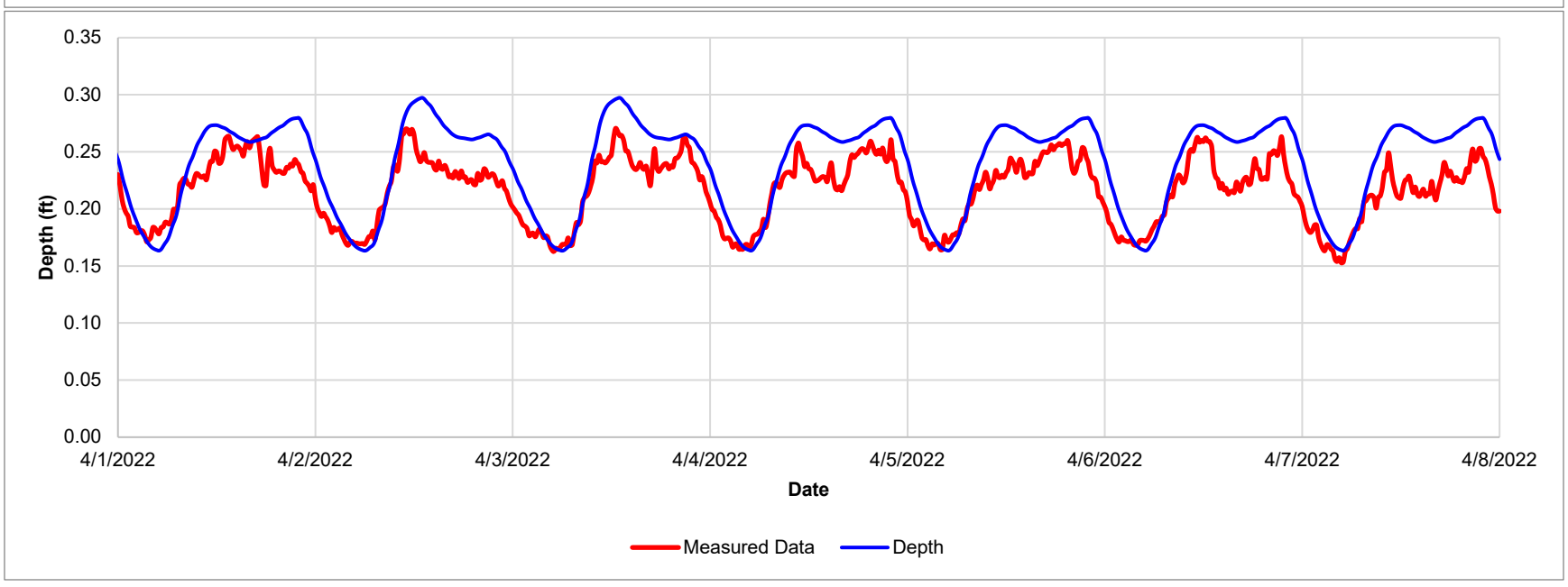


Site 6	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.30	1.71	0.30	0.27	0.32	1.24	0.25	8.6%	-27.5%	-16.6%	-8.8%
Min	0.16	0.61	0.05	0.06	0.17	0.76	0.06				
Avg	0.23	1.20	0.15	0.15	0.25	1.03	0.15	10.4%	-14.0%	0.1%	0.1%
Volume			297,889	297,899			298,133			0.1%	0.1%

1.7 SITE 7 – DWF

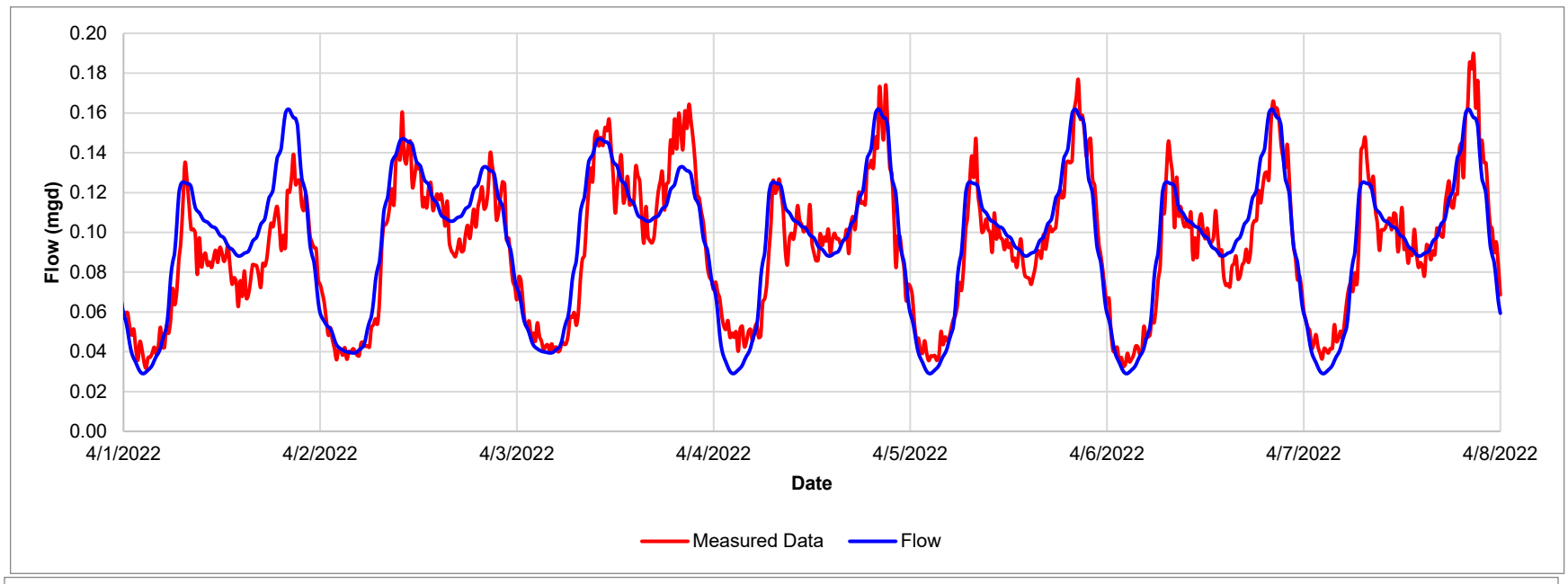


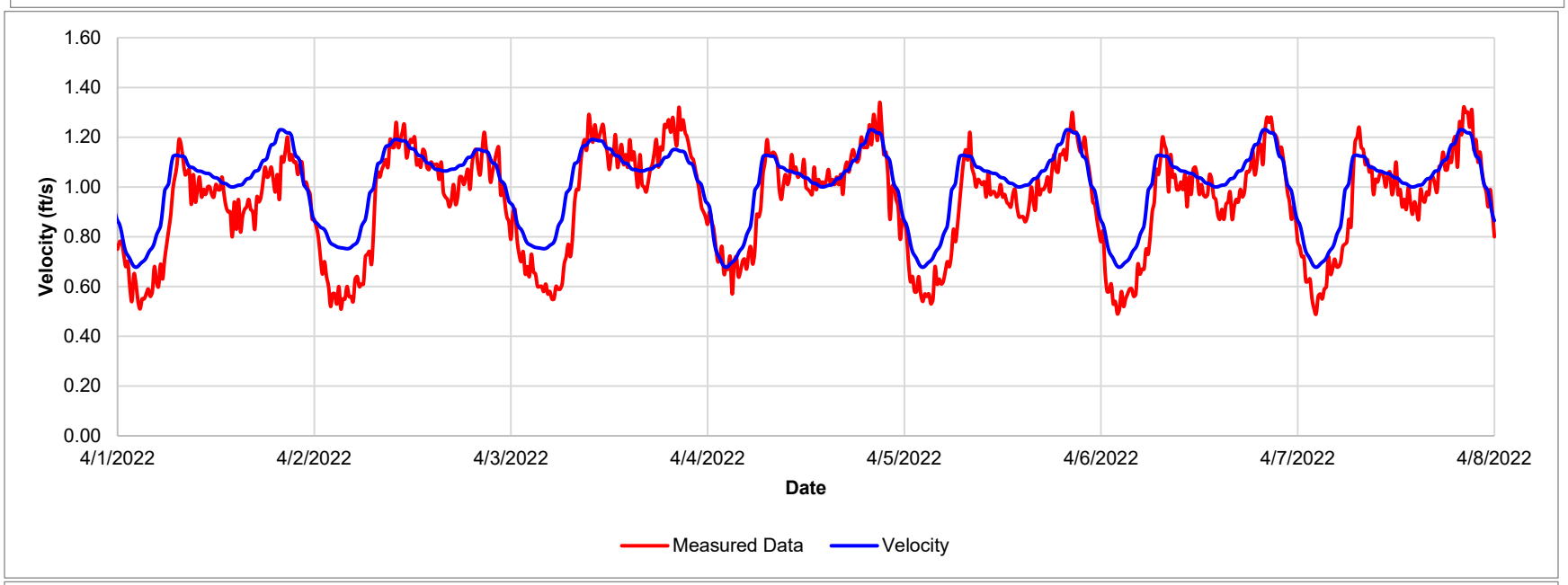


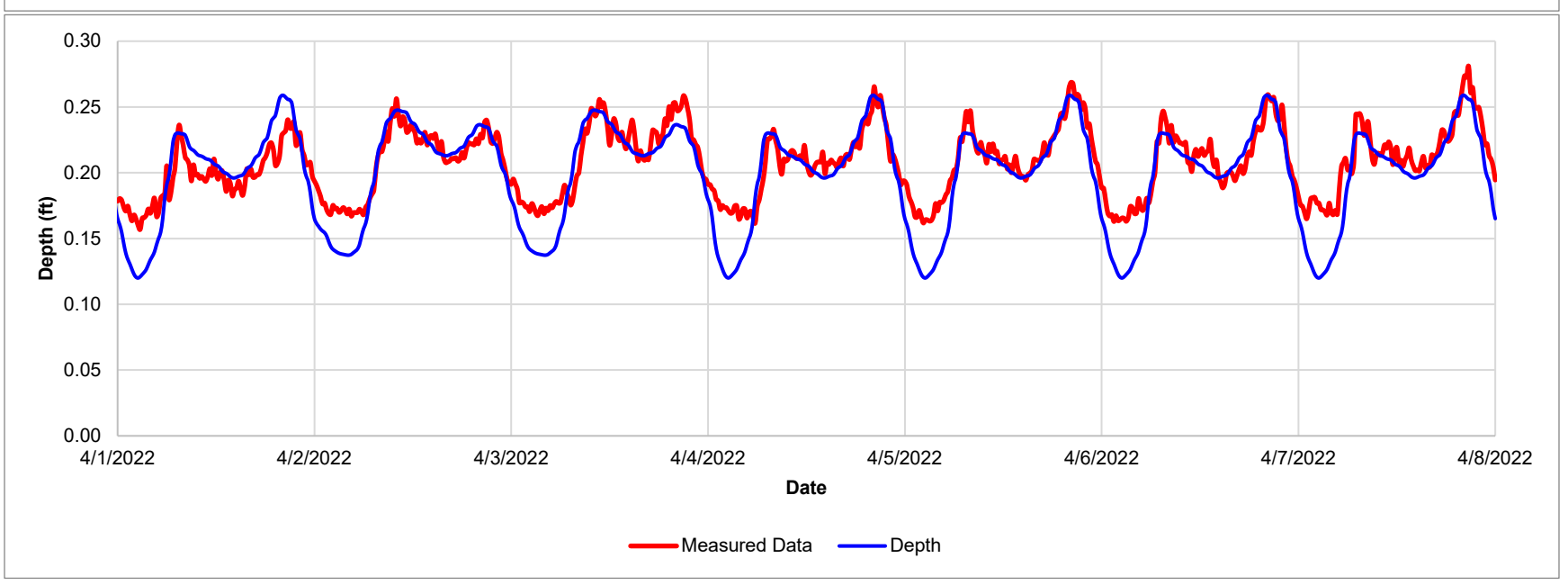


Site 7	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.27	1.74	0.27	0.26	0.30	1.26	0.24	10.0%	-27.5%	-11.4%	-8.4%
Min	0.15	0.80	0.06	0.07	0.16	0.86	0.07				
Avg	0.22	1.28	0.16	0.16	0.24	1.10	0.16	10.4%	-14.1%	-0.6%	-0.7%
Volume			313,823	313,895			311,830			-0.6%	-0.7%

1.8 SITE 8 – DWF

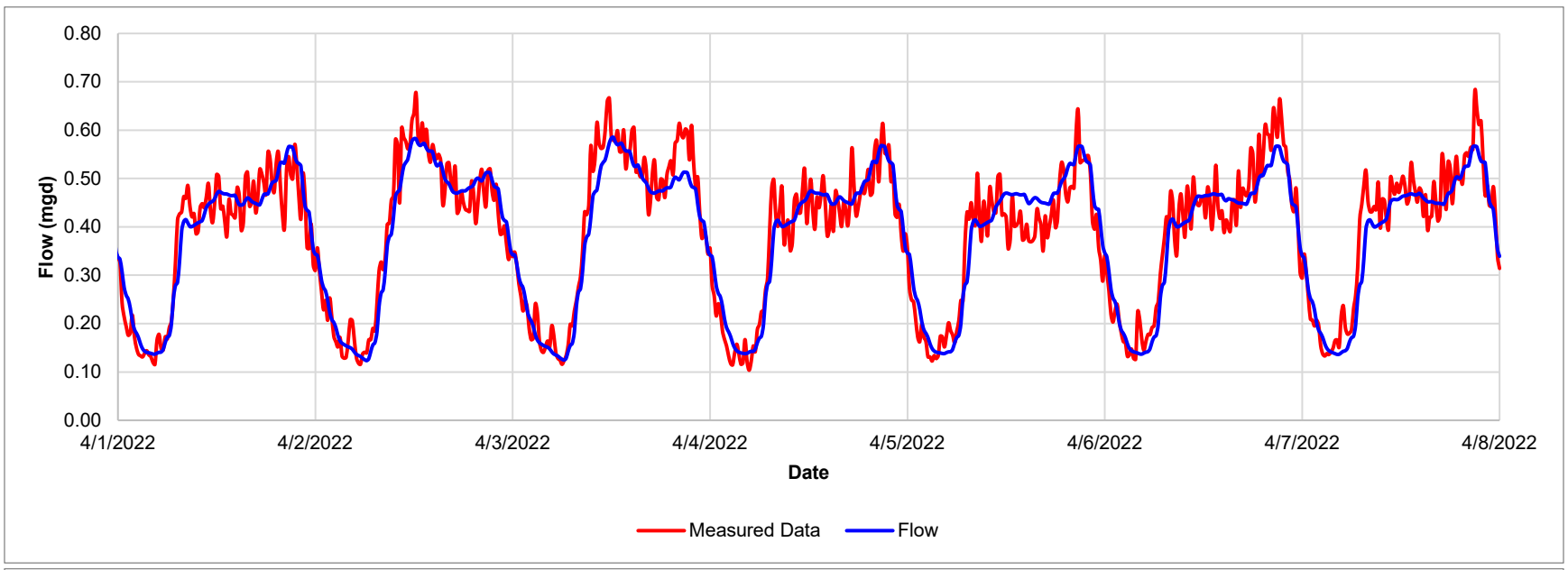


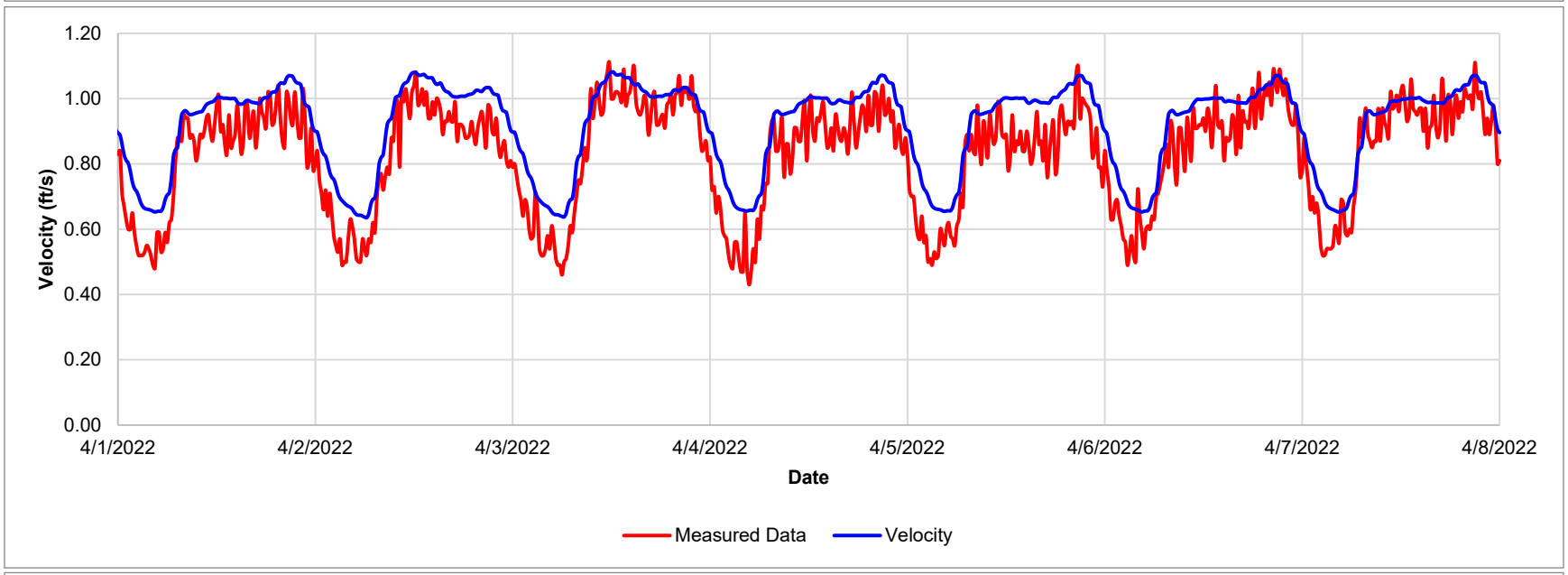


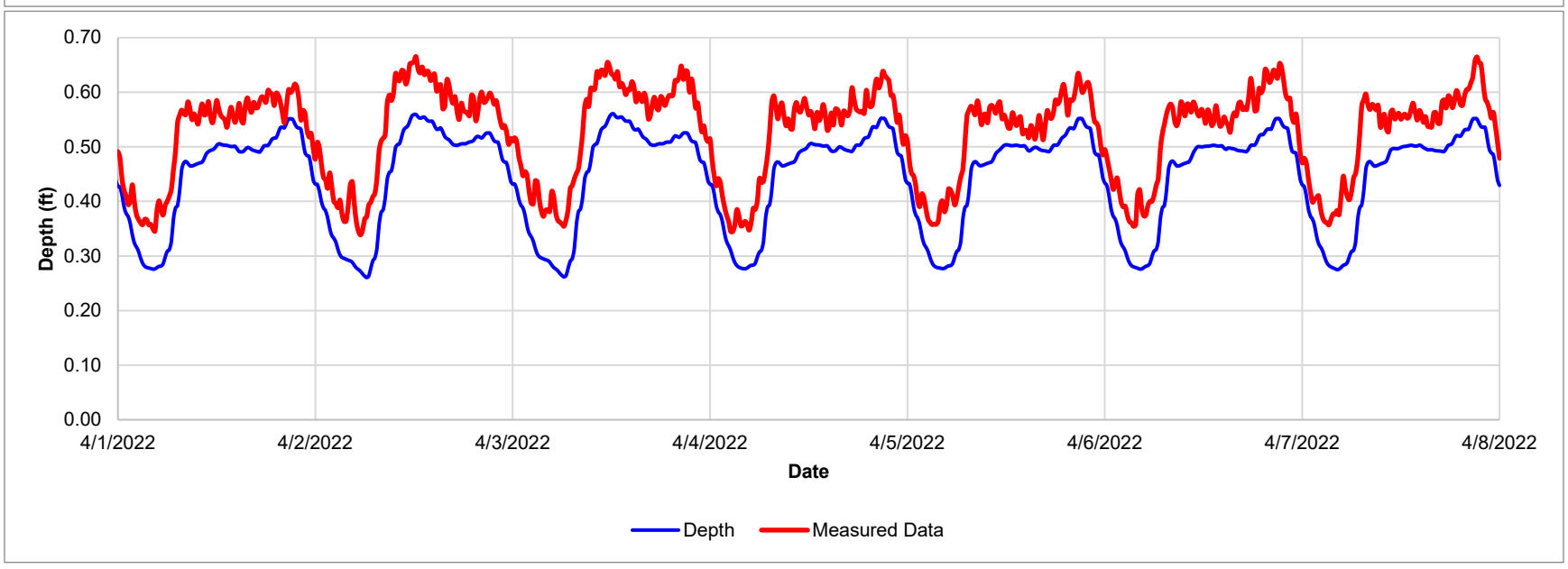


Site 8	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.28	1.34	0.19	0.19	0.26	1.23	0.16	-6.8%	-8.2%	-14.6%	-14.0%
Min	0.16	0.49	0.03	0.04	0.12	0.68	0.03				
Avg	0.21	0.94	0.09	0.10	0.20	1.01	0.10	-5.9%	6.5%	2.9%	-5.9%
Volume			185,394	202,746			190,737			2.9%	-5.9%

1.9 SITE 9 – DWF

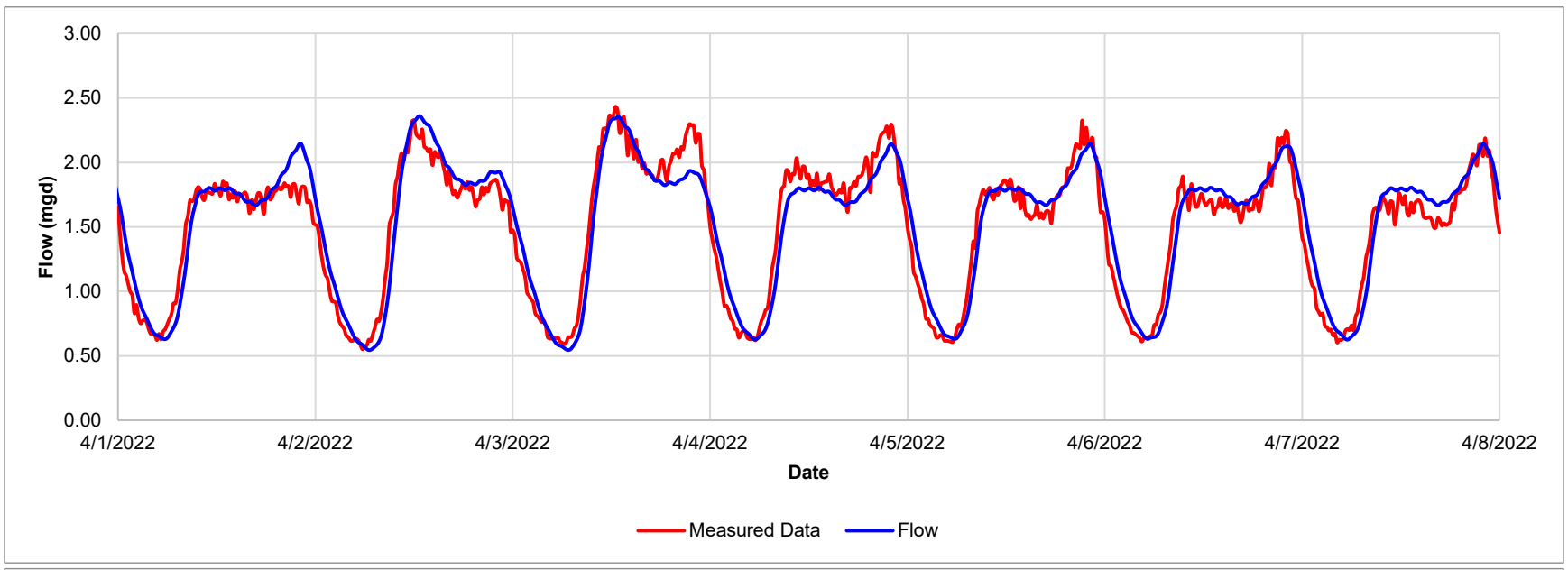


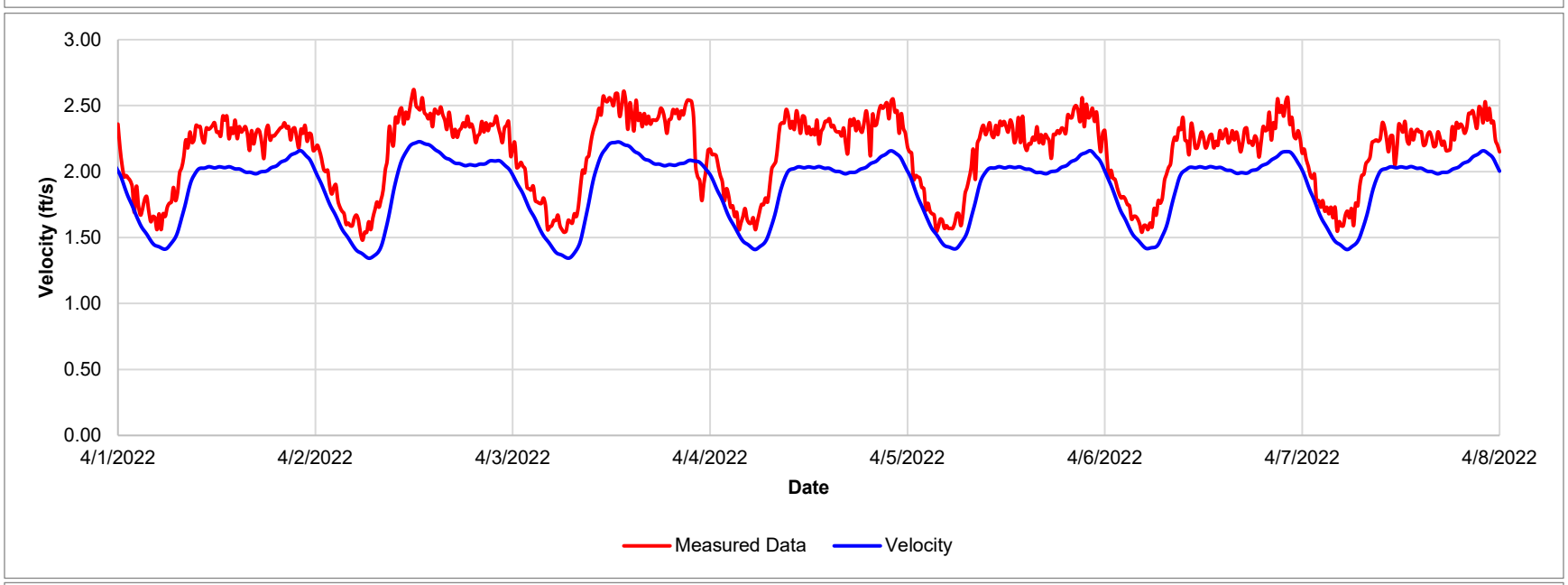


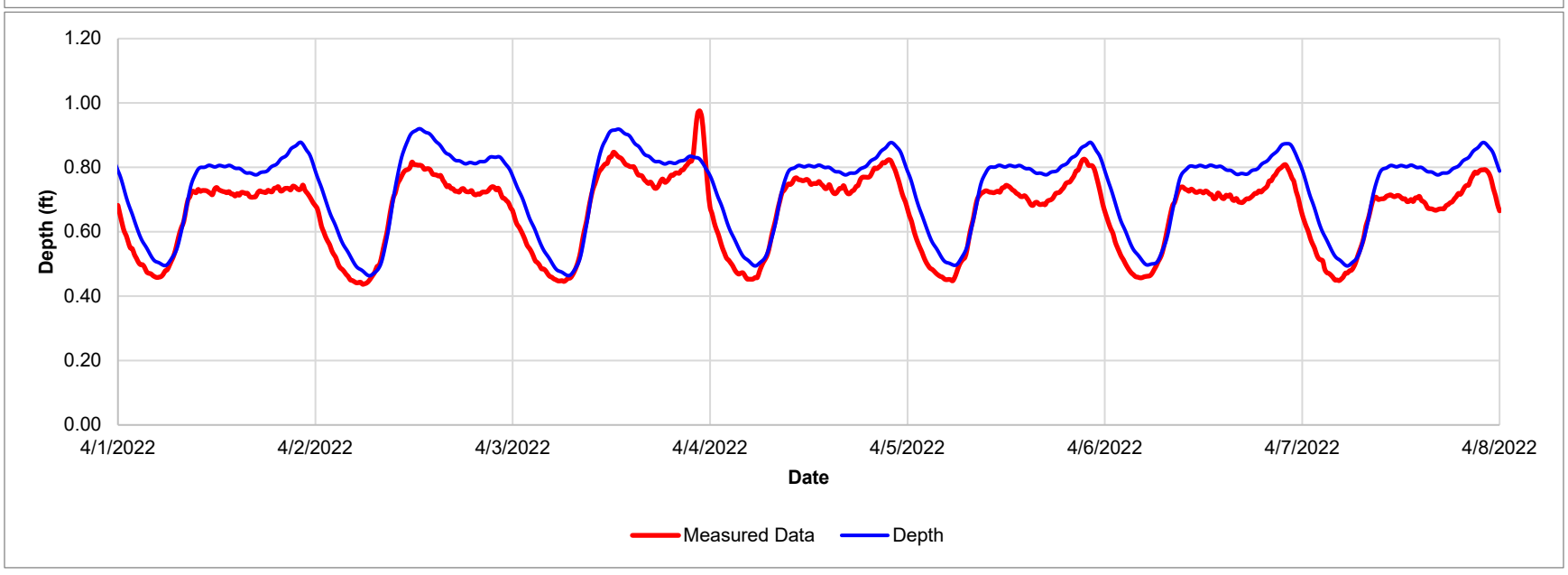


Site 9	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.67	1.11	0.68	0.64	0.56	1.08	0.59	-15.7%	-2.6%	-14.2%	-8.4%
Min	0.34	0.43	0.10	0.12	0.26	0.64	0.12				
Avg	0.52	0.83	0.39	0.39	0.45	0.92	0.38	-15.1%	10.4%	-1.4%	-1.4%
Volume			774,240	774,280			763,615			-1.4%	-1.4%

1.10 SITE 10 – DWF

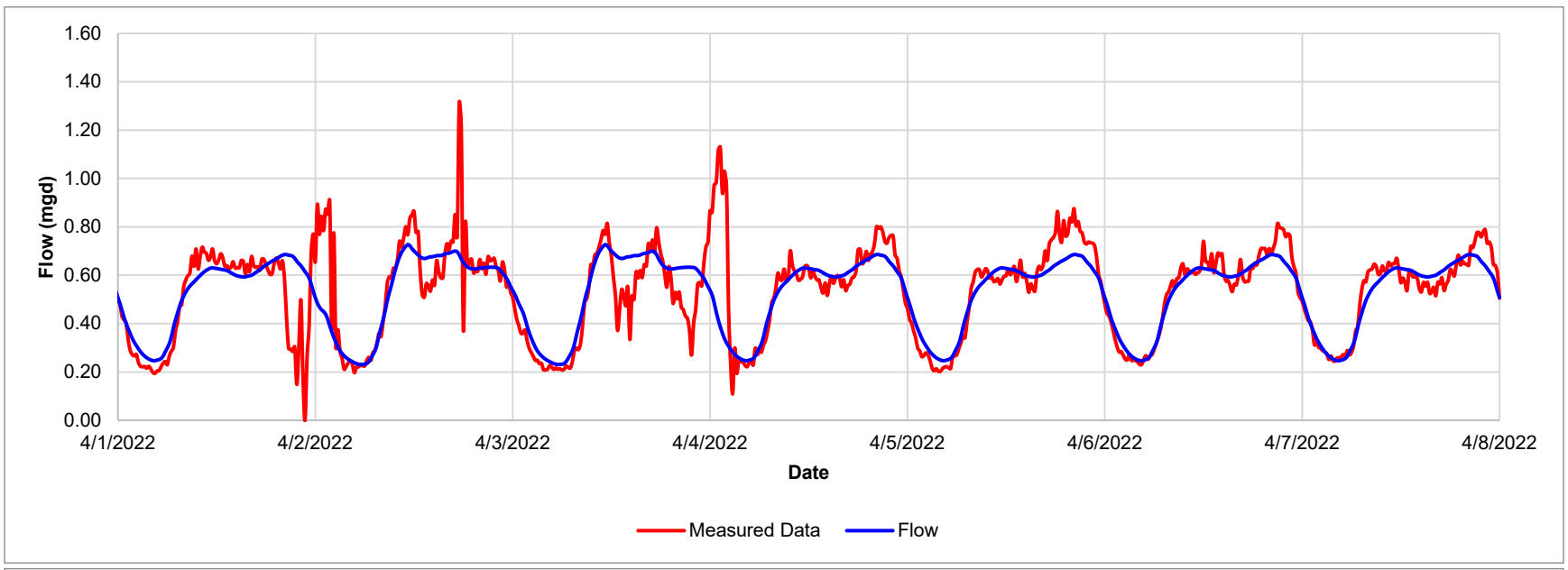


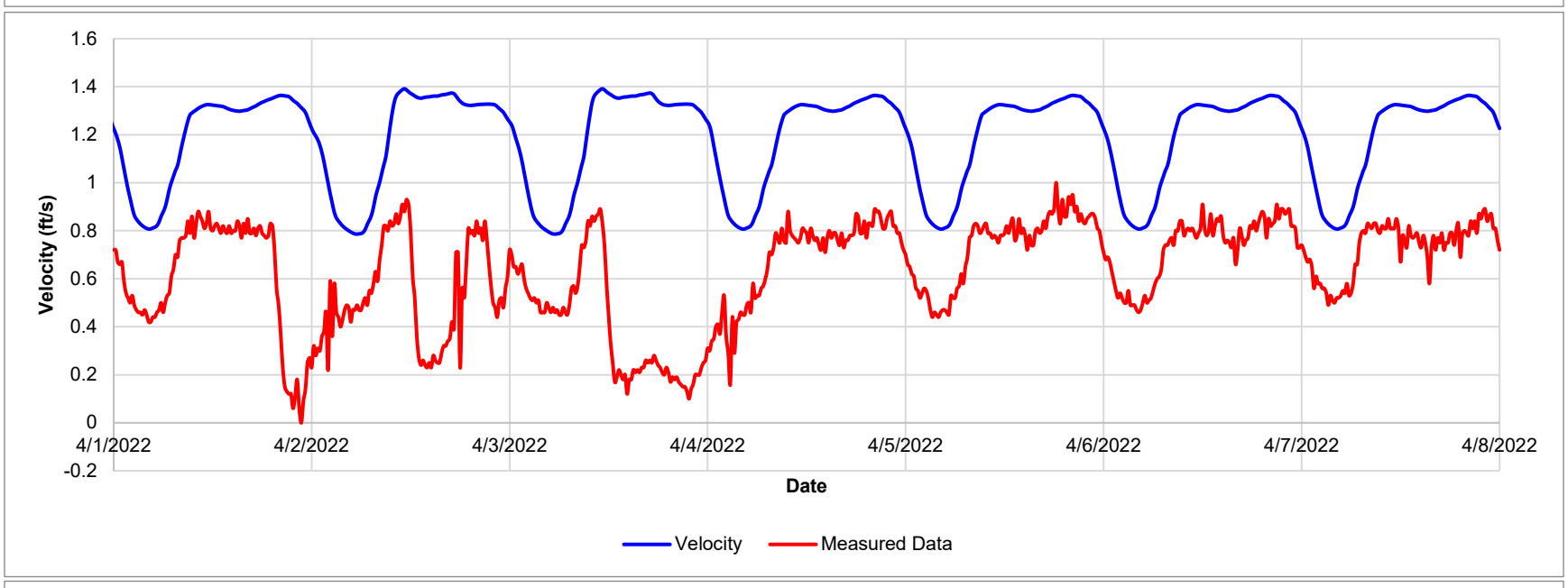


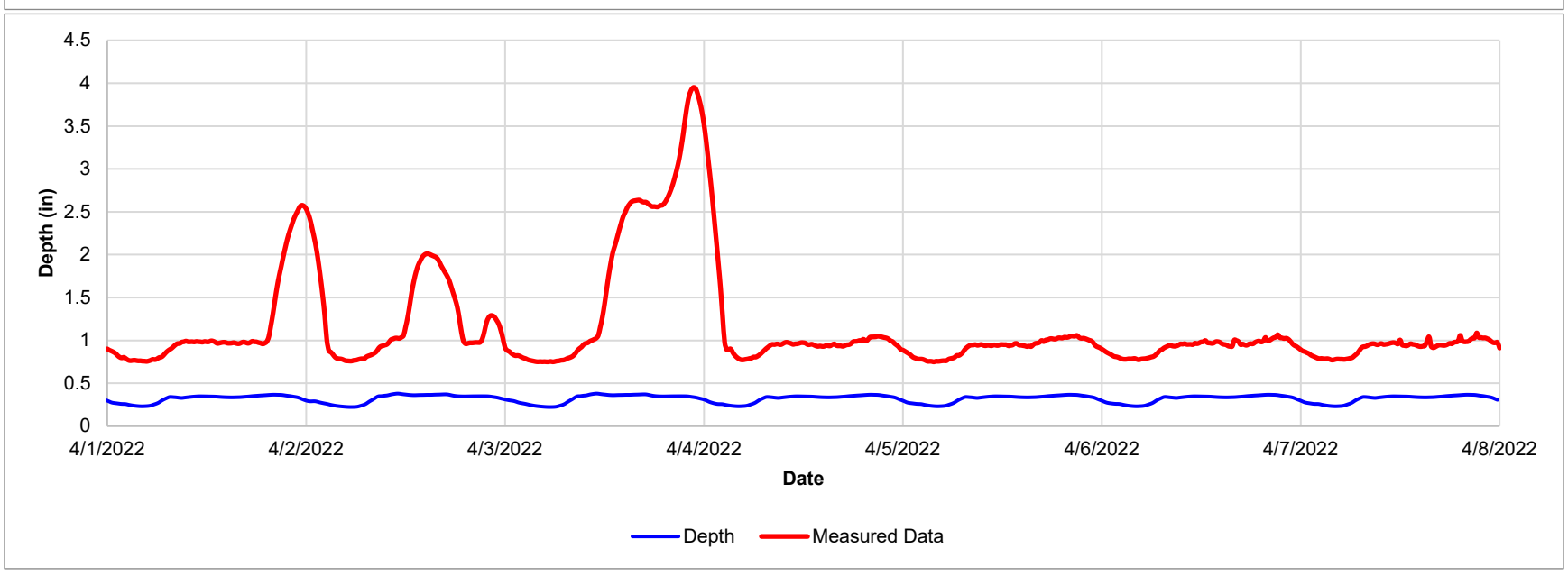


Site 10	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.98	2.62	2.43	2.39	0.92	2.23	2.36	-5.7%	-15.0%	-3.0%	-1.3%
Min	0.44	1.48	0.55	0.57	0.46	1.34	0.54				
Avg	0.66	2.14	1.50	1.50	0.73	1.89	1.52	10.2%	-11.9%	0.9%	0.9%
Volume			3,003,787	3,003,928			3,032,272			0.9%	0.9%

1.11 SITE 11 – DWF

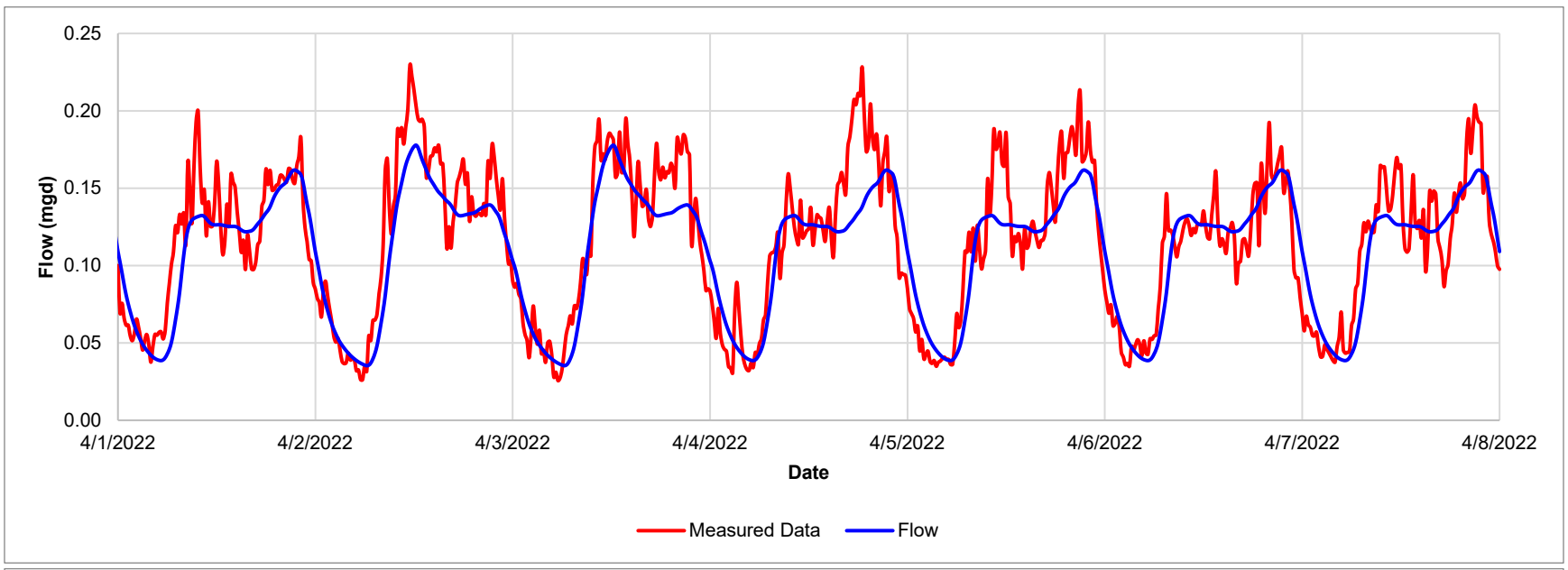


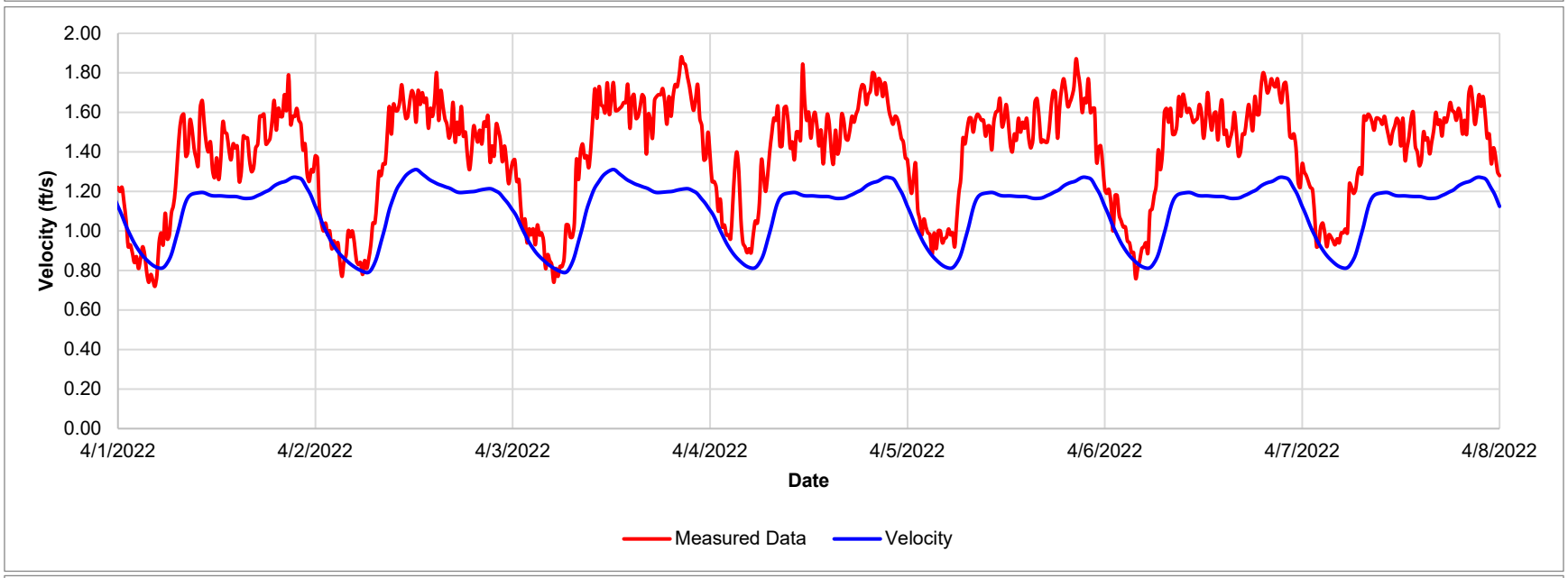


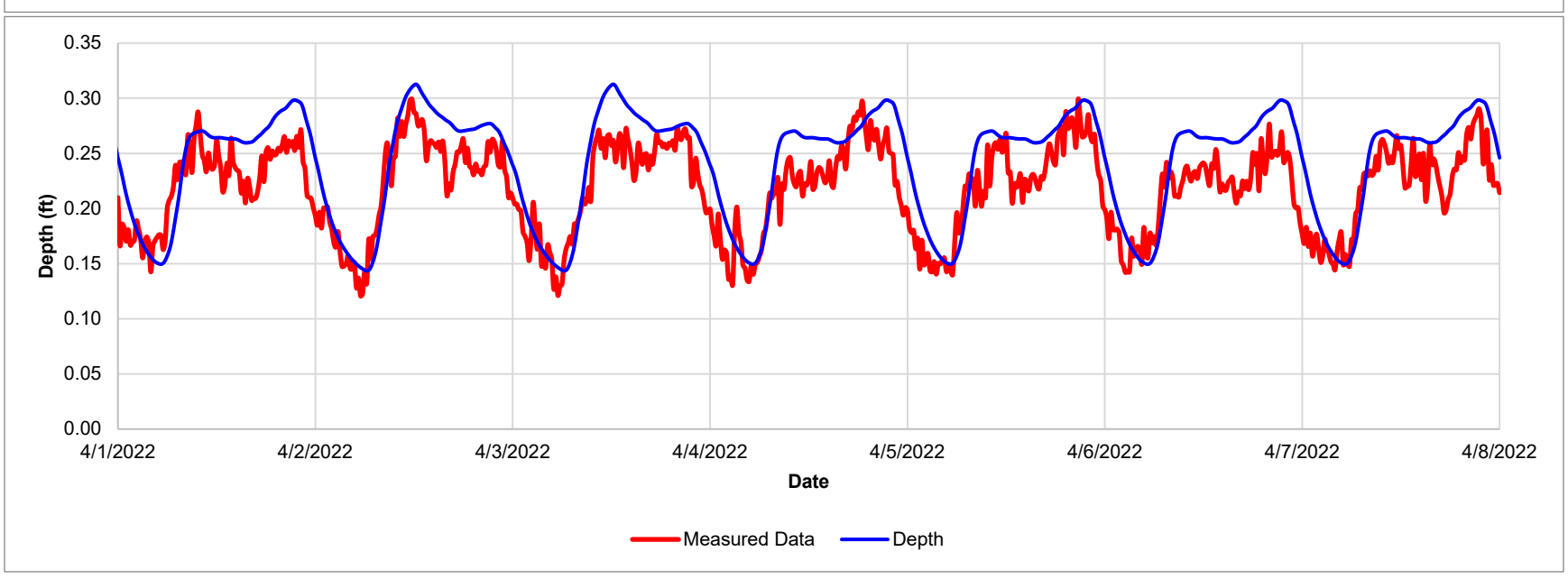


Site 11	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	3.95	1.00	1.31	1.05	0.38	1.39	0.73	-90.4%	39.1%	-44.7%	-31.0%
Min	0.75	0.00	0.00	0.20	0.22	0.79	0.23				
Avg	1.15	0.63	0.53	0.53	0.32	1.19	0.53	-72.2%	87.7%	-1.2%	-1.2%
Volume			1,068,346	1,068,364			1,055,486			-1.2%	-1.2%

1.12 SITE 12 – DWF

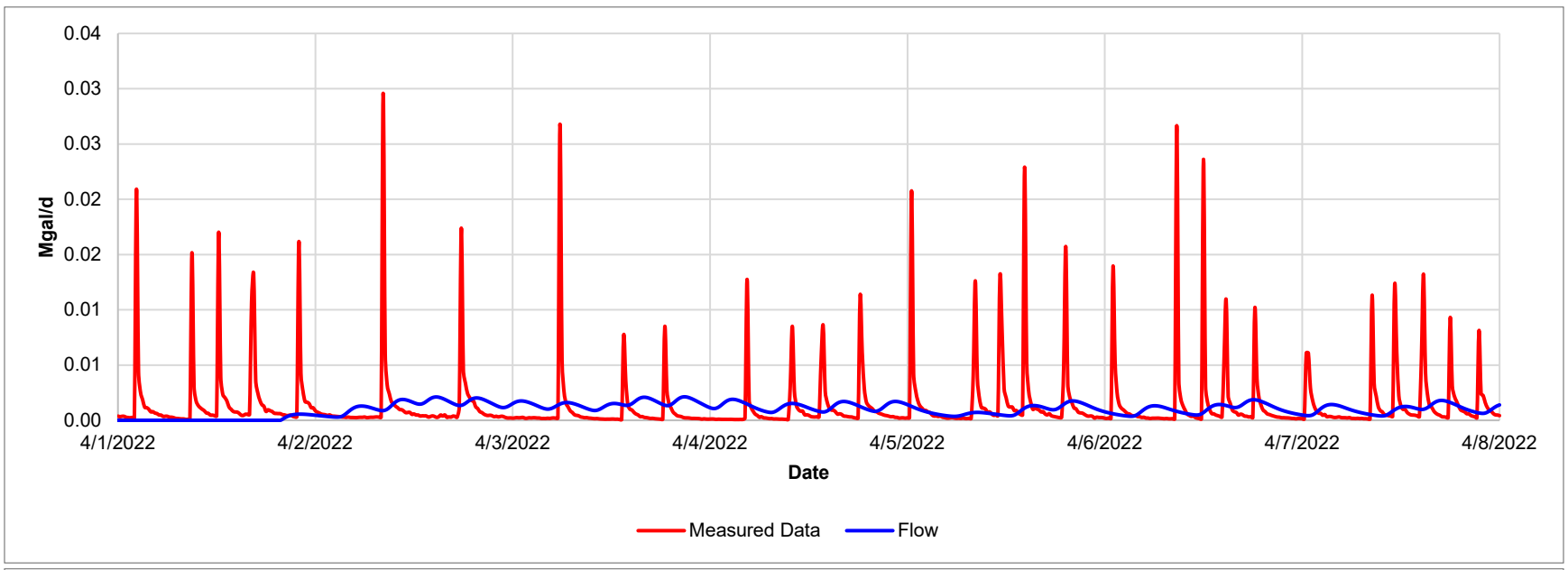


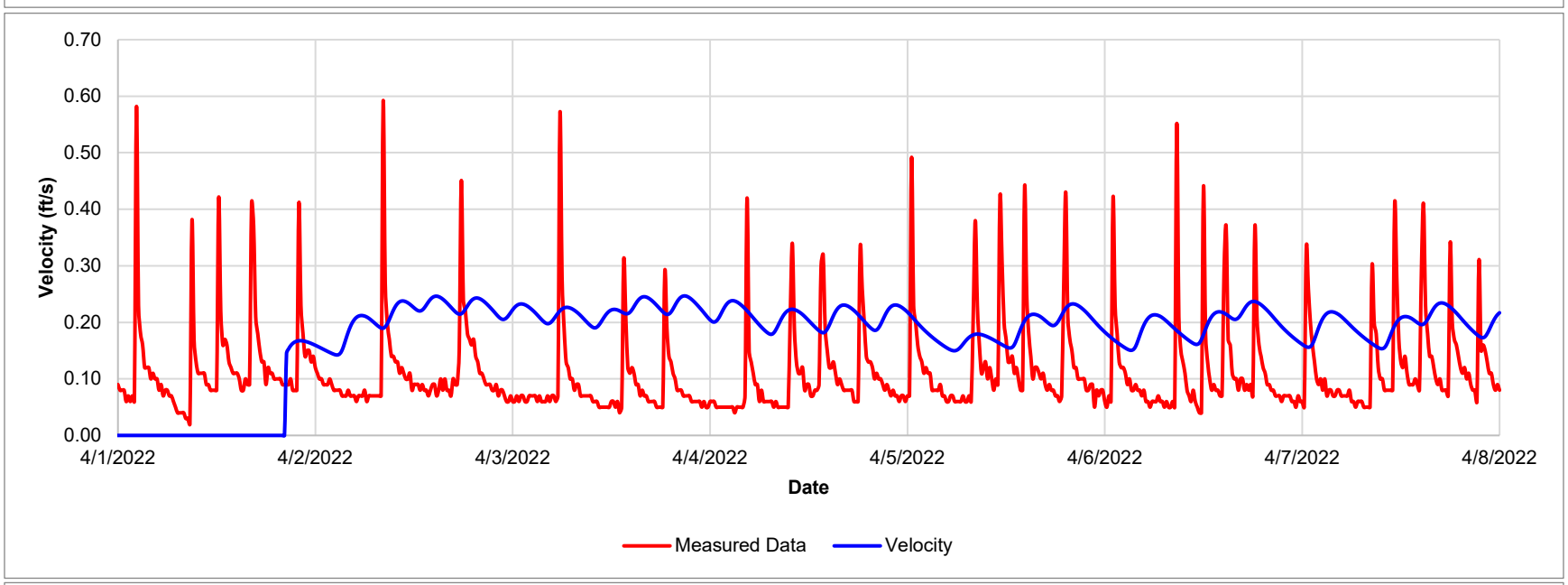


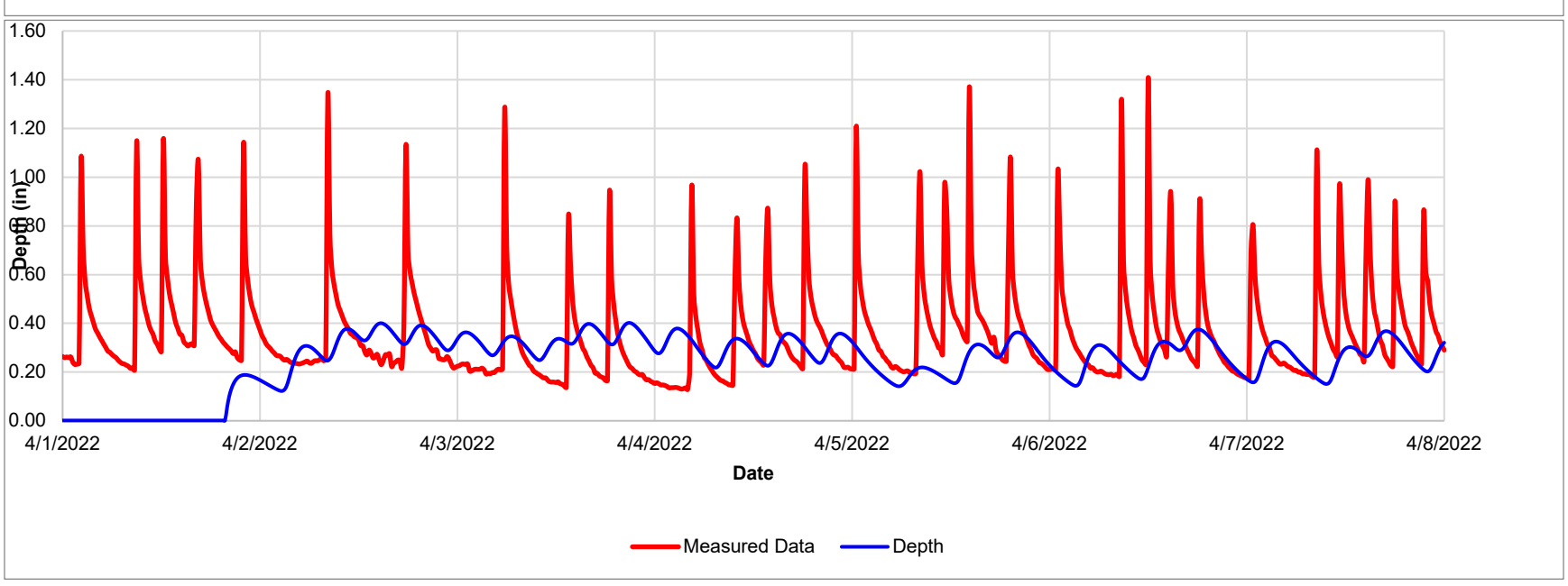


Site 12	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.30	1.82	0.23	0.22	0.31	1.31	0.18	4.5%	-28.0%	-22.5%	-18.0%
Min	0.12	0.70	0.03	0.03	0.14	0.79	0.04				
Avg	0.22	1.33	0.12	0.12	0.24	1.11	0.11	10.5%	-16.9%	-5.4%	-5.4%
Volume			231,775	231,815			219,349			-5.4%	-5.4%

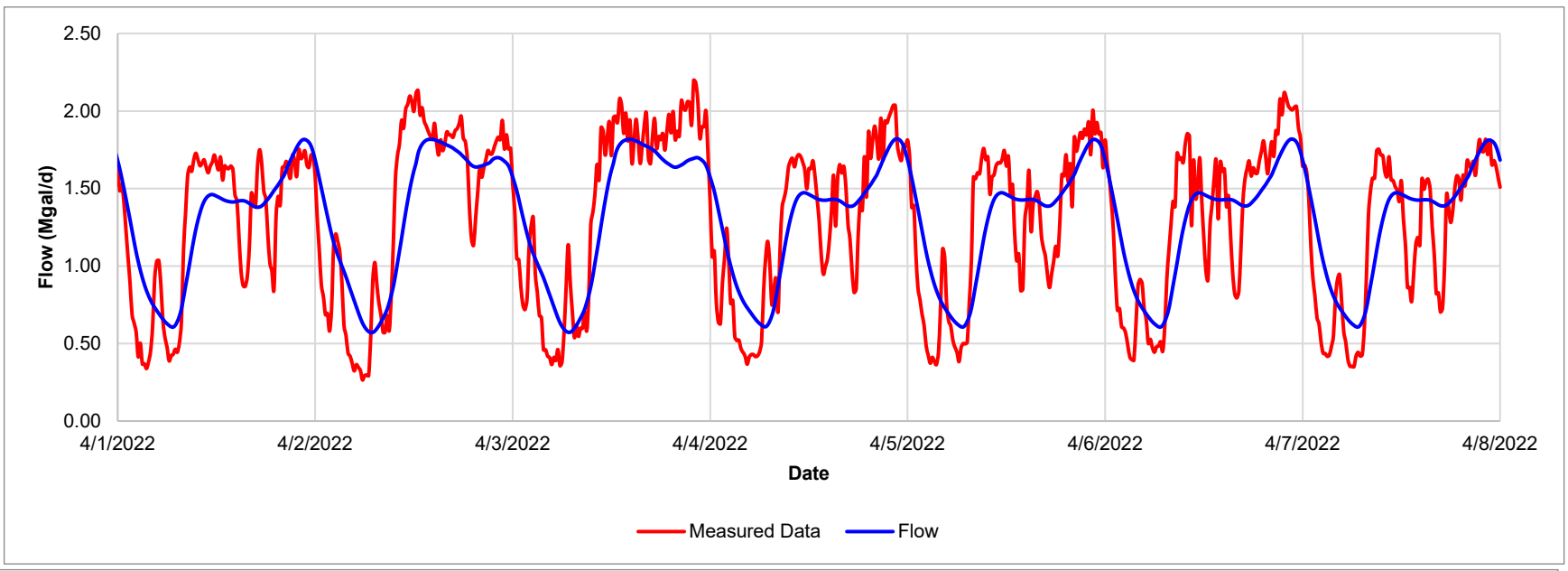
1.13 SITE 13 – DWF (FLOW DATA COULD NOT BE USED)

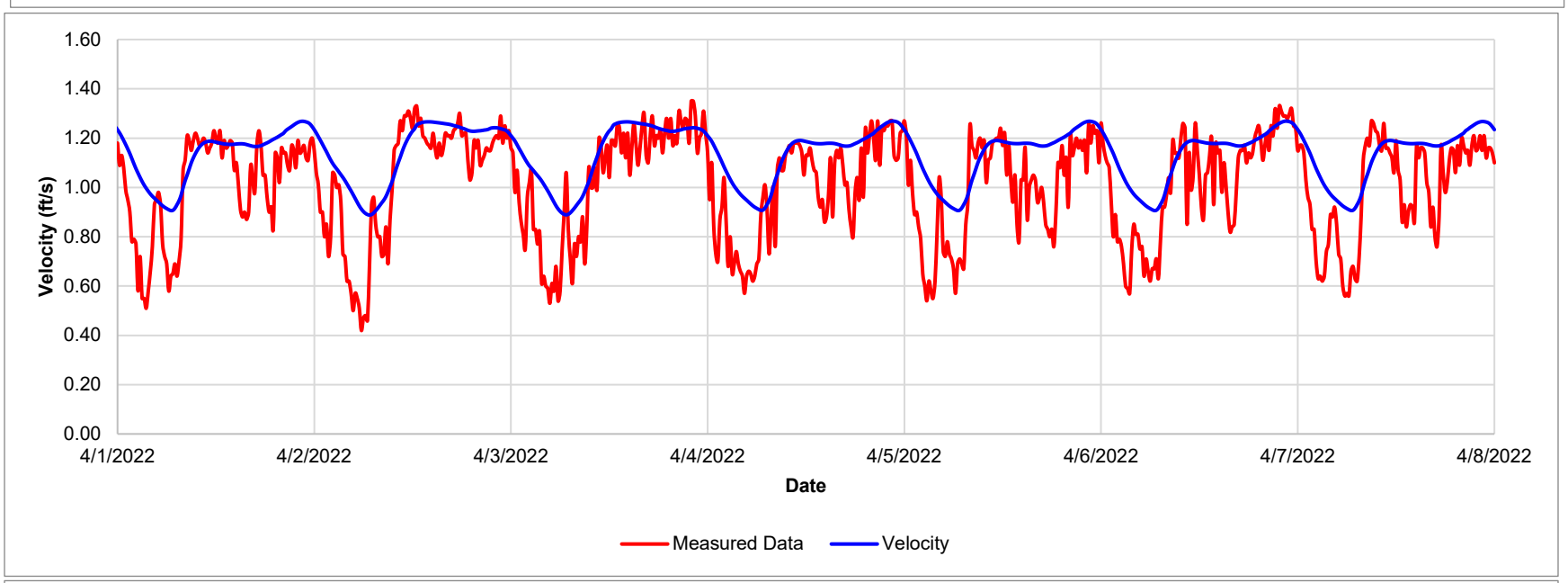


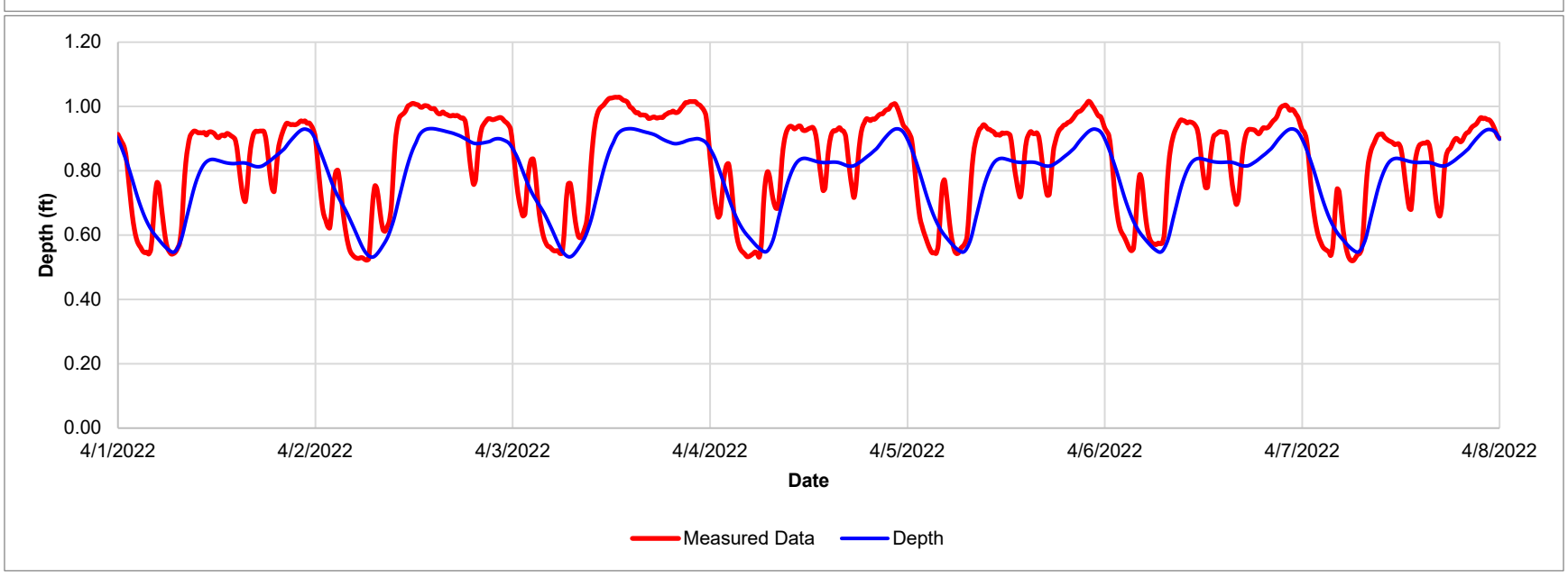




1.14 SITE 14 – DWF

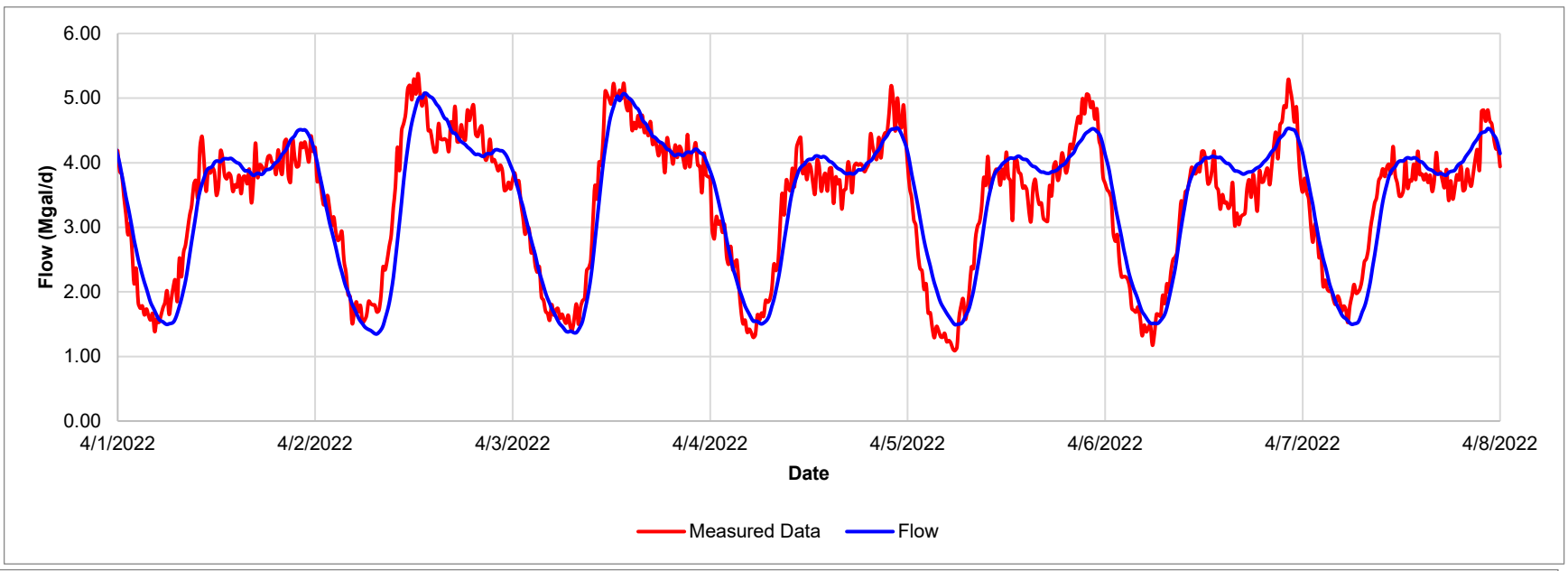


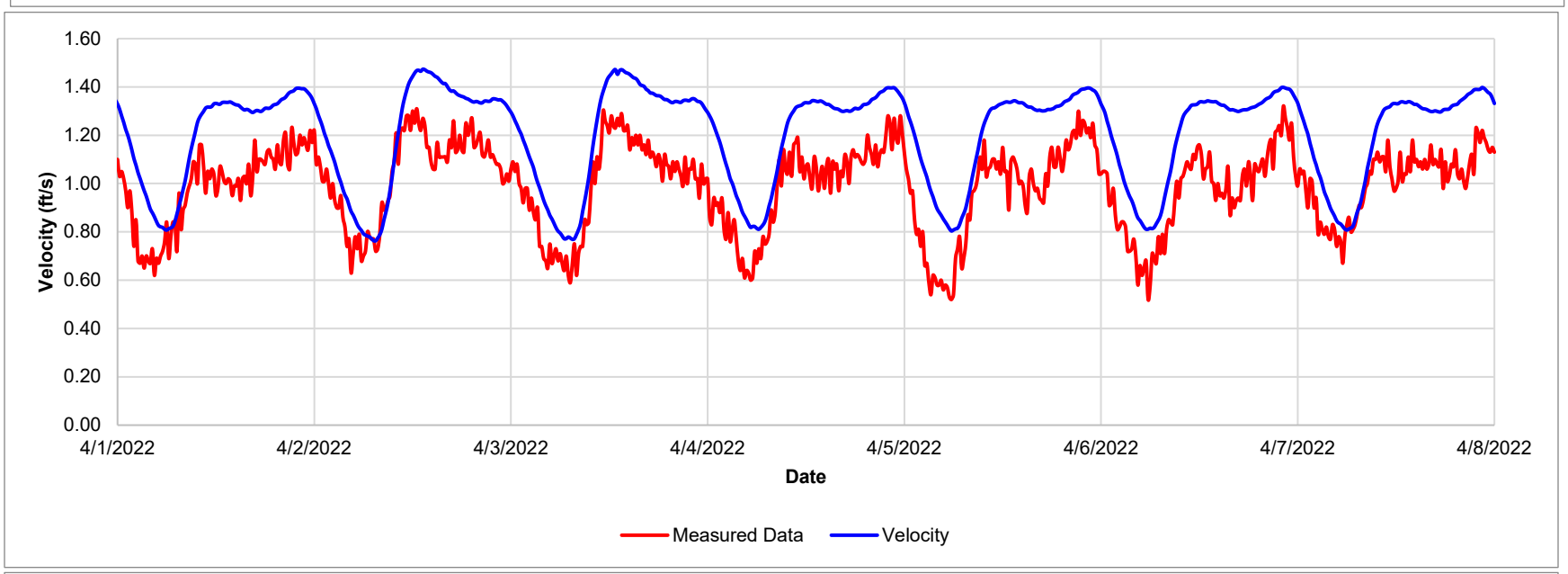


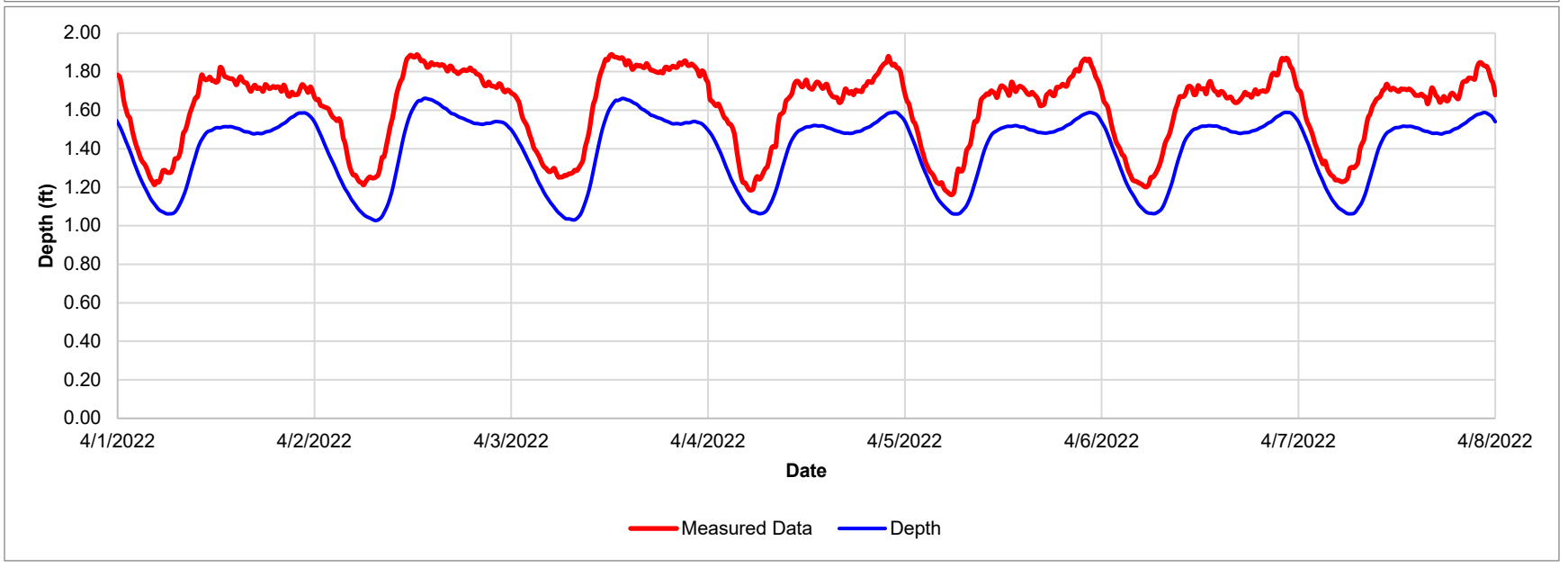


Site 14	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	1.03	1.35	2.20	2.09	0.93	1.27	1.82	-9.5%	-6.0%	-17.2%	-12.9%
Min	0.52	0.42	0.27	0.29	0.53	0.89	0.57				
Avg	0.83	1.01	1.29	1.29	0.78	1.13	1.31	-5.3%	12.5%	1.0%	1.0%
Volume			2,583,853	2,584,016			2,610,837			1.0%	1.0%

1.15 SITE 15 – DWF

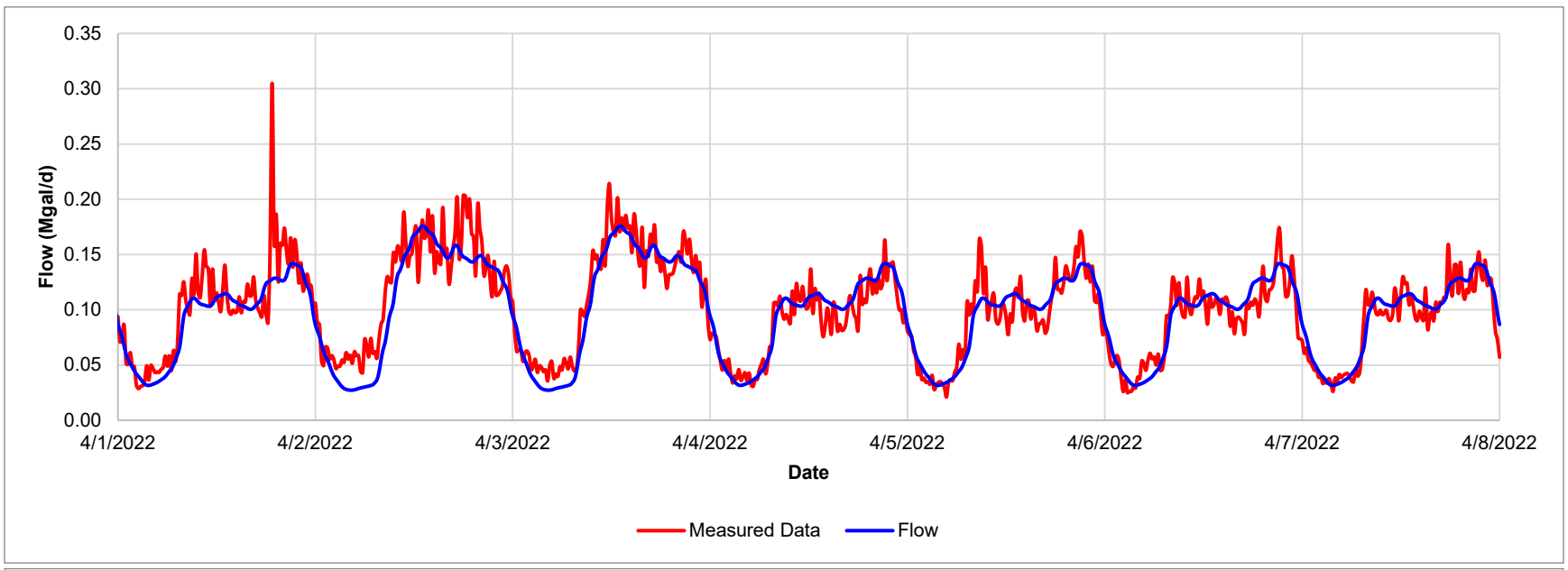


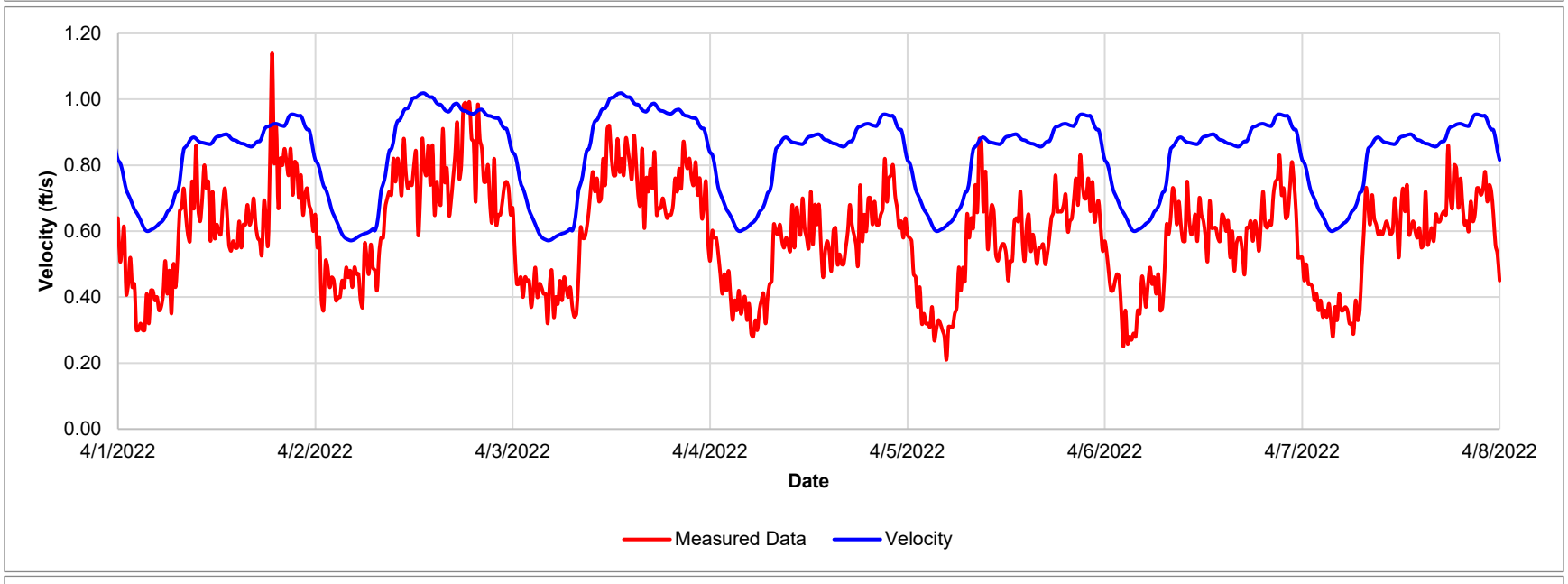


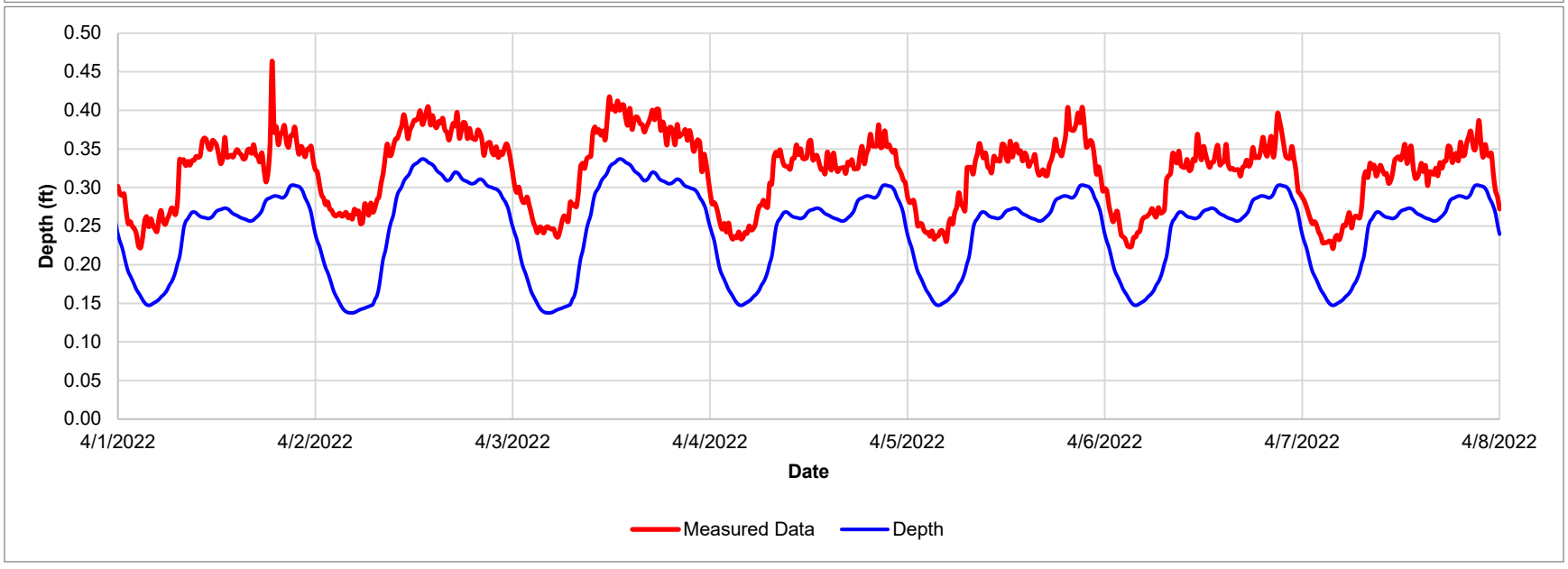


Site 15	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	1.89	1.32	5.38	5.20	1.66	1.47	5.07	-12.1%	11.6%	-5.7%	-2.4%
Min	1.16	0.52	1.09	1.14	1.03	0.76	1.35				
Avg	1.61	0.99	3.37	3.37	1.40	1.20	3.39	-13.1%	21.5%	0.6%	0.6%
Volume			6,737,862	6,737,926			6,778,918			0.6%	0.6%

1.16 SITE 16 – DWF

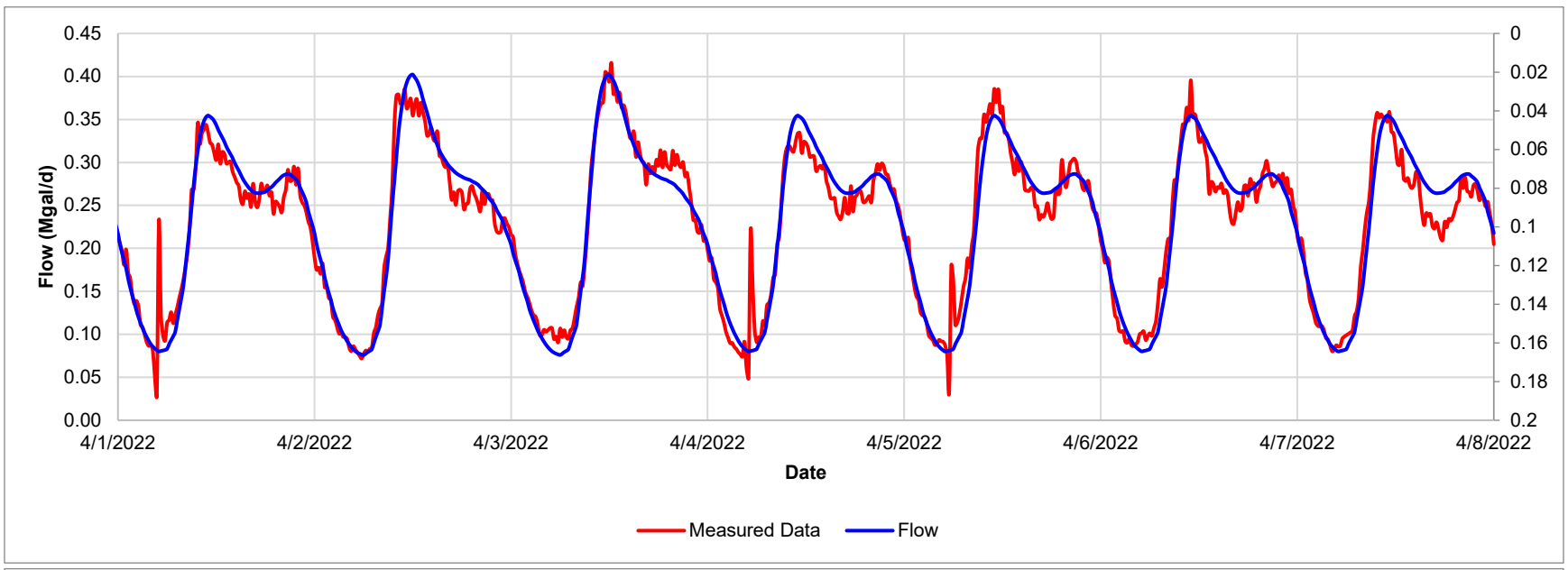


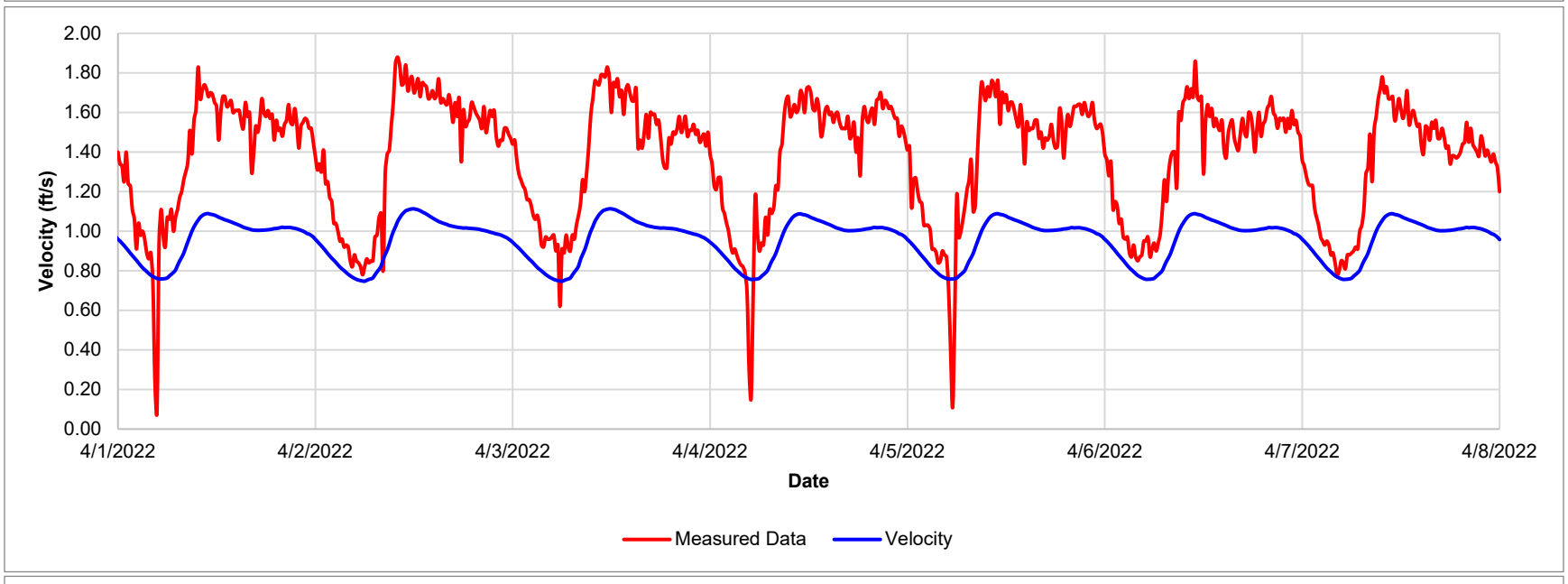


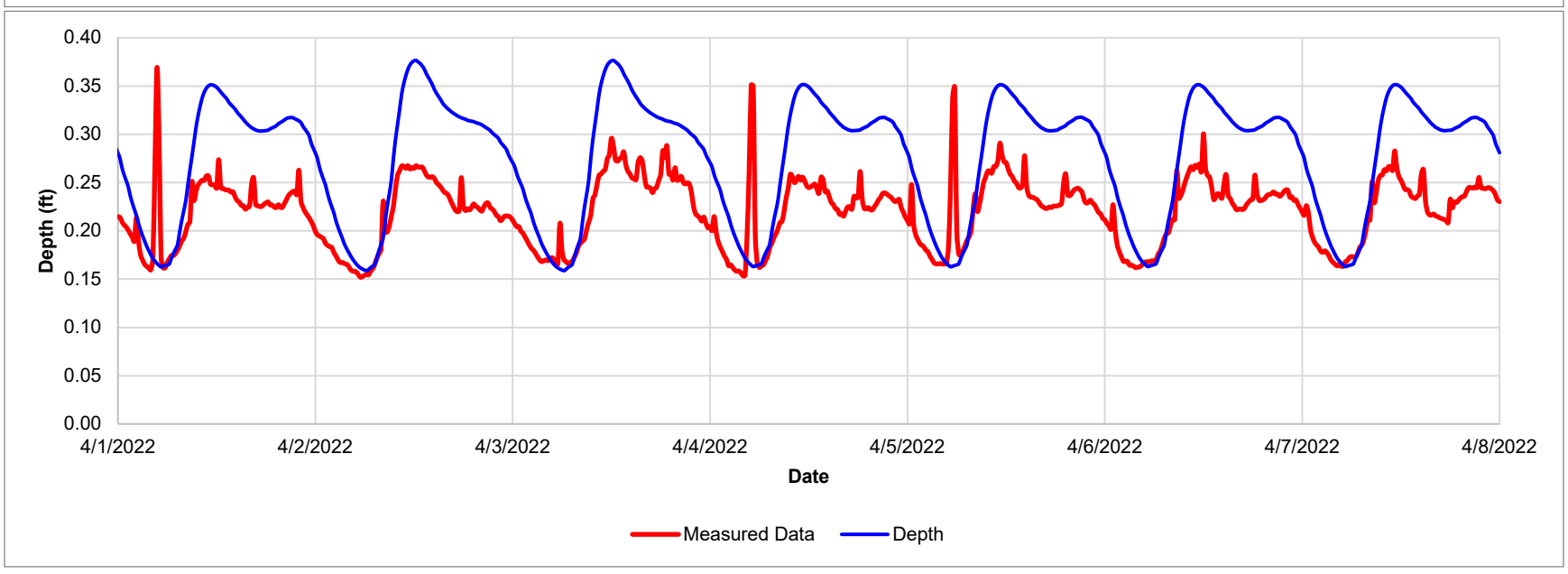


Site 16	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.46	1.14	0.30	0.20	0.34	1.02	0.18	-27.4%	-10.7%	-42.4%	-12.8%
Min	0.22	0.21	0.02	0.03	0.14	0.57	0.03				
Avg	0.32	0.59	0.10	0.10	0.25	0.83	0.10	-23.4%	40.1%	-3.0%	-3.0%
Volume			200,080	200,121			194,162			-3.0%	-3.0%

1.17 SITE 17 – DWF

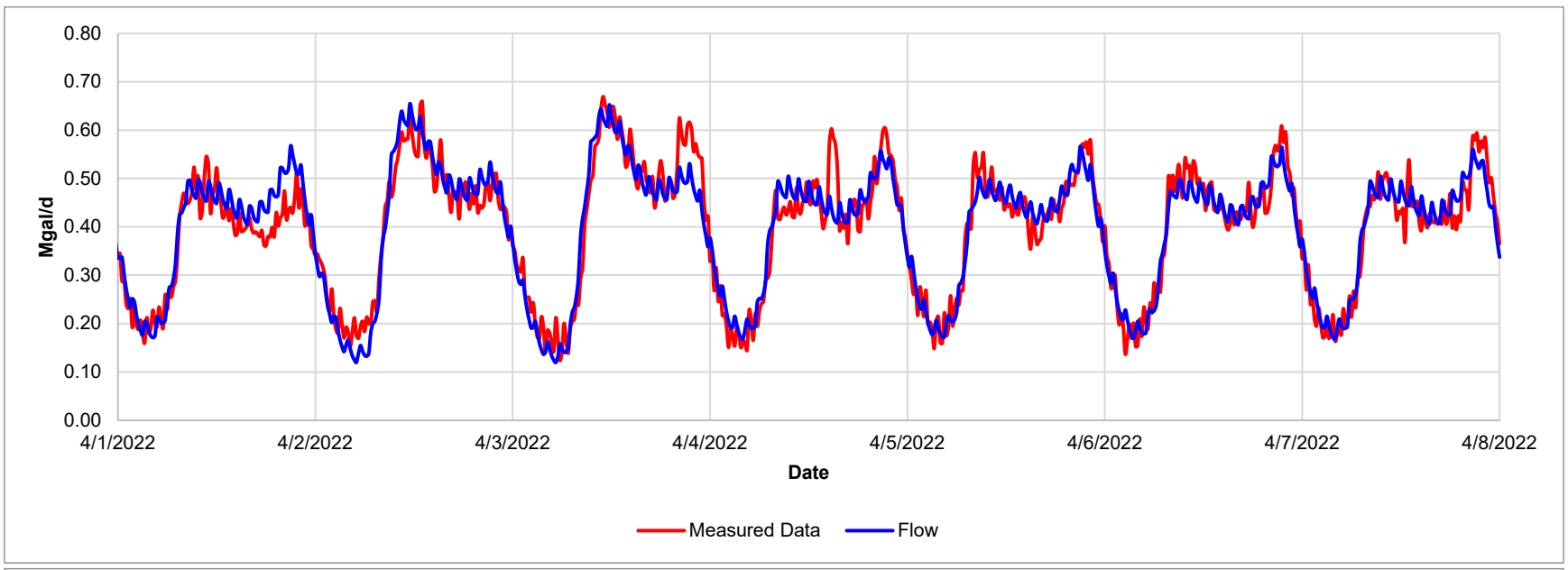


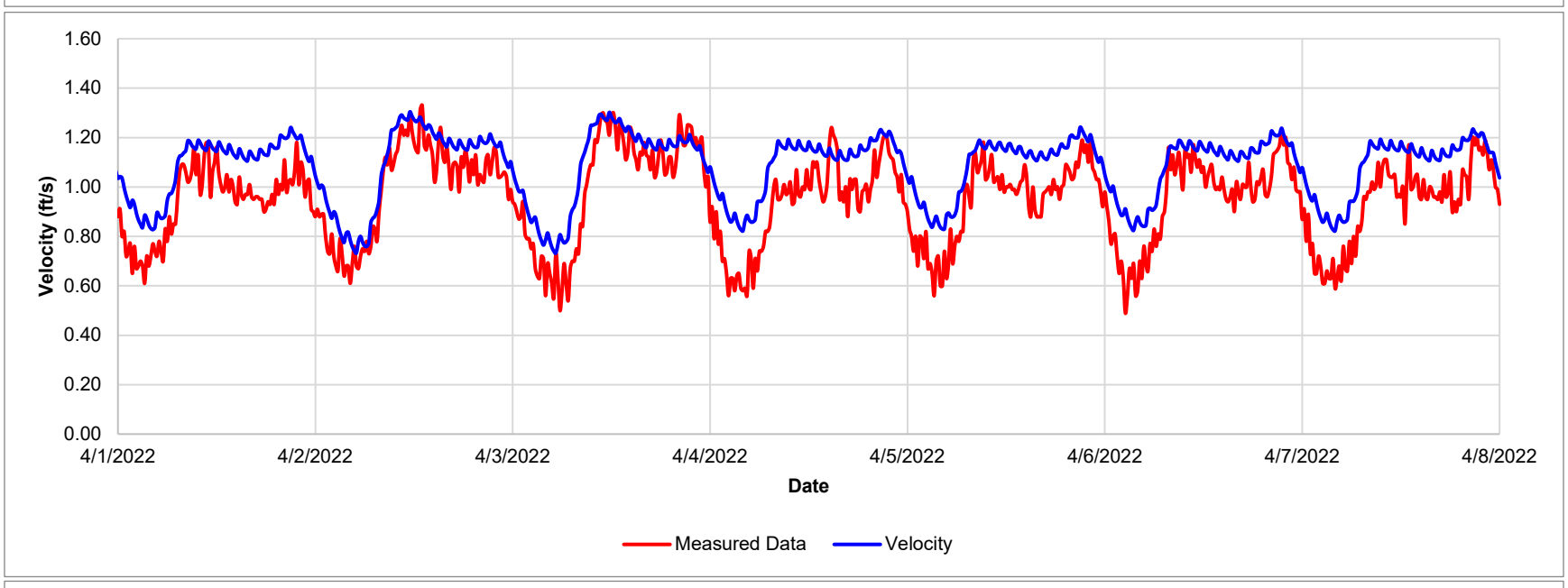


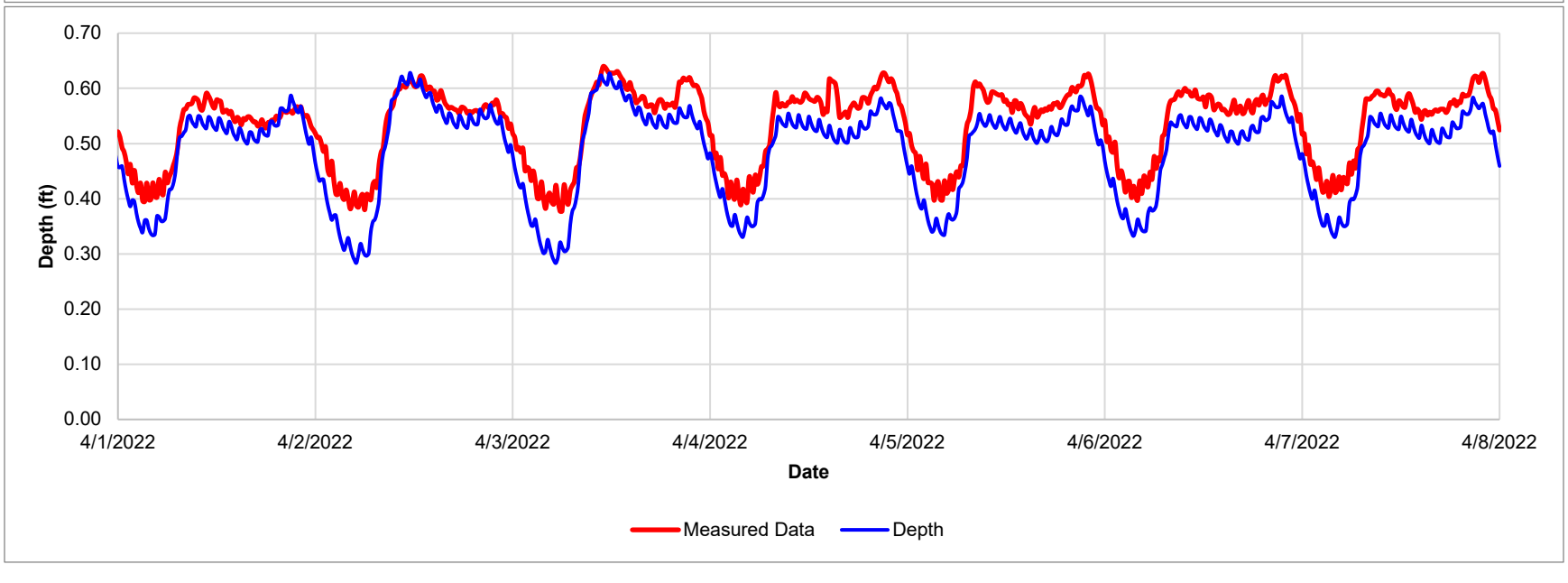


Site 17	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.37	1.88	0.42	0.40	0.38	1.11	0.40	2.0%	-40.8%	-3.3%	-0.5%
Min	0.15	0.09	0.03	0.06	0.16	0.75	0.08				
Avg	0.22	1.38	0.23	0.23	0.28	0.96	0.23	25.0%	-30.5%	0.8%	0.7%
Volume			457,533	457,559			460,966			0.8%	0.7%

1.18 SITE 18 – DWF

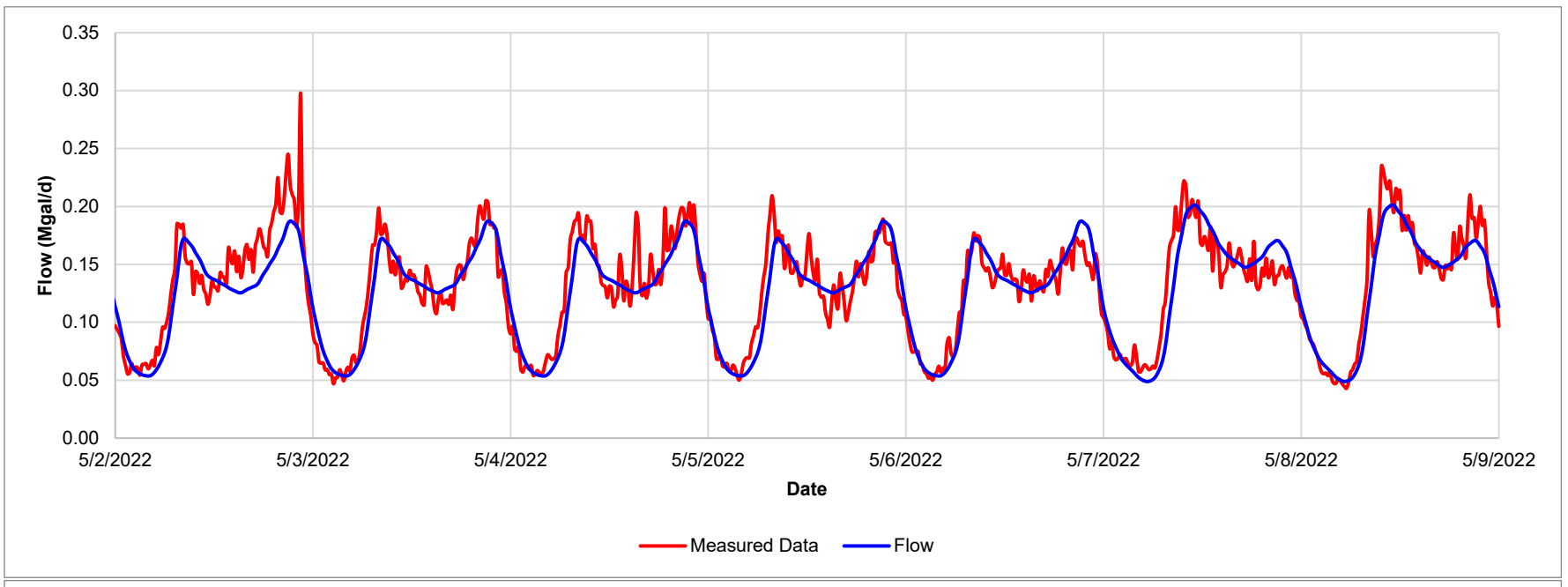


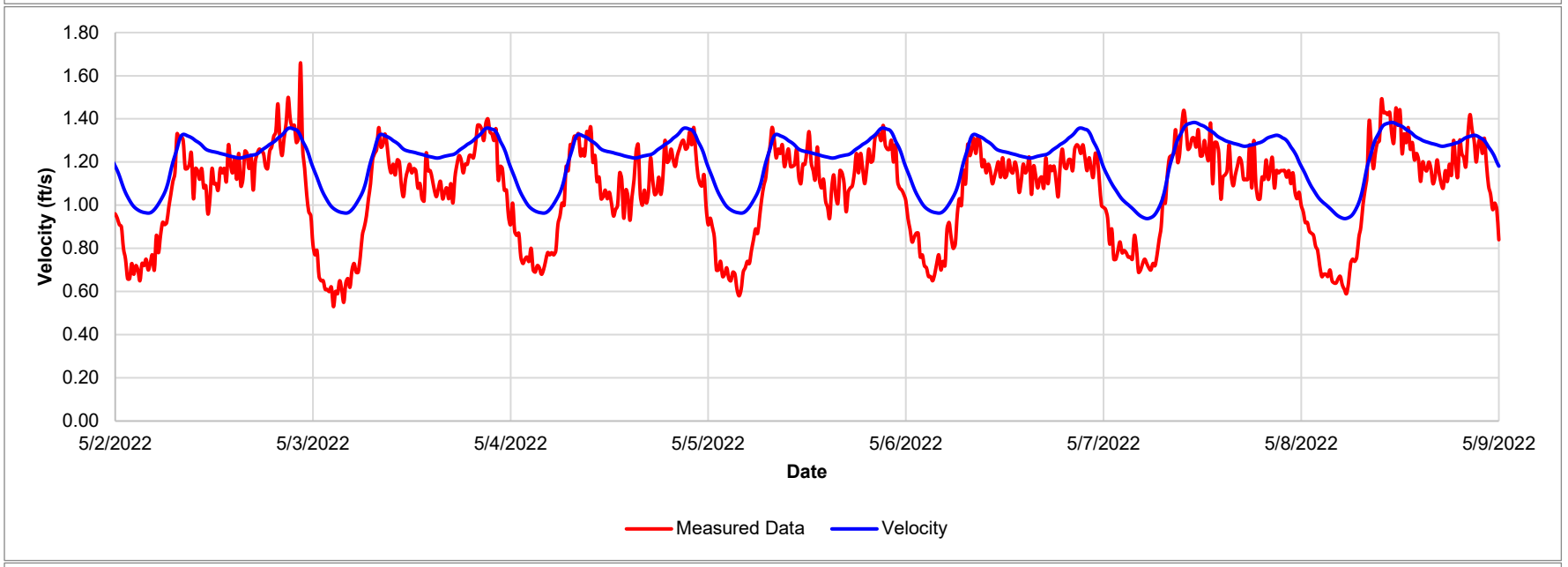


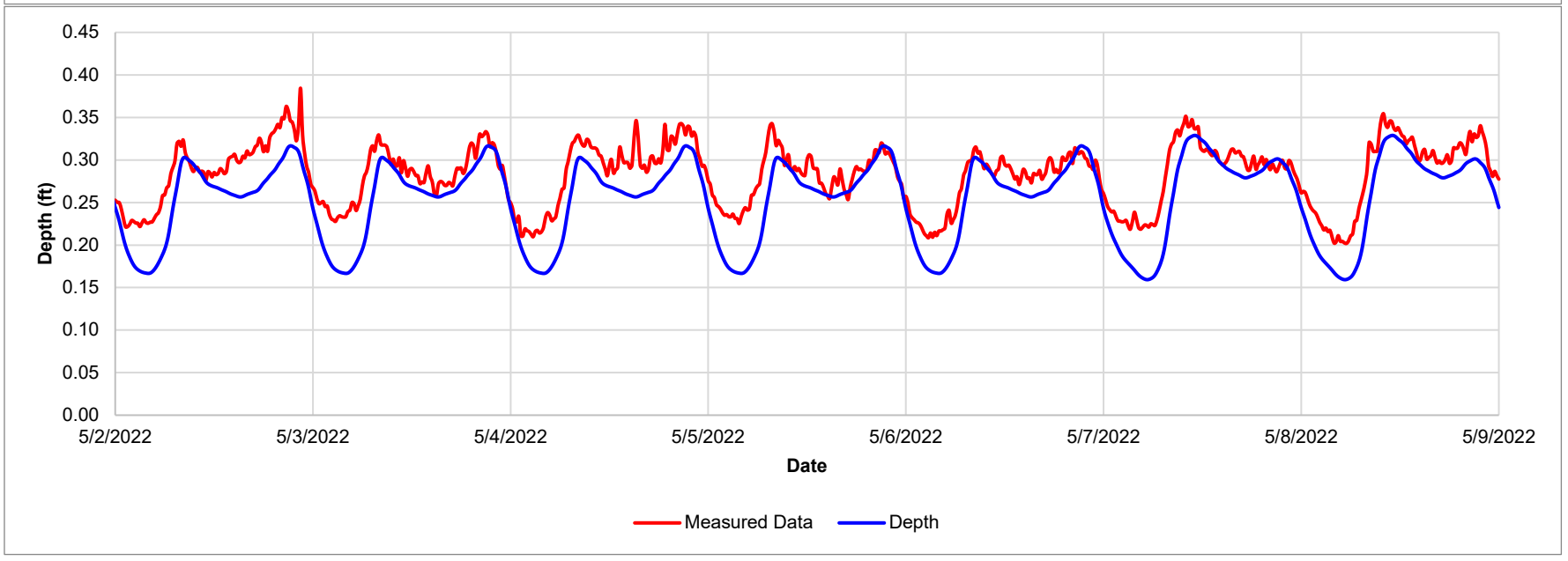


Site 18	Measured				Modeled			Error			
DFW 1	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.64	1.33	0.67	0.65	0.63	1.30	0.65	-1.8%	-1.9%	-2.2%	0.6%
Min	0.38	0.49	0.12	0.16	0.28	0.73	0.12				
Avg	0.53	0.95	0.40	0.40	0.49	1.08	0.40	-8.6%	13.5%	0.4%	0.4%
Volume			792,163	792,126			795,301			0.4%	0.4%

2.1 SITE 1 – DWF

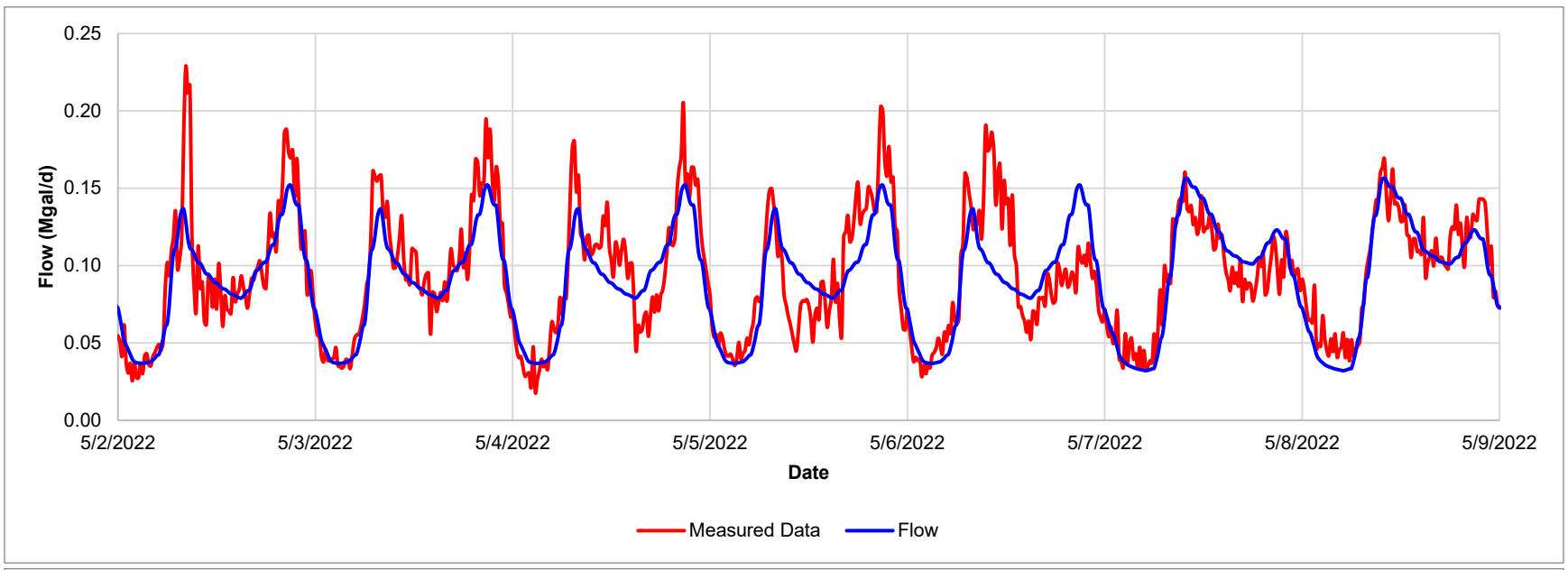


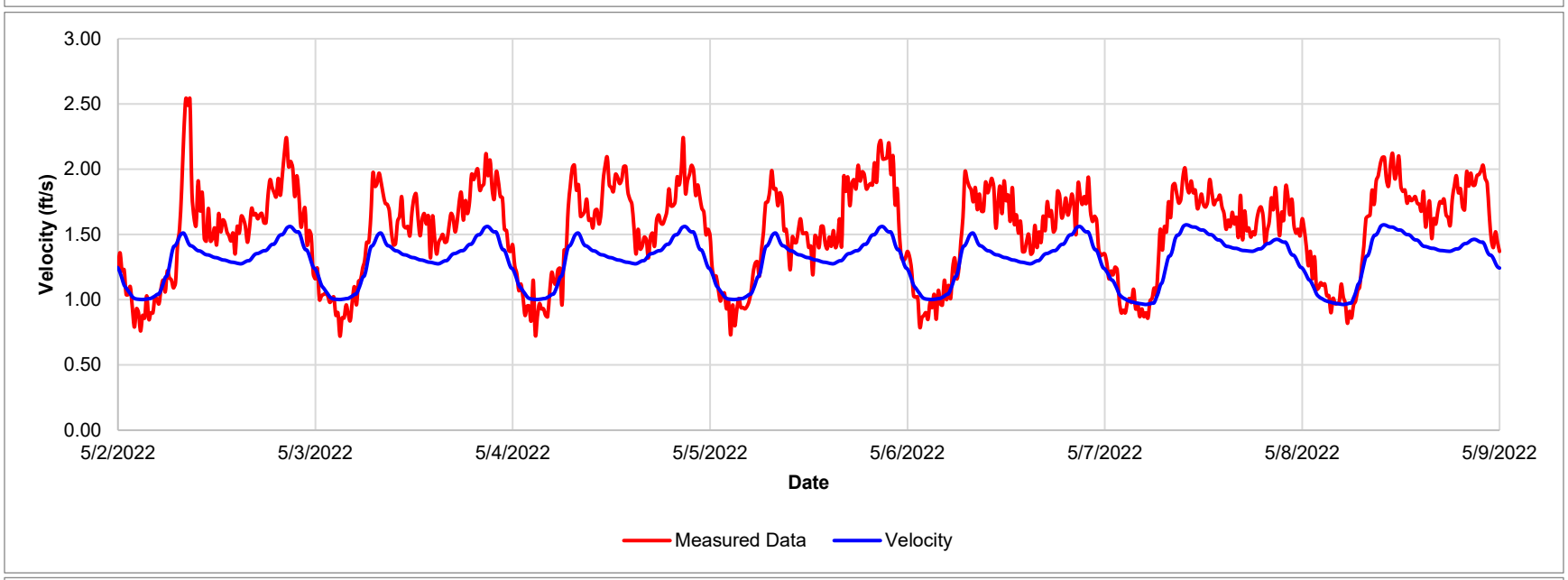


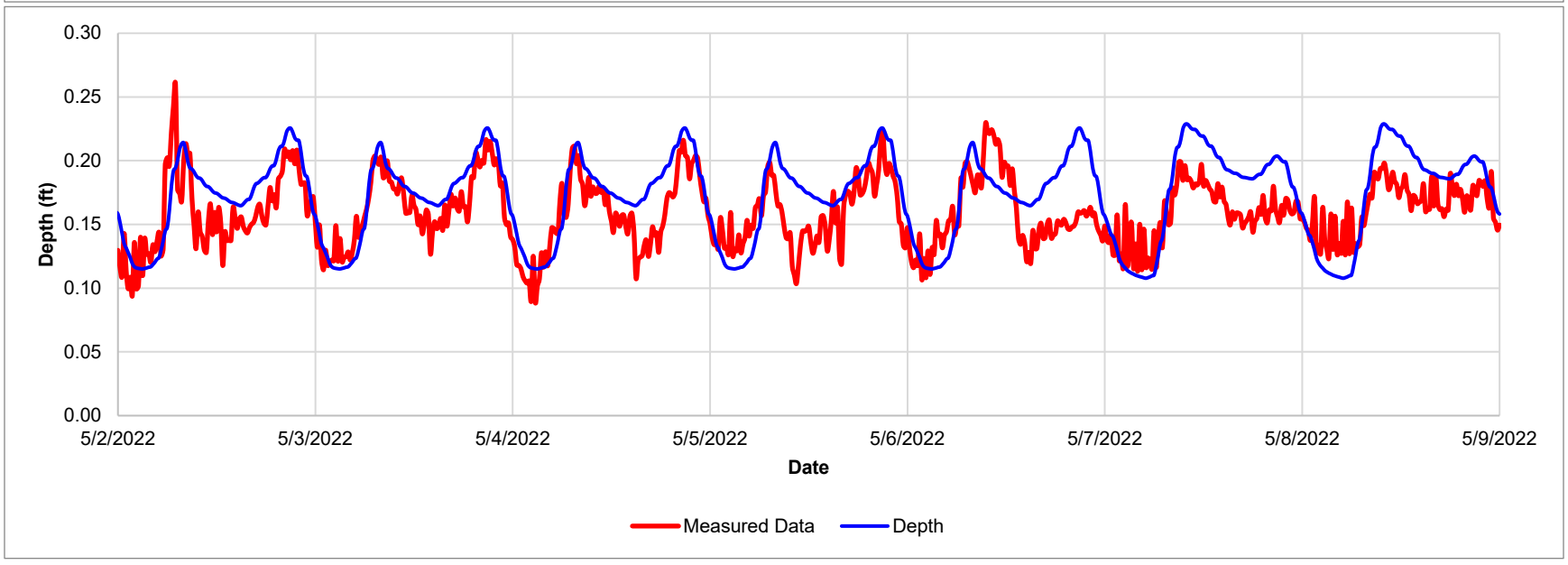


Site 1	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.38	1.66	0.30	0.23	0.33	1.38	0.20	-14.5%	-16.6%	-32.5%	-10.8%
Min	0.20	0.53	0.04	0.05	0.16	0.94	0.05				
Avg	0.28	1.07	0.13	0.13	0.25	1.21	0.13	-10.1%	12.9%	-2.8%	-2.8%
Volume			261,781	261,802			254,364			-2.8%	-2.8%

2.2 SITE 2 – DWF

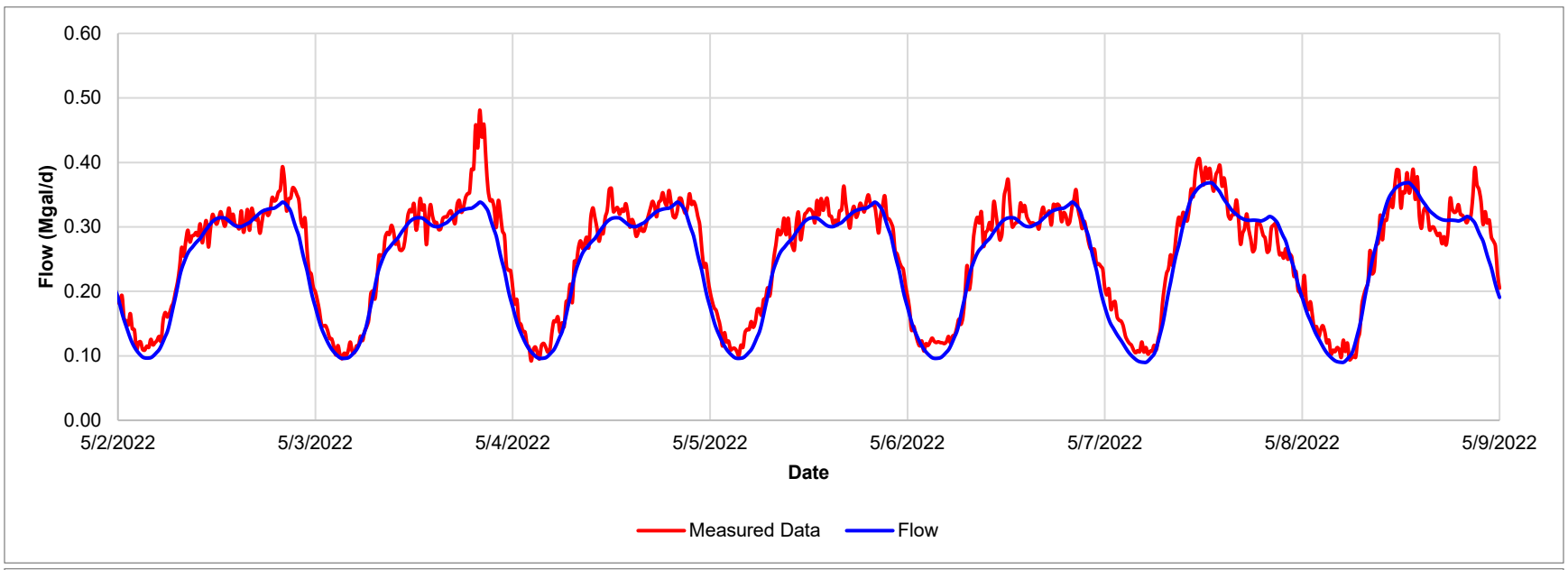


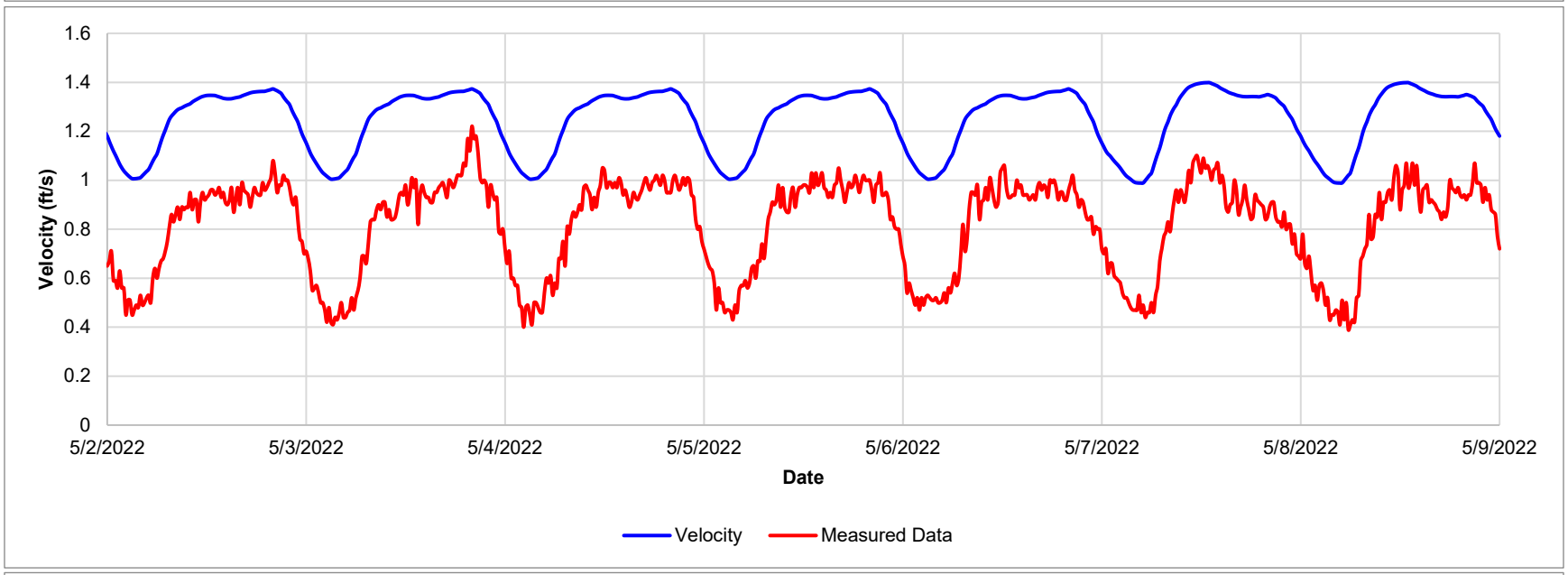


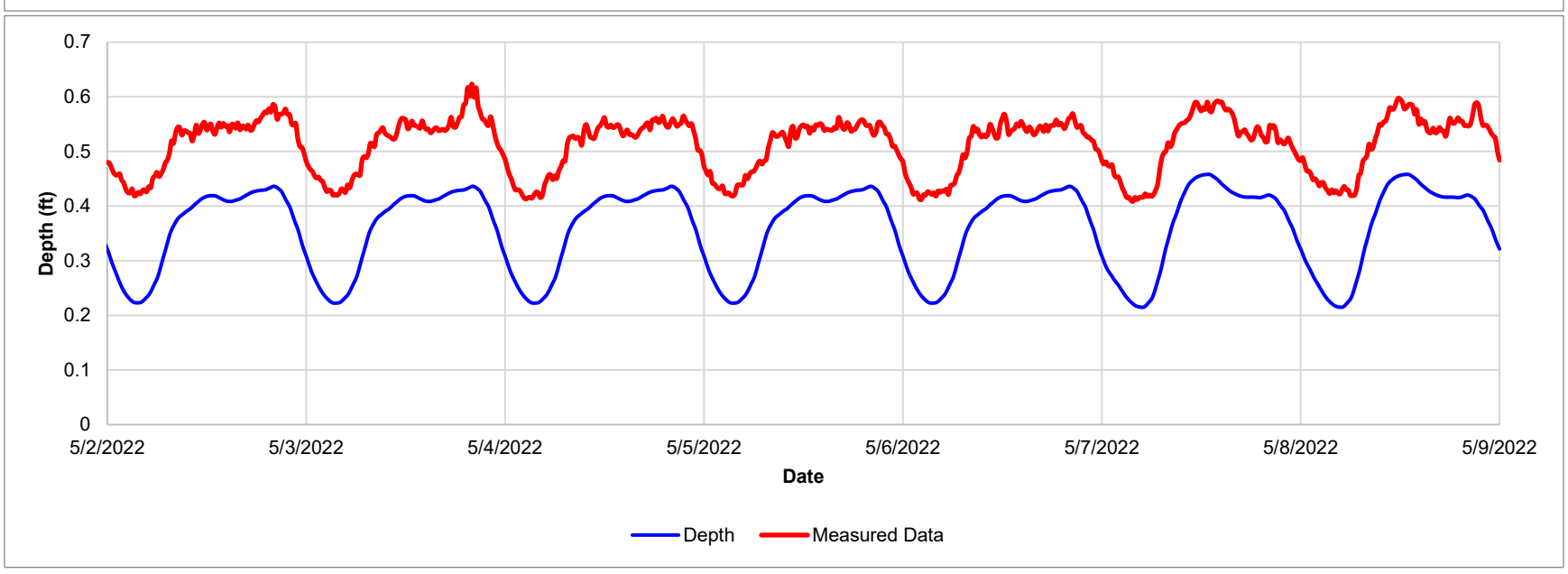


Site 2	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.26	2.54	0.23	0.21	0.23	1.57	0.16	-11.9%	-38.1%	-31.5%	-25.6%
Min	0.09	0.72	0.02	0.03	0.11	0.96	0.03				
Avg	0.16	1.52	0.09	0.09	0.17	1.31	0.09	8.6%	-14.4%	-3.6%	-3.5%
Volume			188,340	188,307			181,630			-3.6%	-3.5%

2.3 SITE 3 – DWF

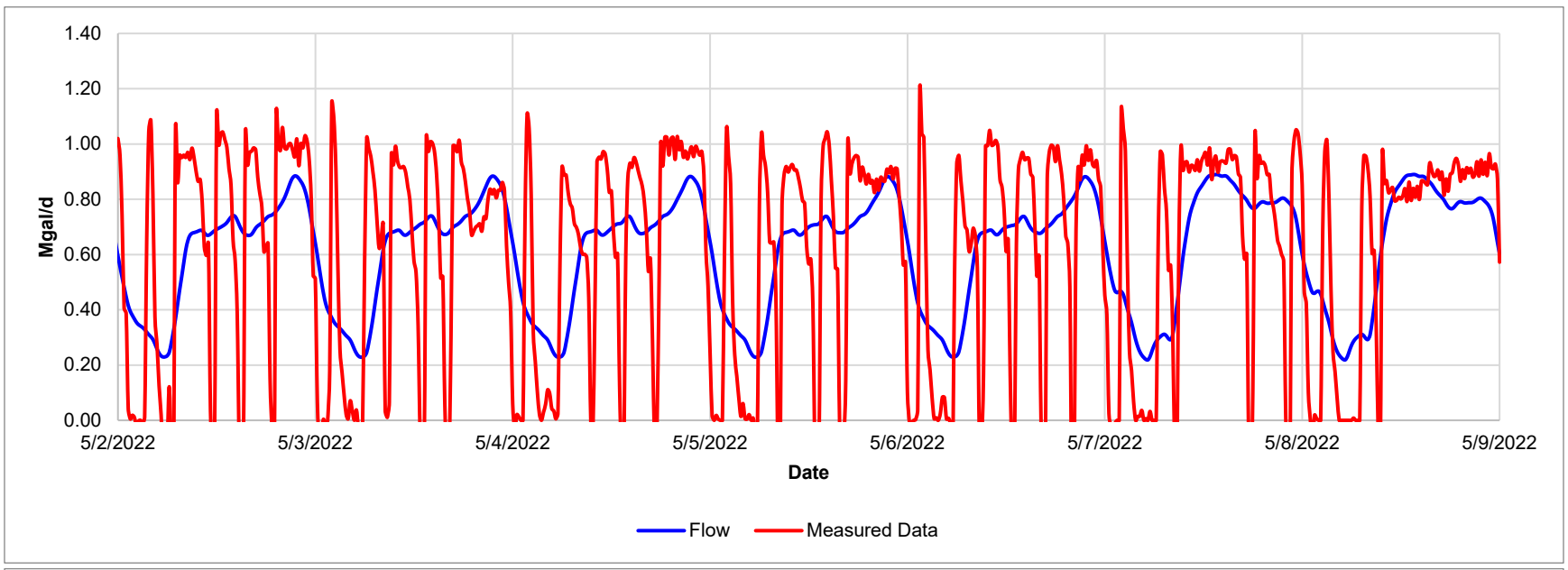


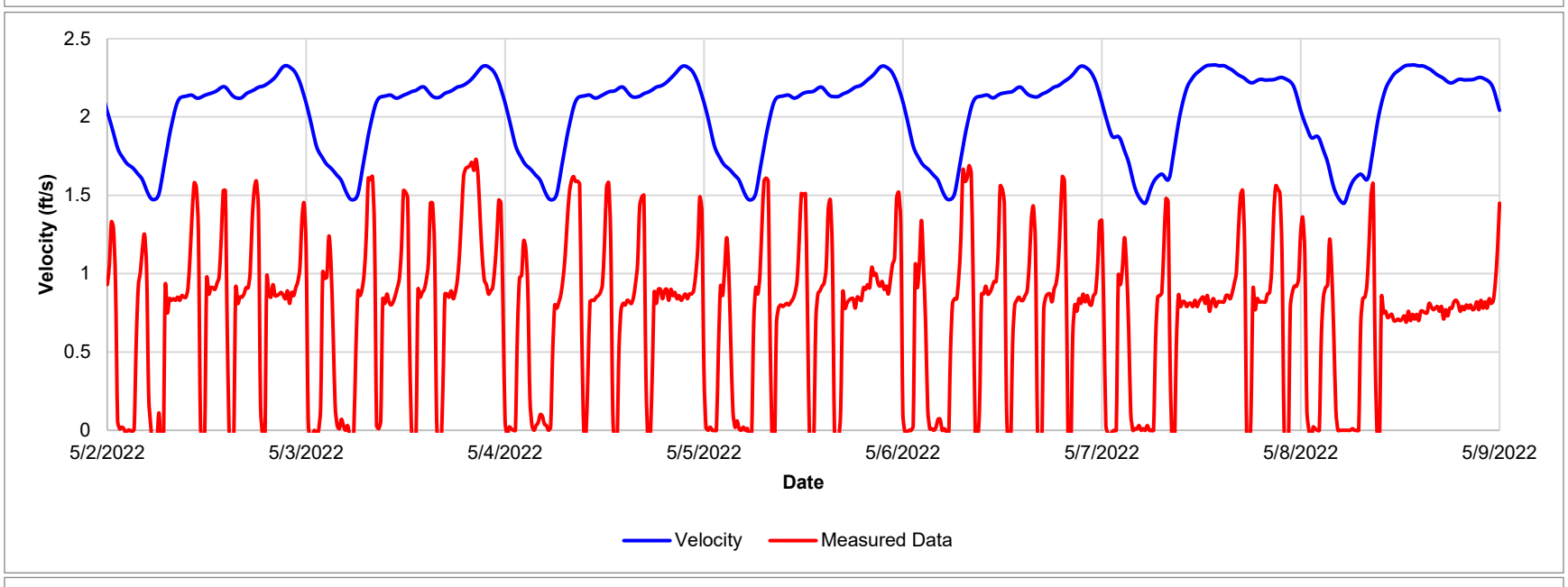


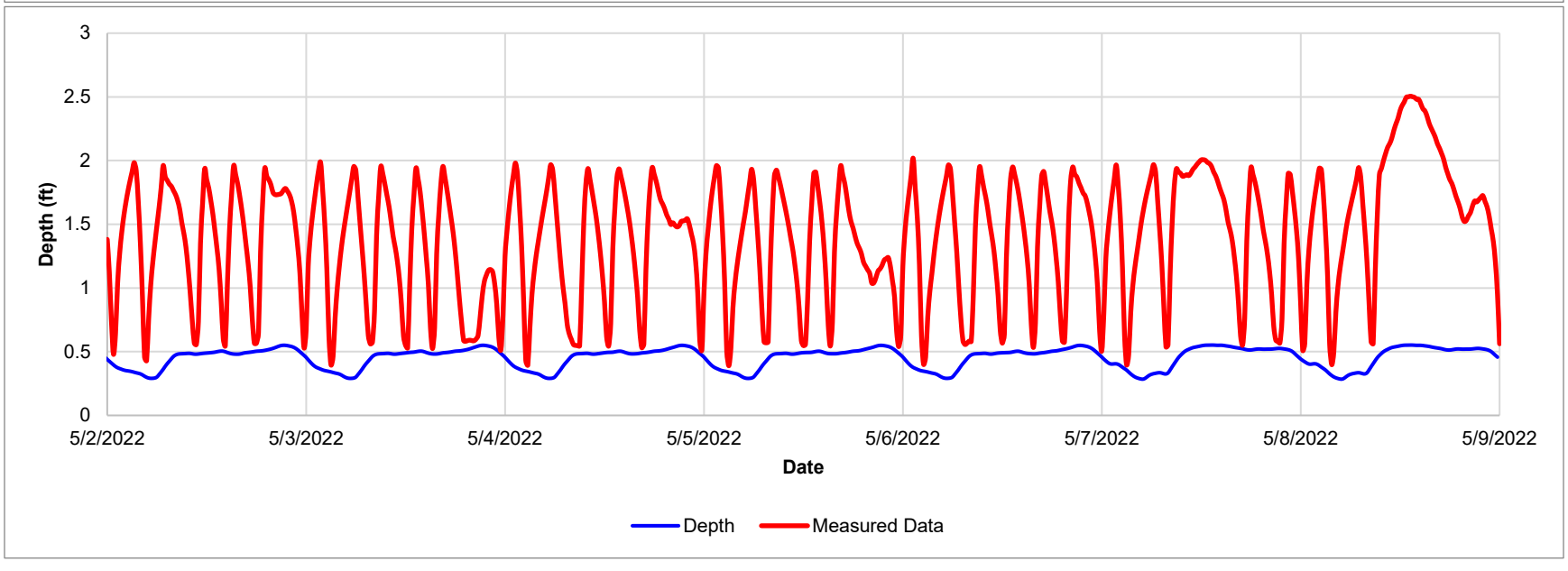


Site 3	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.62	1.22	0.48	0.45	0.46	1.40	0.37	-26.5%	14.6%	-23.4%	-18.2%
Min	0.41	0.39	0.09	0.10	0.21	0.99	0.09				
Avg	0.51	0.81	0.26	0.26	0.36	1.25	0.24	-29.8%	53.1%	-4.7%	-4.7%
Volume			514,002	514,023			489,838			-4.7%	-4.7%

2.4 SITE 4 – DWF

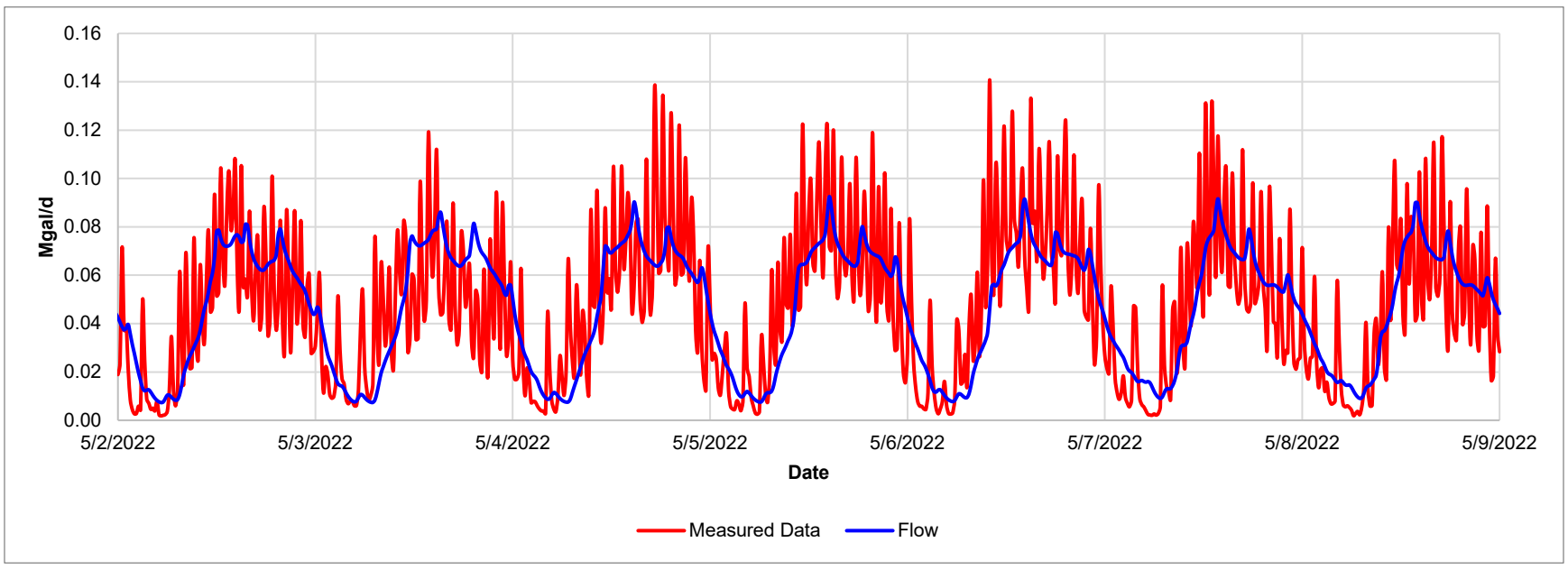


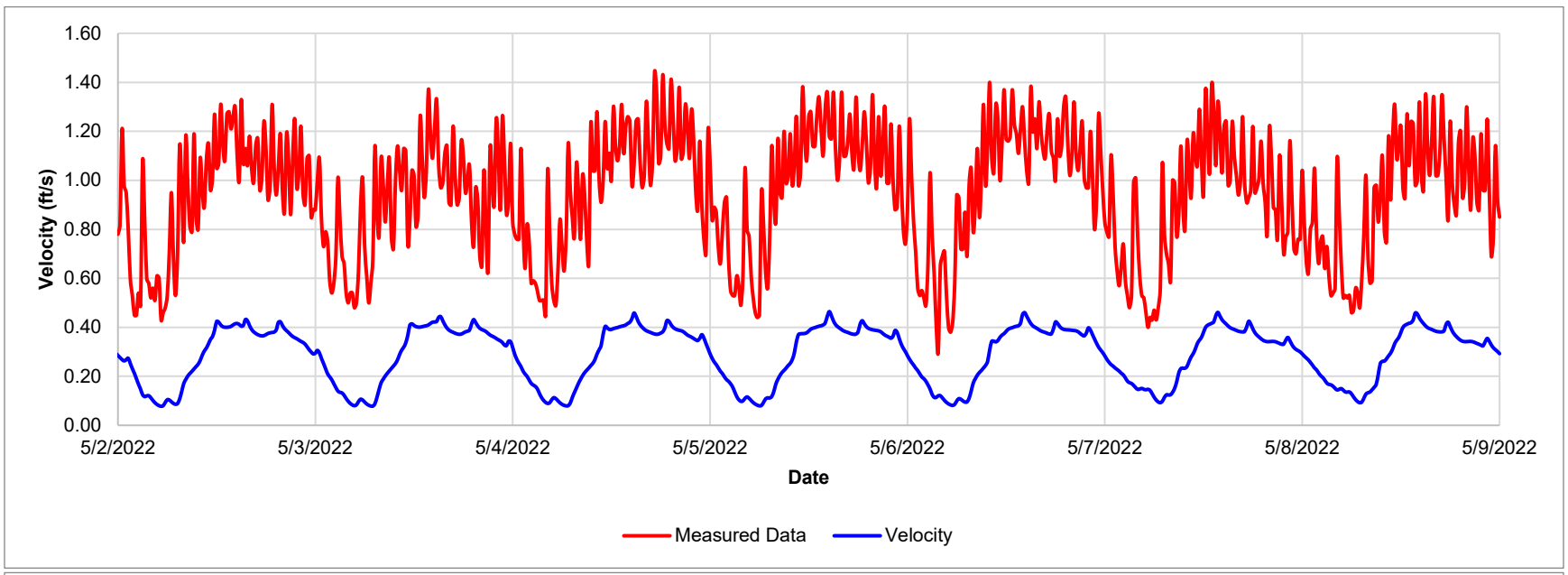


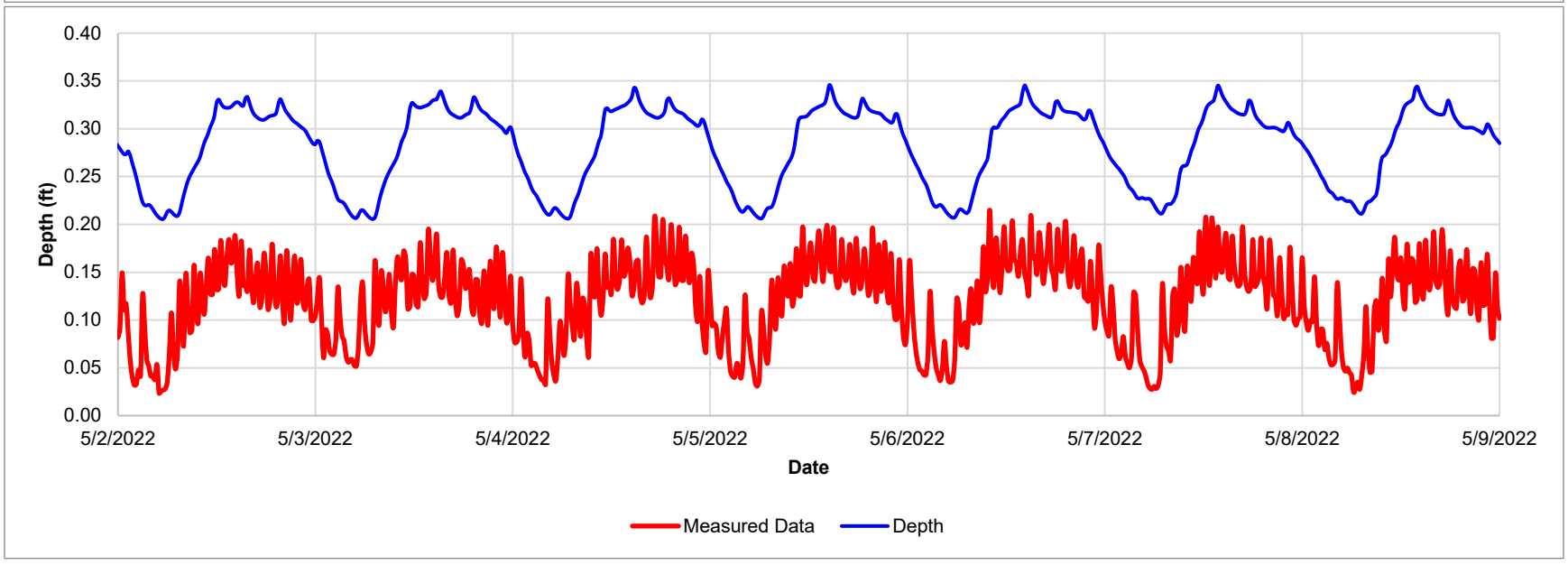


Site 4	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	2.51	1.73	1.20	1.05	0.55	2.33	0.89	-78.0%	34.8%	-25.7%	-15.0%
Min	0.39	-0.27	-0.30	-0.09	0.28	1.45	0.22				
Avg	1.39	0.72	0.60	0.60	0.45	2.03	0.61	-67.4%	181.0%	2.2%	2.2%
Volume			1,201,095	1,201,396			1,228,041			2.2%	2.2%

2.5 SITE 5 – DWF

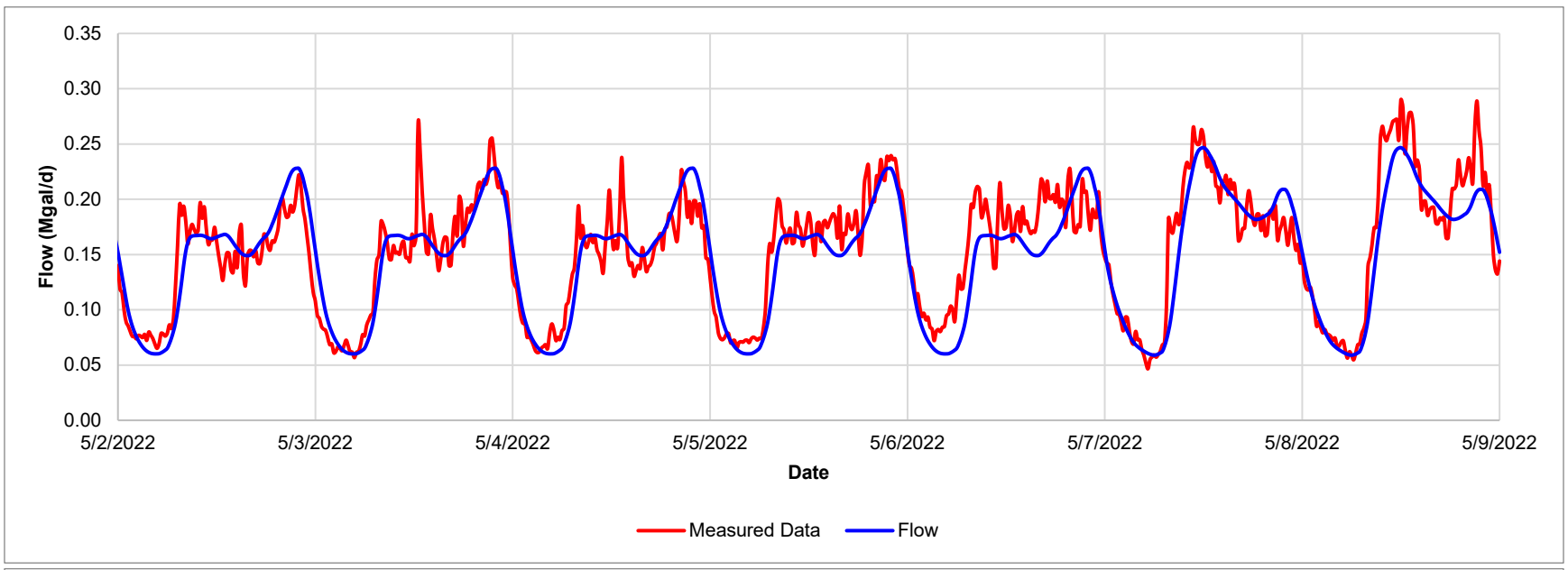


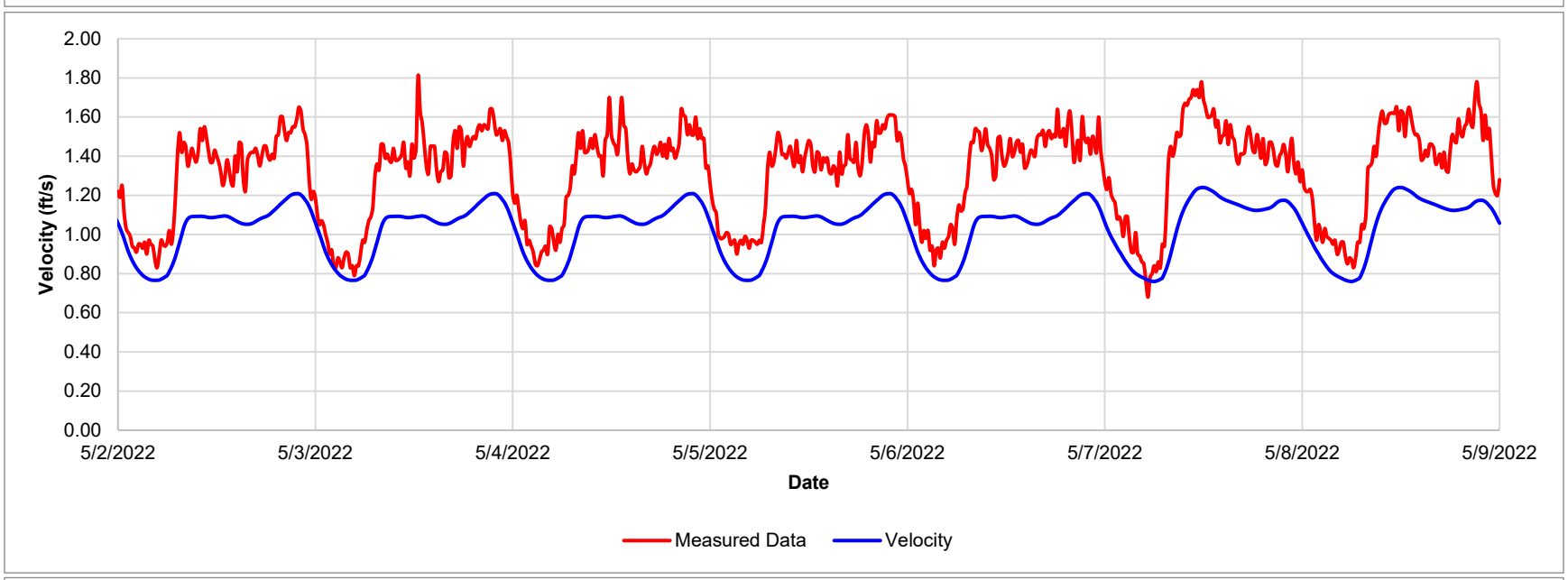


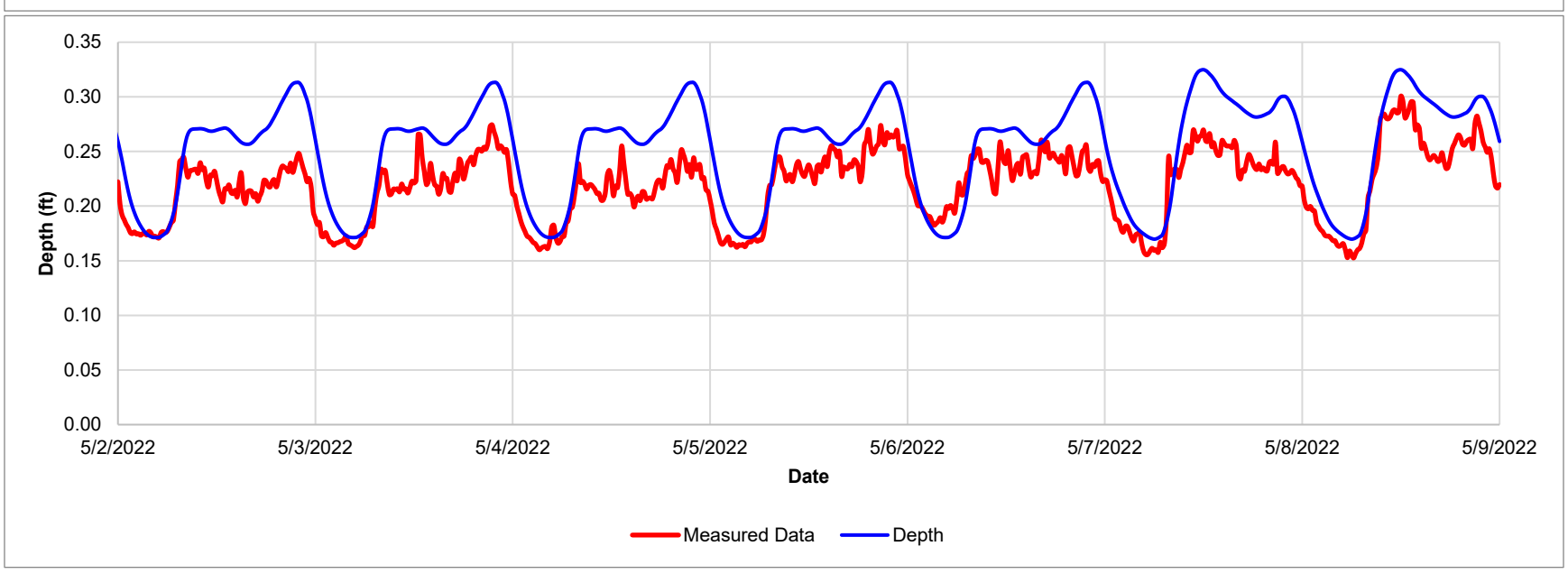


Site 5	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.22	1.44	0.14	0.10	0.35	0.46	0.09	60.8%	-67.8%	-34.3%	-9.0%
Min	0.02	0.30	0.00	0.00	0.21	0.08	0.01				
Avg	0.12	0.95	0.05	0.05	0.28	0.29	0.05	135.6%	-69.5%	-1.7%	-1.7%
Volume			94,964	94,973			93,382			-1.7%	-1.7%

2.6 SITE 6 – DWF

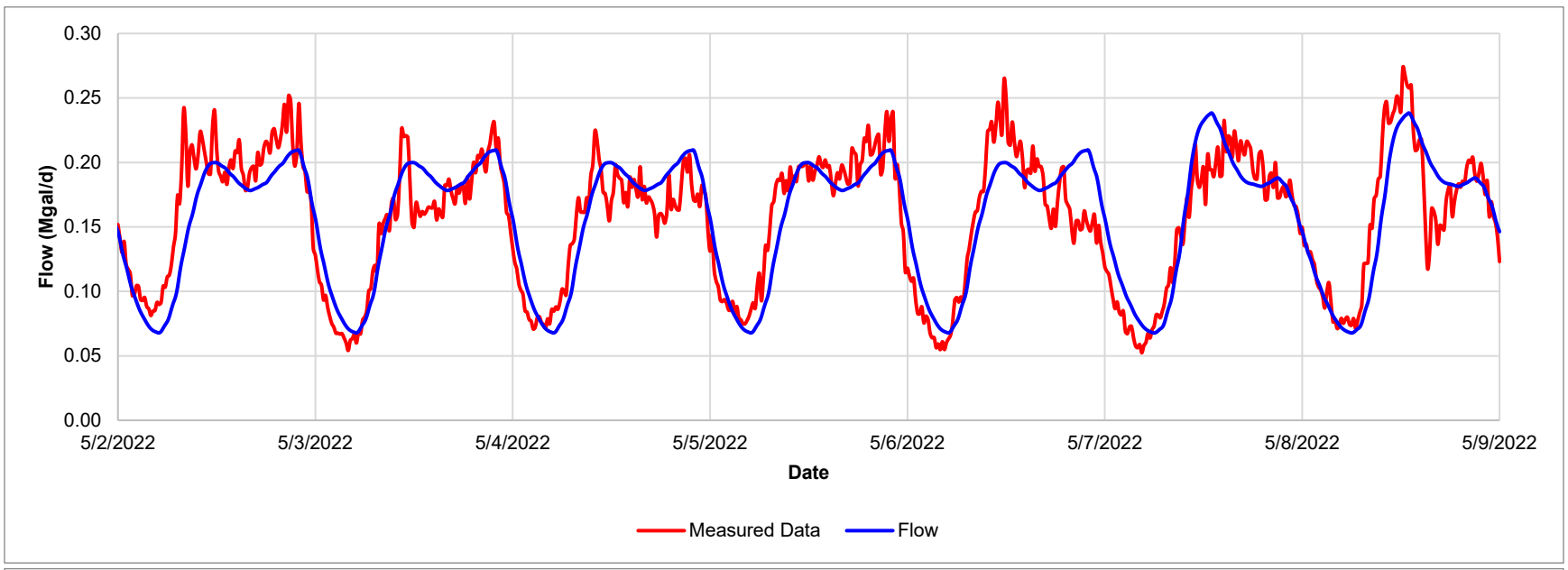


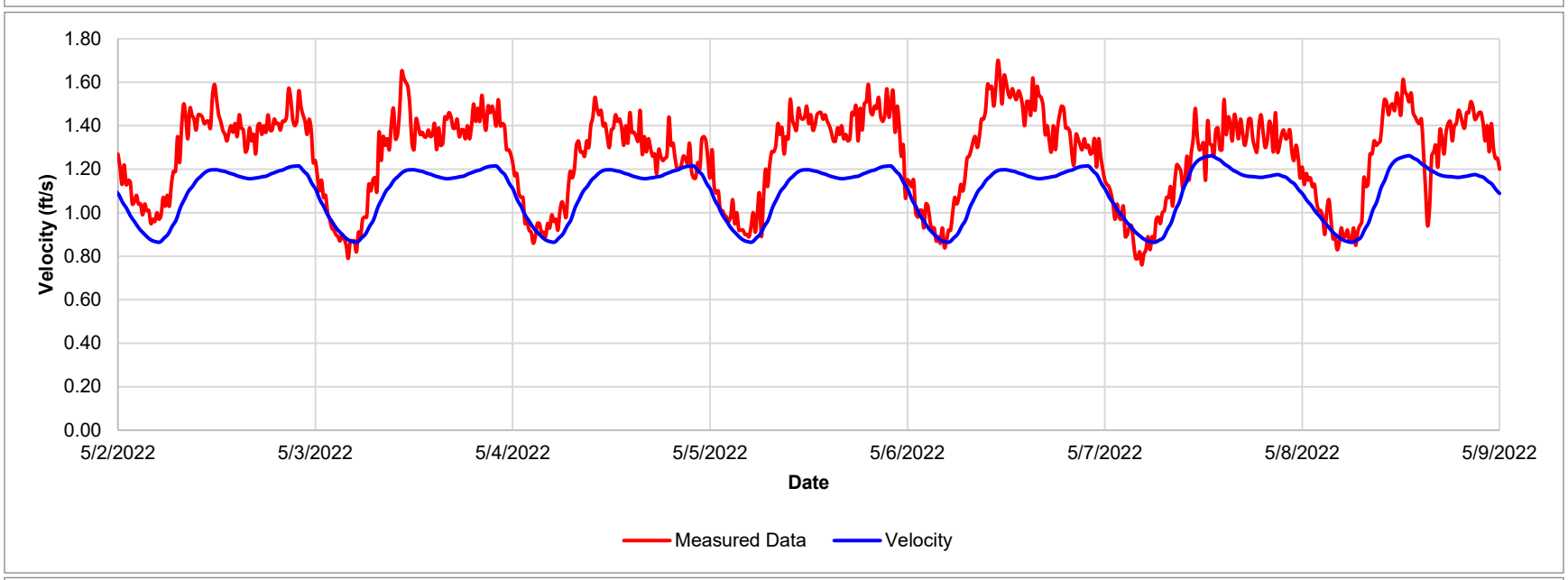


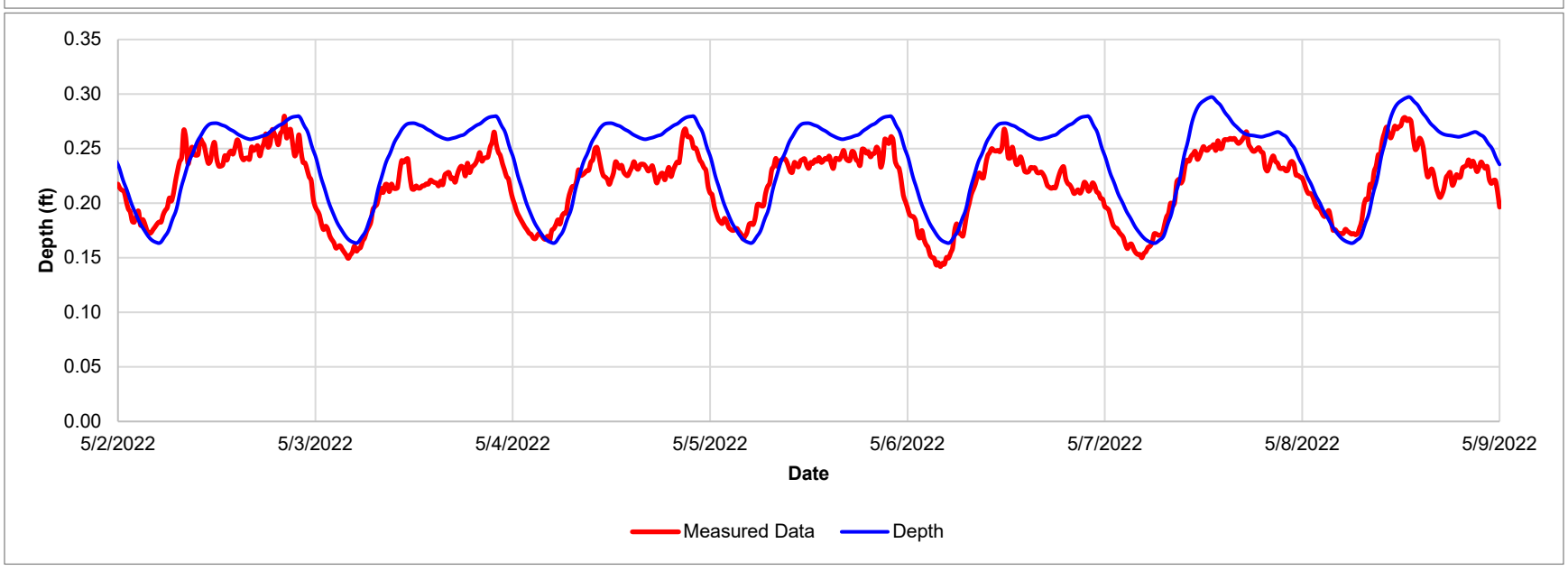


Site 6	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.30	1.81	0.29	0.27	0.32	1.24	0.25	8.1%	-31.5%	-14.9%	-10.1%
Min	0.15	0.68	0.05	0.05	0.17	0.76	0.06				
Avg	0.22	1.32	0.15	0.15	0.25	1.03	0.15	15.0%	-21.7%	-3.7%	-3.7%
Volume			309,497	309,498			298,127			-3.7%	-3.7%

2.7 SITE 7 – DWF

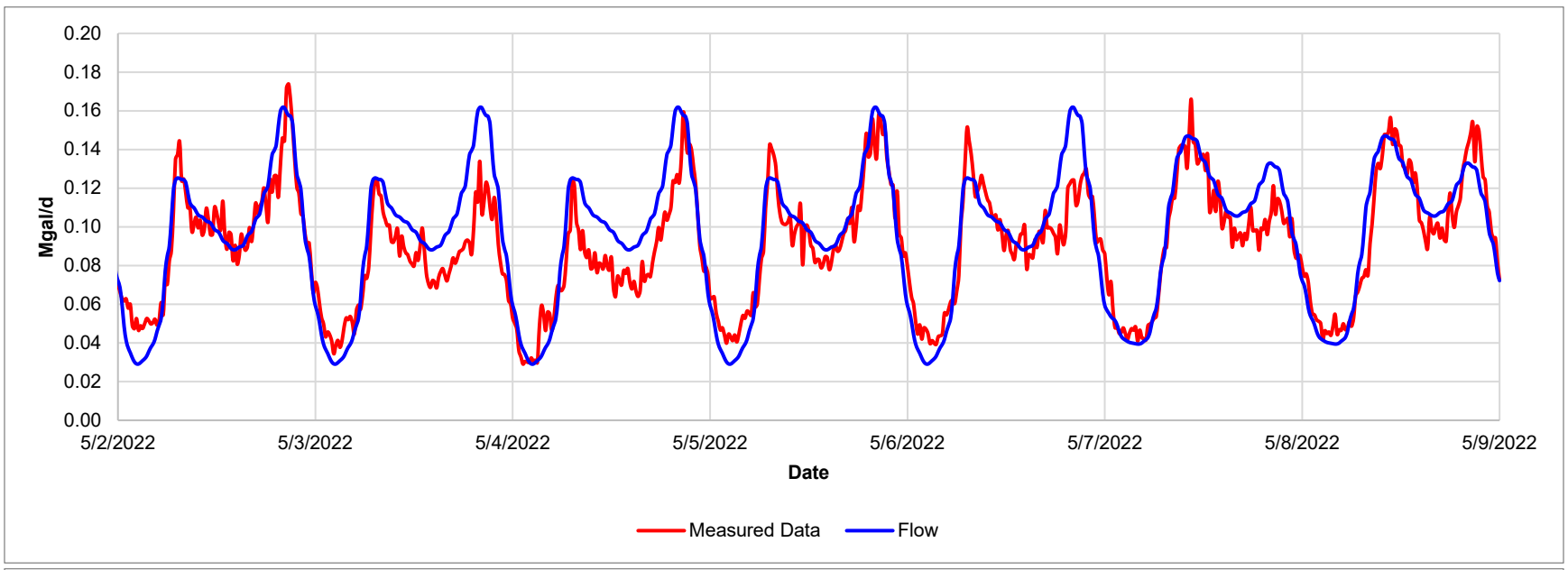


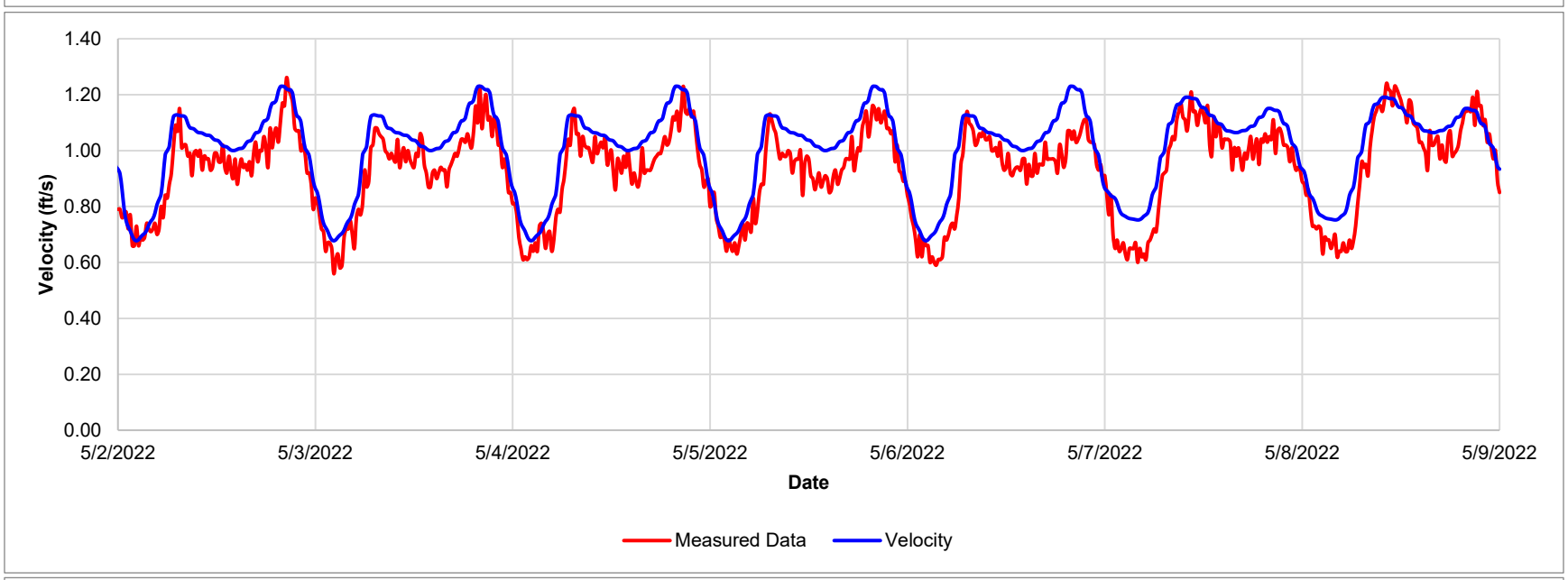


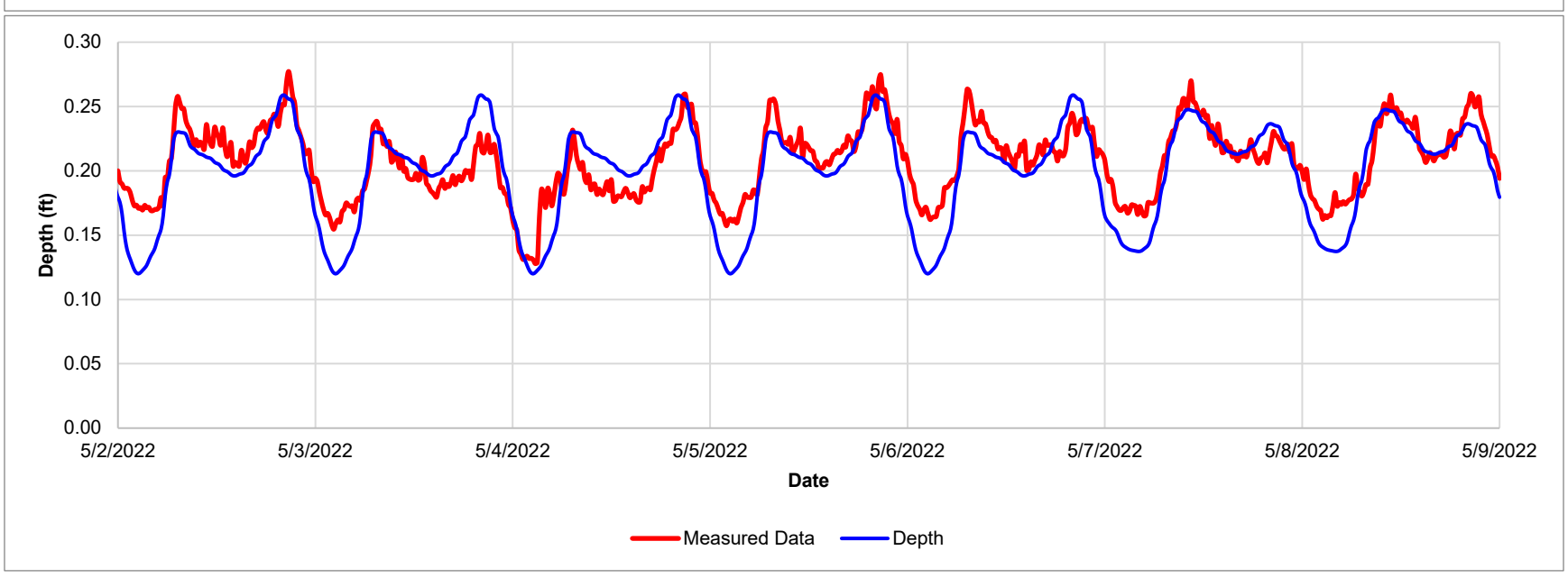


Site 7	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.28	1.70	0.27	0.26	0.30	1.26	0.24	6.3%	-25.8%	-12.9%	-10.0%
Min	0.14	0.76	0.05	0.06	0.16	0.86	0.07				
Avg	0.22	1.26	0.16	0.16	0.24	1.10	0.16	9.5%	-13.1%	-0.8%	-0.8%
Volume			314,158	314,211			311,797			-0.8%	-0.8%

2.8 SITE 8 – DWF

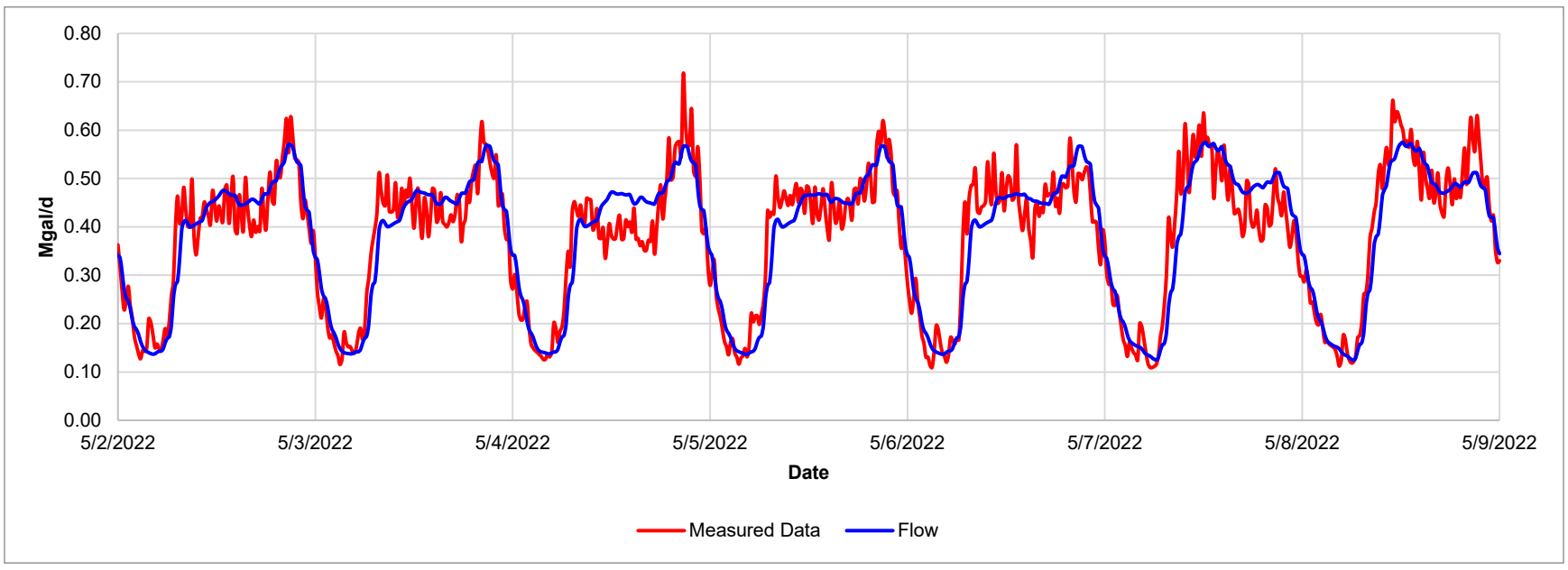


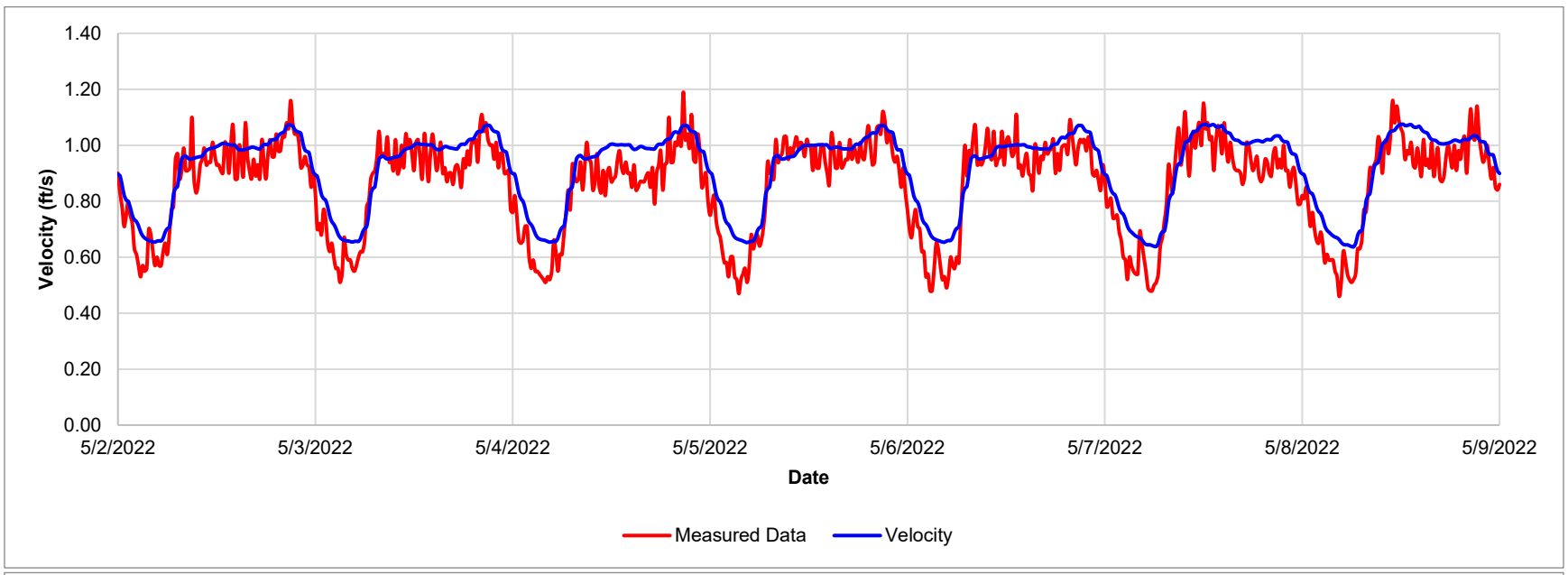


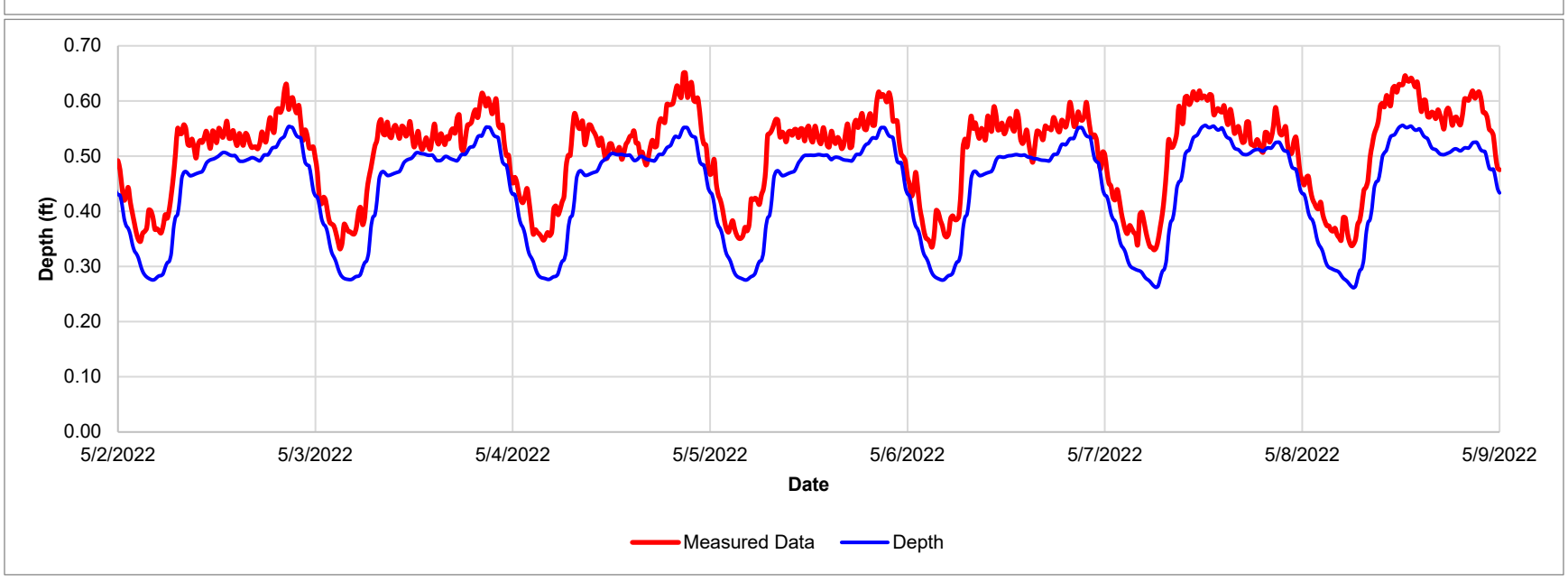


Site 8	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.28	1.26	0.17	0.17	0.26	1.23	0.16	-6.7%	-2.4%	-7.0%	-2.1%
Min	0.13	0.56	0.03	0.03	0.12	0.68	0.03				
Avg	0.21	0.93	0.09	0.09	0.20	1.01	0.10	-4.0%	8.0%	5.3%	5.3%
Volume			181,201	181,208			190,775			5.3%	5.3%

2.9 SITE 9 – DWF

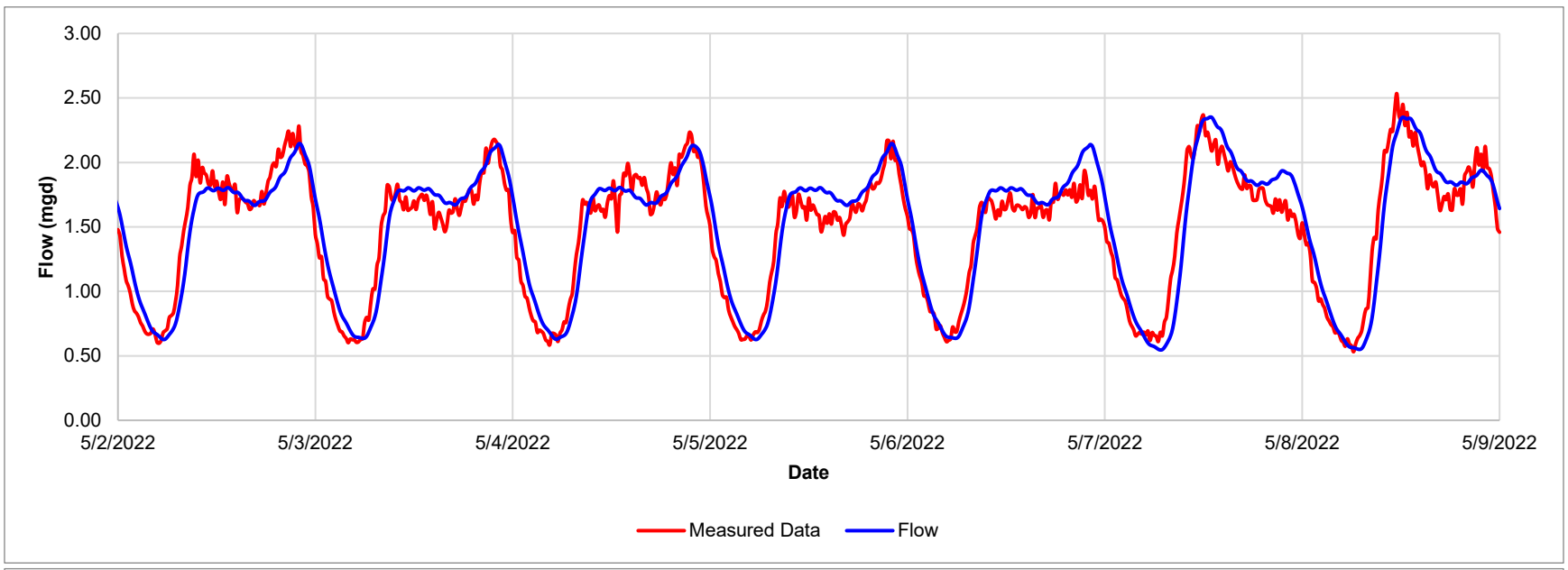


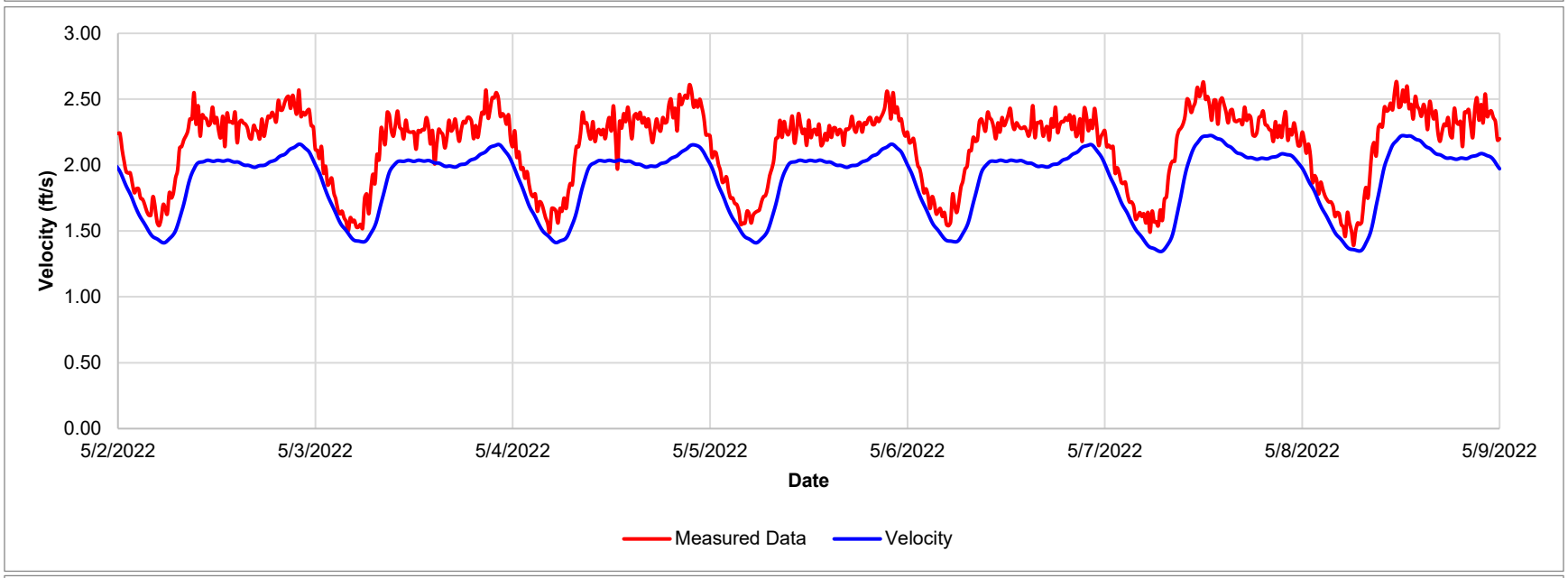


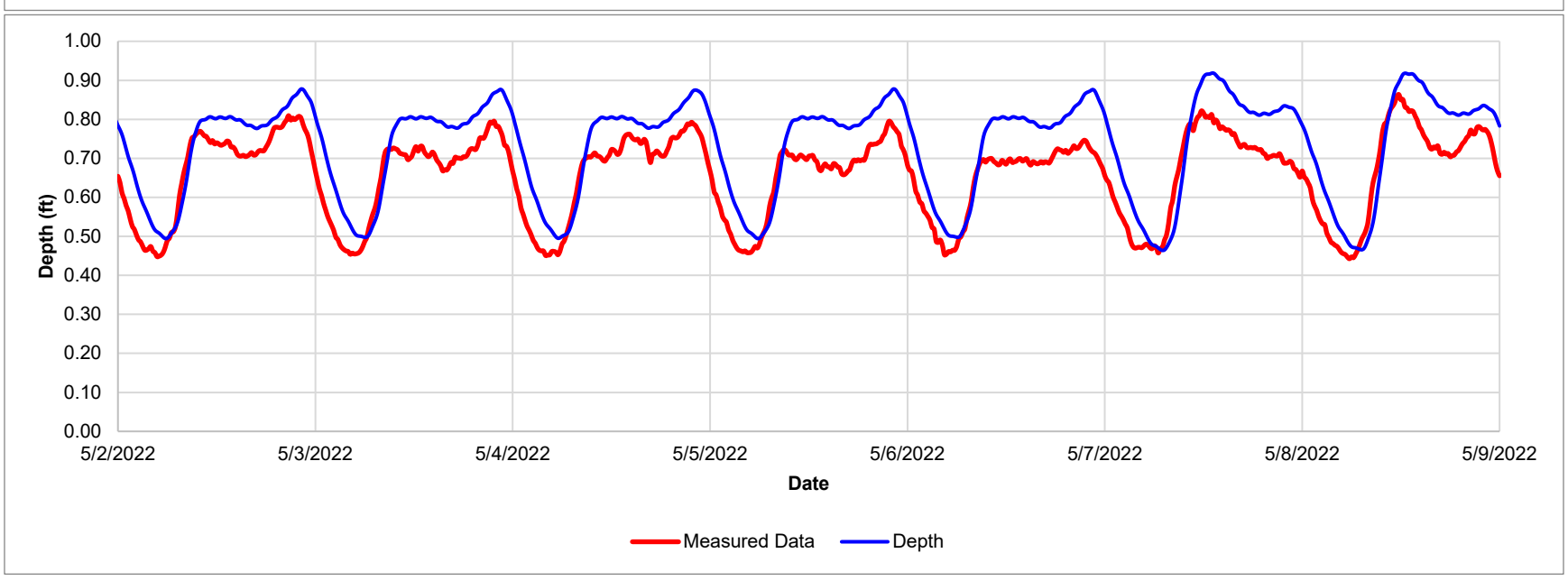


Site 9	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.65	1.19	0.72	0.64	0.56	1.08	0.58	-14.6%	-9.6%	-19.8%	-9.6%
Min	0.33	0.46	0.11	0.11	0.26	0.64	0.12				
Avg	0.51	0.86	0.38	0.38	0.45	0.92	0.38	-12.0%	6.3%	0.1%	0.1%
Volume			762,641	762,623			763,587			0.1%	0.1%

2.10 SITE 10 – DWF

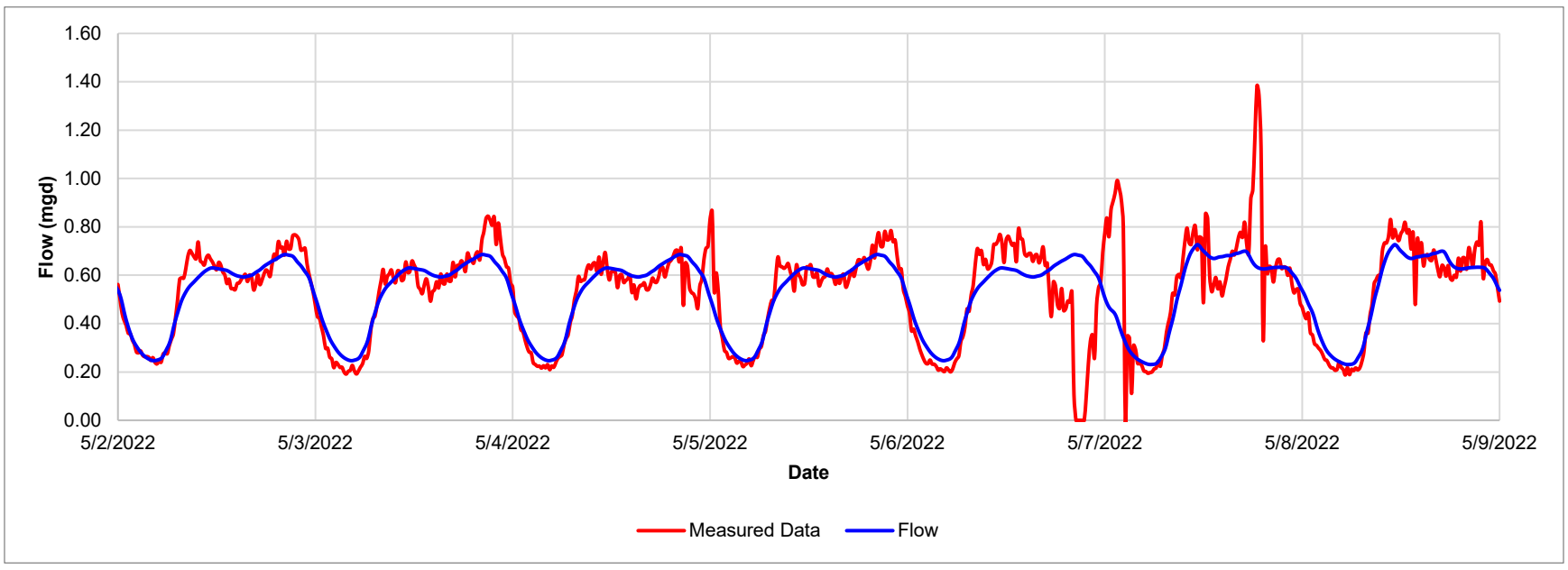


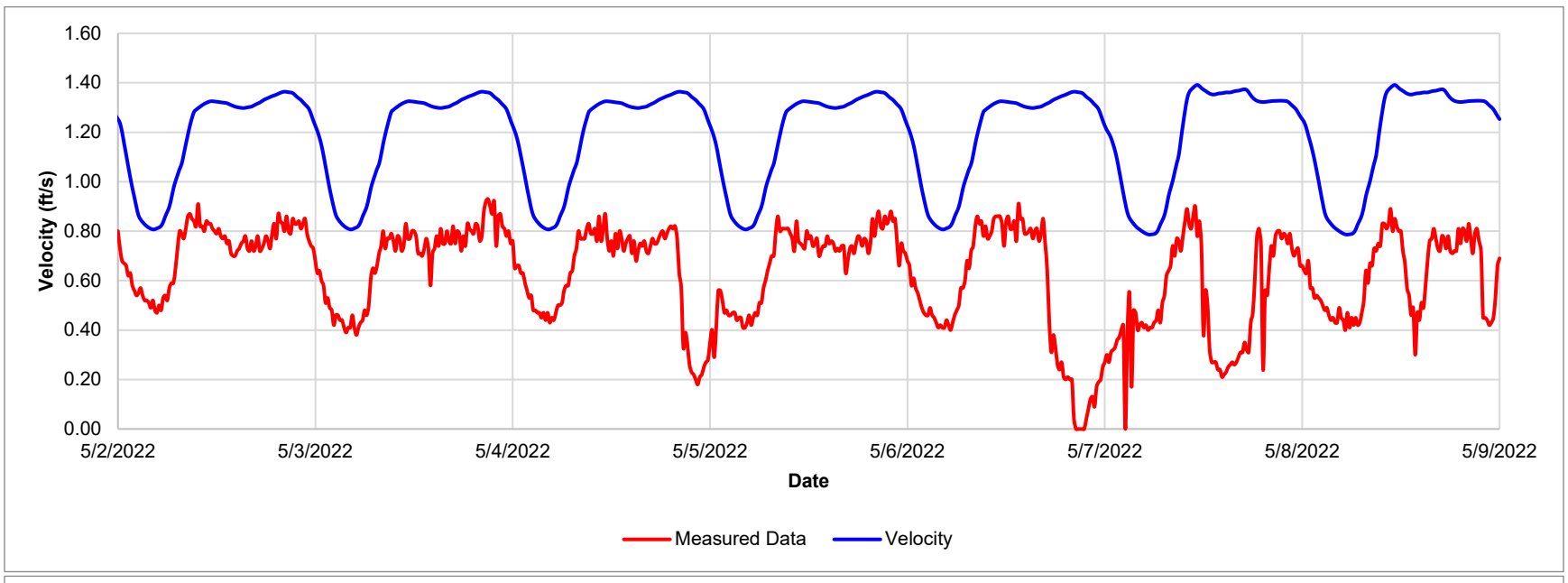


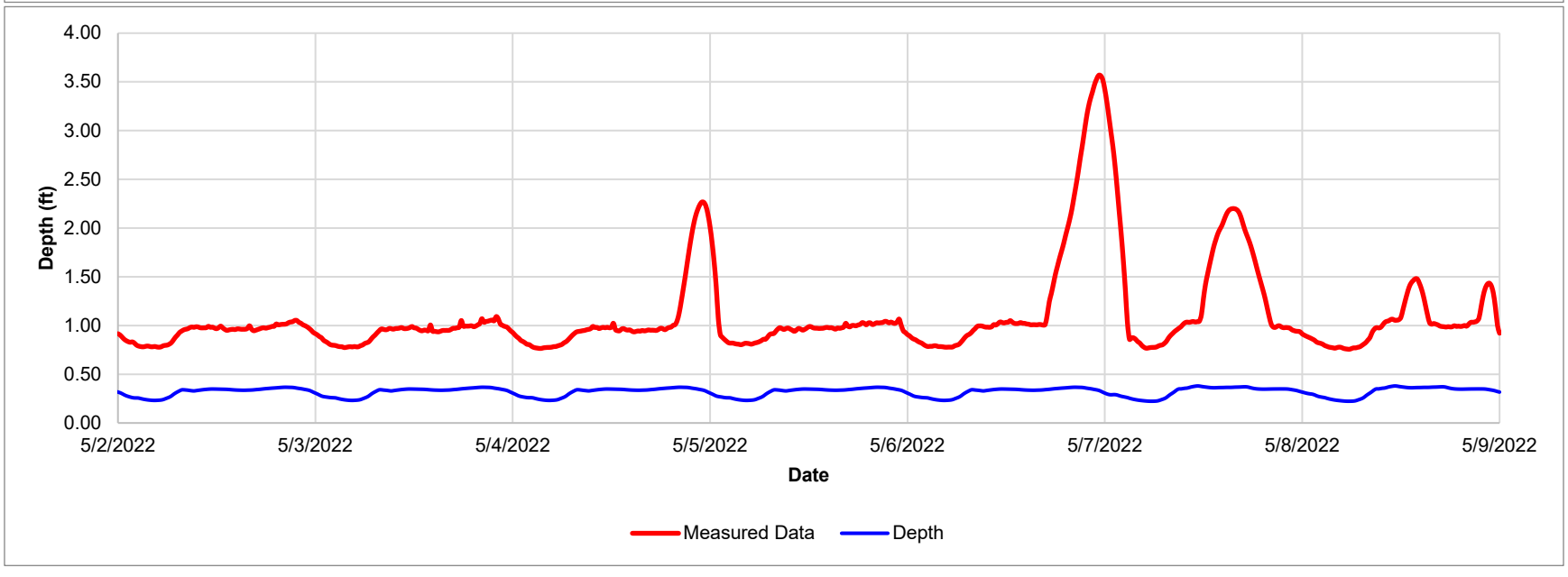


Site 10	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.86	2.63	2.53	2.42	0.92	2.22	2.35	6.3%	-15.4%	-7.2%	-3.0%
Min	0.44	1.39	0.53	0.57	0.46	1.34	0.55				
Avg	0.66	2.15	1.49	1.49	0.73	1.89	1.52	11.1%	-12.2%	1.9%	1.9%
Volume			2,974,654	2,974,852			3,032,040			1.9%	1.9%

2.11 SITE 11 – DWF

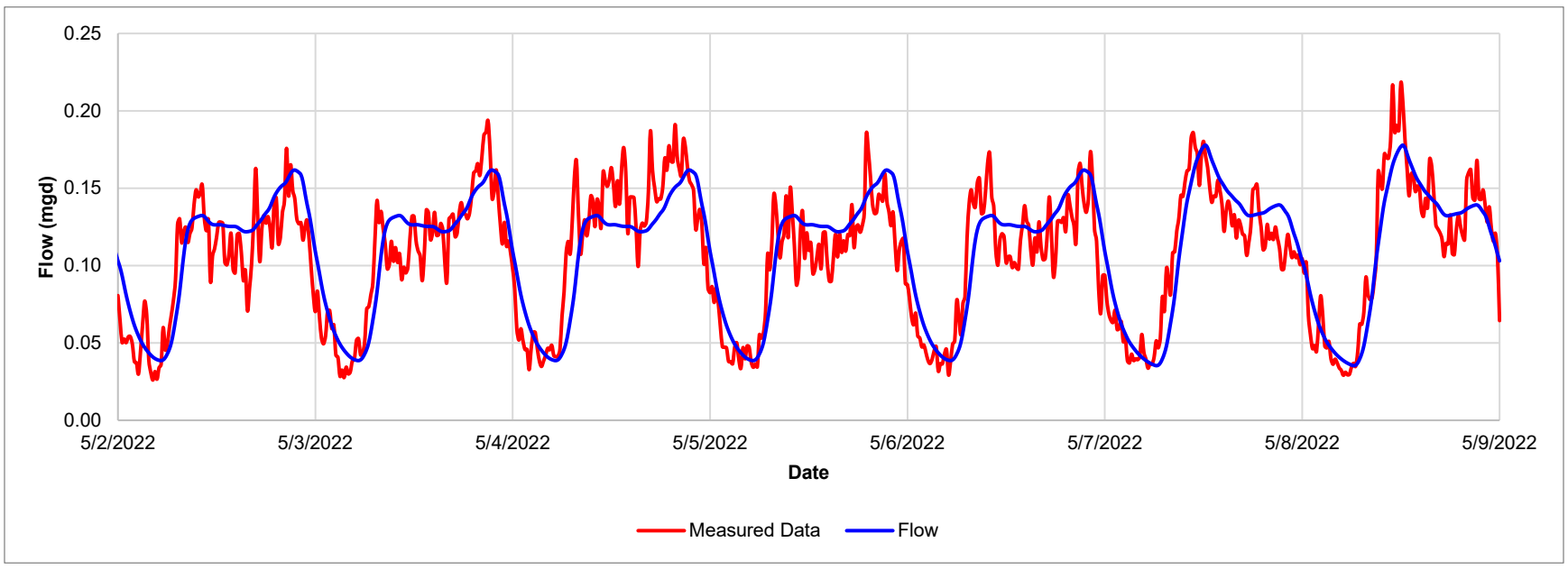


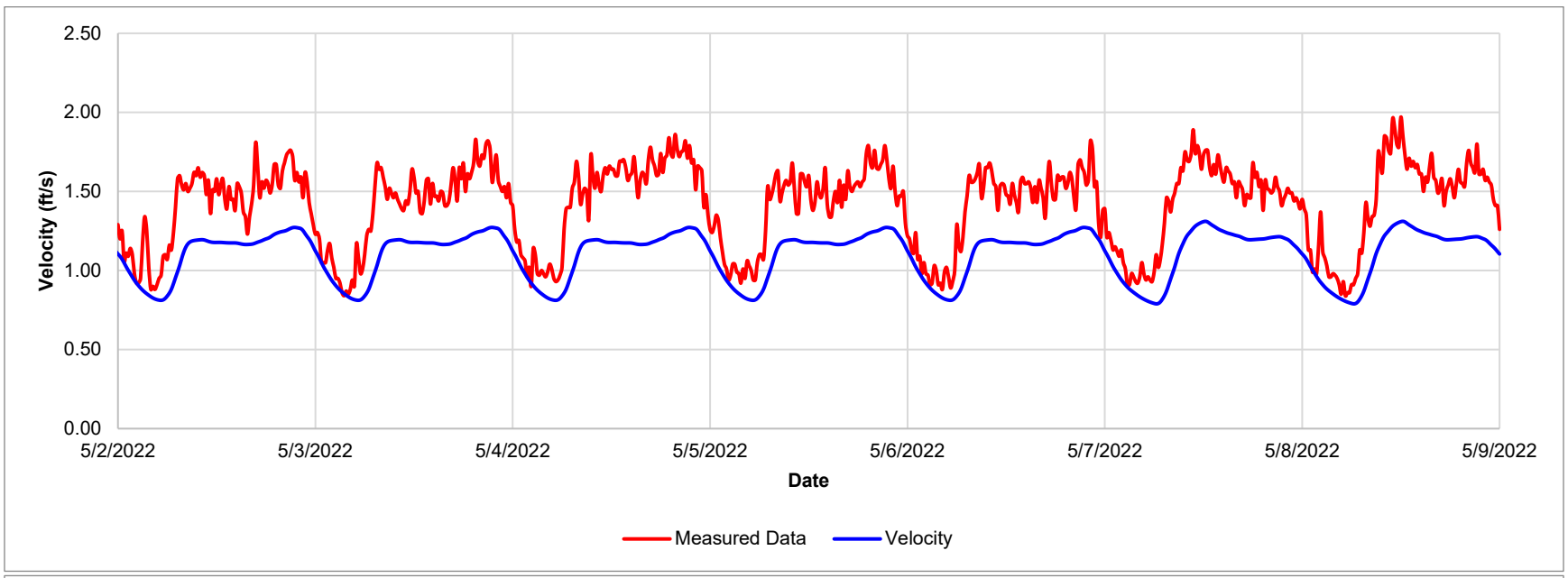


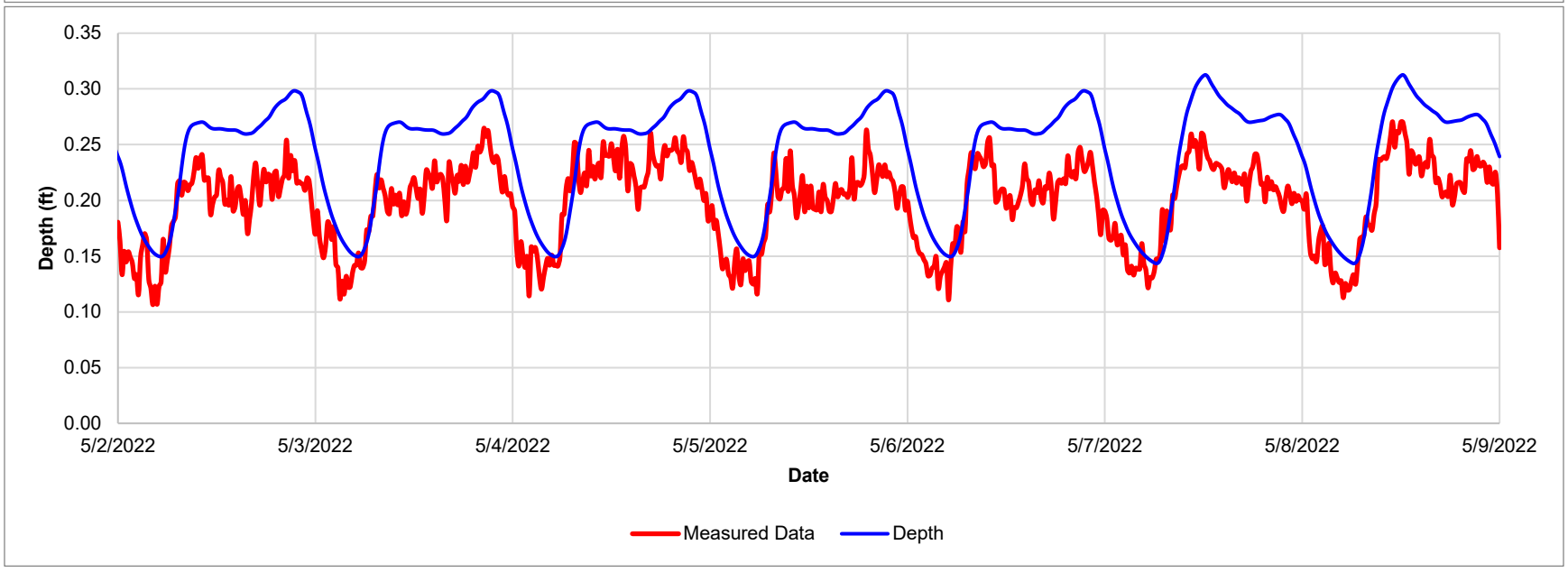


Site 11	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	3.57	0.93	1.38	1.25	0.38	1.39	0.73	-89.4%	49.6%	-47.4%	-42.1%
Min	0.76	0.00	0.00	0.00	0.22	0.79	0.23				
Avg	1.10	0.63	0.53	0.53	0.32	1.19	0.53	-70.8%	89.6%	-0.7%	-0.7%
Volume			1,062,660	1,062,706			1,055,574			-0.7%	-0.7%

2.12 SITE 12 – DWF



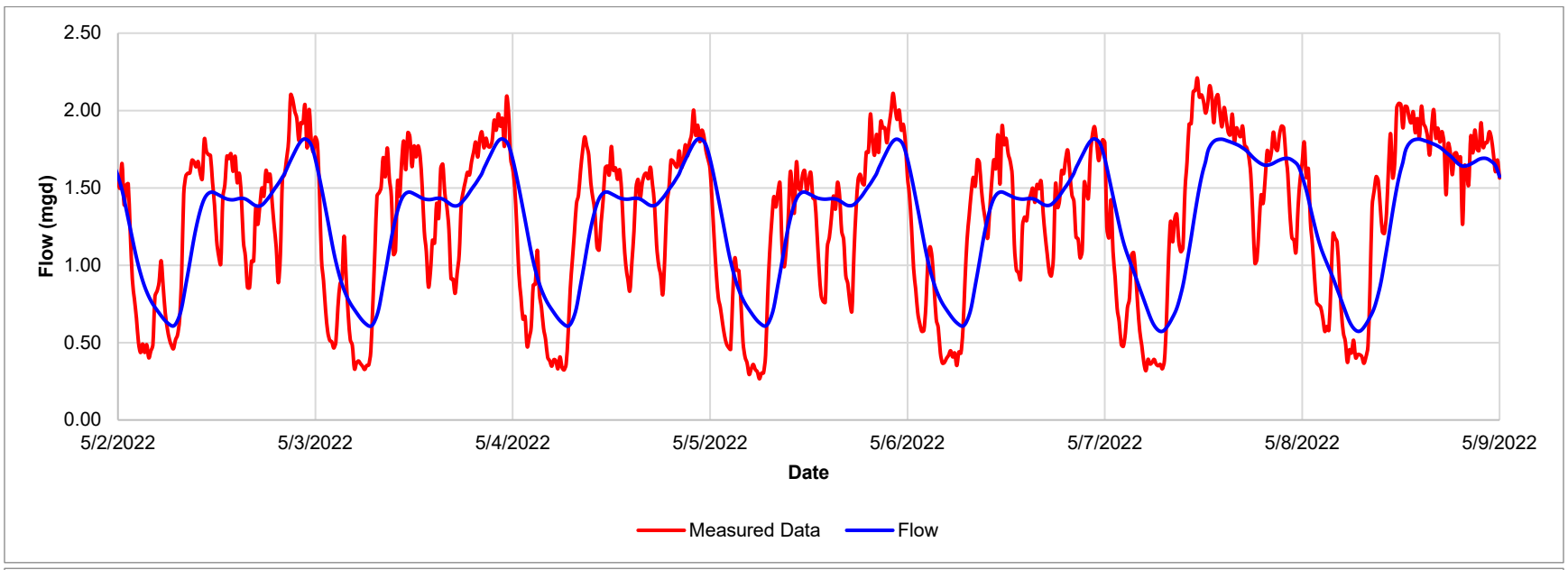


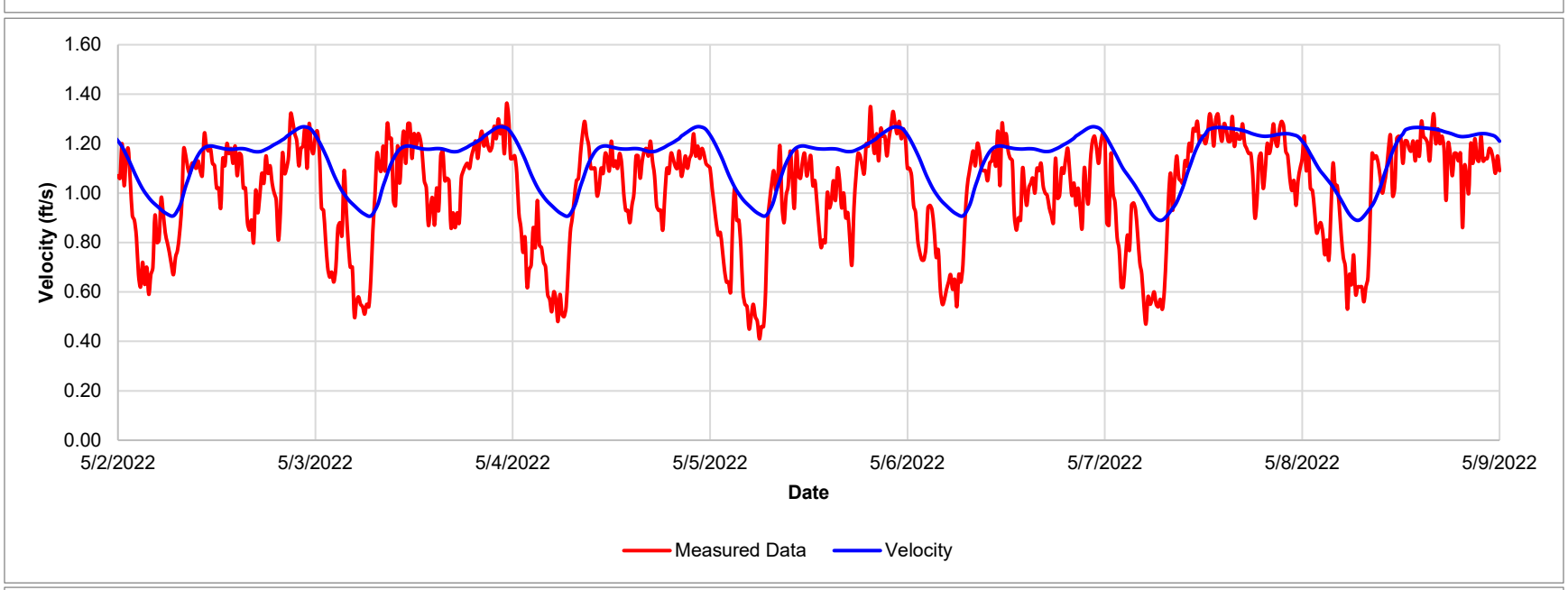


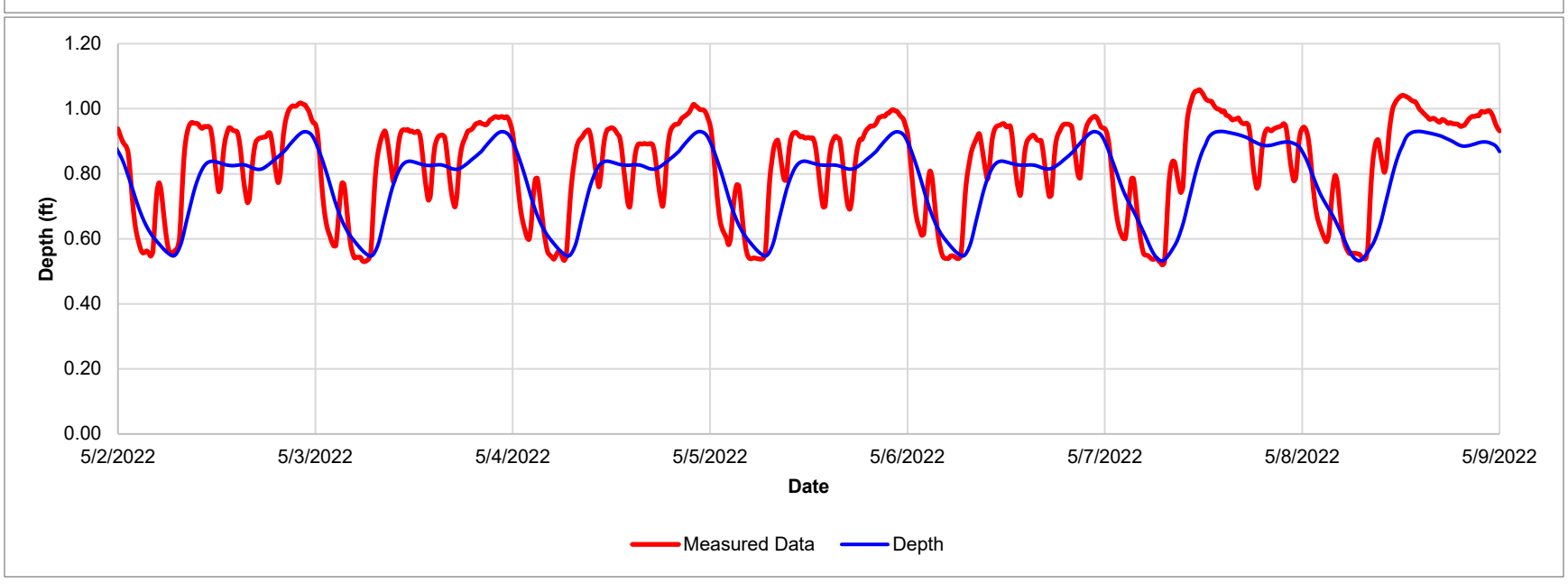
Site 12	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.27	1.97	0.22	0.20	0.31	1.31	0.18	15.6%	-33.5%	-18.5%	-11.2%
Min	0.11	0.84	0.03	0.03	0.14	0.79	0.04				
Avg	0.20	1.41	0.11	0.11	0.24	1.11	0.11	21.7%	-21.9%	2.5%	2.5%
Volume			213,885	213,912			219,331			2.5%	2.5%

2.13 SITE 13 – DWF (DATA COULD NOT BE USED)

2.14 SITE 14 – DWF

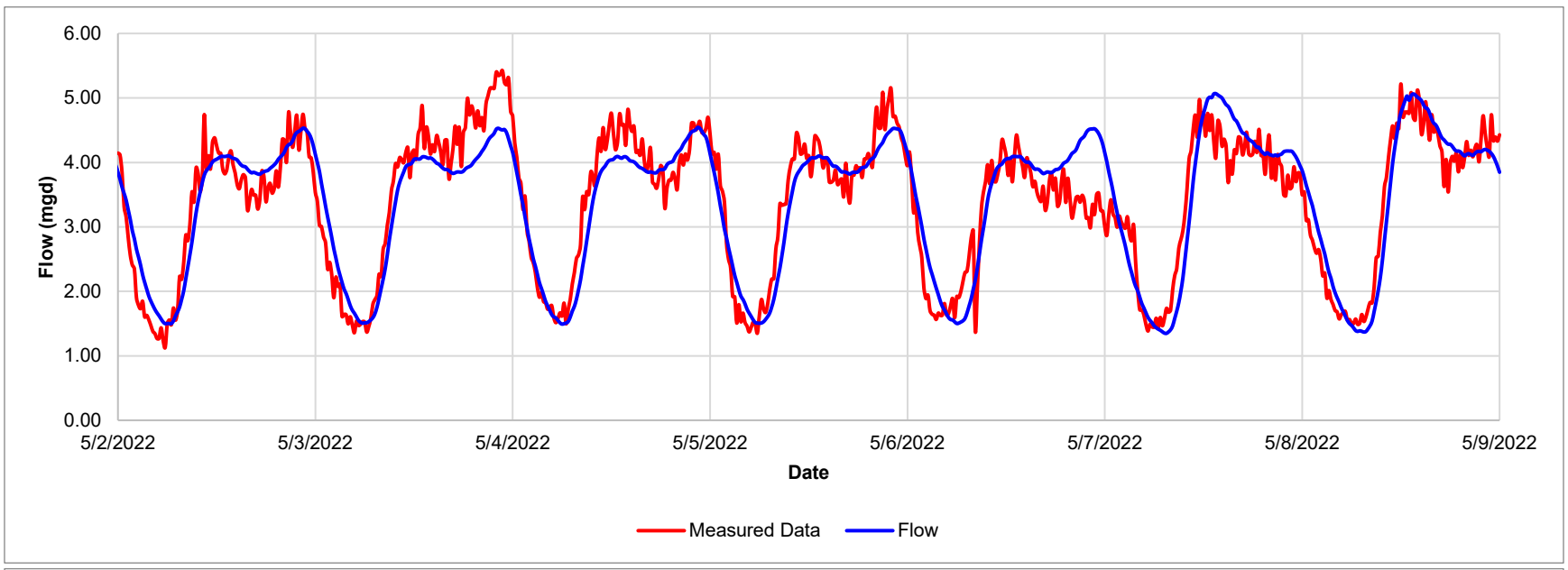


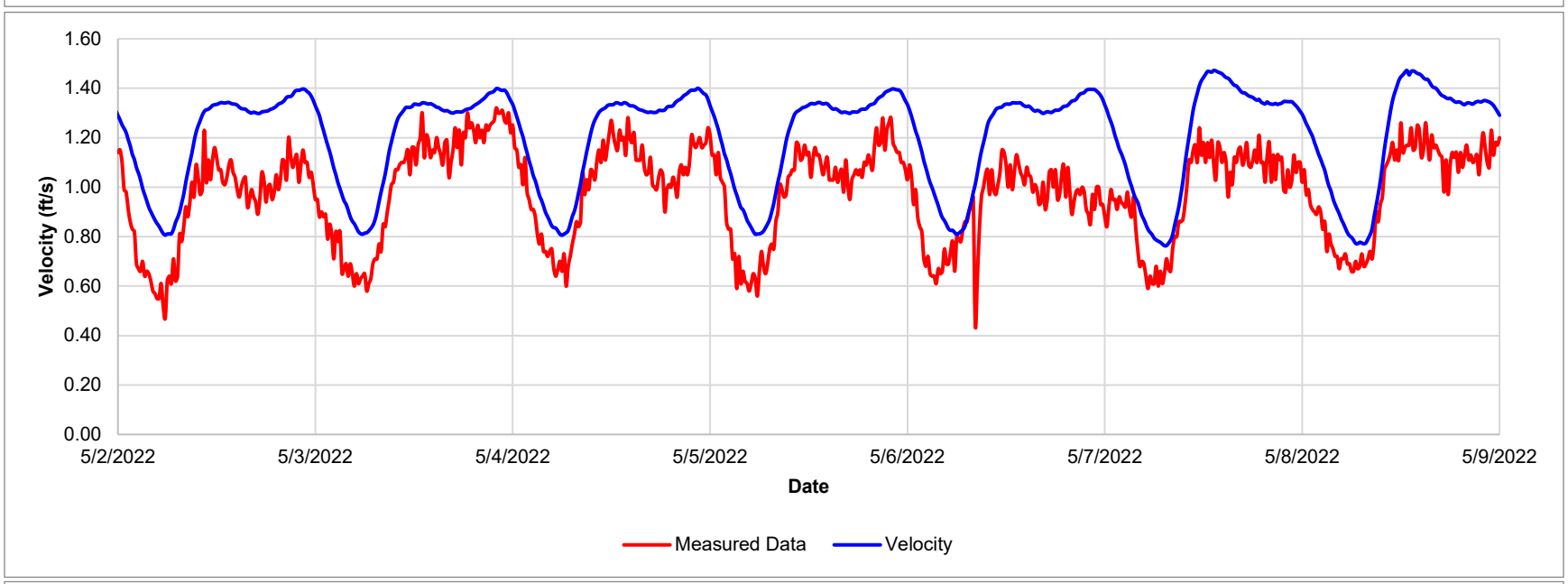


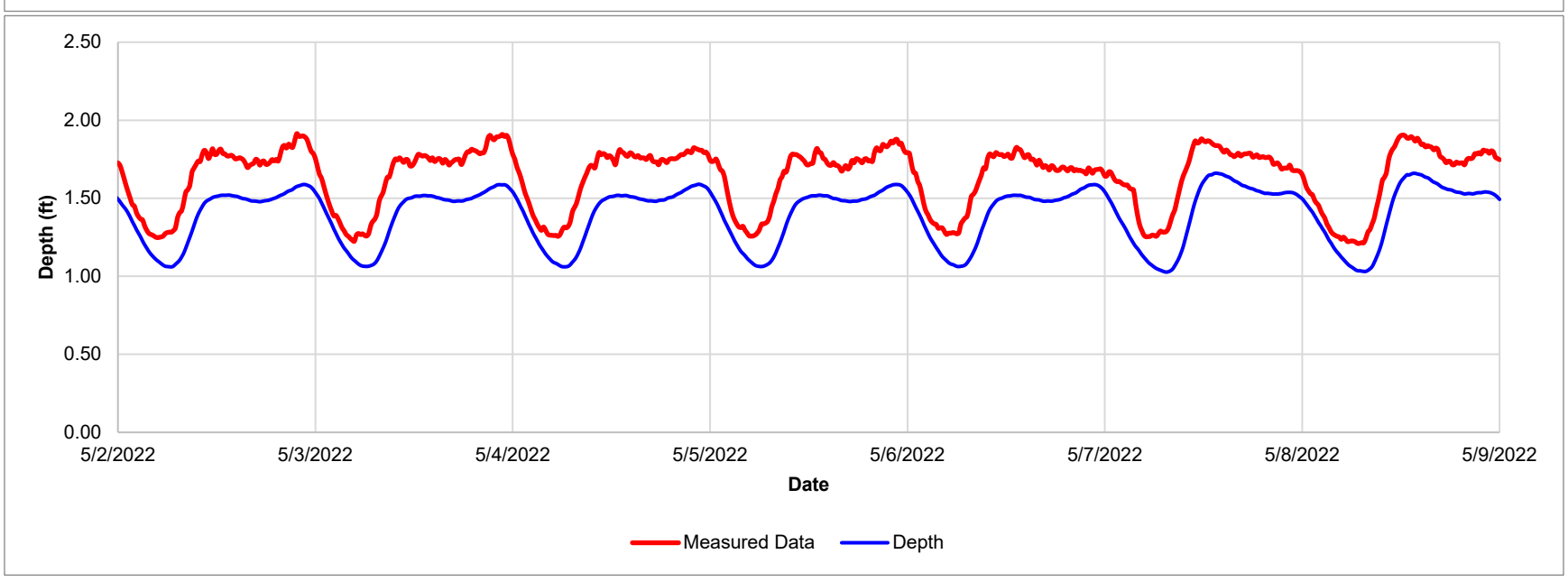


Site 14	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	1.06	1.36	2.21	2.14	0.93	1.27	1.82	-12.1%	-6.7%	-17.8%	-14.9%
Min	0.52	0.41	0.27	0.30	0.53	0.89	0.57				
Avg	0.83	1.01	1.29	1.29	0.78	1.13	1.31	-5.7%	12.8%	0.9%	0.9%
Volume			2,587,737	2,587,425			2,611,076			0.9%	0.9%

2.15 SITE 15 – DWF

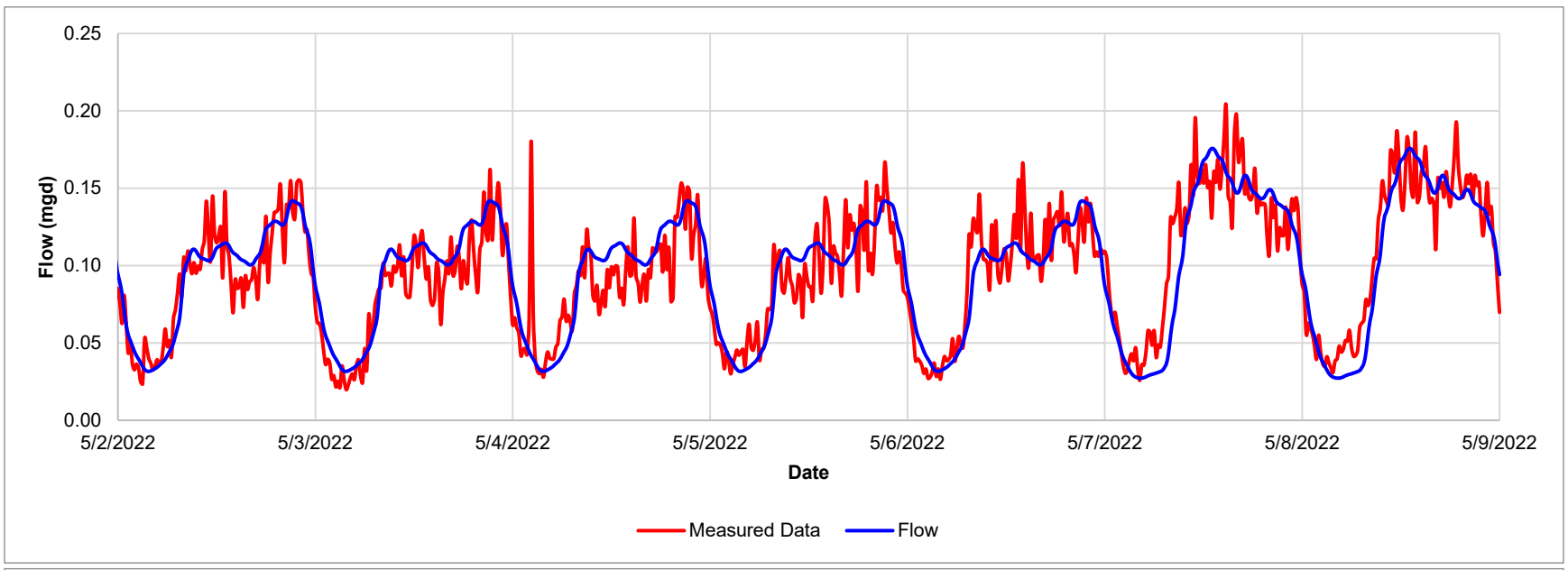


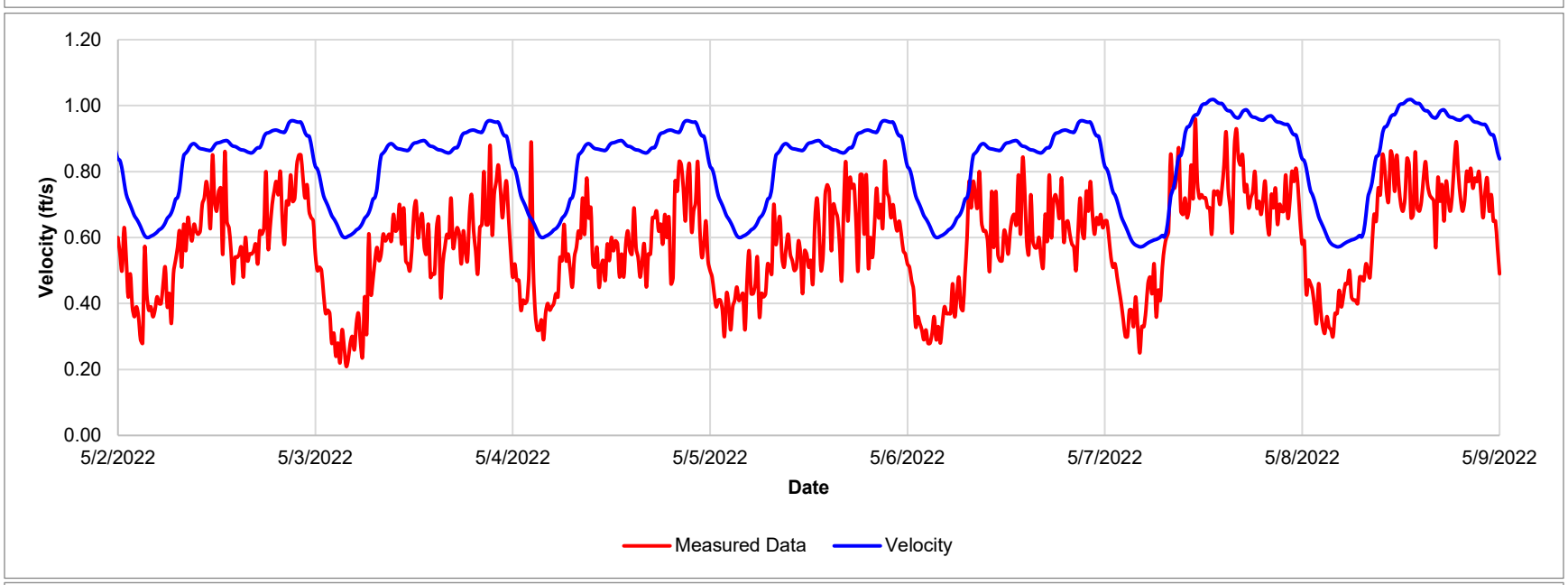


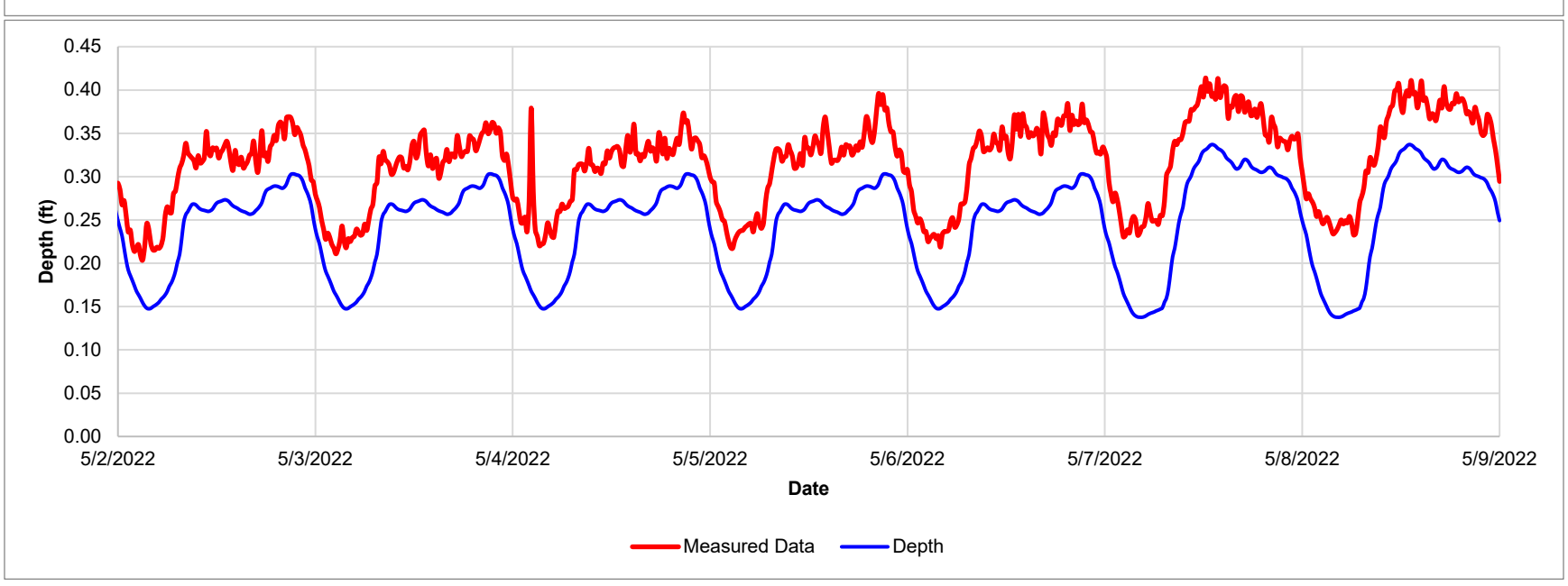


Site 15	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	1.91	1.32	5.42	5.38	1.66	1.47	5.07	-13.2%	11.5%	-6.6%	-5.9%
Min	1.21	0.44	1.13	1.27	1.03	0.76	1.35				
Avg	1.63	0.98	3.40	3.40	1.40	1.20	3.39	-14.3%	22.9%	-0.4%	-0.4%
Volume			6,807,116	6,806,770			6,778,721			-0.4%	-0.4%

2.16 SITE 16 – DWF

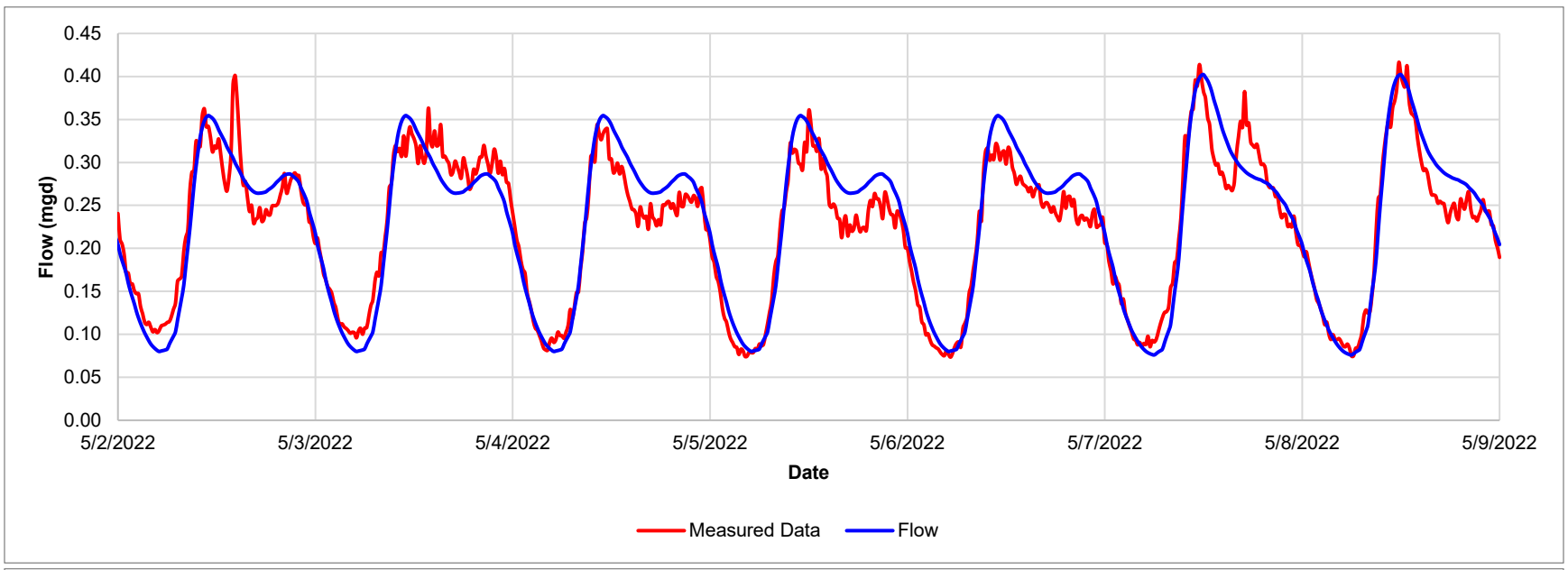


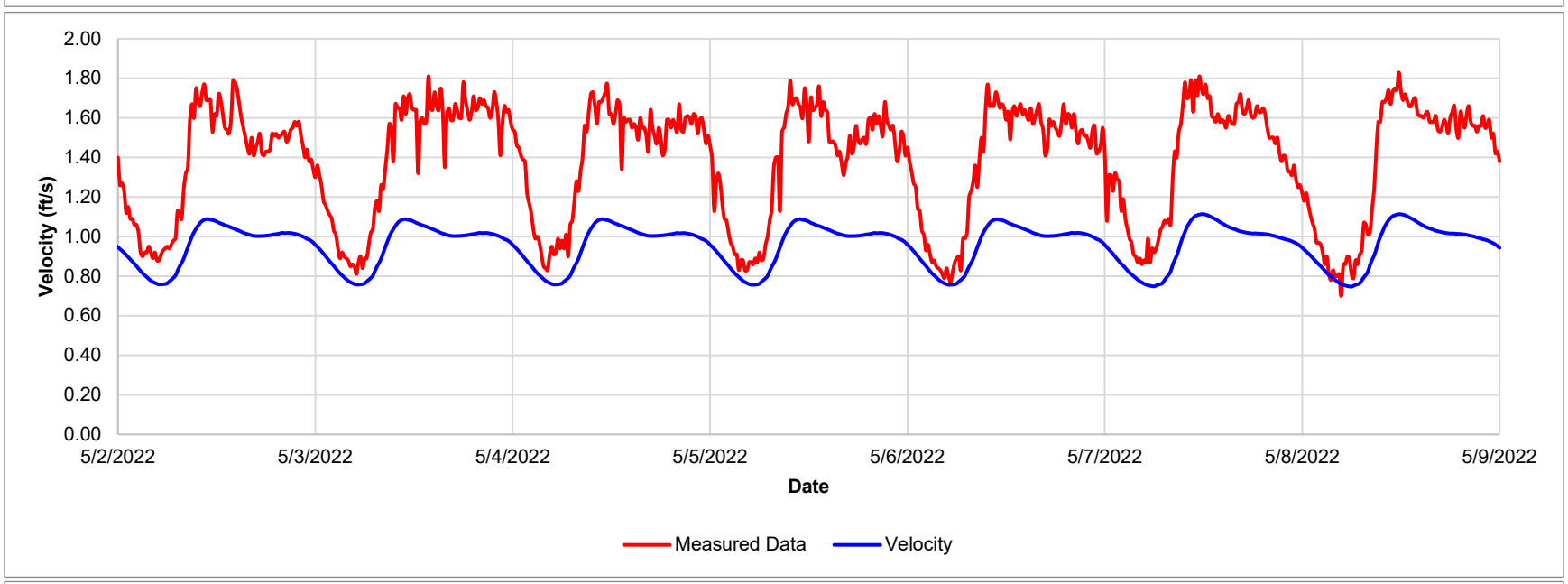


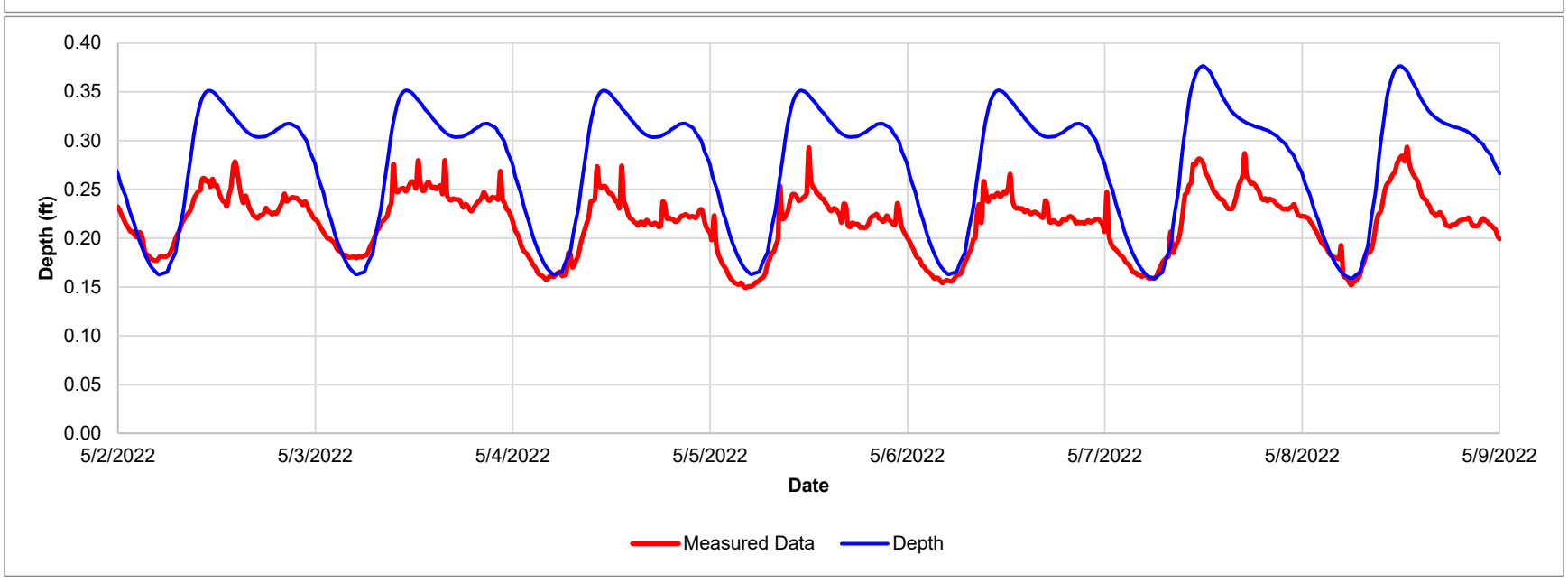


Site 16	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.41	0.96	0.20	0.18	0.34	1.02	0.18	-18.6%	6.1%	-13.6%	-3.1%
Min	0.20	0.21	0.02	0.02	0.14	0.57	0.03				
Avg	0.31	0.58	0.10	0.01	0.25	0.83	0.10	-22.0%	41.8%	0.5%	0.5%
Volume			193,148	193,169			194,184			0.5%	0.5%

2.17 SITE 17 – DWF

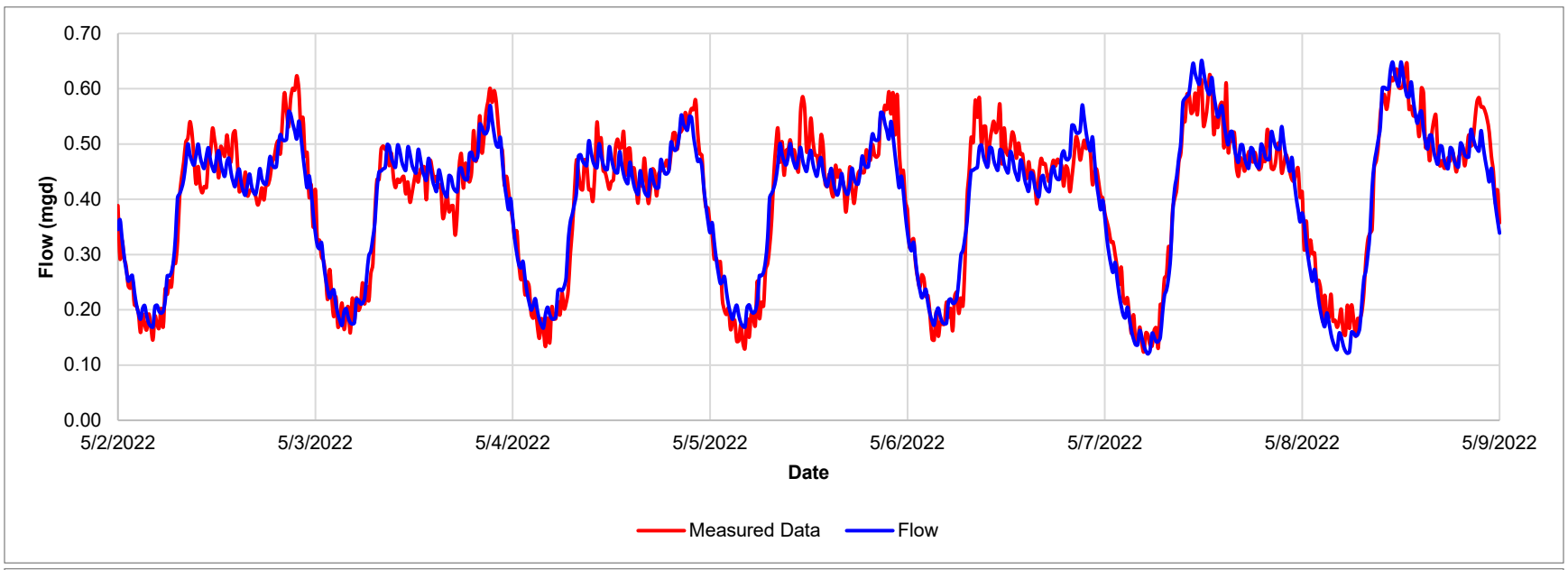


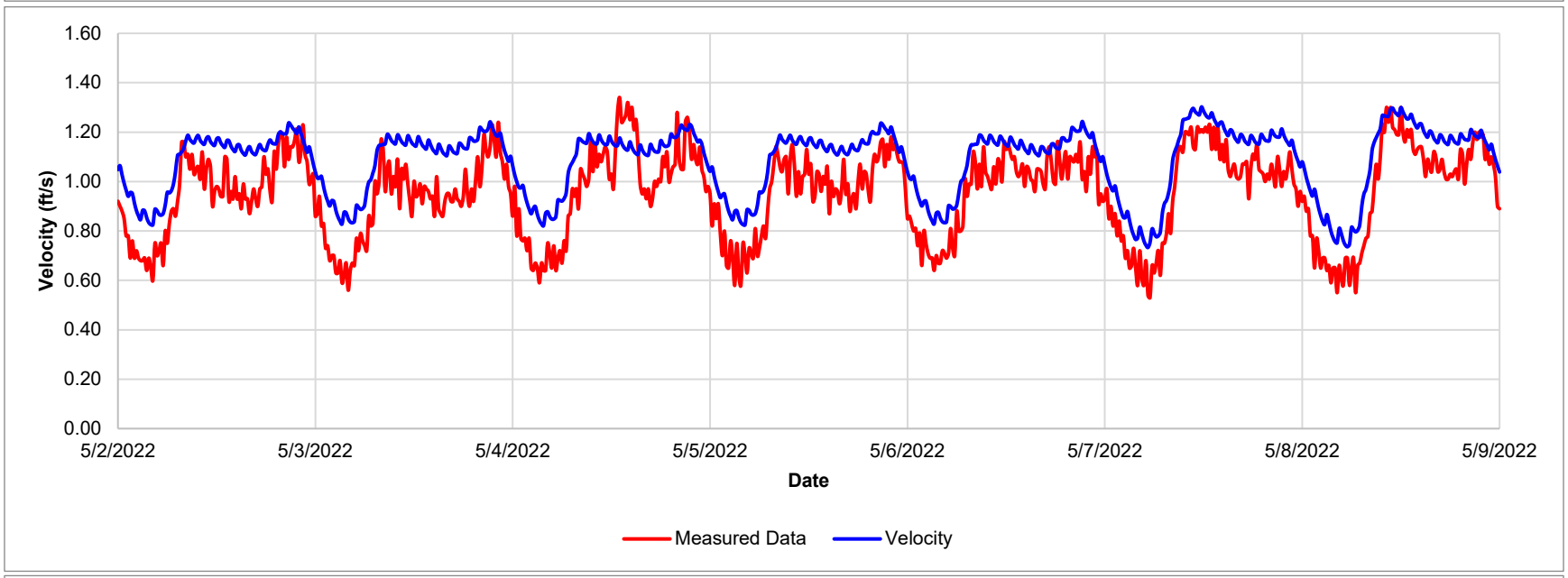


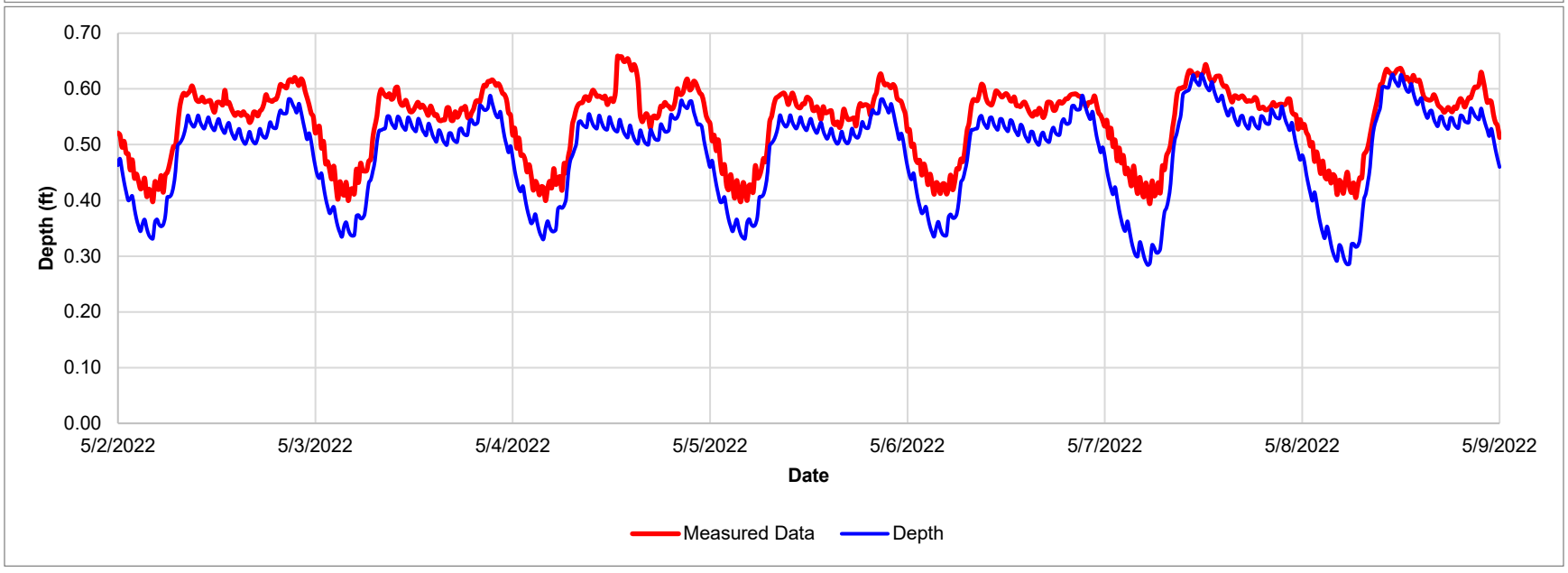


Site 17	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.29	1.83	0.42	0.40	0.38	1.11	0.40	28.2%	-39.2%	-3.4%	0.6%
Min	0.15	0.70	0.07	0.08	0.16	0.75	0.08				
Avg	0.22	1.38	0.22	0.22	0.28	0.96	0.23	27.6%	-31.0%	2.6%	2.6%
Volume			449,233	449,340			460,927			2.6%	2.6%

2.18 SITE 18 – DWF







Site 18	Measured				Modeled			Error			
DWF 2	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Hourly Rolling Average (Mgal/d)	Level (ft)	Vel (ft/s)	Flow (Mgal/d)	Level	Vel	Flow	Hourly Rolling Average
Max	0.66	1.30	0.65	0.68	0.63	1.30	0.65	-2.4%	0.1%	0.8%	-4.3%
Min	0.39	0.47	0.12	0.16	0.28	0.73	0.12				
Avg	0.54	0.95	0.40	0.40	0.49	1.08	0.40	-9.2%	13.5%	-0.7%	-1.4%
Volume			801,129	806,325			795,406			-0.7%	-1.4%

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN

DATE: Nov 2023

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: CITY OF MANTECA

CHECKED BY: SLB

DESCRIPTION: Model Data

TIME PATTERNS

Weekday - Hourly Time Patterns

Time	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Average
12:00 AM	0.4169	0.3792	0.2990	0.2611	0.4266	0.4160	0.5284	0.1457	0.5173	0.7245	0.4319	0.4632	1.0618	0.3947	0.7196	0.4682	0.3918	0.4070	0.4696
1:00 AM	0.2668	0.2241	0.2219	0.4360	0.1514	0.2675	0.3492	0.0378	0.3027	0.4746	0.3193	0.3133	1.0017	0.3445	0.4835	0.3045	0.2017	0.2709	0.3317
2:00 AM	0.2338	0.2174	0.2187	0.5988	0.0957	0.1818	0.2584	0.0939	0.1923	0.3189	0.2660	0.2282	0.5810	0.3530	0.3501	0.1761	0.0973	0.2408	0.2612
3:00 AM	0.2275	0.2357	0.2901	0.5633	0.1070	0.1814	0.1945	0.2039	0.2004	0.2402	0.2792	0.1792	1.1920	0.2829	0.2816	0.2126	0.1036	0.3085	0.2935
4:00 AM	0.3375	0.3115	0.4072	0.1472	0.0844	0.1954	0.2220	0.3745	0.2348	0.2122	0.3686	0.1924	0.7112	0.1360	0.3071	0.2665	0.1669	0.4102	0.2825
5:00 AM	0.5120	0.6116	0.6181	0.3224	0.0815	0.2957	0.3936	0.9113	0.3601	0.2782	0.6510	0.3800	0.5109	0.3036	0.4232	0.3679	0.2841	0.6574	0.4424
6:00 AM	1.0319	1.3328	0.9884	1.1070	0.4382	0.6632	0.5998	1.4656	0.7867	0.4723	1.0966	0.7795	0.4508	0.9280	0.6665	0.5576	0.6139	1.2022	0.8434
7:00 AM	1.5362	1.6986	1.1287	1.3175	0.6009	1.2258	0.9823	1.4419	1.2738	0.8342	1.2392	1.2606	1.2220	1.2967	0.9715	1.1036	1.1574	1.3227	1.2008
8:00 AM	1.4402	1.3031	1.1624	1.2752	0.7323	1.2101	1.1200	1.2354	1.1811	1.2023	1.2261	1.2526	1.5526	1.3461	1.1733	1.2452	1.6561	1.2817	1.2553
9:00 AM	1.3142	1.1763	1.2468	1.3008	1.1069	1.2182	1.3203	1.1643	1.1837	1.2521	1.2617	1.2690	1.8431	1.3471	1.2393	1.1577	1.7904	1.2750	1.3037
10:00 AM	1.1471	1.0675	1.3560	1.0502	1.4610	1.1725	1.4188	1.1230	1.2755	1.2673	1.2603	1.1777	1.3422	1.2176	1.2131	1.1362	1.6800	1.2559	1.2568
11:00 AM	1.1151	0.9880	1.3774	1.0856	1.6402	1.2146	1.3770	1.0528	1.2605	1.2556	1.1968	1.1981	1.8831	1.1342	1.2722	1.2606	1.5358	1.2481	1.2831
12:00 PM	1.0708	0.9286	1.3515	1.0839	1.7007	1.2293	1.3321	0.9663	1.2478	1.2611	1.1842	1.1778	1.8431	1.0902	1.2890	1.2931	1.4413	1.1985	1.2605
1:00 PM	1.0238	0.8774	1.2667	1.2747	1.8414	1.1014	1.2643	0.9111	1.2301	1.2421	1.1235	1.1824	1.5526	1.1115	1.1988	1.1959	1.3300	1.1341	1.2145
2:00 PM	0.9934	0.8432	1.3045	0.9390	1.6253	1.0256	1.2049	0.9420	1.1360	1.2019	1.1273	1.1293	0.9516	1.0217	1.1442	1.1400	1.2040	1.0916	1.1125
3:00 PM	1.0414	0.9212	1.3506	0.9655	1.5018	1.0486	1.1836	1.0443	1.1678	1.1634	1.1834	1.1550	0.9015	0.9743	1.1616	1.0975	1.1767	1.0991	1.1187
4:00 PM	1.0703	1.1161	1.4290	1.1663	1.4307	1.1782	1.2348	1.1718	1.1798	1.1733	1.2750	1.2436	0.8715	1.1474	1.2046	1.1859	1.2067	1.1494	1.1908
5:00 PM	1.2022	1.1914	1.4392	1.2822	1.5437	1.2304	1.2612	1.3731	1.2777	1.2292	1.3557	1.3215	0.5810	1.2779	1.2080	1.4317	1.2285	1.2155	1.2583
6:00 PM	1.3174	1.3623	1.4444	1.2368	1.5693	1.4272	1.3621	1.6738	1.3671	1.3116	1.4008	1.4685	0.9215	1.3320	1.2489	1.4785	1.3191	1.3256	1.3648
7:00 PM	1.4724	1.6513	1.5300	1.3418	1.5462	1.6269	1.4007	1.9973	1.4731	1.3861	1.4407	1.5060	0.6311	1.4740	1.3126	1.4399	1.3555	1.5016	1.4493
8:00 PM	1.6790	1.9262	1.3247	1.5175	1.3751	1.8099	1.4896	1.9188	1.6348	1.4978	1.3810	1.6239	0.5209	1.5888	1.4173	1.6552	1.2910	1.5370	1.5105
9:00 PM	1.6091	1.7300	1.0763	1.4945	1.2609	1.7896	1.4692	1.4140	1.5221	1.5694	1.1945	1.5524	0.5609	1.6035	1.4018	1.6222	1.1715	1.2964	1.4077
10:00 PM	1.2054	1.1903	0.7220	1.3736	0.9914	1.4408	1.1836	0.8893	1.1698	1.3657	1.0434	1.1733	0.7112	1.4380	1.2965	1.3593	0.9474	0.9429	1.1358
11:00 PM	0.7357	0.7162	0.4466	0.8594	0.6873	0.8499	0.8497	0.4483	0.8250	1.0657	0.6940	0.7726	0.6010	0.8562	1.0156	0.8440	0.6496	0.6280	0.7525

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN

DATE: Nov 2023

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: CITY OF MANTECA

CHECKED BY: SLB

DESCRIPTION: Model Data

TIME PATTERNS

Weekend - Hourly Time Patterns

Time	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Average
12:00 AM	0.5119	0.4998	0.4167	0.4881	0.5795	0.5945	0.6280	0.3854	0.6014	0.7825	0.7387	0.4734	1.0017	0.5472	0.8050	0.5241	0.4158	0.3907	0.534
1:00 AM	0.3553	0.2497	0.2765	0.9961	0.3354	0.3956	0.4597	0.2361	0.3830	0.5460	0.3569	0.3286	1.7496	0.6337	0.6345	0.2714	0.2343	0.2003	0.444
2:00 AM	0.2842	0.1900	0.1942	0.5529	0.2436	0.2497	0.3414	0.2105	0.2400	0.3667	0.2514	0.2489	1.4023	0.3586	0.4544	0.1387	0.1157	0.1056	0.306
3:00 AM	0.1969	0.1630	0.1976	0.0662	0.2940	0.2141	0.2401	0.2017	0.2309	0.2435	0.2356	0.1871	0.7746	0.1026	0.3203	0.1296	0.1064	0.0837	0.205
4:00 AM	0.1701	0.1469	0.2273	0.1205	0.1118	0.1655	0.2074	0.2462	0.1786	0.1890	0.2292	0.1541	1.3222	0.0673	0.2991	0.1630	0.1082	0.1014	0.216
5:00 AM	0.2243	0.1753	0.4097	0.7853	0.1100	0.1733	0.2167	0.4573	0.1434	0.1679	0.2846	0.1411	2.0301	0.3366	0.3064	0.1815	0.1310	0.2123	0.333
6:00 AM	0.4151	0.5038	0.7741	0.8010	0.2556	0.2591	0.3138	0.8513	0.2973	0.2251	0.5420	0.3794	1.2821	0.4415	0.3529	0.2185	0.3429	0.5920	0.455
7:00 AM	0.9550	1.0649	1.0740	0.2886	0.3228	0.7609	0.5887	1.3260	0.7227	0.4355	1.0238	0.7522	1.4558	0.5477	0.5810	0.6389	0.7860	1.1875	0.746
8:00 AM	1.4548	1.6466	1.3121	1.0950	0.5843	1.2999	0.9322	1.6464	1.1354	0.8865	1.3856	1.2318	2.3907	1.1911	0.9397	1.0747	1.5320	1.6195	1.200
9:00 AM	1.7730	1.9941	1.5636	1.4535	0.9530	1.6868	1.3534	1.7767	1.4605	1.3145	1.6385	1.5253	1.9366	1.5563	1.2906	1.5490	1.9245	1.8195	1.468
10:00 AM	1.8167	1.9039	1.6210	1.4610	1.3398	1.9783	1.6759	1.7469	1.6327	1.5648	1.6148	1.7385	2.6311	1.6431	1.5330	1.7793	2.0621	1.8189	1.622
11:00 AM	1.7191	1.7986	1.6540	1.4483	1.7583	1.9770	1.6977	1.5832	1.7088	1.7114	1.3151	1.8034	1.6962	1.6459	1.5820	2.0064	1.9404	1.7584	1.583
12:00 PM	1.5789	1.6424	1.6435	1.4901	1.8141	1.8386	1.7448	1.4478	1.6320	1.6681	1.2116	1.5816	1.1219	1.5712	1.5398	2.1024	1.7009	1.6267	1.488
1:00 PM	1.4182	1.4710	1.5064	1.4859	1.7649	1.6460	1.5555	1.3113	1.5571	1.6066	1.2643	1.4715	2.2705	1.5209	1.4541	2.0114	1.5048	1.4773	1.454
2:00 PM	1.3320	1.2927	1.4086	1.5161	1.5856	1.5655	1.4002	1.1936	1.4345	1.4323	1.3330	1.3966	1.2154	1.4944	1.3873	1.8513	1.3952	1.3481	1.314
3:00 PM	1.2803	1.2451	1.3571	1.5192	1.5066	1.4863	1.2949	1.1675	1.3212	1.3212	1.4325	1.3389	1.7362	1.5017	1.3269	1.7095	1.3481	1.2918	1.294
4:00 PM	1.2271	1.1889	1.3317	1.4847	1.5173	1.3932	1.2306	1.2026	1.2664	1.2782	1.5069	1.2391	2.5109	1.4583	1.3669	1.8754	1.2924	1.2737	1.318
5:00 PM	1.2693	1.1718	1.3513	1.3015	1.3692	1.3399	1.2384	1.2752	1.2869	1.2722	1.2747	1.2740	1.6962	1.3814	1.3662	1.7207	1.2875	1.2729	1.241
6:00 PM	1.3241	1.2368	1.3281	1.4317	1.2343	1.3745	1.2154	1.4257	1.3238	1.2851	1.2589	1.2826	1.1352	1.3608	1.2963	1.6659	1.2683	1.3027	1.220
7:00 PM	1.4452	1.3793	1.4129	1.3648	1.2625	1.4285	1.2676	1.5724	1.3897	1.2884	1.2866	1.3331	0.9616	1.4516	1.2650	1.7516	1.2000	1.3803	1.256
8:00 PM	1.4907	1.4969	1.2458	1.3469	1.1761	1.6364	1.2979	1.5338	1.4713	1.3500	1.2777	1.3462	0.9349	1.4878	1.2659	1.6210	1.1169	1.4081	1.259
9:00 PM	1.3848	1.4070	1.0747	1.3780	1.0149	1.5973	1.1895	1.3043	1.3597	1.3313	1.2625	1.2387	1.8831	1.4364	1.2494	1.5793	1.0322	1.2416	1.231
10:00 PM	1.1174	1.0499	0.7934	1.3411	1.0154	1.3109	1.0297	0.9755	1.1168	1.2263	1.1295	1.0131	1.3088	1.2978	1.1174	1.3827	0.8643	0.9448	1.029
11:00 PM	0.7818	0.7418	0.5619	0.6395	0.8199	0.8964	0.8067	0.6541	0.8489	1.0094	0.9373	0.8010	1.8164	0.7435	0.9595	0.9638	0.6309	0.6689	0.785

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN

DATE: Nov 2023

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: CITY OF MANTECA

CHECKED BY: SLB

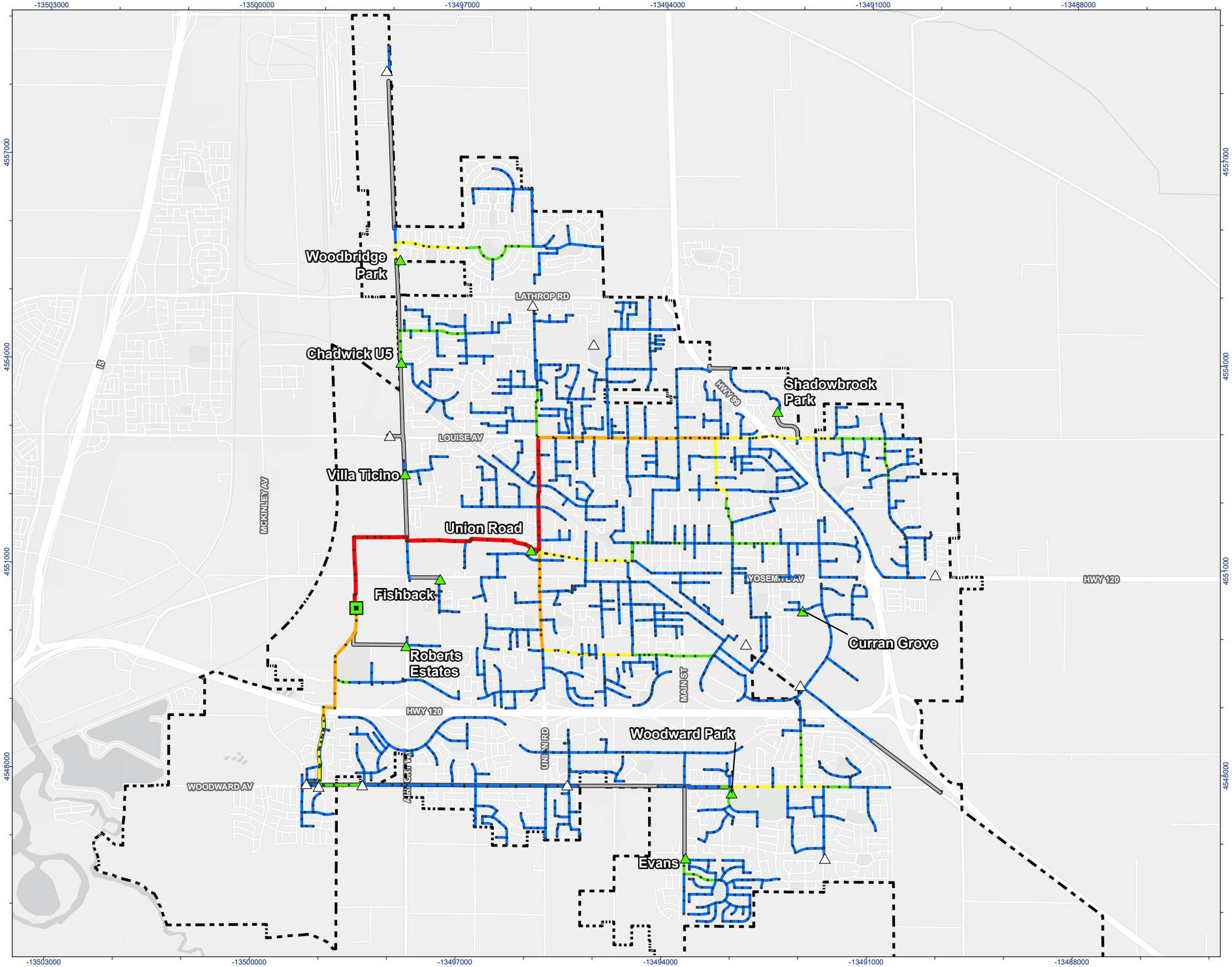
DESCRIPTION: Model Data

ENR: 13,176

Unit Hydrograph RTK Parameters

RTK Parameters

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Average
R - Short-Term	0.0150	0.0100	0.0130	0.0100	0.0030	0.0090	0.0170	0.0100	0.0110	0.0075	0.0080	0.0080	0.0010	0.0020	0.0110	0.0120	0.0110	0.0110	0.0094
R - Medium-Term	0.0150	0.0150	0.0100	0.0100	0.0050	0.0090	0.0110	0.0100	0.0070	0.0030	0.0030	0.0040	0.0015	0.0020	0.0050	0.0120	0.0050	0.0060	0.0074
R - Long-Term	0.0200	0.0150	0.0200	0.0200	0.0200	0.0100	0.0200	0.0100	0.0100	0.0100	0.0100	0.0100	0.0001	0.0010	0.0010	0.0100	0.0100	0.0100	0.0115
T - Short-Term	0.5	0.5	1.0	0.5	0.5	0.5	0.5	1.0	0.5	0.8	1.0	0.8	0.5	0.5	0.5	0.8	0.5	0.6	0.6
T - Medium-Term	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	4	4	2
T - Long-Term	20	20	20	20	20	20	20	20	20	20	20	20	10	20	20	20	20	20	19
K - Short-Term	3	3	1	3	3	3	3	2	3	3	2	2	3	3	3	3	4	1	3
K - Medium-Term	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
K - Long-Term	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30



Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Modeled Forcemain
- Modeled Wastewater Sewer

Peak Flow (Mgal/d)

- <= 0.5 Mgal/d
- > 0.5 Mgal/d - 1.0 Mgal/d
- > 1.0 Mgal/d - 2.0 Mgal/d
- > 2.0 Mgal/d - 5.0 Mgal/d
- > 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
1:45,000

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-1

Title
Scenario 1
Peak Sewer Flow

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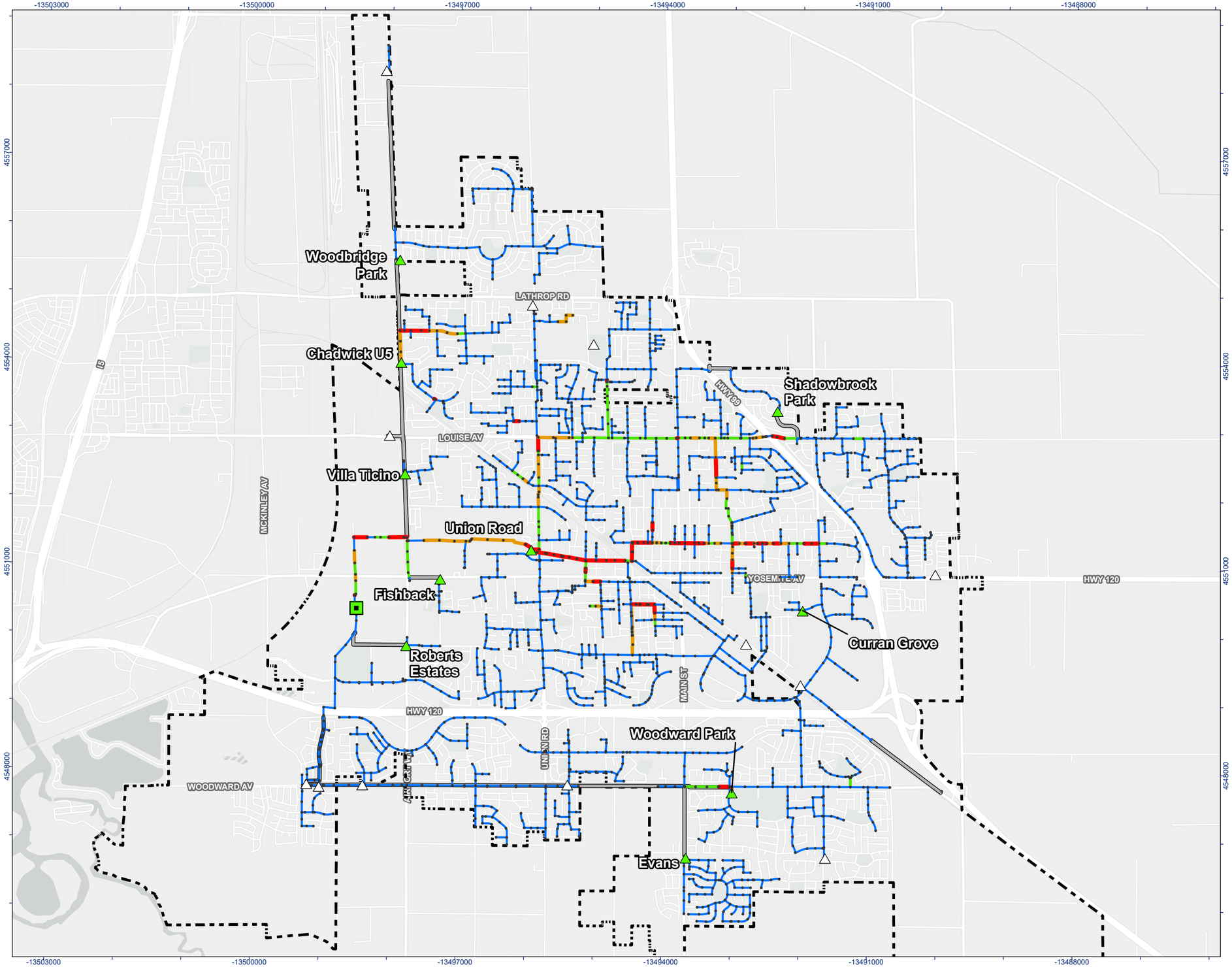

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Modeled Forcemain

Peak Pipe Utilization (% of FPC)

- <= 50%
- > 50% - 75%
- > 75% - 50%
- > 100%
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
1:45,000

Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-2

Title
Scenario 1
Peak Pipe Utilization (% of FPC)

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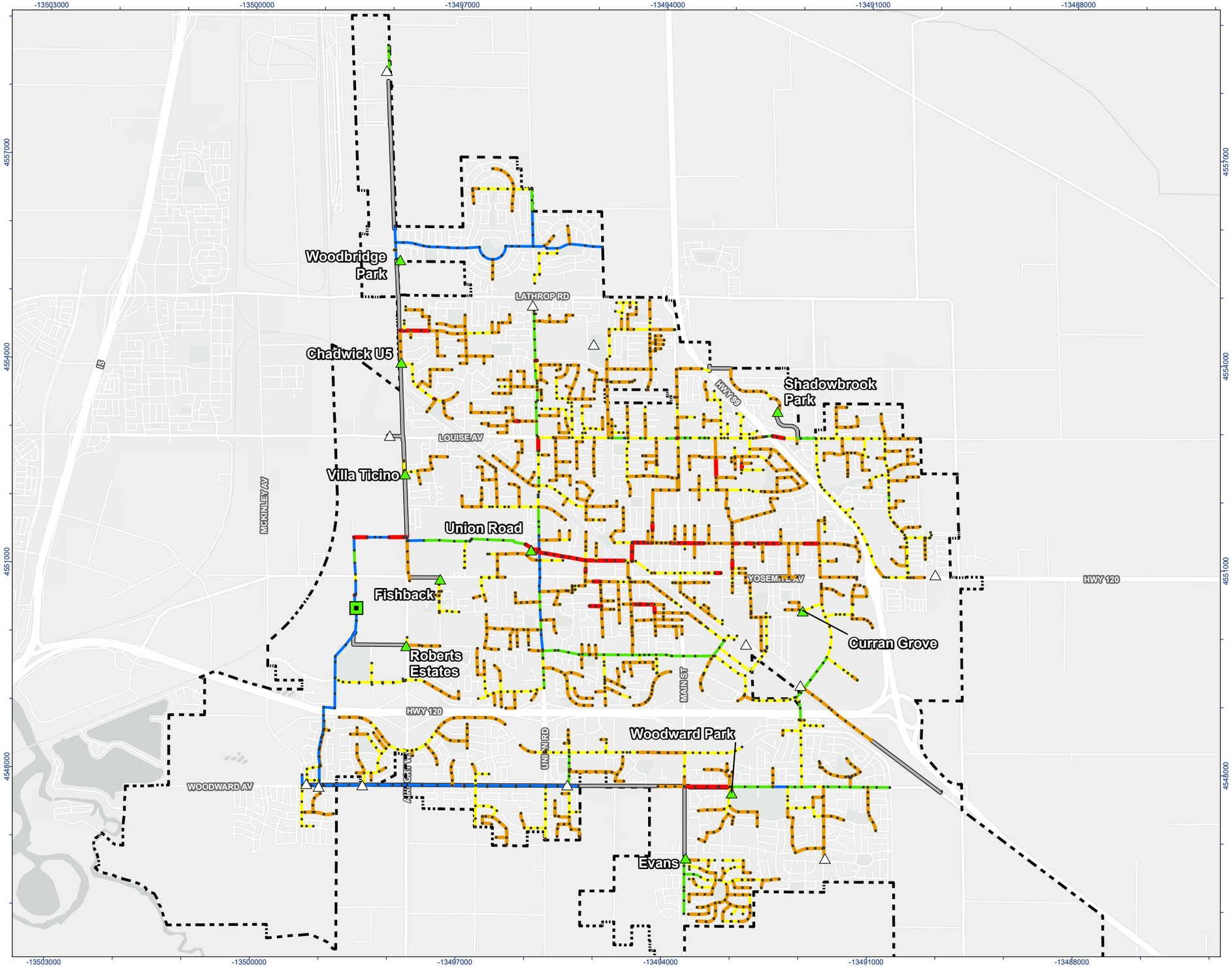

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Modeled Forcemain

Residual Capacity

- No Residual Capacity
- < 0.0 Mgal/d - 0.5 Mgal/d
- < 0.5 Mgal/d - 2.0 Mgal/d
- < 2.0 Mgal/d - 5.0 Mgal/d
- < 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-3

Title
Scenario 1
Residual Capacity

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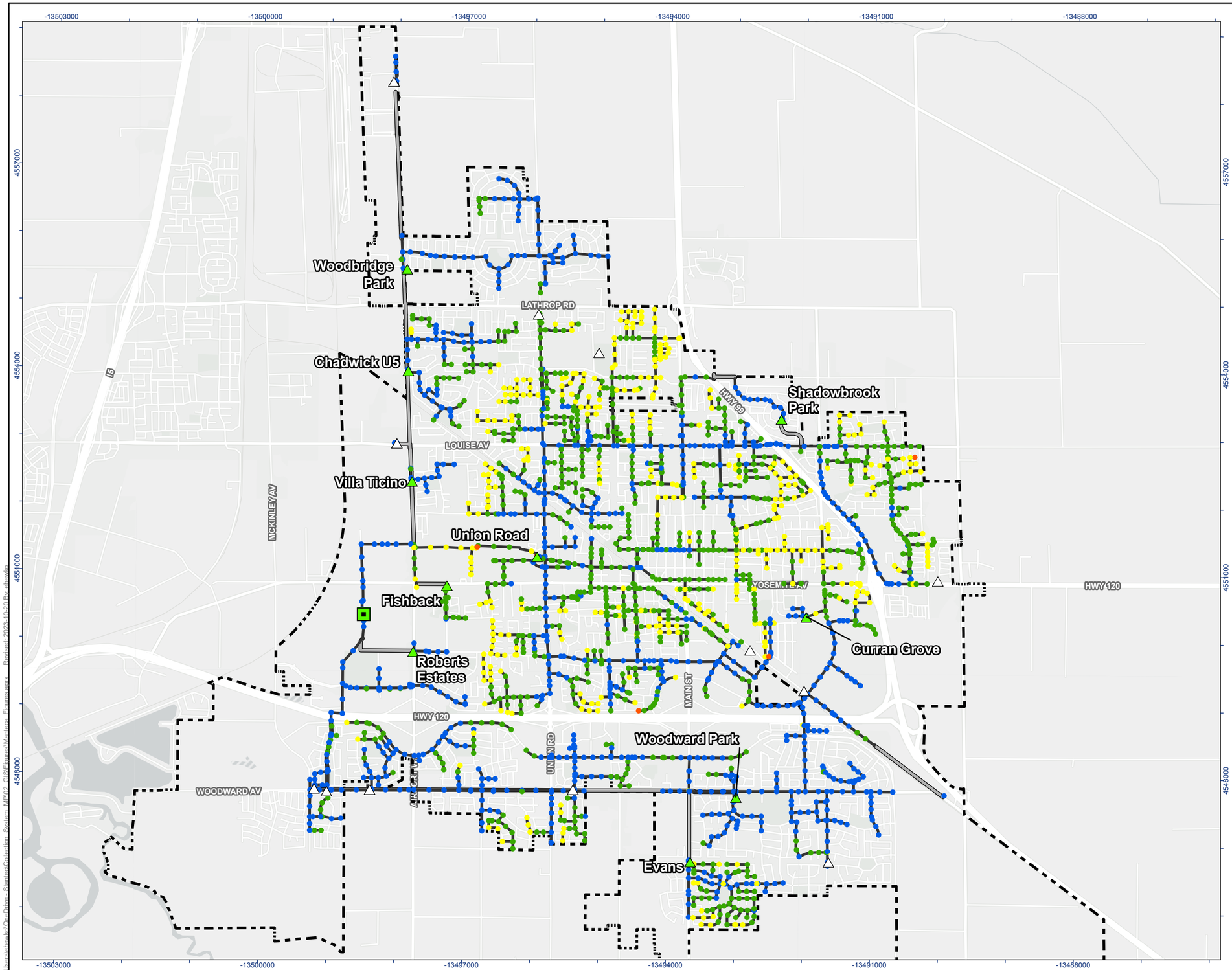

Stantec

MANTECA CALIFORNIA

Legend

- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Modeled Forcemain
- Modeled Sanitary Sewer

Manhole Freeboard (ft)

- <= 2 ft
- > 2 ft - 6 ft
- > 6 ft - 10 ft
- > 10 ft
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-4

Title
Scenario 1
Manhole Surcharging (Depth Below Rim)

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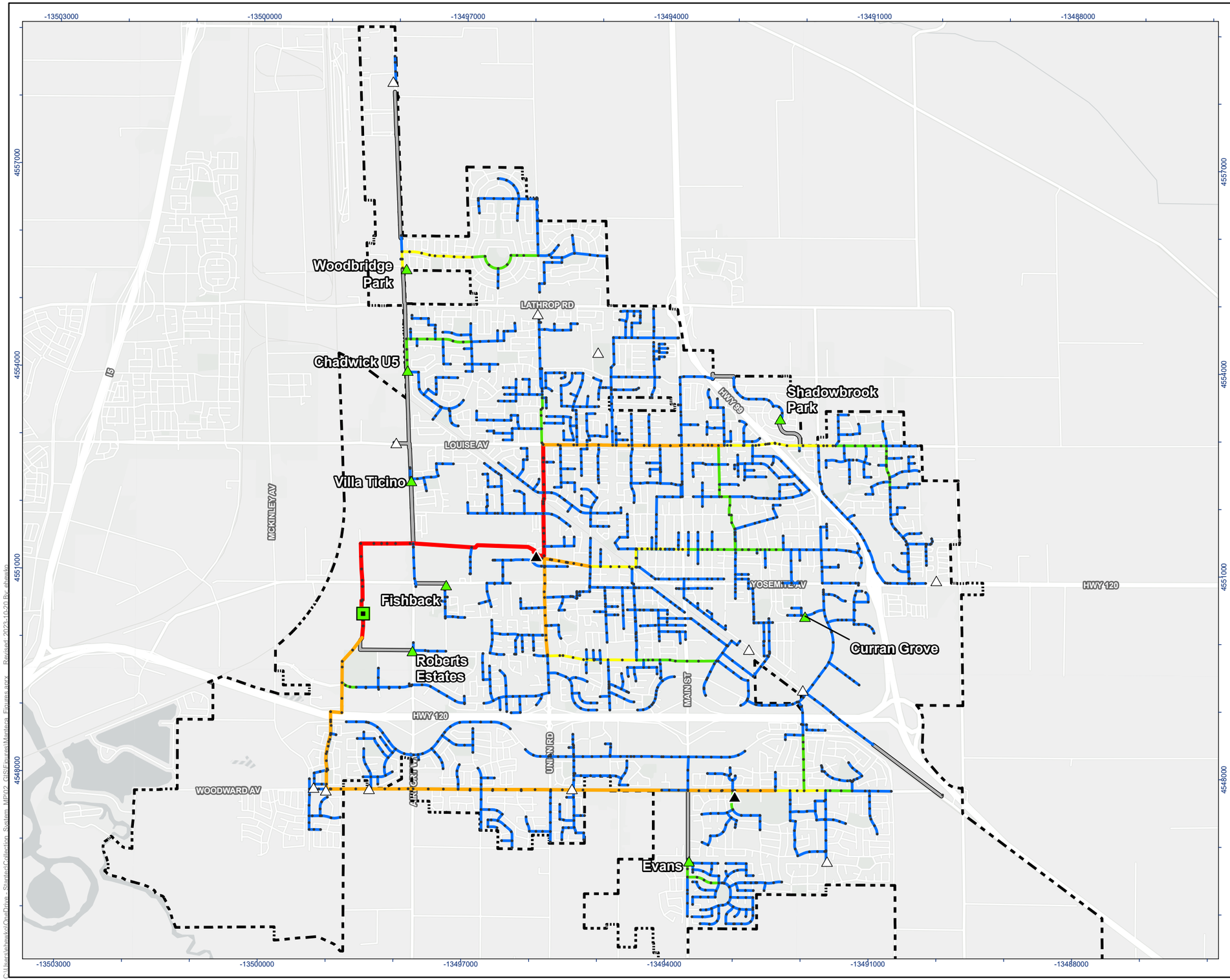

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Flow (Mgal/d)

- <= 0.5 Mgal/d
- > 0.5 Mgal/d - 1.0 Mgal/d
- > 1.0 Mgal/d - 2.0 Mgal/d
- > 2.0 Mgal/d - 5.0 Mgal/d
- > 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-5

Title
Scenario 1 + Improvements 1-6
Peak Sewer Flow

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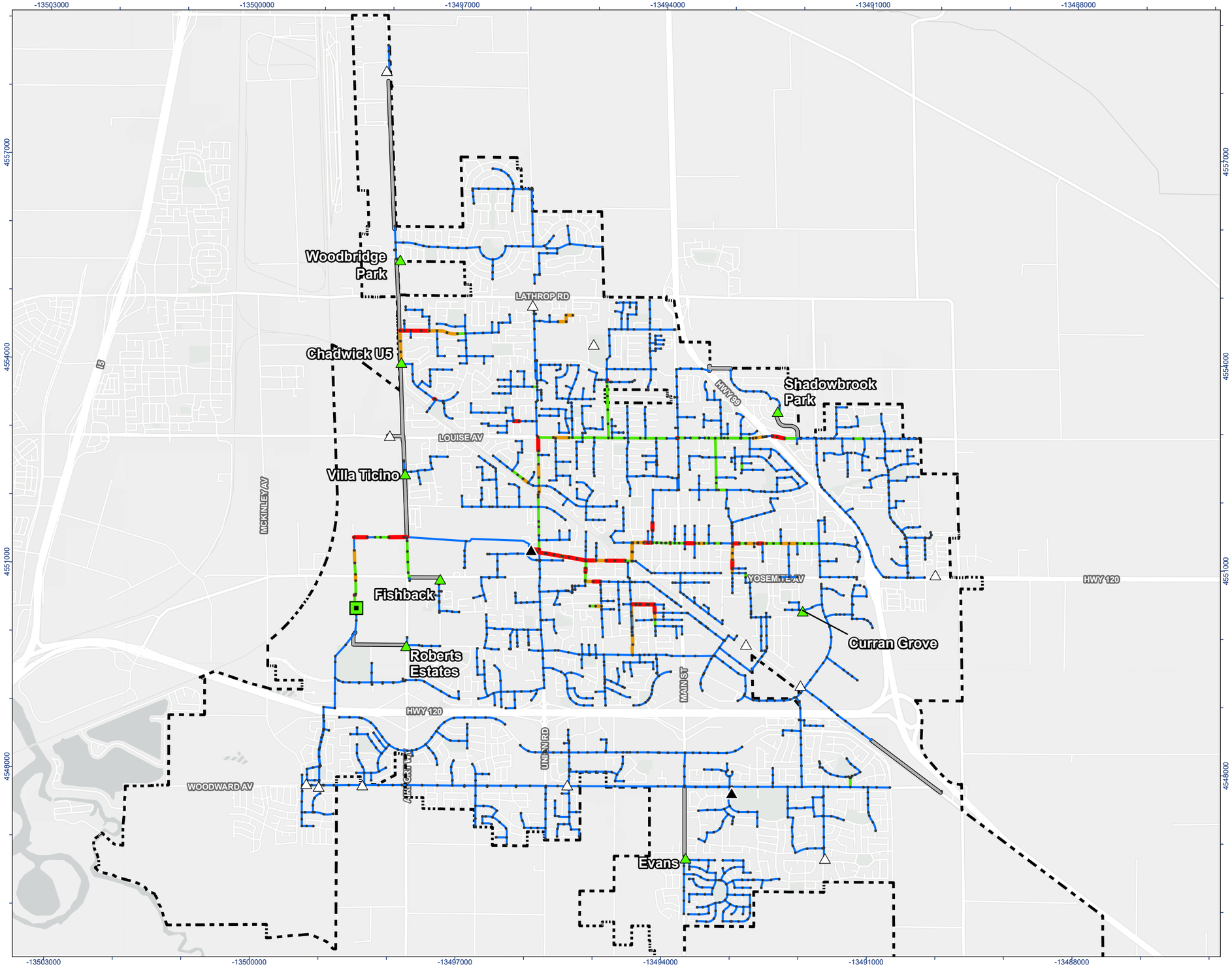

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Pipe Utilization (% of FPC)

- <= 50%
- > 50% - 75%
- > 75% - 50%
- > 100%
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-6

Title
Scenario 1 + Improvements 1-6
Peak Pipe Utilization (% of FPC)

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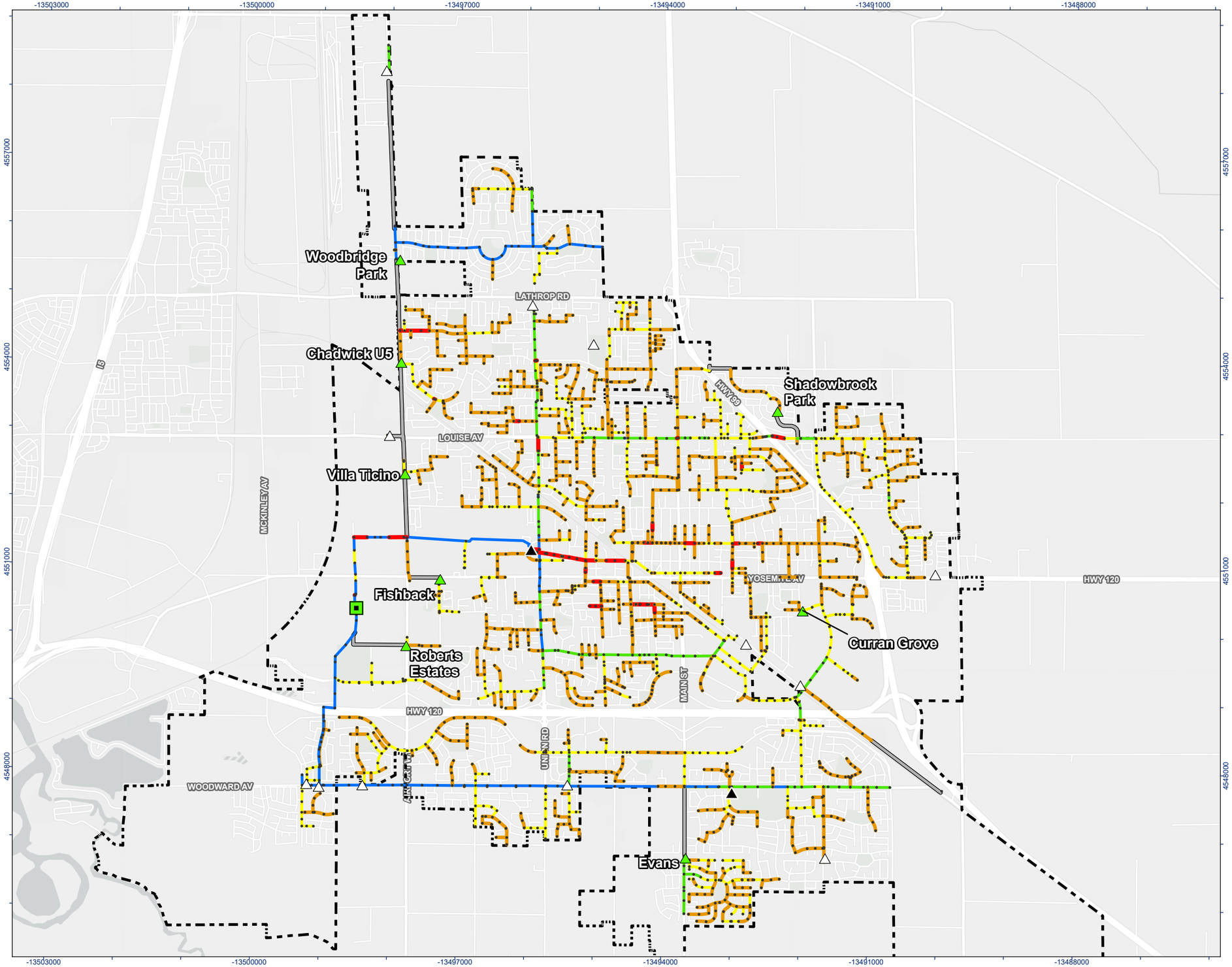

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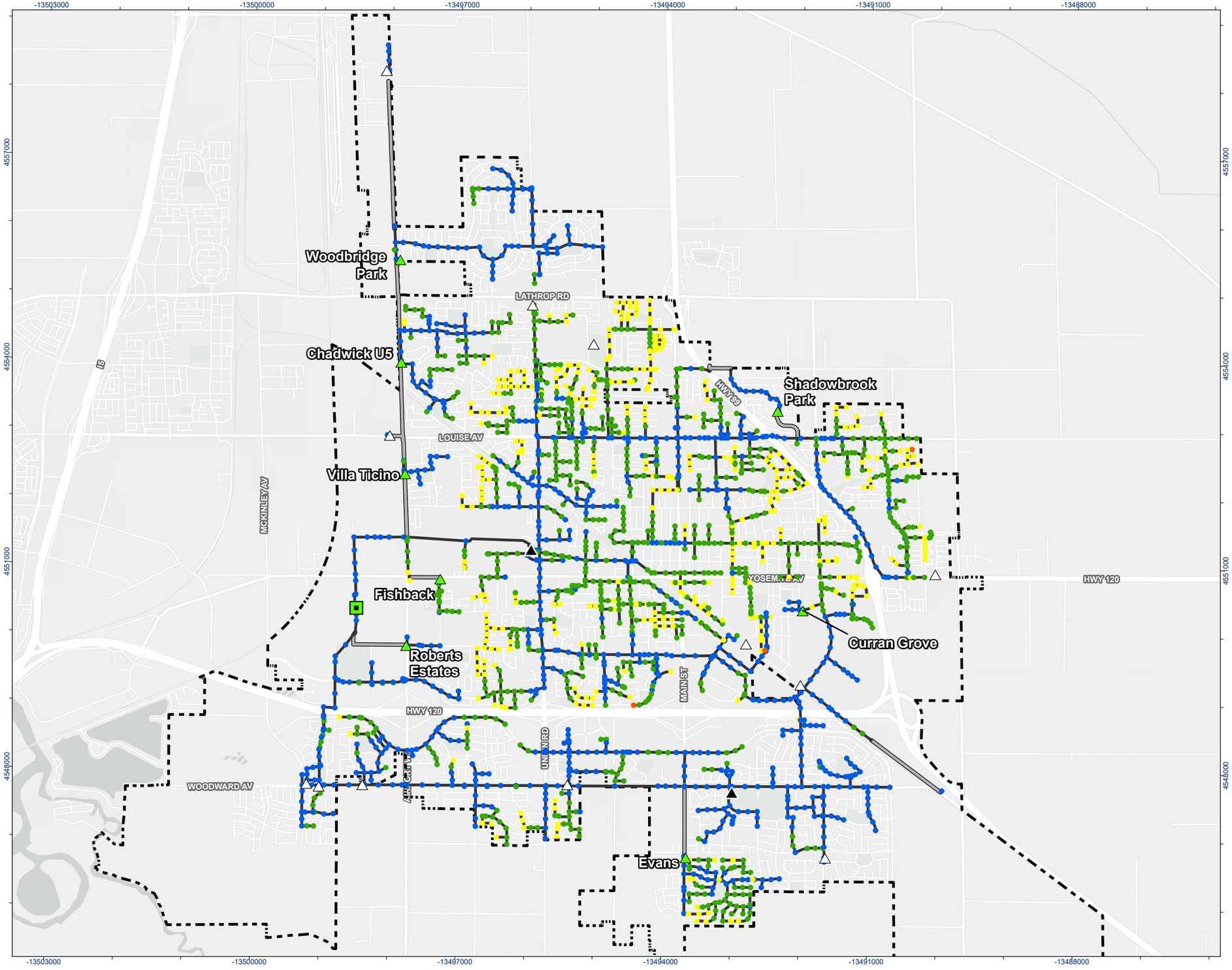

Stantec

MANTECA CALIFORNIA

Legend

- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain
- Modeled Sanitary Sewer

Manhole Freeboard (ft)

- <= 2 ft
- > 2 ft - 6 ft
- > 6 ft - 10 ft
- > 10 ft
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
1:45,000

Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-8

Title
Scenario 1 + Improvements 1-6
Manhole Surcharging (Depth Below Rim)

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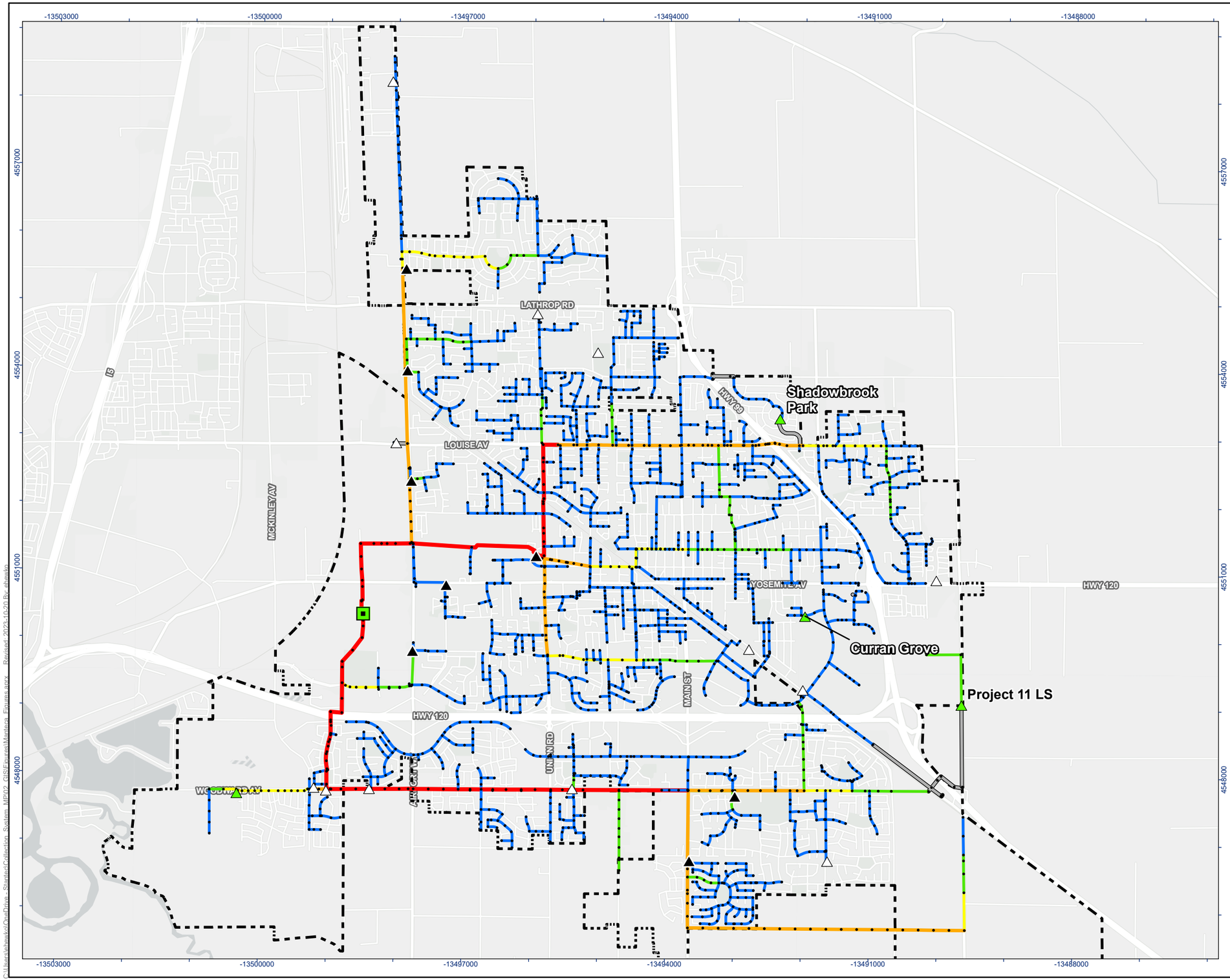

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Flow (Mgal/d)

- <= 0.5 Mgal/d
- > 0.5 Mgal/d - 1.0 Mgal/d
- > 1.0 Mgal/d - 2.0 Mgal/d
- > 2.0 Mgal/d - 5.0 Mgal/d
- > 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-9

Title
Scenario 2 + Improvements 1-15
Peak Sewer Flow

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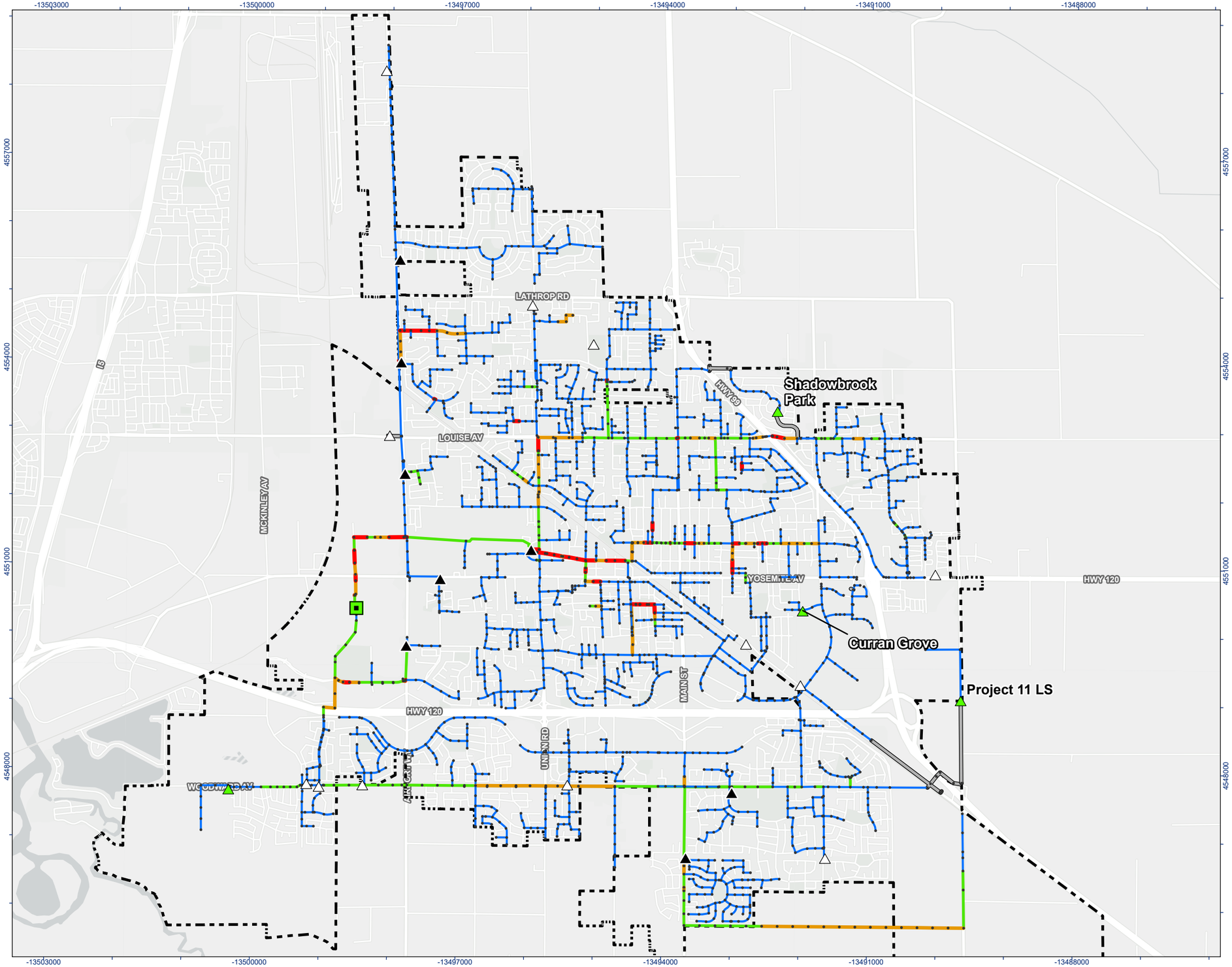

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Pipe Utilization (% of FPC)

- <= 50%
- > 50% - 75%
- > 75% - 50%
- > 100%
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-10

Title
Scenario 2 + Improvements 1-15
Peak Pipe Utilization (% of FPC)

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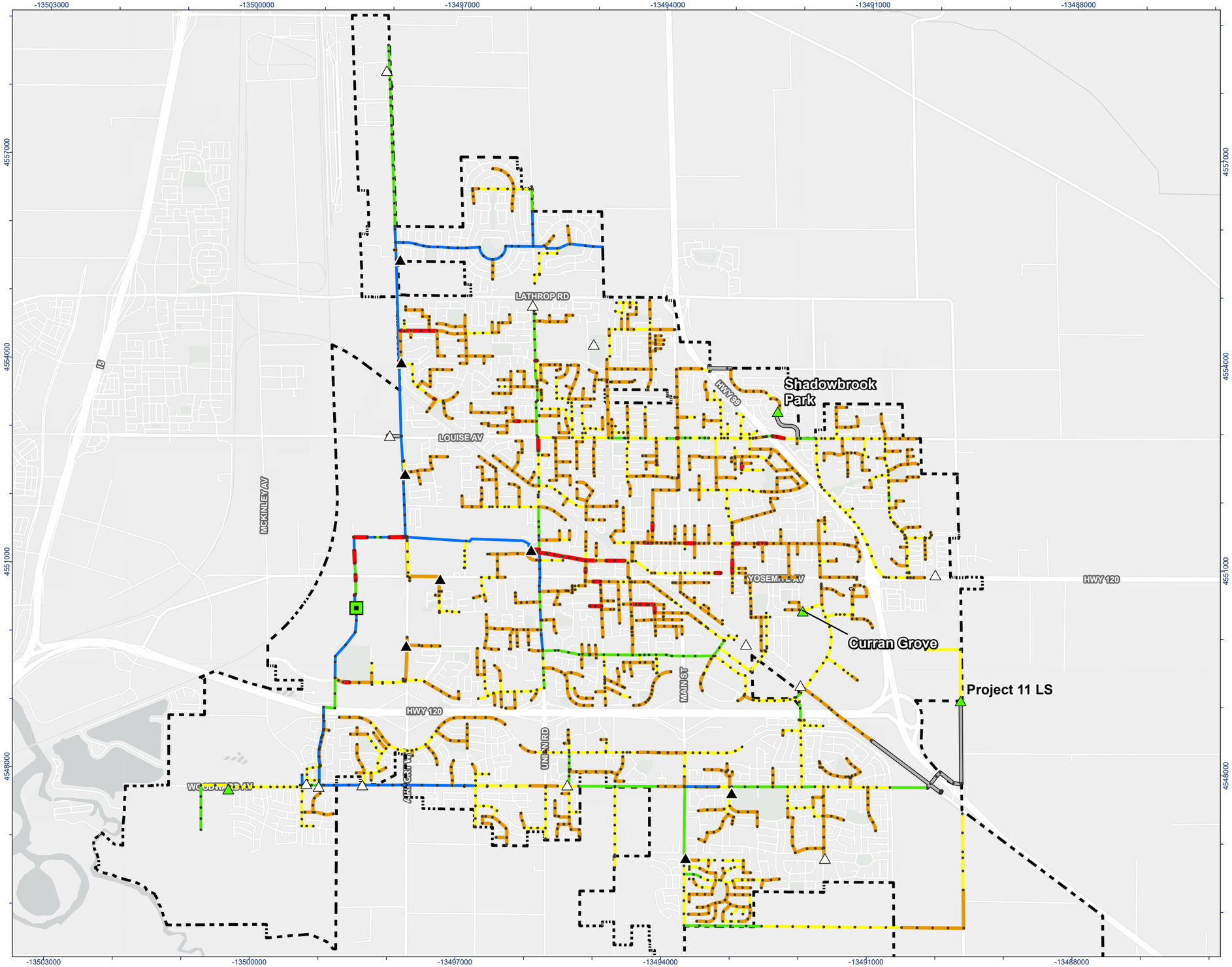

Notes

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3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-11

Title
Scenario 2 + Improvements 1-15
Residual Capacity

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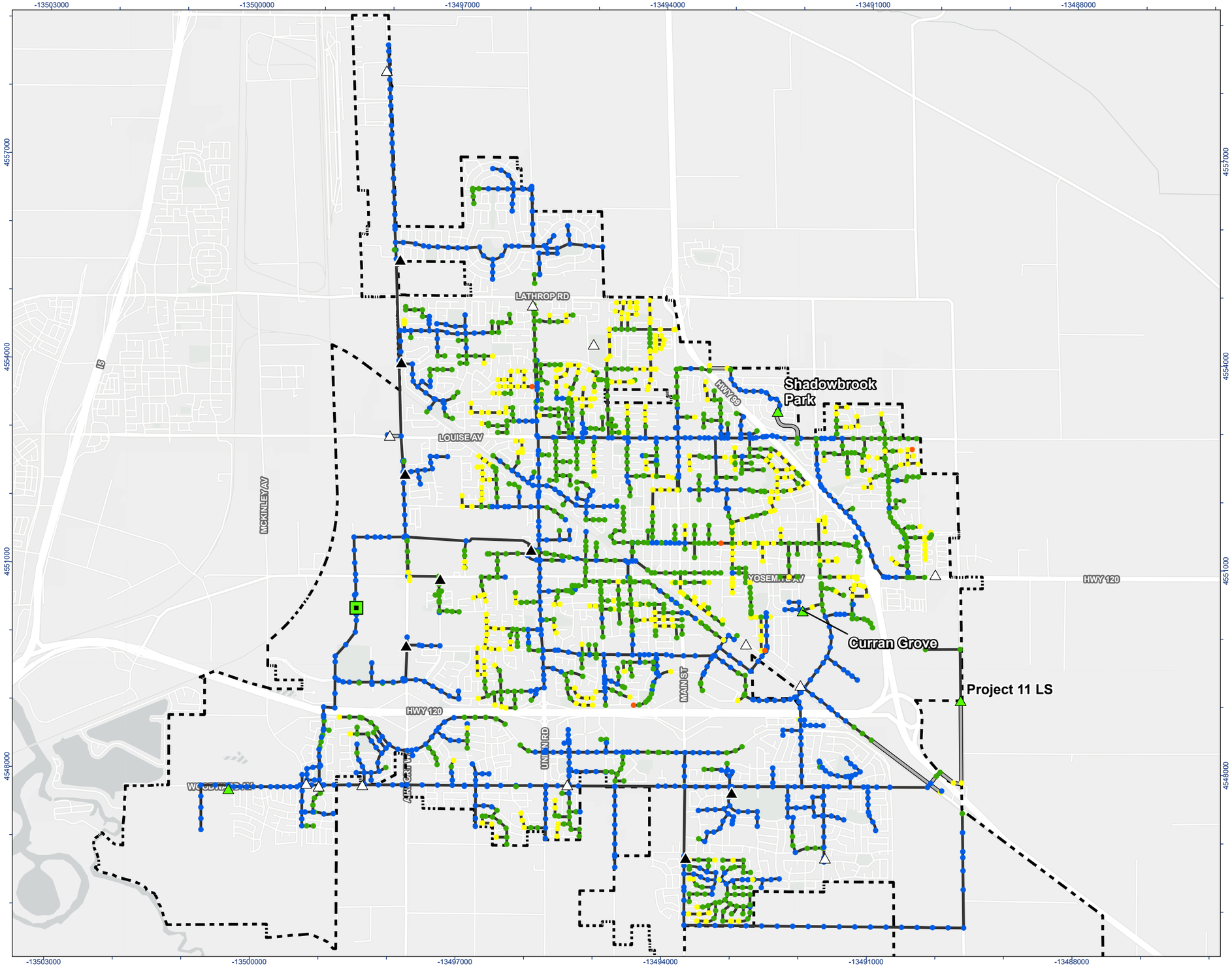

Stantec

MANTECA CALIFORNIA

Legend

- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain
- Modeled Sanitary Sewer

Manhole Freeboard (ft)

- <= 2 ft
- > 2 ft - 6 ft
- > 6 ft - 10 ft
- > 10 ft
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

1. Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-12

Title
Scenario 2 + Improvements 1-15
Manhole Surcharging (Depth Below Rim)

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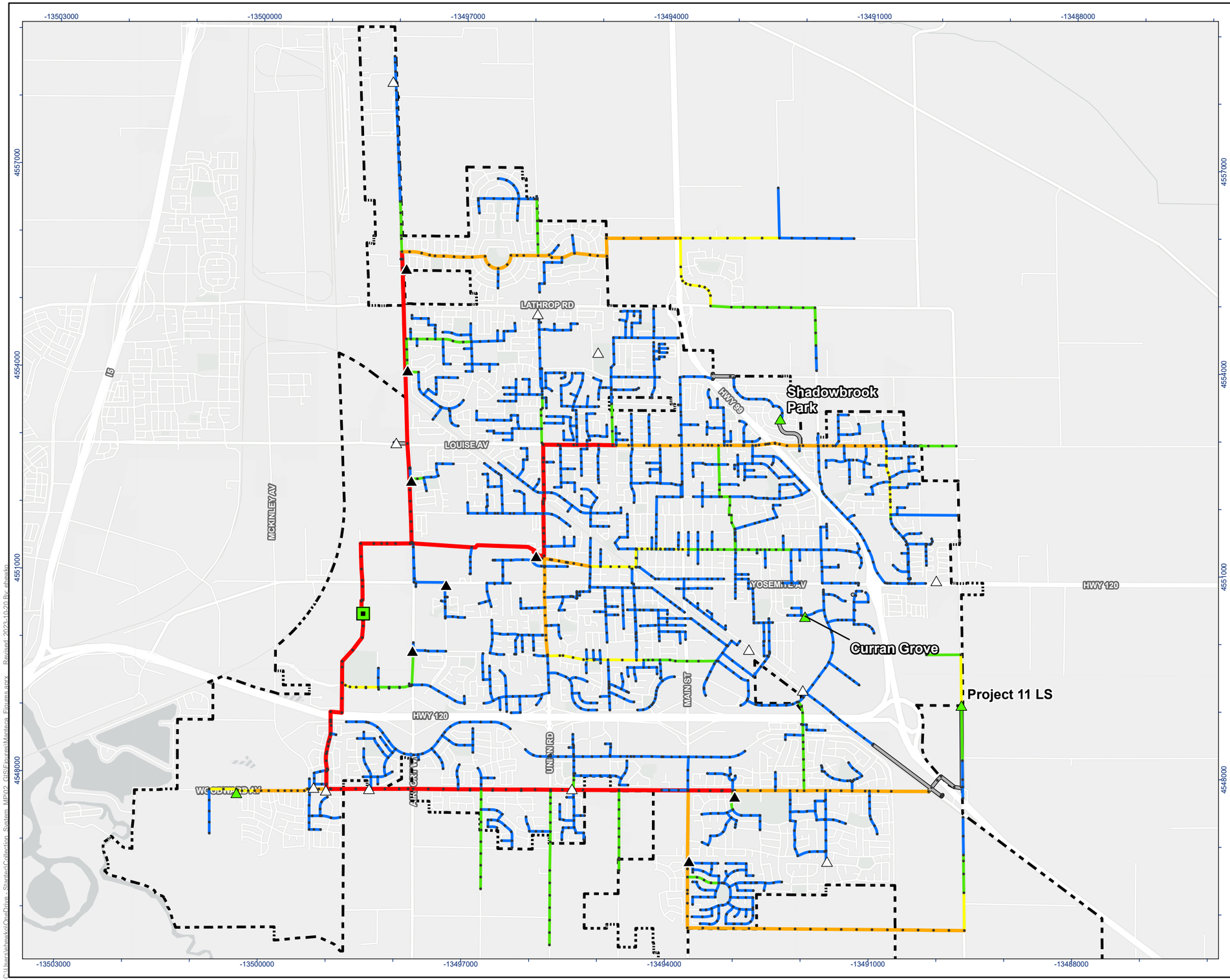

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Flow (Mgal/d)

- <= 0.5 Mgal/d
- > 0.5 Mgal/d - 1.0 Mgal/d
- > 1.0 Mgal/d - 2.0 Mgal/d
- > 2.0 Mgal/d - 5.0 Mgal/d
- > 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-13

Title
Scenario 3 + Improvements 1-22
Peak Sewer Flow

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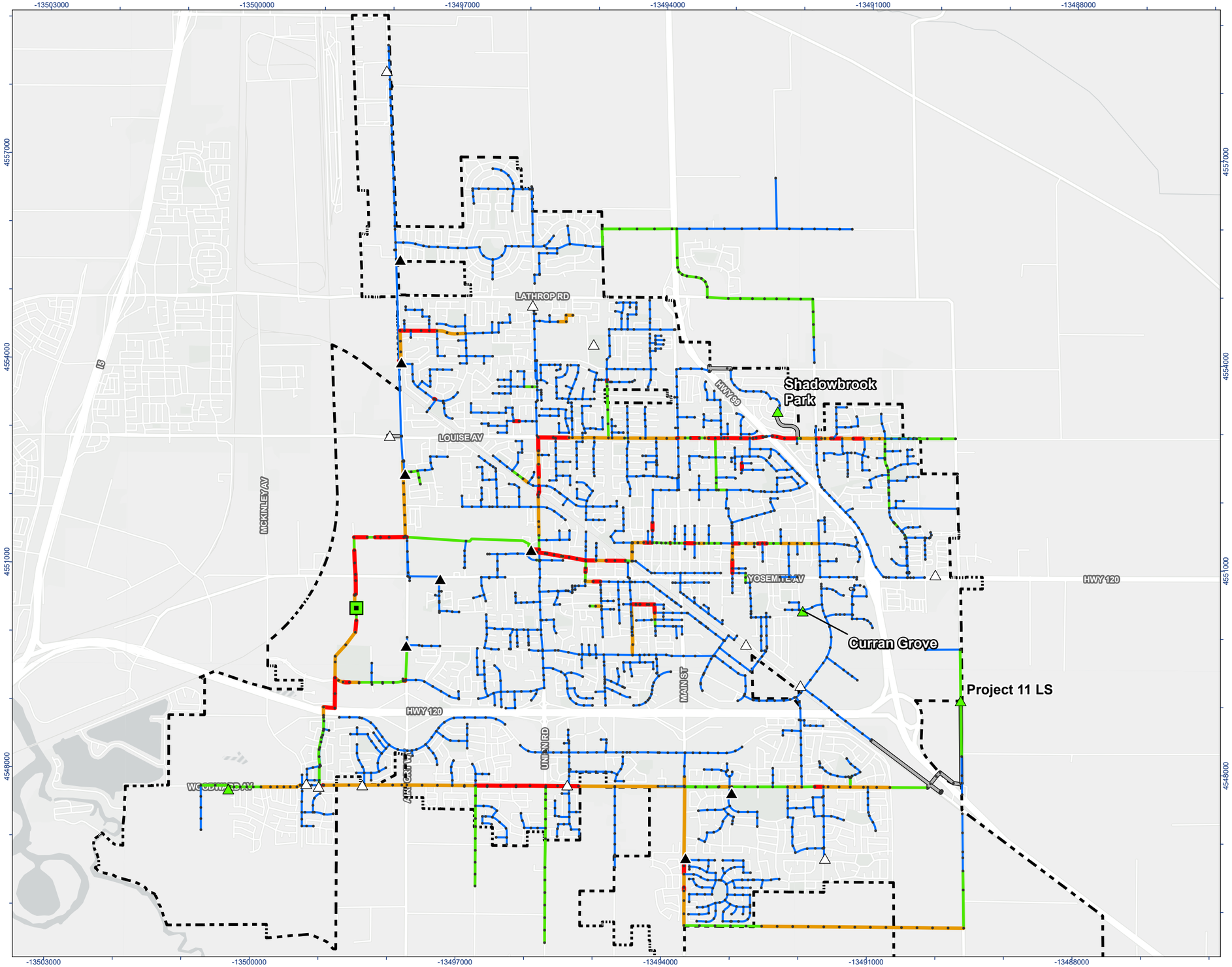

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Pipe Utilization (% of FPC)

- <= 50%
- > 50% - 75%
- > 75% - 50%
- > 100%
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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2. Data Sources: City of Manteca
3. Background: San Joaquin County GIS/Planning, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Merced County Association of Gov, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-14

Title
Scenario 3 + Improvements 1-22
Peak Pipe Utilization (% of FPC)

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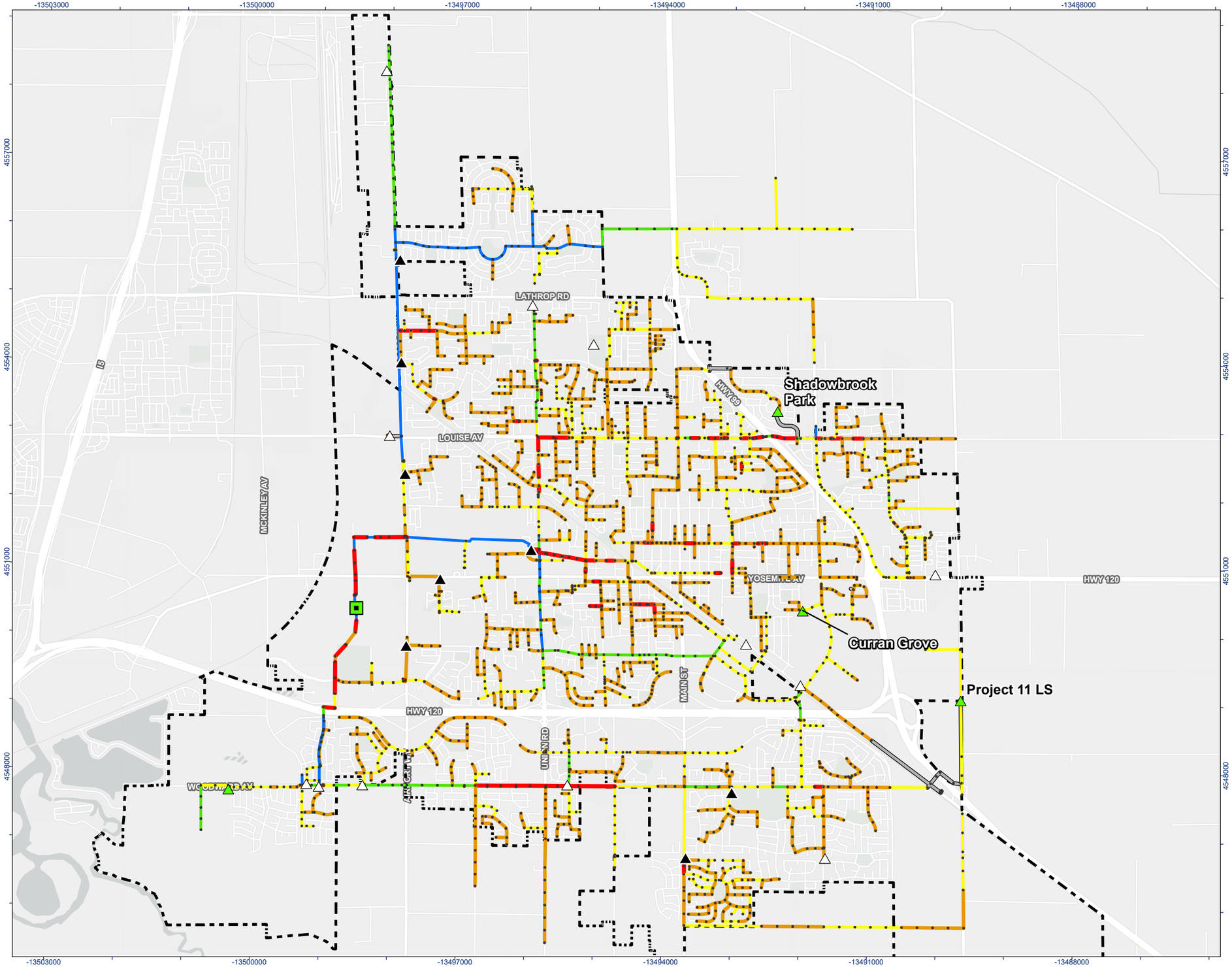

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Residual Capacity

- No Residual Capacity
- < 0.0 Mgal/d - 0.5 Mgal/d
- < 0.5 Mgal/d - 2.0 Mgal/d
- < 2.0 Mgal/d - 5.0 Mgal/d
- < 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-15

Title
Scenario 3 + Improvements 1-22
Residual Capacity

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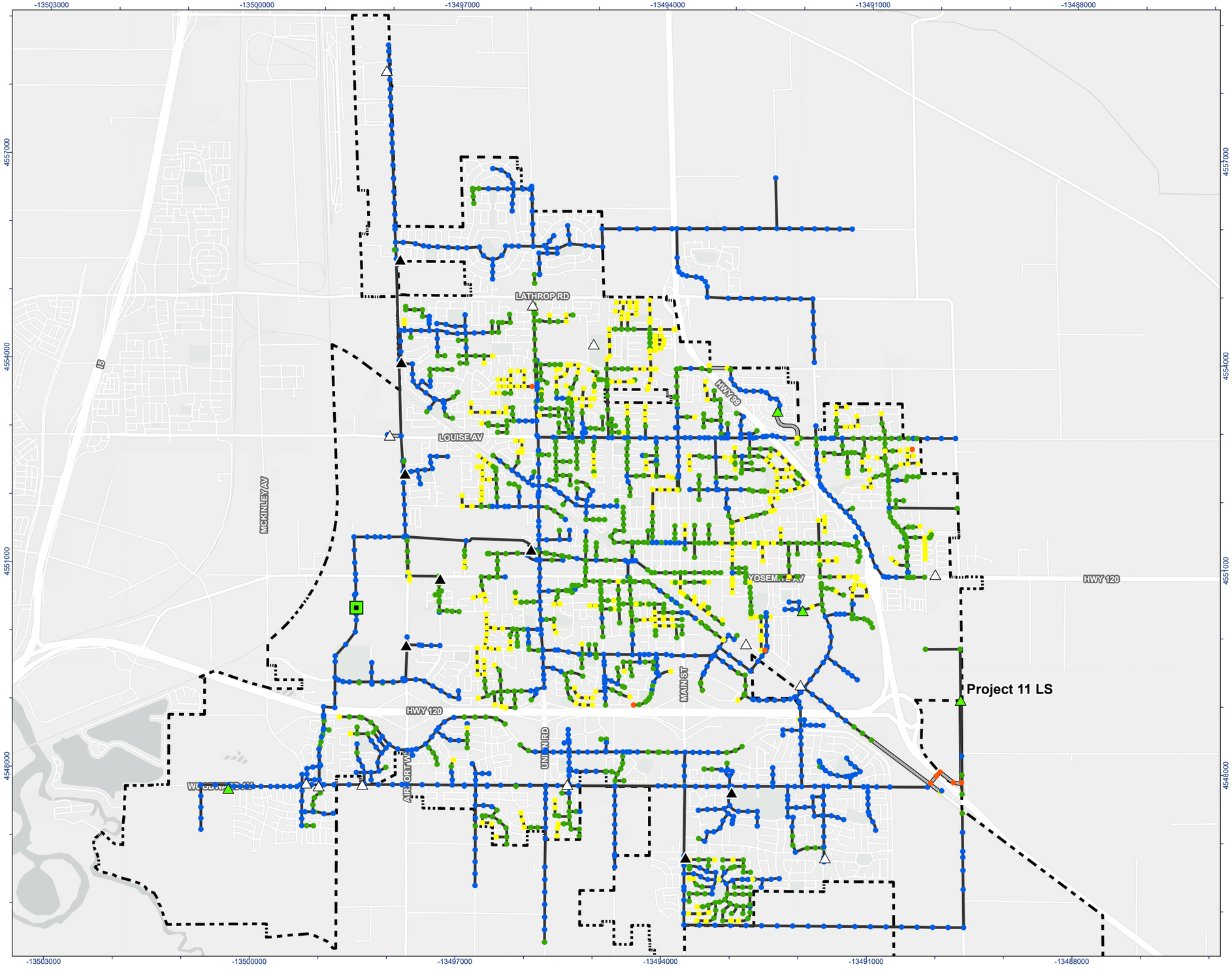

Stantec

MANTECA CALIFORNIA

Legend

- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain
- Modeled Sanitary Sewer

Manhole Freeboard (ft)

- <= 2 ft
- > 2 ft - 6 ft
- > 6 ft - 10 ft
- > 10 ft
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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Project Location
Manteca,
California

Prepared by EH on 10/20/2023
TR by MA on 10/20/2023
IR Review by MVD on 10/20/2023

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-16

Title
Scenario 3 + Improvements 1-22
Manhole Surcharging (Depth Below Rim)

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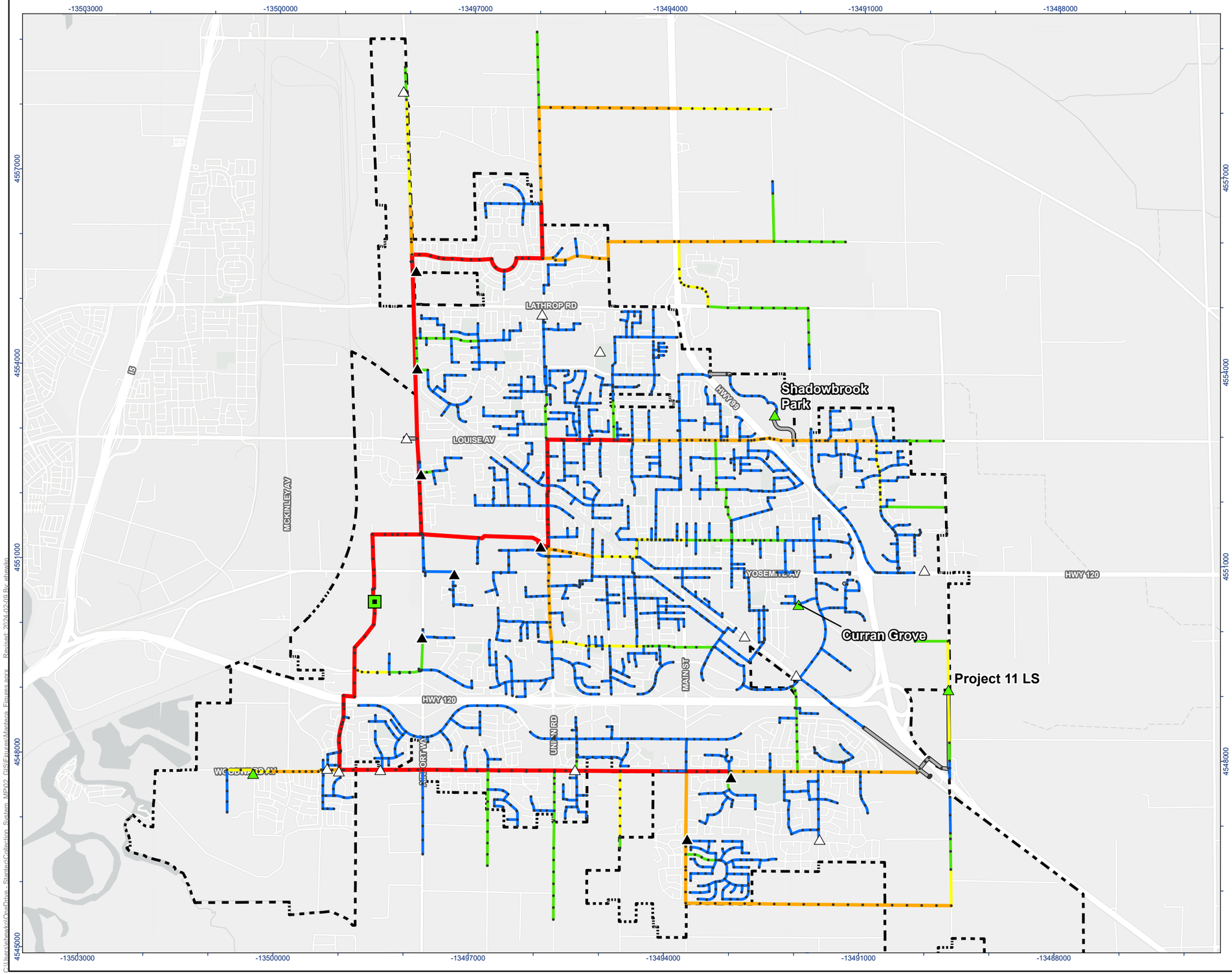

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain
- Modeled Wastewater Sewer

Peak Flow (Mgal/d)

- <= 0.5 Mgal/d
- > 0.5 Mgal/d - 1.0 Mgal/d
- > 1.0 Mgal/d - 2.0 Mgal/d
- > 2.0 Mgal/d - 5.0 Mgal/d
- > 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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2. Data Sources: City of Manteca
3. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, San Joaquin County GIS/Planning, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 2/9/2024
TR by MA on 2/9/2024
IR Review by MVD on 2/9/2024

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-17

Title
Scenario 4 + Improvements 1-25
Peak Sewer Flow

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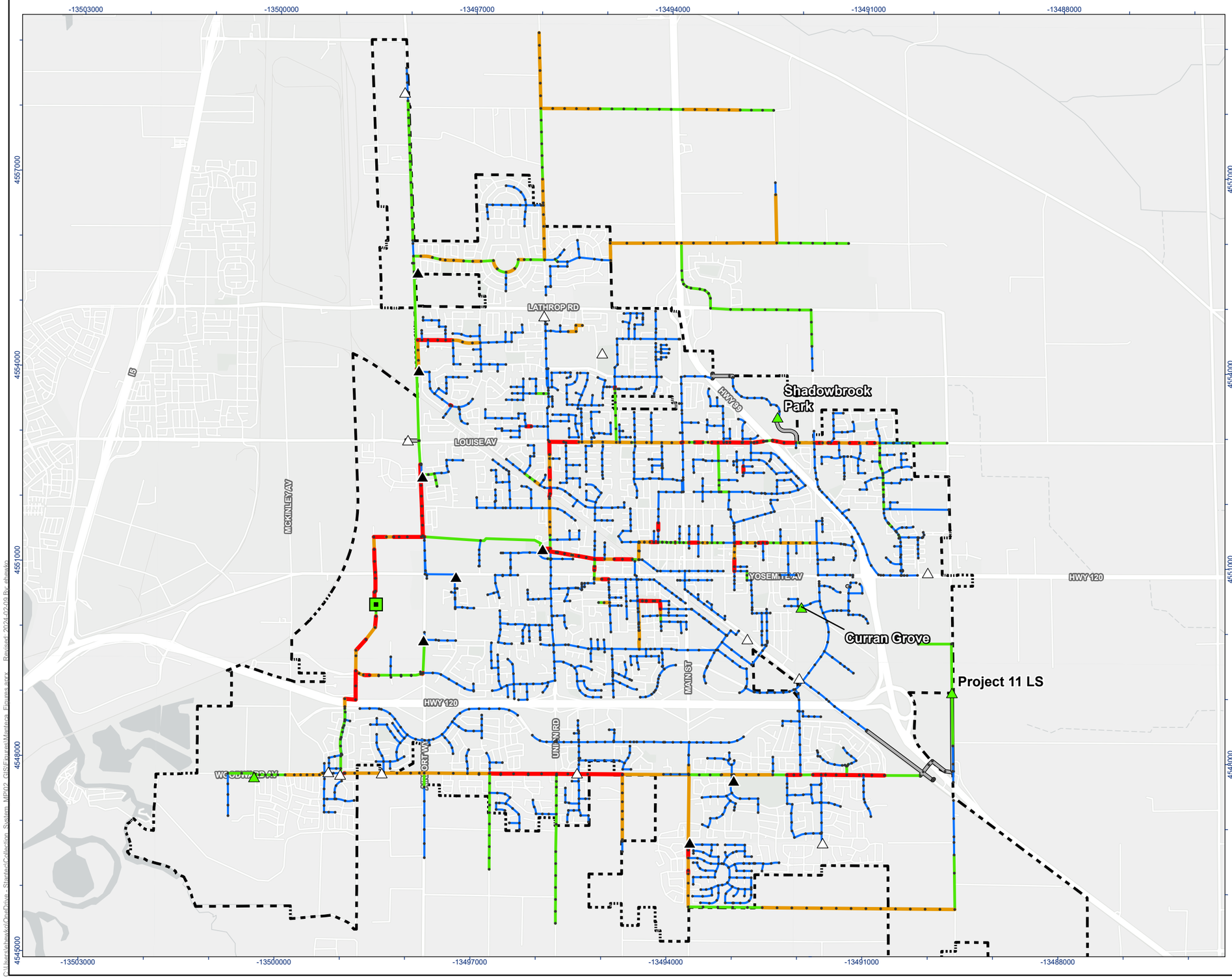

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Peak Pipe Utilization (% of FPC)

- <= 50%
- > 50% - 75%
- > 75% - 50%
- > 100%
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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2. Data Sources: City of Manteca
3. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, San Joaquin County GIS/Planning, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 2/9/2024
TR by MA on 2/9/2024
IR Review by MVD on 2/9/2024

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-18

Title
Scenario 4 + Improvements 1-25
Peak Pipe Utilization (% of FPC)

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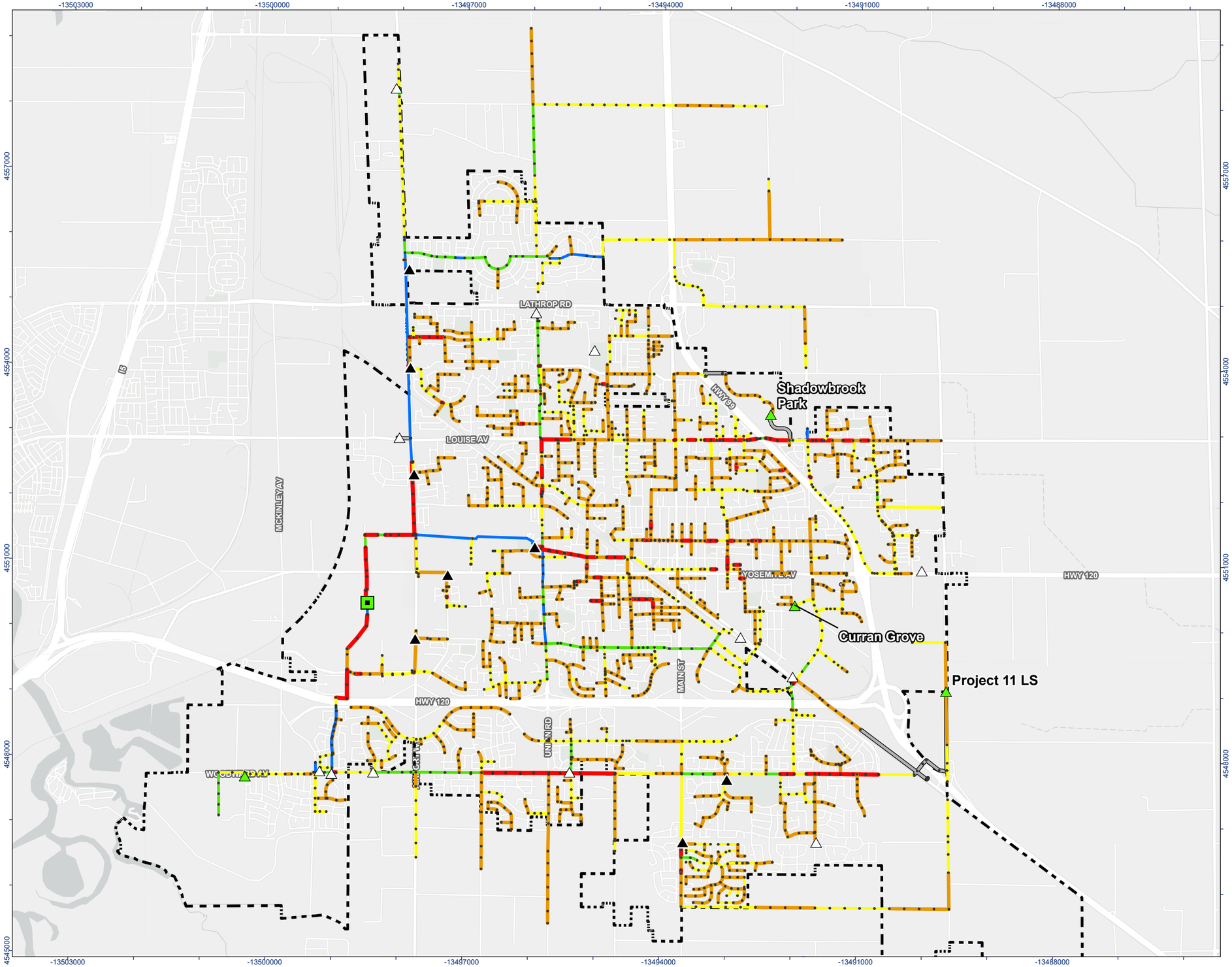

Stantec

MANTECA CALIFORNIA

Legend

- Modeled Sanitary Manholes
- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain

Residual Capacity

- No Residual Capacity
- < 0.0 Mgal/d - 0.5 Mgal/d
- < 0.5 Mgal/d - 2.0 Mgal/d
- < 2.0 Mgal/d - 5.0 Mgal/d
- < 5.0 Mgal/d
- City of Manteca Limit

N

0 0.5 1 Miles

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Notes

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2. Data Sources: City of Manteca
3. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, San Joaquin County GIS/Planning, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS, Esri, USGS

Project Location
Manteca,
California

Prepared by EH on 2/9/2024
TR by MA on 2/9/2024
IR Review by MVD on 2/9/2024

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-19

Title
Scenario 4 + Improvements 1-25
Residual Capacity

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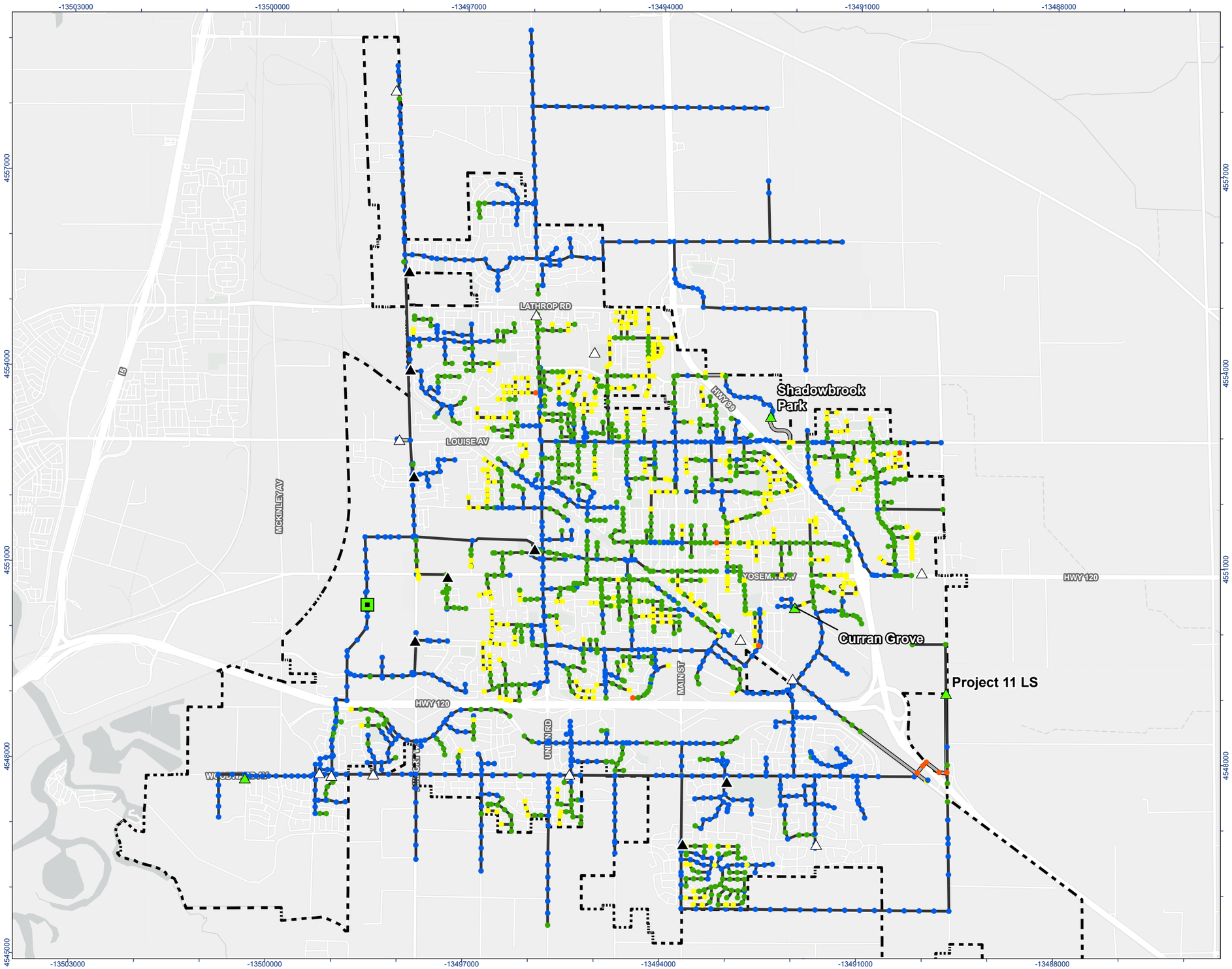

Stantec

MANTECA CALIFORNIA

Legend

- Water Quality Control Facility
- Modeled Lift Station
- Unmodeled Lift Station
- Lift Station No Longer Needed
- Modeled Forcemain
- Modeled Sanitary Sewer

Manhole Freeboard (ft)

- <= 2 ft
- > 2 ft - 6 ft
- > 6 ft - 10 ft
- > 10 ft
- City of Manteca Limit

N

0 0.5 1 Miles

(At original document size of 11x17)
1:47,000

Notes

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Project Location
Manteca,
California

Prepared by EH on 2/9/2024
TR by MA on 2/9/2024
IR Review by MVD on 2/9/2024

Client/Project
City of Manteca
Wastewater Servicing Master Plan

184031535

Figure No.
F-20

Title
Scenario 4 + Improvements 1-25
Manhole Surcharging (Depth Below Rim)

C:\Users\abowyo\OneDrive - Stantec\Collection_System_MP\12_GIS\Figures\Manteca_Figures.aprx - Revised: 2024-02-09 By: abowyo

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APPENDIX G

Collection System Capacity Improvement Cost Estimate Details

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN
PROJECT COSTS

DATE: 9/1/2023

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: CITY OF MANTECA

CHECKED BY: SLB

DESCRIPTION: Unit Costs

ENR: 13,176

UNIT COST TABLES

TABLE 1 - GRAVITY SEWER UNIT COST ($/LF) *Scaled to match bids provided by the City of Manteca, scaled and correlated with North Trunk Sewer bid results. 10-inch pipes use 12-inch costs for conservative estimates.*

Size	Pipe Depth (ft) < same cost under 9-feet																					
(in)	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
12	$ 514	$ 551	$ 588	$ 624	$ 661	$ 707	$ 717	$ 727	$ 737	$ 747	$ 757	$ 767	$ 792	$ 818	$ 844	$ 870	$ 917	$ 961	$ 983	$ 1,005	$ 1,027	$ 1,049
15	$ 603	$ 639	$ 675	$ 710	$ 746	$ 794	$ 807	$ 820	$ 832	$ 845	$ 858	$ 871	$ 891	$ 912	$ 933	$ 954	$ 1,004	$ 1,062	$ 1,091	$ 1,120	$ 1,149	$ 1,178
18	$ 648	$ 696	$ 745	$ 793	$ 842	$ 906	$ 921	$ 937	$ 953	$ 968	$ 984	$ 999	$ 1,024	$ 1,049	$ 1,073	$ 1,098	$ 1,156	$ 1,222	$ 1,255	$ 1,288	$ 1,321	$ 1,354
21	$ 757	$ 801	$ 846	$ 890	$ 935	$ 1,003	$ 1,027	$ 1,052	$ 1,076	$ 1,100	$ 1,124	$ 1,148	$ 1,180	$ 1,213	$ 1,246	$ 1,278	$ 1,348	$ 1,421	$ 1,458	$ 1,495	$ 1,532	$ 1,569
24	$ 846	$ 903	$ 961	$ 1,018	$ 1,075	$ 1,156	$ 1,179	$ 1,203	$ 1,226	$ 1,249	$ 1,273	$ 1,296	$ 1,328	$ 1,359	$ 1,391	$ 1,423	$ 1,496	$ 1,578	$ 1,619	$ 1,660	$ 1,702	$ 1,743
27	$ 915	$ 975	$ 1,036	$ 1,096	$ 1,157	$ 1,244	$ 1,271	$ 1,297	$ 1,324	$ 1,351	$ 1,378	$ 1,405	$ 1,443	$ 1,482	$ 1,521	$ 1,559	$ 1,639	$ 1,721	$ 1,763	$ 1,804	$ 1,845	$ 1,886
30	$ 1,004	$ 1,077	$ 1,151	$ 1,224	$ 1,297	$ 1,394	$ 1,417	$ 1,440	$ 1,463	$ 1,487	$ 1,510	$ 1,533	$ 1,567	$ 1,601	$ 1,634	$ 1,668	$ 1,747	$ 1,837	$ 1,882	$ 1,927	$ 1,972	$ 2,017
33	$ 1,158	$ 1,222	$ 1,286	$ 1,350	$ 1,415	$ 1,502	$ 1,524	$ 1,547	$ 1,569	$ 1,592	$ 1,615	$ 1,637	$ 1,676	$ 1,714	$ 1,753	$ 1,792	$ 1,893	$ 2,018	$ 2,081	$ 2,144	$ 2,206	$ 2,269
36	$ 1,271	$ 1,331	$ 1,390	$ 1,449	$ 1,509	$ 1,599	$ 1,630	$ 1,661	$ 1,692	$ 1,724	$ 1,755	$ 1,786	$ 1,819	$ 1,853	$ 1,887	$ 1,920	$ 2,030	$ 2,181	$ 2,257	$ 2,333	$ 2,409	$ 2,485
39	$ 1,360	$ 1,433	$ 1,505	$ 1,577	$ 1,649	$ 1,749	$ 1,777	$ 1,804	$ 1,832	$ 1,859	$ 1,887	$ 1,914	$ 1,972	$ 2,029	$ 2,086	$ 2,144	$ 2,268	$ 2,401	$ 2,467	$ 2,534	$ 2,600	$ 2,667
42	$ 1,469	$ 1,541	$ 1,614	$ 1,686	$ 1,758	$ 1,879	$ 1,928	$ 1,977	$ 2,025	$ 2,074	$ 2,123	$ 2,172	$ 2,223	$ 2,274	$ 2,326	$ 2,377	$ 2,490	$ 2,613	$ 2,675	$ 2,737	$ 2,798	$ 2,860
48	$ 1,583	$ 1,698	$ 1,812	$ 1,927	$ 2,042	$ 2,198	$ 2,240	$ 2,282	$ 2,323	$ 2,365	$ 2,407	$ 2,449	$ 2,503	$ 2,557	$ 2,612	$ 2,666	$ 2,770	$ 2,869	$ 2,919	$ 2,968	$ 3,017	$ 3,067
54	$ 1,697	$ 1,854	$ 2,011	$ 2,169	$ 2,326	$ 2,518	$ 2,552	$ 2,587	$ 2,622	$ 2,656	$ 2,691	$ 2,726	$ 2,783	$ 2,840	$ 2,898	$ 2,955	$ 3,050	$ 3,125	$ 3,162	$ 3,199	$ 3,237	$ 3,274
60	$ 1,810	$ 2,010	$ 2,210	$ 2,410	$ 2,610	$ 2,837	$ 2,865	$ 2,892	$ 2,920	$ 2,947	$ 2,975	$ 3,003	$ 3,063	$ 3,123	$ 3,184	$ 3,244	$ 3,330	$ 3,380	$ 3,405	$ 3,431	$ 3,456	$ 3,481
66	$ 1,924	$ 2,167	$ 2,409	$ 2,651	$ 2,894	$ 3,157	$ 3,177	$ 3,198	$ 3,218	$ 3,239	$ 3,259	$ 3,280	$ 3,343	$ 3,406	$ 3,470	$ 3,533	$ 3,609	$ 3,636	$ 3,649	$ 3,662	$ 3,675	$ 3,689
72	$ 2,038	$ 2,323	$ 2,608	$ 2,893	$ 3,178	$ 3,476	$ 3,489	$ 3,503	$ 3,516	$ 3,530	$ 3,543	$ 3,557	$ 3,623	$ 3,689	$ 3,755	$ 3,822	$ 3,889	$ 3,891	$ 3,892	$ 3,894	$ 3,895	$ 3,896

TABLE 2 - FORCEMAIN UNIT COSTS (< 10 feet deep)

Size	Cost
4-inch	$ 194/LF
6-inch	$ 207/LF
8-inch	$ 221/LF
10-inch	$ 235/LF
12-inch	$ 249/LF
14-inch	$ 339/LF
16-inch	$ 380/LF
18-inch	$ 415/LF
20-inch	$ 491/LF

TABLE 3 - LIFT STATION COST ESTIMATES

Item	Description	*Yosemite Square* Cost	*Woodbridge Park* Cost	*Villa Ticino* Cost	*Chadwick Unit 5* Cost
1	Pump Station (PS)	$1,578,000	$5,407,000	$818,000	$1,578,000
2	Wet-well	$65,000	$223,000	$34,000	$65,000
3	Emergency Storage or Power	$515,000	$1,766,000	$267,000	$515,000
4	Yard Piping	$182,000	$622,000	$94,000	$182,000
5	Biofilter/Odor Control	$84,000	$289,000	$44,000	$84,000
6	SCADA & PLC Instrumentation	$91,000	$311,000	$47,000	$91,000
7	Decommissioning, Demo, Restoration	$0	$1,474,000	$223,000	$430,000
	Project Subtotal	**$2,515,000**	**$10,092,000**	**$1,527,000**	**$2,945,000**
9	Bonds, Insurance, Overhead, Supervision (5.5%)	$138,325	$555,060	$83,985	$161,975
10	Contractor Profit (10%)	$251,500	$1,009,200	$152,700	$294,500
	Base Construction Costs	**$2,900,000**	**$11,660,000**	**$1,760,000**	**$3,400,000**

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN
PROJECT COSTS

DATE: 9/1/2023

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CHECKED BY: SLB

DESCRIPTION: Project Costs

ENR: 13,176

PIPELINE IMPROVEMENT PROJECTS

North Trunk Cost Estimate

Bid estimate used to calibrate unit costs table (NOT A PROJECT)

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
C13	SSMH-01	WWMH3995	29.1	29.2	16	29.1	60	$ 3,456	$ 54,008
C14	SSMH-02	SSMH-01	28.5	29.1	54	28.8	54	$ 3,199	$ 173,642
C15	SSMH-03	SSMH-02	28.9	28.5	503	28.7	54	$ 3,199	$ 1,609,280
C16	SSMH-04	SSMH-03	30.1	28.9	240	29.5	54	$ 3,237	$ 777,455
C17	SSMH-05	SSMH-04	28.3	30.1	432	29.2	54	$ 3,237	$ 1,398,815
C18	SSMH-07	SSMH-06	24.4	26.4	496	25.4	54	$ 3,050	$ 1,514,003
C19	SSMH-06	SSMH-05	26.4	28.3	477	27.3	54	$ 3,162	$ 1,509,322
C20	SSMH-08	SSMH-07	23.7	24.4	502	24.0	54	$ 2,955	$ 1,483,271
C21	SSMH-09	SSMH-08	24.1	23.7	293	23.9	54	$ 2,898	$ 849,864
C22	SSMH-10	SSMH-09	24.3	24.1	212	24.2	54	$ 2,955	$ 626,132
C23	SSMH-11	SSMH-10	24.1	24.3	324	24.2	54	$ 2,955	$ 958,860
C24	SSMH-12	SSMH-11	25.7	24.1	557	24.9	54	$ 3,012	$ 1,679,097
C25	SSMH-13	SSMH-12	24.8	25.7	115	25.2	36	$ 2,030	$ 233,423
C26	SSFMManifo	SSMH-13	5.4	24.8	23	15.1	24	$ 1,179	$ 26,589
C27	WWMH1204	36x36T	7.6	7.3	120	7.4	36	$ 1,271	$ 152,219
C30	36x36T	SSMH-13	7.3	24.8	25	16.0	36	$ 1,661	$ 41,544
Subtotal	North Trunk Cost Estimate							**Base Construction Costs:**	**$ 13,088,000**

Calibration		
Final Bid	**ENR**	**Date**
$ 11,323,175	11,396	2/1/2020
$ 13,091,800	13,176	3/1/2023

Estimating Contingency (30%)	$ 3,926,000
Total Construction Costs:	**$ 17,014,000**
Engineering and Environmental Documentation (35%)	$ 5,955,000
Total Project Costs:	**$ 22,970,000**

W Center Street Trunk

Project No. 1

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM056	WWMH0344	WWMH0342	11.5	11.4	404	11.5	18	$ 745	$ 300,964
WWGM056	WWMH0341	WWMH0344	10.6	11.5	386	11.0	18	$ 745	$ 287,555
WWGM056	WWMH0346	WWMH0341	11.4	10.6	325	11.0	18	$ 696	$ 226,357
WWGM057	WWMH0348	WWMH0346	13.6	11.4	392	12.5	18	$ 793	$ 311,028
WWGM057	WWMH0349	WWMH0348	14.1	13.6	250	13.9	18	$ 890	$ 222,598
WWGM088	WWMH0342	WWMH5062	11.4	12.5	330	12.0	18	$ 745	$ 245,837
WWGM088	WWMH0369	WWMH5063	9.5	7.7	238	8.6	18	$ 648	$ 154,226
WWGM088	WWMH0368	WWMH0370	9.8	8.0	279	8.9	18	$ 648	$ 180,794
WWGM088	WWMH0370	WWMH1132	8.0	8.4	278	8.2	18	$ 648	$ 180,146
WWGM088	WWMH5090	WWMH0373	8.3	9.2	310	8.7	18	$ 648	$ 200,882
WWGM088	WWMH0373	WWMH3125	9.2	18.5	189	13.9	18	$ 890	$ 168,284
WWGM597	WWMH5063	WWMH0368	7.7	9.8	57	8.8	18	$ 648	$ 36,936
WWGM597	WWMH5062	WWMH0369	12.5	9.5	301	11.0	18	$ 745	$ 224,233
WWGM600	WWMH1132	WWMH5090	8.4	8.3	63	8.3	18	$ 648	$ 40,824
Subtotal	W Center Street Trunk							**Base Construction Costs:**	**$ 2,781,000**

Estimating Contingency (30%)	$ 834,000
Total Construction Costs:	**$ 3,615,000**
Engineering and Environmental Documentation (35%)	$ 1,265,000
Total Project Costs:	**$ 4,880,000**

Elm/West North Street Trunk — Project No. 2

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM031	WWMH0883	WWMH1021	5.9	9.2	17	7.5	15	$ 603	$ 10,259
WWGM033	WWMH1021	WWMH0477	9.2	8.0	424	8.6	15	$ 603	$ 255,879
WWGM034	WWMH0477	WWMH0473	8.0	8.5	243	8.2	15	$ 603	$ 146,648
WWGM034	WWMH0473	WWMH0480	8.5	10.1	218	9.3	15	$ 603	$ 131,560
WWGM036	WWMH1112	WWMH1115	12.1	10.0	169	11.1	15	$ 675	$ 114,028
WWGM036	WWMH1109	WWMH1112	12.6	12.1	171	12.4	15	$ 710	$ 121,467
WWGM041	WWMH0479	WWMH3168	9.5	10.5	169	10.0	15	$ 639	$ 108,008
WWGM041	WWMH0445	WWMH0446	12.4	12.6	220	12.5	15	$ 710	$ 156,274
WWGM041	WWMH0446	WWMH1107	12.6	12.2	159	12.4	15	$ 710	$ 112,943
WWGM041	WWMH1107	WWMH1109	12.2	12.6	175	12.4	15	$ 710	$ 124,309
WWGM042	WWMH1118	WWMH1121	9.7	10.0	168	9.8	15	$ 603	$ 101,386
WWGM042	WWMH1119	WWMH1118	12.1	9.7	167	10.9	15	$ 639	$ 106,730
WWGM042	WWMH1115	WWMH1119	10.0	12.1	173	11.1	15	$ 675	$ 116,726
WWGM057	WWMH1127	WWMH0349	8.5	14.1	348	11.3	15	$ 675	$ 234,802
WWGM057	WWMH4278	WWMH1127	9.2	8.5	326	8.8	15	$ 603	$ 196,737
WWGM058	WWMH1121	WWMH1123	10.0	10.1	158	10.0	15	$ 639	$ 100,978
WWGM058	WWMH1123	WWMH1125	10.1	9.4	221	9.8	15	$ 603	$ 133,371
WWGM058	WWMH1125	WWMH1128	9.4	9.1	221	9.2	15	$ 603	$ 133,371
WWGM153	WWMH0480	WWMH0478	10.1	9.3	182	9.7	15	$ 603	$ 109,835
WWGM153	WWMH0478	WWMH0479	9.3	9.5	190	9.4	15	$ 603	$ 114,663
WWGM380	WWMH3168	WWMH0445	10.5	12.4	366	11.4	15	$ 675	$ 246,947
WWGM536	WWMH1128	WWMH4278	9.1	9.2	25	9.1	15	$ 603	$ 15,087
Subtotal	Elm/West North Street Trunk							**Base Construction Costs:**	**$ 2,892,000**
								Estimating Contingency (30%)	$ 868,000
								Total Construction Costs:	**$ 3,760,000**
								Engineering and Environmental Documentation (35%)	$ 1,316,000
								Total Project Costs:	**$ 5,080,000**

10-inch East North Street Trunk — Project No. 3

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM199	WWMH0885	WWMH0883	6.0	5.9	255	6.0	12	$ 514	$ 131,184
WWGM199	WWMH3060	WWMH0885	8.1	6.0	231	7.1	12	$ 514	$ 118,838
WWGM199	WWMH0884	WWMH3060	4.9	8.1	19	6.5	12	$ 514	$ 9,775
WWGM200	WWMH0844	WWMH0747	6.5	6.3	261	6.4	12	$ 514	$ 134,271
WWGM200	WWMH0901	WWMH0844	6.7	6.5	281	6.6	12	$ 514	$ 144,560
WWGM203	WWMH0747	WWMH0755	6.3	6.2	162	6.3	12	$ 514	$ 83,341
WWGM212	WWMH0757	WWMH0884	5.4	4.9	312	5.2	12	$ 514	$ 160,508
WWGM212	WWMH0442	WWMH0757	8.7	5.4	136	7.1	12	$ 514	$ 69,965
WWGM213	WWMH0755	WWMH0442	6.2	8.7	173	7.5	12	$ 514	$ 89,000
Subtotal	10-inch East North Street Trunk							**Base Construction Costs:**	**$ 941,000**
								Estimating Contingency (30%)	$ 282,000
								Total Construction Costs:	**$ 1,223,000**
								Engineering and Environmental Documentation (35%)	$ 428,000
								Total Project Costs:	**$ 1,660,000**

8-inch East North Street Trunk — Project No. 4

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM202	WWMH1433	WWMH0896	7.1	7.2	280	7.1	10	$ 514	$ 144,046
WWGM202	WWMH1432	WWMH1433	7.5	7.1	280	7.3	10	$ 514	$ 144,046
Subtotal	8-inch East North Street Trunk							**Base Construction Costs:**	**$ 288,000**
								Estimating Contingency (30%)	$ 86,000
								Total Construction Costs:	**$ 374,000**
								Engineering and Environmental Documentation (35%)	$ 131,000
								Total Project Costs:	**$ 510,000**

Stantec

PROJECT:	WASTEWATER COLLECTION SYSTEM MASTER PLAN PROJECT COSTS	**DATE:**	9/1/2023
JOB NUMBER:	184031535	**PREPARED BY:**	BEW
CLIENT:	CITY OF MANTECA	**CHECKED BY:**	SLB
DESCRIPTION:	Project Costs	**ENR:**	13,176

IMPROVEMENT PROJECTS

South Woodward Trunk Extension — Project No. 5

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC5_1	WWMH0481	BOSSMH9	23.1	19.3	2,653	21.2	36	$ 1,819	$ 4,827,062
BOC5_2	BOSSMH9	WWMH4162	19.3	17.5	1,377	18.4	36	$ 1,724	$ 2,372,526
Subtotal	South Woodward Trunk Extension							**Base Construction Costs:**	**$ 7,200,000**
								Estimating Contingency (30%)	$ 2,160,000
								Total Construction Costs:	**$ 9,360,000**
								Engineering and Environmental Documentation (35%)	$ 3,276,000
								Total Project Costs:	**$ 12,640,000**

Central Union Road Trunk Extension — Project No. 6

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_1	WWMH3125	SSMH2	18.5	22.0	2,788	20.2	36	$ 1,786	$ 4,979,469
BOC4_28	SSMH2	SSMH-13	22.0	24.8	2,242	23.4	36	$ 1,887	$ 4,229,959
Subtotal	Central Union Road Trunk Extension							**Base Construction Costs:**	**$ 9,209,000**
								Estimating Contingency (30%)	$ 2,763,000
								Total Construction Costs:	**$ 11,972,000**
								Engineering and Environmental Documentation (35%)	$ 4,190,000
								Total Project Costs:	**$ 16,170,000**

North Trunk Extension on Airport Way — Project No. 7A

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC16_1	SSMH1	73	23.6	26.2	952	24.9	48	$ 2,721	$ 2,591,359
BOC16_6	WWMH3392	BOSSMH92	20.3	22.2	3,851	21.2	48	$ 2,503	$ 9,638,820
BOC16_8	BOSSMH92	BOSSMH93	22.2	22.3	134	22.3	48	$ 2,557	$ 342,779
BOC16_9	BOSSMH93	SSMH1	22.3	23.6	2,734	22.9	48	$ 2,557	$ 6,991,119
Subtotal	North Trunk Extension on Airport Way							**Base Construction Costs:**	**$ 19,564,000**
								Estimating Contingency (30%)	$ 5,869,000
								Total Construction Costs:	**$ 25,433,000**
								Engineering and Environmental Documentation (35%)	$ 8,902,000
								Total Project Costs:	**$ 34,340,000**

Expand North Shed Lift Stations — Project No. 7B

Lift Station	Capacity Mgal/d							Cost
Woodbridge Park	12.4							$ 11,660,000
Villa Ticino	1.0							$ 1,760,000
Chadwick Unit 5	2.4							$ 3,400,000
Subtotal Expand North Shed Lift Stations							**Base Construction Costs:**	**$ 16,820,000**
							Estimating Contingency (30%)	$ 5,050,000
							Total Construction Costs:	**$ 21,870,000**
							Engineering and Environmental Documentation (35%)	$ 7,655,000
							Total Project Costs:	**$ 29,530,000**

S. Main Trunk to Evans — Project No. 8

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
1	WWMH5022	WWMH0481	23.6	23.1	2,688	23.3	27	$ 1,521	$ 4,087,094
Subtotal S. Main Trunk to Evans								**Base Construction Costs:**	**$ 4,087,000**
								Estimating Contingency (30%)	$ 1,226,000
								Total Construction Costs:	**$ 5,313,000**
								Engineering and Environmental Documentation (35%)	$ 1,860,000
								Total Project Costs:	**$ 7,180,000**

S. Airport Way and Yosemite Ave. (Fishback) — Project No. 9

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_12	10	SSMH-13	11.7	24.8	1,490	18.2	10	$ 747	$ 1,113,278
2_14	BOSSMH400	10	10.1	11.7	1,179	10.9	10	$ 551	$ 649,450
Subtotal S. Airport Way and Yosemite Ave. (Fishback)								**Base Construction Costs:**	**$ 1,763,000**
								Estimating Contingency (30%)	$ 529,000
								Total Construction Costs:	**$ 2,292,000**
								Engineering and Environmental Documentation (35%)	$ 802,000
								Total Project Costs:	**$ 3,100,000**

S. Airport Way Roberts Estates to Daniels — Project No. 10

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_11	WWMH2754	WWMH2321	19.0	20.0	1,317	19.5	10	$ 757	$ 996,427
Subtotal S. Airport Way Roberts Estates to Daniels								**Base Construction Costs:**	**$ 996,000**
								Estimating Contingency (30%)	$ 299,000
								Total Construction Costs:	**$ 1,295,000**
								Engineering and Environmental Documentation (35%)	$ 453,000
								Total Project Costs:	**$ 1,750,000**

Yosemite Square Lift Station and Improvements — Project No. 11

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
12_2	24	50	14.6	11.0	205	12.8	8	$ 221	$ 45,195
12_4	50	51	11.0	14.7	354	12.8	8	$ 221	$ 78,202
12_5	51	20	14.7	14.6	188	14.6	8	$ 221	$ 41,584
8	49	29	11.0	11.2	321	11.1	8	$ 221	$ 70,842
8_11	29	24	11.2	14.6	645	12.9	8	$ 221	$ 142,532
13	20	WWMH3342	14.6	18.4	1,425	16.5	15	$ 820	$ 1,168,426
2	BOSSMH41	BOSSMH45	7.6	8.7	1,315	8.1	15	$ 603	$ 793,454
BOC6_1	BOSSMH45	12	8.7	12.0	1,919	10.3	15	$ 639	$ 1,226,201
Lift Station									$ 2,900,000
force main					3,143		8	$ 221	$ 870,000
Subtotal	Yosemite Square Lift Station and Improvements							**Base Construction Costs:**	**$ 7,336,000**
								Estimating Contingency (30%)	$ 2,201,000
								Total Construction Costs:	**$ 9,537,000**
								Engineering and Environmental Documentation (35%)	$ 3,338,000
								Total Project Costs:	**$ 12,880,000**

Austin Road Industrial Area Trunk — Project No. 12

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC7_1	BOSSMH23	BOSSMH32	19.3	19.4	589	19.4	18	$ 984	$ 579,171
BOC7_10	BOSSMH6	BOSSMH31	16.6	17.4	589	17.0	18	$ 937	$ 551,710
BOC7_11	BOSSMH31	BOSSMH23	17.4	19.3	589	18.4	18	$ 968	$ 570,017
BOC7_12	BOSSMH32	BOSSMH24	19.4	19.8	589	19.6	18	$ 984	$ 579,171
BOC7_13	BOSSMH33	BOSSMH25	18.4	16.8	589	17.6	21	$ 1,076	$ 633,260
BOC7_14	BOSSMH34	BOSSMH26	17.8	17.6	589	17.7	21	$ 1,076	$ 633,260
BOC7_15	BOSSMH35	BOSSMH27	18.6	19.5	589	19.0	21	$ 1,124	$ 661,553
BOC7_16	BOSSMH36	BOSSMH28	19.9	19.7	589	19.8	21	$ 1,124	$ 661,553
BOC7_2	BOSSMH24	BOSSMH33	19.8	18.4	589	19.1	21	$ 1,124	$ 661,553
BOC7_3	BOSSMH25	BOSSMH34	16.8	17.8	589	17.3	21	$ 1,076	$ 633,260
BOC7_4	BOSSMH26	BOSSMH35	17.6	18.6	589	18.1	21	$ 1,100	$ 647,406
BOC7_5	BOSSMH27	BOSSMH36	19.5	19.9	589	19.7	21	$ 1,124	$ 661,553
BOC7_6	BOSSMH28	BOSSMH37	19.7	19.2	589	19.5	21	$ 1,124	$ 661,553
BOC7_17	BOSSMH37	BOSSMH29	19.2	19.3	589	19.3	24	$ 1,273	$ 749,344
BOC7_18	BOSSMH38	BOSSMH30	18.9	18.6	589	18.7	24	$ 1,249	$ 735,613
BOC7_19	BOSSMH39	BOSSMH8	18.9	19.6	589	19.3	24	$ 1,273	$ 749,344
BOC7_7	BOSSMH29	BOSSMH38	19.3	18.9	589	19.1	24	$ 1,273	$ 749,344
BOC7_8	BOSSMH30	BOSSMH39	18.6	18.9	589	18.8	24	$ 1,249	$ 735,613
Subtotal	Austin Road Industrial Area Trunk							**Base Construction Costs:**	**$ 11,854,000**
								Estimating Contingency (30%)	$ 3,556,000
								Total Construction Costs:	**$ 15,410,000**
								Engineering and Environmental Documentation (35%)	$ 5,394,000
								Total Project Costs:	**$ 20,810,000**

South Austin Road - Industrial Area — Project No. 13

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
12_1	BOSSMH54	BOSSMH6	18.5	16.6	1,444	17.6	15	$ 832	$ 1,202,375
BOC6_12	BOSSMH50	BOSSMH51	9.6	10.5	722	10.0	15	$ 639	$ 461,493
BOC6_13	BOSSMH51	BOSSMH52	10.5	11.7	722	11.1	15	$ 675	$ 487,223
BOC6_15	BOSSMH53	BOSSMH54	15.4	18.5	722	17.0	15	$ 820	$ 591,967
BOC6_25	42	BOSSMH53	12.5	15.4	497	14.0	15	$ 782	$ 388,780
BOC6_7	BOSSMH52	42	11.7	12.5	225	12.1	15	$ 710	$ 159,610
Subtotal	South Austin Road - Industrial Area							**Base Construction Costs:**	**$ 3,291,000**
								Estimating Contingency (30%)	$ 987,000
								Total Construction Costs:	**$ 4,278,000**
								Engineering and Environmental Documentation (35%)	$ 1,497,000
								Total Project Costs:	**$ 5,780,000**

Yosemite Square Service Area — Project No. 14

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC6_10	BOSSMH49	BOSSMH48	7.7	8.9	722	8.3	15	$ 603	$ 435,753
BOC6_11	BOSSMH47	12	11.7	13.2	2,132	12.5	15	$ 710	$ 1,514,541
BOC6_9	BOSSMH48	BOSSMH47	8.9	11.7	722	10.3	15	$ 639	$ 461,457
Subtotal	Yosemite Square Service Area							**Base Construction Costs:**	**$ 2,412,000**
								Estimating Contingency (30%)	$ 724,000
								Total Construction Costs:	**$ 3,136,000**
								Engineering and Environmental Documentation (35%)	$ 1,098,000
								Total Project Costs:	**$ 4,240,000**

Oleander Avenue Extension — Project No. 15

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC18_15	77	78	19.4	15.6	451	17.5	12	$ 737	$ 332,068
BOC18_16	78	79	15.6	14.8	451	15.2	12	$ 717	$ 323,154
BOC18_17	79	WWMH4922	14.8	10.5	451	12.6	12	$ 624	$ 281,255
BOC18_2	BOSSMH19	25	13.3	13.8	451	13.6	12	$ 697	$ 314,239
BOC18_3	25	77	13.8	19.4	451	16.6	12	$ 727	$ 327,611
Subtotal	Oleander Avenue Extension							**Base Construction Costs:**	**$ 1,578,000**
								Estimating Contingency (30%)	$ 473,000
								Total Construction Costs:	**$ 2,051,000**
								Engineering and Environmental Documentation (35%)	$ 718,000
								Total Project Costs:	**$ 2,770,000**

Highway 99 Crossing At Northland Road — Project No. 16

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_10	9	BOSSMH108	25.9	25.3	662	25.6	24	$ 1,537	$ 1,017,578
2_15	BOSSMH020	6	24.8	25.2	184	25.0	24	$ 1,454	$ 268,004
2_7	6	7	25.2	25.2	662	25.2	24	$ 1,496	$ 990,282
2_8	7	8	25.2	25.8	662	25.5	24	$ 1,496	$ 990,282
2_9	8	9	25.8	25.9	662	25.9	24	$ 1,537	$ 1,017,578
BOC25	BOSSMH108	WWMH3470	25.3	25.3	682	25.3	24	$ 1,496	$ 1,019,541
Subtotal	Highway 99 Crossing At Northland Road							**Base Construction Costs:**	**$ 5,303,000**
								Estimating Contingency (30%)	$ 1,591,000
								Total Construction Costs:	**$ 6,894,000**
								Engineering and Environmental Documentation (35%)	$ 2,413,000
								Total Project Costs:	**$ 9,310,000**

East Lathrop Road Trunk — Project No. 17

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
10	18	19	21.2	21.9	366	21.5	18	$ 1,024	$ 375,175
11	19	BOSSMH020	21.9	24.8	1,098	23.3	18	$ 1,073	$ 1,178,417
14	11	34	23.7	20.2	457	22.0	15	$ 891	$ 407,718
3_2	23	BOMH00012	22.6	18.7	796	20.6	15	$ 871	$ 693,378
3_4	34	35	20.2	18.3	457	19.2	15	$ 858	$ 392,397
3_5	35	36	18.3	18.1	457	18.2	15	$ 845	$ 386,579
3_6	36	37	18.1	17.7	457	17.9	15	$ 832	$ 380,761
3_7	37	38	17.7	18.2	457	17.9	15	$ 832	$ 380,761
3_8	38	39	18.2	19.9	457	19.0	15	$ 858	$ 392,397
3_9	39	23	19.9	22.6	457	21.2	15	$ 891	$ 407,718
4	BOMH00012	13	18.7	20.2	397	19.4	18	$ 984	$ 390,919
5	13	14	20.2	20.6	205	20.4	18	$ 999	$ 204,842
6	14	15	20.6	20.7	193	20.6	18	$ 999	$ 192,729
7	15	16	20.7	20.8	208	20.7	18	$ 999	$ 207,531
8_1	16	21	20.8	20.9	353	20.8	18	$ 999	$ 352,769
8_3	21	22	20.9	21.0	180	20.9	18	$ 999	$ 180,060
8_4	22	17	21.0	21.1	159	21.0	18	$ 1,024	$ 162,805
9	17	18	21.1	21.2	178	21.1	18	$ 1,024	$ 182,168
Subtotal	East Lathrop Road Trunk							**Base Construction Costs:**	**$ 6,869,000**
								Estimating Contingency (30%)	$ 2,061,000
								Total Construction Costs:	**$ 8,930,000**
								Engineering and Environmental Documentation (35%)	$ 3,126,000
								Total Project Costs:	**$ 12,060,000**

Northland Road Trunk — Project No. 18

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_1	BOSSMH89	1	19.2	22.2	662	20.7	18	$ 999	$ 661,644
2_13	5	BOSSMH020	16.2	24.8	478	20.5	18	$ 999	$ 477,505
2_2	1	2	22.2	18.9	662	20.6	18	$ 999	$ 661,644
2_3	2	3	18.9	24.9	662	21.9	18	$ 1,024	$ 678,021
2_4	3	4	24.9	17.8	662	21.3	18	$ 1,024	$ 678,021
2_5	4	5	17.8	16.2	662	17.0	18	$ 937	$ 620,467
Subtotal	Northland Road Trunk							**Base Construction Costs:**	**$ 3,777,000**
								Estimating Contingency (30%)	$ 1,133,000
								Total Construction Costs:	**$ 4,910,000**
								Engineering and Environmental Documentation (35%)	$ 1,719,000
								Total Project Costs:	**$ 6,630,000**

Northland Road Branches — Project No. 19

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC18_10	BOSSMH169	BOSSMH170	12.1	13.0	476	12.5	12	$ 624	$ 297,390
BOC18_11	BOSSMH170	BOSSMH171	13.0	14.2	476	13.6	12	$ 697	$ 332,265
BOC18_12	BOSSMH171	BOSSMH172	14.2	15.5	476	14.8	12	$ 707	$ 336,978
BOC18_13	BOSSMH172	BOSSMH173	15.5	16.7	476	16.1	12	$ 727	$ 346,404
BOC18_14	BOSSMH173	BOSSMH89	16.7	19.2	476	17.9	12	$ 737	$ 351,117
BOC18_9	BOSSMH168	BOSSMH169	12.2	12.1	476	12.2	12	$ 624	$ 297,389
BOC19_7	BOSSMH178	BOSSMH177	11.3	11.7	479	11.5	12	$ 588	$ 281,612
BOC19_8	BOSSMH177	BOSSMH89	11.7	19.2	1,917	15.4	12	$ 717	$ 1,374,998
Subtotal	Northland Road Branches							**Base Construction Costs:**	**$ 3,618,000**
								Estimating Contingency (30%)	$ 1,085,000
								Total Construction Costs:	**$ 4,703,000**
								Engineering and Environmental Documentation (35%)	$ 1,646,000
								Total Project Costs:	**$ 6,350,000**

Louise/ Nehemiah Branches — Project No. 20

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_31	BOSSMH99	53	15.8	11.6	535	13.7	12	$ 697	$ 372,885
2_32	53	54	11.6	11.9	535	11.7	12	$ 588	$ 314,176
2_33	54	55	11.9	11.9	535	11.9	12	$ 588	$ 314,176
2_34	55	56	11.9	11.4	535	11.6	12	$ 588	$ 314,176
2_35	56	WWMH2114	11.4	9.5	535	10.4	12	$ 551	$ 294,606
BOC3_2	BOSSMH3	WWMH1430	9.1	10.9	2,579	10.0	12	$ 514	$ 1,326,509
Subtotal	Louise/ Nehemiah Branches							**Base Construction Costs:**	**$ 2,937,000**
								Estimating Contingency (30%)	$ 881,000
								Total Construction Costs:	**$ 3,818,000**
								Engineering and Environmental Documentation (35%)	$ 1,336,000
								Total Project Costs:	**$ 5,160,000**

South Union Road Extension — Project No. 21

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
15_2	BOSSMH20	27	8.2	11.1	475	9.7	12	$ 514	$ 244,293
15_3	27	28	11.1	14.5	475	12.8	12	$ 624	$ 296,440
15_4	28	74	14.5	14.0	475	14.3	12	$ 707	$ 335,903
15_5	74	75	14.0	13.3	475	13.6	12	$ 697	$ 331,205
15_6	75	76	13.3	13.4	475	13.3	12	$ 661	$ 313,823
15_7	76	26	13.4	13.8	475	13.6	12	$ 697	$ 331,205
BOC17_1	26	WWMH4954	13.8	13.5	1,090	13.6	12	$ 697	$ 760,054
Subtotal	South Union Road Extension							**Base Construction Costs:**	**$ 2,613,000**
								Estimating Contingency (30%)	$ 784,000
								Total Construction Costs:	**$ 3,397,000**
								Engineering and Environmental Documentation (35%)	$ 1,189,000
								Total Project Costs:	**$ 4,590,000**

Cottage Avenue — Project No. 22

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_21	BOMH00029	30	12.4	13.7	482	13.0	12	$ 661	$ 318,278
2_22	30	BOMH00031	13.7	13.6	482	13.7	12	$ 697	$ 335,907
2_23	BOMH00031	32	13.6	17.0	482	15.3	12	$ 717	$ 345,437
2_24	32	33	17.0	20.9	482	18.9	12	$ 747	$ 359,731
2_25	33	11	20.9	23.7	482	22.3	12	$ 818	$ 394,036
Subtotal	Cottage Avenue							**Base Construction Costs:**	**$ 1,753,000**
								Estimating Contingency (30%)	$ 526,000
								Total Construction Costs:	**$ 2,279,000**
								Engineering and Environmental Documentation (35%)	$ 798,000
								Total Project Costs:	**$ 3,080,000**

North Shed Union Road Trunk — Project No. 23

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_13	BOSSMH18	BOSSMH205	21.0	20.4	469	20.7	30	$ 1,533	$ 719,386
BOC4_14	BOSSMH205	BOSSMH206	20.4	20.8	469	20.6	30	$ 1,533	$ 719,511
BOC4_15	BOSSMH206	BOSSMH207	20.8	21.7	469	21.3	30	$ 1,567	$ 735,294
BOC4_16	BOSSMH207	BOSSMH208	21.7	22.5	469	22.1	30	$ 1,601	$ 751,079
BOC4_17	BOSSMH208	BOSSMH209	22.5	23.4	469	22.9	30	$ 1,601	$ 751,077
BOC4_18	BOSSMH209	BOSSMH210	23.4	23.5	469	23.4	30	$ 1,634	$ 766,861
BOC4_19	BOSSMH210	BOSSMH211	23.5	23.7	469	23.6	30	$ 1,634	$ 766,860
BOC4_20	BOSSMH211	BOSSMH212	23.7	23.6	469	23.7	30	$ 1,634	$ 766,861
BOC4_21	BOSSMH212	WWMH3784_	23.6	23.7	100	23.6	30	$ 1,634	$ 164,252
BOC4_21.5	WWMH3784	BOSSMH213	23.7	23.7	369	23.7	30	$ 1,634	$ 602,608
BOC4_22	BOSSMH213	WWMH3782	23.7	19.4	469	21.6	30	$ 1,567	$ 735,426
Subtotal	North Shed Union Road Trunk							**Base Construction Costs:**	**$ 7,479,000**
								Estimating Contingency (30%)	$ 2,244,000
								Total Construction Costs:	**$ 9,723,000**
								Engineering and Environmental Documentation (35%)	$ 3,403,000
								Total Project Costs:	**$ 13,130,000**

Manteca Junction Trunk — Project No. 24

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_2	BOSSMH4	BOSSMH214	11.5	13.0	501	12.2	10	$ 624	$ 312,961
BOC4_23	BOSSMH214	BOSSMH215	13.0	14.4	501	13.7	10	$ 697	$ 349,703
BOC4_24	BOSSMH215	BOSSMH216	14.4	15.3	501	14.8	10	$ 707	$ 354,662
BOC4_25	BOSSMH216	BOSSMH217	15.3	16.3	501	15.8	10	$ 717	$ 359,623
BOC4_26	BOSSMH217	BOSSMH218	16.3	17.5	501	16.9	10	$ 727	$ 364,583
BOC4_27	BOSSMH218	BOSSMH18	17.5	21.0	501	19.2	10	$ 757	$ 379,506
Subtotal	Manteca Junction Trunk							**Base Construction Costs:**	**$ 2,121,000**
								Estimating Contingency (30%)	$ 636,000
								Total Construction Costs:	**$ 2,757,000**
								Engineering and Environmental Documentation (35%)	$ 965,000
								Total Project Costs:	**$ 3,730,000**

Lovelace Road - 99 Crossing Project No. 25

Pipeline ID	Upstream Manhole	Downstream Manhole	Upstream Depth (ft)	Downstream Depth (ft)	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC17_10	BOSSMH192	BOSSMH193	21.3	20.8	471	21.1	24	$ 1,328	$ 625,246
BOC17_11	BOSSMH193	BOSSMH194	20.8	20.0	471	20.4	24	$ 1,296	$ 610,337
BOC17_12	BOSSMH194	BOSSMH195	20.0	19.2	471	19.6	24	$ 1,273	$ 599,355
BOC17_13	BOSSMH195	BOSSMH196	19.2	19.1	471	19.2	24	$ 1,273	$ 599,355
BOC17_14	BOSSMH196	BOSSMH197	19.1	18.9	471	19.0	24	$ 1,273	$ 599,355
BOC17_15	BOSSMH197	BOSSMH198	18.9	19.5	471	19.2	24	$ 1,273	$ 599,355
BOC17_16	BOSSMH198	BOSSMH199	19.5	19.7	471	19.6	24	$ 1,273	$ 599,355
BOC17_17	BOSSMH199	BOSSMH200	19.7	19.5	471	19.6	24	$ 1,273	$ 599,355
BOC17_18	BOSSMH200	BOSSMH201	19.5	19.6	471	19.6	24	$ 1,273	$ 599,354
BOC17_19	BOSSMH201	BOSSMH18	19.6	21.0	471	20.3	24	$ 1,296	$ 610,337
BOC17_6	BOSSMH87	BOSSMH189	18.8	19.5	471	19.2	15	$ 858	$ 404,007
BOC17_7	BOSSMH189	BOSSMH190	19.5	21.0	471	20.3	15	$ 871	$ 409,998
BOC17_8	BOSSMH190	BOSSMH191	21.0	21.4	471	21.2	24	$ 1,328	$ 625,245
BOC17_9	BOSSMH191	BOSSMH192	21.4	21.3	471	21.4	24	$ 1,328	$ 625,248
BOC20_10	BOSSMH186	BOSSMH187	16.8	17.4	444	17.1	15	$ 832	$ 369,563
BOC20_11	BOSSMH187	BOSSMH188	17.4	18.1	444	17.8	15	$ 832	$ 369,563
BOC20_12	BOSSMH188	BOSSMH87	18.1	18.8	444	18.5	15	$ 845	$ 375,209
BOC20_7	BOSSMH88	BOSSMH184	14.8	15.6	444	15.2	15	$ 807	$ 358,269
BOC20_8	BOSSMH184	BOSSMH185	15.6	16.7	444	16.1	15	$ 820	$ 363,916
BOC20_9	BOSSMH185	BOSSMH186	16.7	16.8	444	16.7	15	$ 820	$ 363,916
Subtotal	Lovelace Road - 99 Crossing						**Base Construction Costs:**		**$ 10,306,000**
							Estimating Contingency (30%)		$ 3,092,000
							Total Construction Costs:		**$ 13,398,000**
							Engineering and Environmental Documentation (35%)		$ 4,689,000
							Total Project Costs:		**$ 18,090,000**

Stantec

PROJECT: WASTEWATER COLLECTION SYSTEM MASTER PLAN PROJECT COSTS

DATE: 9/1/2023

JOB NUMBER: 184031535

PREPARED BY: BEW

CLIENT: CITY OF MANTECA

CHECKED BY: SLB

DESCRIPTION: Project Costs

ENR: 13,176

PROJECT COSTS SUMMARY

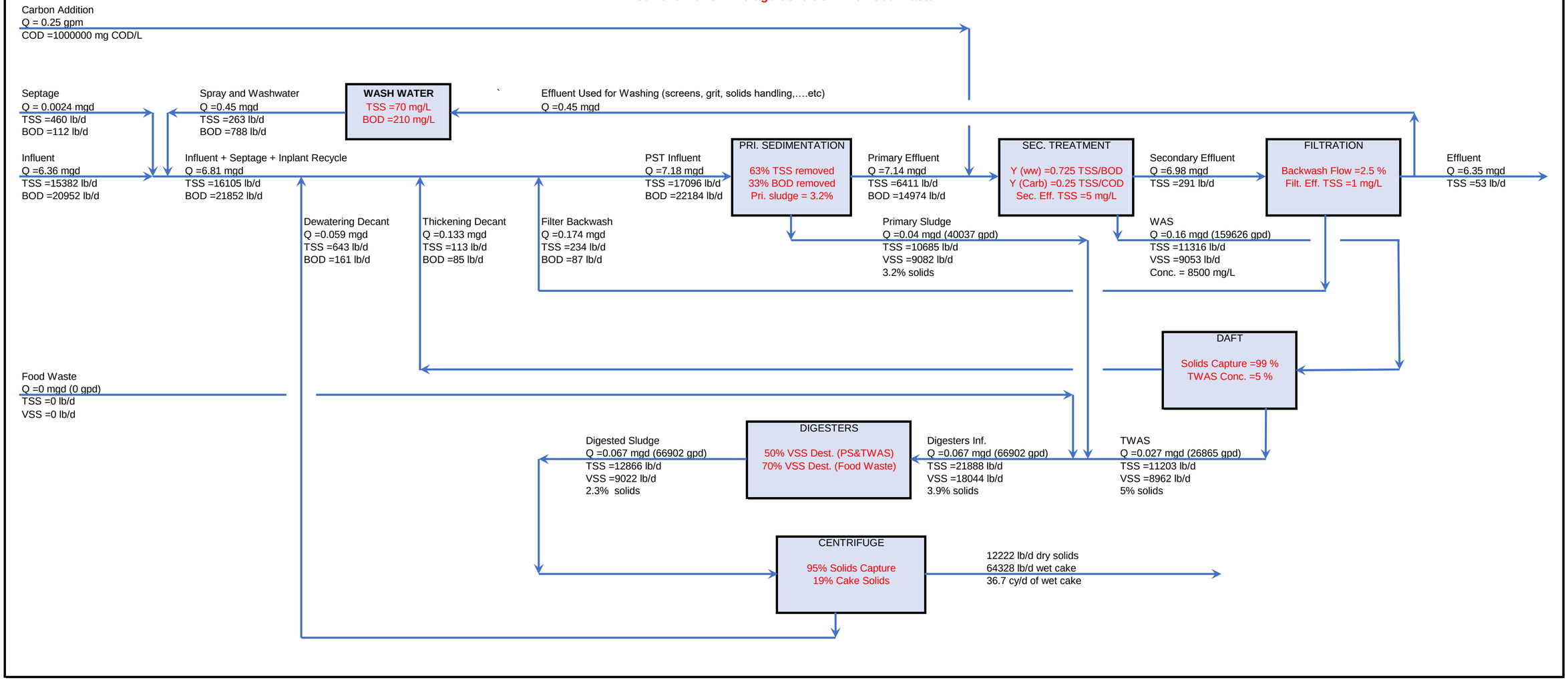
ID	Name	Base Construction Costs	Estimating Contingency (30%)	Total Construction Costs:	Engineering and Environmental Documentation (35%)	Total Project Costs:
Scenario 1 Improvements						
1	W Center Street Trunk	$2,781,000	$834,000	$3,615,000	$1,265,000	$4,880,000
2	Elm/West North Street Trunk	$2,892,000	$868,000	$3,760,000	$1,316,000	$5,080,000
3	10-inch East North Street Trunk	$941,000	$282,000	$1,223,000	$428,000	$1,660,000
4	8-inch East North Street Trunk	$288,000	$86,000	$374,000	$131,000	$510,000
5A	South Woodward Trunk Extension	$7,200,000	$2,160,000	$9,360,000	$3,276,000	$12,640,000
6	Central Union Road Trunk Extension	$9,209,000	$2,763,000	$11,972,000	$4,190,000	$16,170,000
Scenario 2 Improvements						
7A	North Trunk Extension on Airport Way	$19,564,000	$5,869,000	$25,433,000	$8,902,000	$34,340,000
8	S. Main Trunk to Evans	$4,087,000	$1,226,000	$5,313,000	$1,860,000	$7,180,000
9	S. Airport Way and Yosemite Ave. (Fishback)	$1,763,000	$529,000	$2,292,000	$802,000	$3,100,000
10	S. Airport Way Roberts Estates to Daniels	$996,000	$299,000	$1,295,000	$453,000	$1,750,000
11	Yosemite Square Lift Station and Improvements	$7,336,000	$2,201,000	$9,537,000	$3,338,000	$12,880,000
12	Austin Road Industrial Area Trunk	$11,854,000	$3,556,000	$15,410,000	$5,394,000	$20,810,000
13	South Austin Road - Industrial Area	$3,291,000	$987,000	$4,278,000	$1,497,000	$5,780,000
Scenario 3 Improvements						
14	Yosemite Square Service Area	$2,412,000	$724,000	$3,136,000	$1,098,000	$4,240,000
15	Oleander Avenue Extension	$1,578,000	$473,000	$2,051,000	$718,000	$2,770,000
16	Highway 99 Crossing at Northland Road	$5,303,000	$1,591,000	$6,894,000	$2,413,000	$9,310,000
17	East Lathrop Road Trunk	$6,869,000	$2,061,000	$8,930,000	$3,126,000	$12,060,000
18	Northland Road Trunk	$3,777,000	$1,133,000	$4,910,000	$1,719,000	$6,630,000
19	Northland Road Branches	$3,618,000	$1,085,000	$4,703,000	$1,646,000	$6,350,000
20	Louise/ Nehemiah Branches	$2,937,000	$881,000	$3,818,000	$1,336,000	$5,160,000
21	South Union Road Extension	$2,613,000	$784,000	$3,397,000	$1,189,000	$4,590,000
22	Cottage Avenue	$1,753,000	$526,000	$2,279,000	$798,000	$3,080,000
Scenario 4 Improvements						
23	North Shed Union Road Trunk	$7,479,000	$2,244,000	$9,723,000	$3,403,000	$13,130,000
24	Manteca Junction Trunk	$2,121,000	$636,000	$2,757,000	$965,000	$3,730,000
25	Lovelace Road - 99 Crossing	$10,306,000	$3,092,000	$13,398,000	$4,689,000	$18,090,000

APPENDIX H

Solids Mass Balances Flow Diagrams

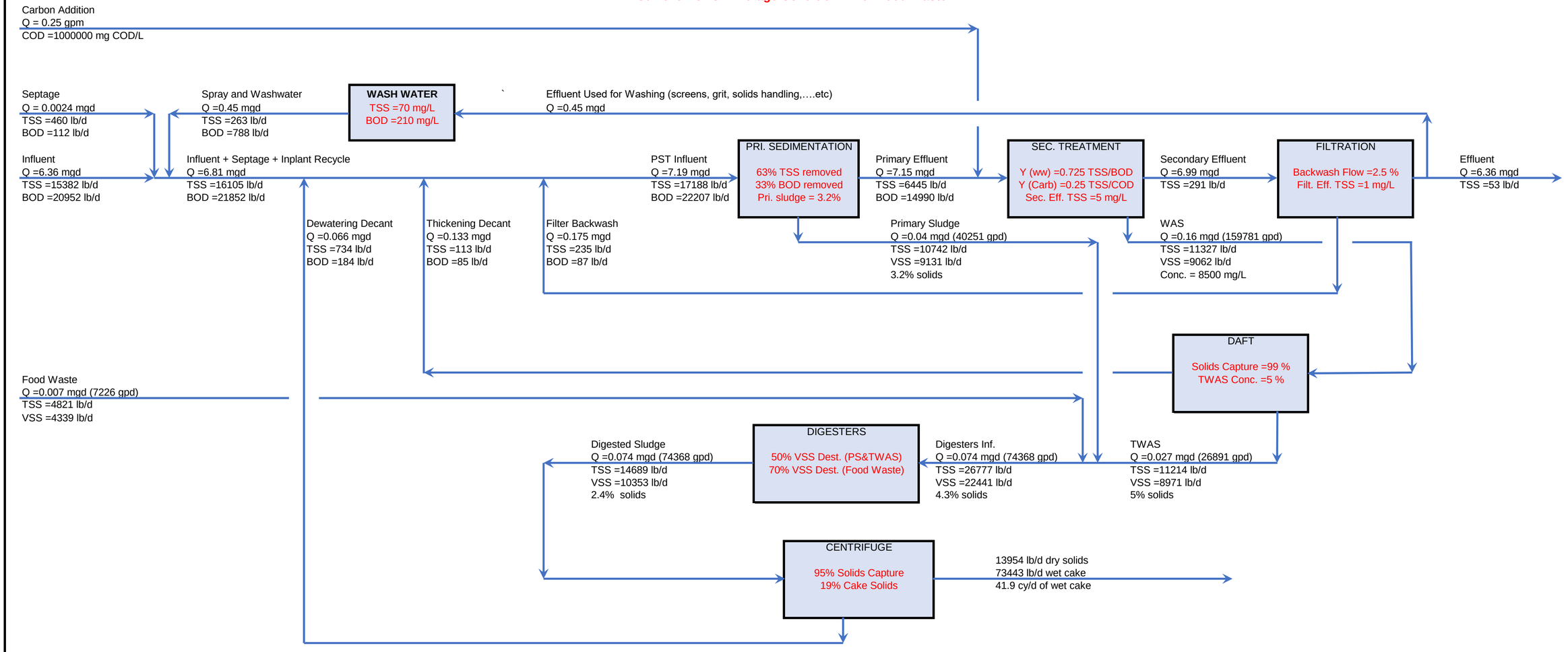
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Current Flows - Average Condition - No Food Waste



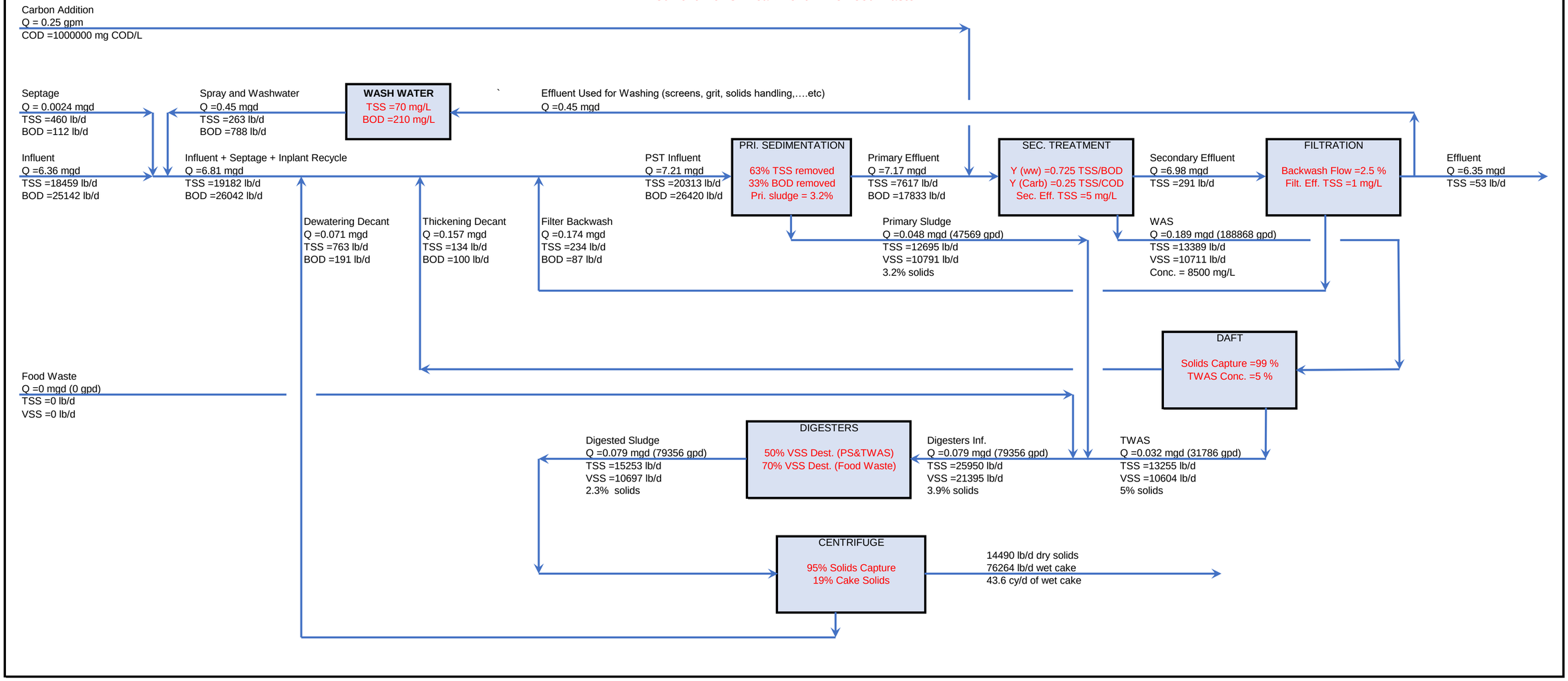
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Current Flows - Average Condition - with Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Current Flows - Peak Month - No Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Current Flows - Peak Month - with Food Waste

Carbon Addition
Q = 0.25 gpm
COD =1000000 mg COD/L

Septage
Q = 0.0024 mgd
TSS =460 lb/d
BOD =112 lb/d

Spray and Washwater
Q =0.45 mgd
TSS =263 lb/d
BOD =788 lb/d

WASH WATER
TSS =70 mg/L
BOD =210 mg/L

Effluent Used for Washing (screens, grit, solids handling,….etc)
Q =0.45 mgd

Influent
Q =6.36 mgd
TSS =18459 lb/d
BOD =25142 lb/d

Influent + Septage + Inplant Recycle
Q =6.81 mgd
TSS =19182 lb/d
BOD =26042 lb/d

PST Influent
Q =7.22 mgd
TSS =20404 lb/d
BOD =26443 lb/d

PRI. SEDIMENTATION
63% TSS removed
33% BOD removed
Pri. sludge = 3.2%

Primary Effluent
Q =7.17 mgd
TSS =7652 lb/d
BOD =17849 lb/d

SEC. TREATMENT
Y (ww) =0.725 TSS/BOD
Y (Carb) =0.25 TSS/COD
Sec. Eff. TSS =5 mg/L

Secondary Effluent
Q =6.98 mgd
TSS =291 lb/d

FILTRATION
Backwash Flow =2.5 %
Filt. Eff. TSS =1 mg/L

Effluent
Q =6.36 mgd
TSS =53 lb/d

Dewatering Decant
Q =0.077 mgd
TSS =854 lb/d
BOD =213 lb/d

Thickening Decant
Q =0.157 mgd
TSS =134 lb/d
BOD =100 lb/d

Filter Backwash
Q =0.175 mgd
TSS =234 lb/d
BOD =87 lb/d

Primary Sludge
Q =0.048 mgd (47784 gpd)
TSS =12753 lb/d
VSS =10840 lb/d
3.2% solids

WAS
Q =0.189 mgd (189022 gpd)
TSS =13400 lb/d
VSS =10720 lb/d
Conc. = 8500 mg/L

DAFT
Solids Capture =99 %
TWAS Conc. =5 %

Food Waste
Q =0.007 mgd (7226 gpd)
TSS =4821 lb/d
VSS =4339 lb/d

DIGESTERS
50% VSS Dest. (PS&TWAS)
70% VSS Dest. (Food Waste)

Digested Sludge
Q =0.087 mgd (86822 gpd)
TSS =17076 lb/d
VSS =12028 lb/d
2.4% solids

Digesters Inf.
Q =0.087 mgd (86822 gpd)
TSS =30839 lb/d
VSS =25791 lb/d
4.3% solids

TWAS
Q =0.032 mgd (31812 gpd)
TSS =13266 lb/d
VSS =10613 lb/d
5% solids

CENTRIFUGE
95% Solids Capture
19% Cake Solids

16222 lb/d dry solids
85380 lb/d wet cake
48.8 cy/d of wet cake

CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Interim - Average - No Food Waste

Carbon Addition
Q = 0.25 gpm
COD =1000000 mg COD/L

Septage
Q = 0.0031 mgd
TSS =596 lb/d
BOD =145 lb/d

Spray and Washwater
Q =0.58 mgd
TSS =340 lb/d
BOD =1020 lb/d

WASH WATER
TSS =70 mg/L
BOD =210 mg/L

Effluent Used for Washing (screens, grit, solids handling,….etc)
Q =0.58 mgd

Influent
Q =8.23 mgd
TSS =19905 lb/d
BOD =27112 lb/d

Influent + Septage + Inplant Recycle
Q =8.82 mgd
TSS =20841 lb/d
BOD =28277 lb/d

PST Influent
Q =9.29 mgd
TSS =22114 lb/d
BOD =28704 lb/d

PRI. SEDIMENTATION
63% TSS removed
33% BOD removed
Pri. sludge = 3.2%

Primary Effluent
Q =9.24 mgd
TSS =8293 lb/d
BOD =19375 lb/d

SEC. TREATMENT
Y (ww) =0.725 TSS/BOD
Y (Carb) =0.25 TSS/COD
Sec. Eff. TSS =5 mg/L

Secondary Effluent
Q =9.03 mgd
TSS =377 lb/d

FILTRATION
Backwash Flow =2.5 %
Filt. Eff. TSS =1 mg/L

Effluent
Q =8.22 mgd
TSS =69 lb/d

Dewatering Decant
Q =0.077 mgd
TSS =826 lb/d
BOD =206 lb/d

Thickening Decant
Q =0.169 mgd
TSS =144 lb/d
BOD =108 lb/d

Filter Backwash
Q =0.226 mgd
TSS =303 lb/d
BOD =112 lb/d

Primary Sludge
Q =0.052 mgd (51789 gpd)
TSS =13821 lb/d
VSS =11748 lb/d
3.2% solids

WAS
Q =0.203 mgd (203427 gpd)
TSS =14421 lb/d
VSS =11537 lb/d
Conc. = 8500 mg/L

DAFT
Solids Capture =99 %
TWAS Conc. =5 %

Food Waste
Q =0 mgd (0 gpd)
TSS =0 lb/d
VSS =0 lb/d

DIGESTERS
50% VSS Dest. (PS&TWAS)
70% VSS Dest. (Food Waste)

Digested Sludge
Q =0.086 mgd (86025 gpd)
TSS =16513 lb/d
VSS =11585 lb/d
2.3% solids

Digesters Inf.
Q =0.086 mgd (86025 gpd)
TSS =28098 lb/d
VSS =23170 lb/d
3.9% solids

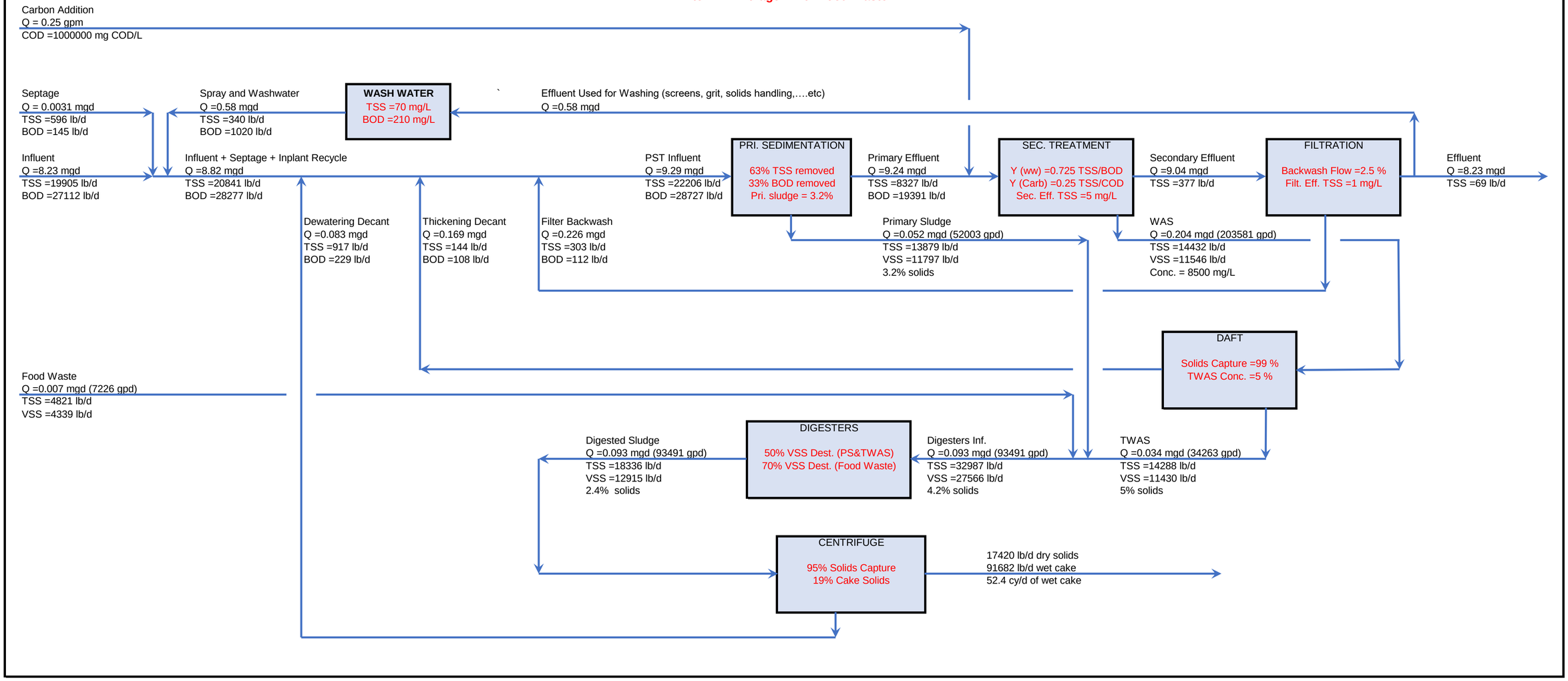
TWAS
Q =0.034 mgd (34237 gpd)
TSS =14277 lb/d
VSS =11421 lb/d
5% solids

CENTRIFUGE
95% Solids Capture
19% Cake Solids

15688 lb/d dry solids
82566 lb/d wet cake
47.2 cy/d of wet cake

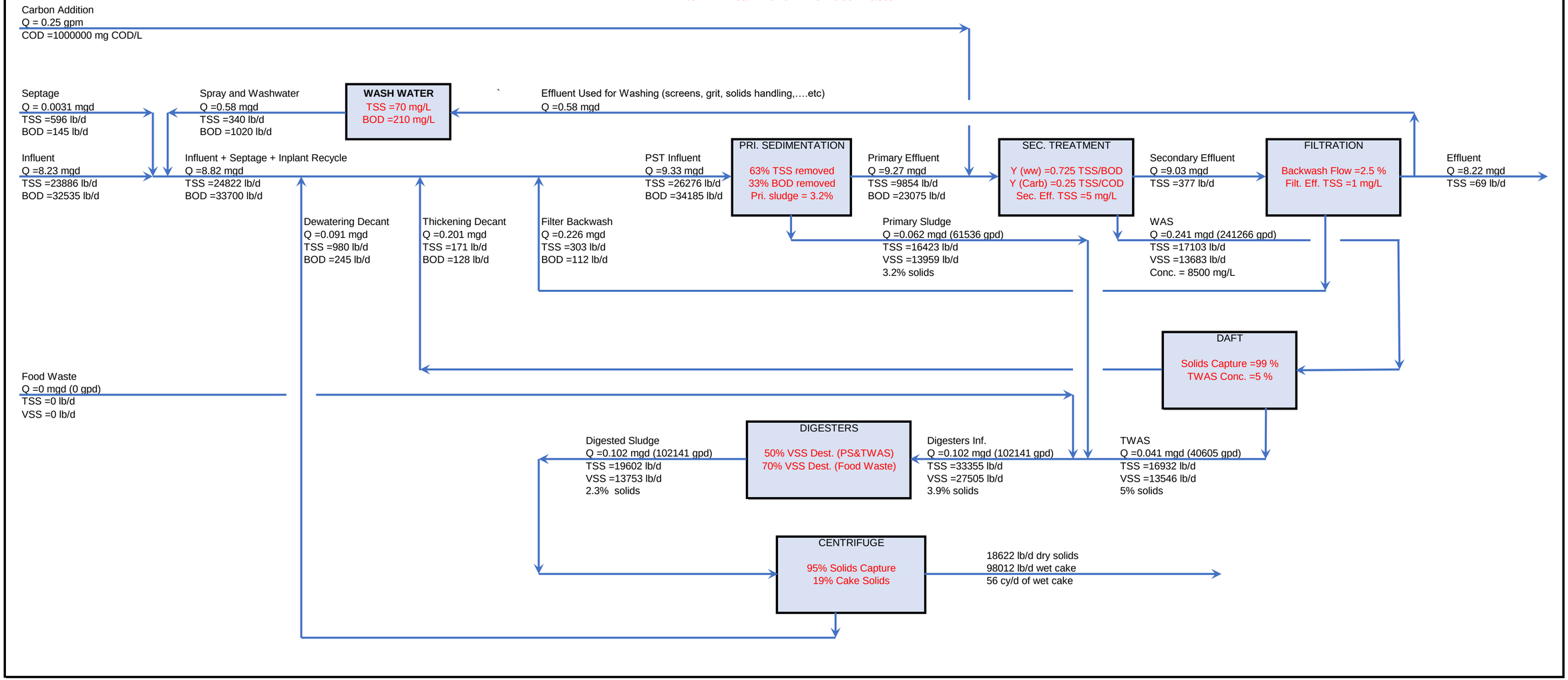
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Interim - Average - with Food Waste



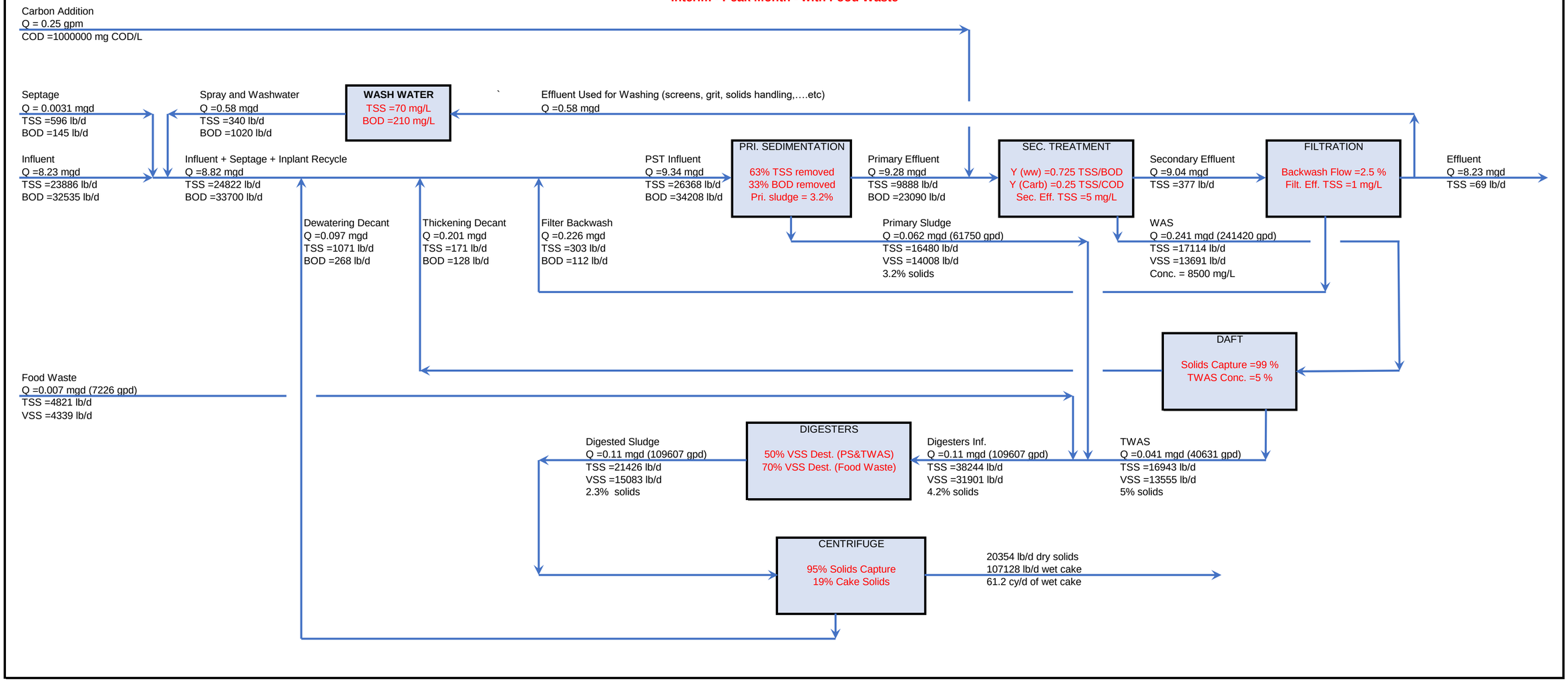
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Interim - Peak Month - No Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Interim - Peak Month - with Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 1 - Average - No Food Waste

Carbon Addition
Q = 0 gpm
COD =1000000 mg COD/L

Septage
Q = 0.0049 mgd
TSS =933 lb/d
BOD =227 lb/d

Spray and Washwater
Q =0.91 mgd
TSS =532 lb/d
BOD =1597 lb/d

WASH WATER
TSS =70 mg/L
BOD =210 mg/L

Effluent Used for Washing (screens, grit, solids handling,….etc)
Q =0.91 mgd

Influent
Q =12.89 mgd
TSS =31176 lb/d
BOD =42464 lb/d

Influent + Septage + Inplant Recycle
Q =13.81 mgd
TSS =32641 lb/d
BOD =44288 lb/d

PST Influent
Q =14.51 mgd
TSS =34544 lb/d
BOD =44922 lb/d

PRI. SEDIMENTATION
63% TSS removed
33% BOD removed
Pri. sludge = 3.2%

Primary Effluent
Q =14.43 mgd
TSS =12954 lb/d
BOD =30322 lb/d

SEC. TREATMENT
Y (ww) =0.69 TSS/BOD
Y (Carb) =0.25 TSS/COD
Sec. Eff. TSS =5 mg/L

Secondary Effluent
Q =14.15 mgd
TSS =590 lb/d

FILTRATION
Backwash Flow =2.5 %
Filt. Eff. TSS =1 mg/L

Effluent
Q =12.88 mgd
TSS =107 lb/d

Dewatering Decant
Q =0.115 mgd
TSS =1225 lb/d
BOD =306 lb/d

Thickening Decant
Q =0.239 mgd
TSS =203 lb/d
BOD =152 lb/d

Filter Backwash
Q =0.354 mgd
TSS =475 lb/d
BOD =176 lb/d

Primary Sludge
Q =0.081 mgd (80897 gpd)
TSS =21590 lb/d
VSS =18351 lb/d
3.2% solids

WAS
Q =0.287 mgd (286817 gpd)
TSS =20332 lb/d
VSS =16266 lb/d
Conc. = 8500 mg/L

DAFT
Solids Capture =99 %
TWAS Conc. =5 %

Food Waste
Q =0 mgd (0 gpd)
TSS =0 lb/d
VSS =0 lb/d

DIGESTERS
50% VSS Dest. (PS&TWAS)
70% VSS Dest. (Food Waste)

Digested Sludge
Q =0.129 mgd (129168 gpd)
TSS =24492 lb/d
VSS =17227 lb/d
2.3% solids

Digesters Inf.
Q =0.129 mgd (129168 gpd)
TSS =41719 lb/d
VSS =34455 lb/d
3.9% solids

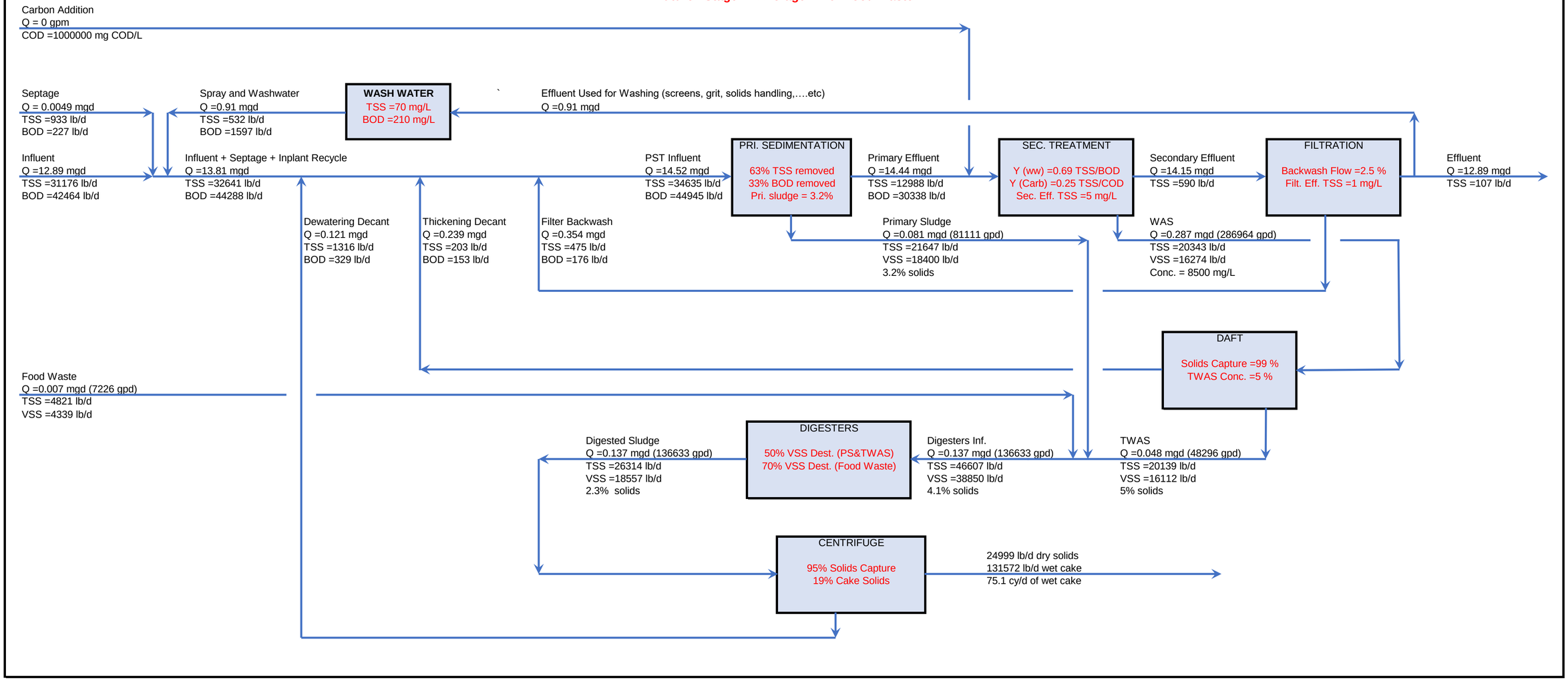
TWAS
Q =0.048 mgd (48271 gpd)
TSS =20129 lb/d
VSS =16103 lb/d
5% solids

CENTRIFUGE
95% Solids Capture
19% Cake Solids

23267 lb/d dry solids
122458 lb/d wet cake
69.9 cy/d of wet cake

CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 1 - Average - with Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 1 - Peak Month - No Food Waste

Carbon Addition
Q = 0 gpm
COD =1000000 mg COD/L

Septage
Q = 0.0049 mgd
TSS =933 lb/d
BOD =227 lb/d

Spray and Washwater
Q =0.91 mgd
TSS =532 lb/d
BOD =1597 lb/d

WASH WATER
TSS =70 mg/L
BOD =210 mg/L

Effluent Used for Washing (screens, grit, solids handling,….etc)
Q =0.91 mgd

Influent
Q =12.89 mgd
TSS =37411 lb/d
BOD =50956 lb/d

Influent + Septage + Inplant Recycle
Q =13.81 mgd
TSS =38876 lb/d
BOD =52780 lb/d

PST Influent
Q =14.58 mgd
TSS =41054 lb/d
BOD =53503 lb/d

PRI. SEDIMENTATION
63% TSS removed
33% BOD removed
Pri. sludge = 3.2%

Primary Effluent
Q =14.49 mgd
TSS =15395 lb/d
BOD =36115 lb/d

SEC. TREATMENT
Y (ww) =0.69 TSS/BOD
Y (Carb) =0.25 TSS/COD
Sec. Eff. TSS =5 mg/L

Secondary Effluent
Q =14.14 mgd
TSS =590 lb/d

FILTRATION
Backwash Flow =2.5 %
Filt. Eff. TSS =1 mg/L

Effluent
Q =12.88 mgd
TSS =107 lb/d

Dewatering Decant
Q =0.137 mgd
TSS =1460 lb/d
BOD =365 lb/d

Thickening Decant
Q =0.285 mgd
TSS =243 lb/d
BOD =182 lb/d

Filter Backwash
Q =0.354 mgd
TSS =475 lb/d
BOD =176 lb/d

Primary Sludge
Q =0.096 mgd (96144 gpd)
TSS =25659 lb/d
VSS =21810 lb/d
3.2% solids

WAS
Q =0.343 mgd (343200 gpd)
TSS =24329 lb/d
VSS =19464 lb/d
Conc. = 8500 mg/L

DAFT
Solids Capture =99 %
TWAS Conc. =5 %

Food Waste
Q =0 mgd (0 gpd)
TSS =0 lb/d
VSS =0 lb/d

DIGESTERS
50% VSS Dest. (PS&TWAS)
70% VSS Dest. (Food Waste)

Digested Sludge
Q =0.154 mgd (153905 gpd)
TSS =29206 lb/d
VSS =20539 lb/d
2.3% solids

Digesters Inf.
Q =0.154 mgd (153905 gpd)
TSS =49745 lb/d
VSS =41079 lb/d
3.9% solids

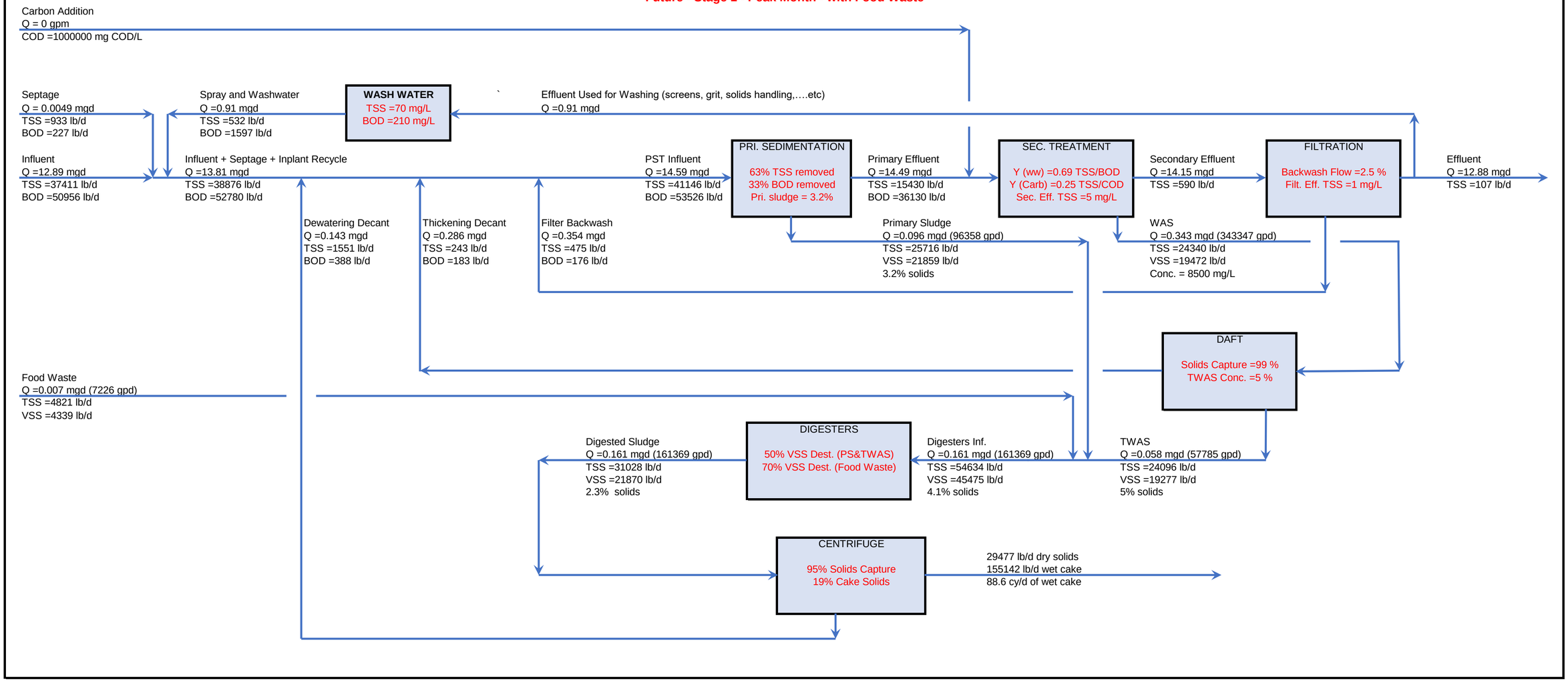
TWAS
Q =0.058 mgd (57761 gpd)
TSS =24086 lb/d
VSS =19269 lb/d
5% solids

CENTRIFUGE
95% Solids Capture
19% Cake Solids

27745 lb/d dry solids
146028 lb/d wet cake
83.4 cy/d of wet cake

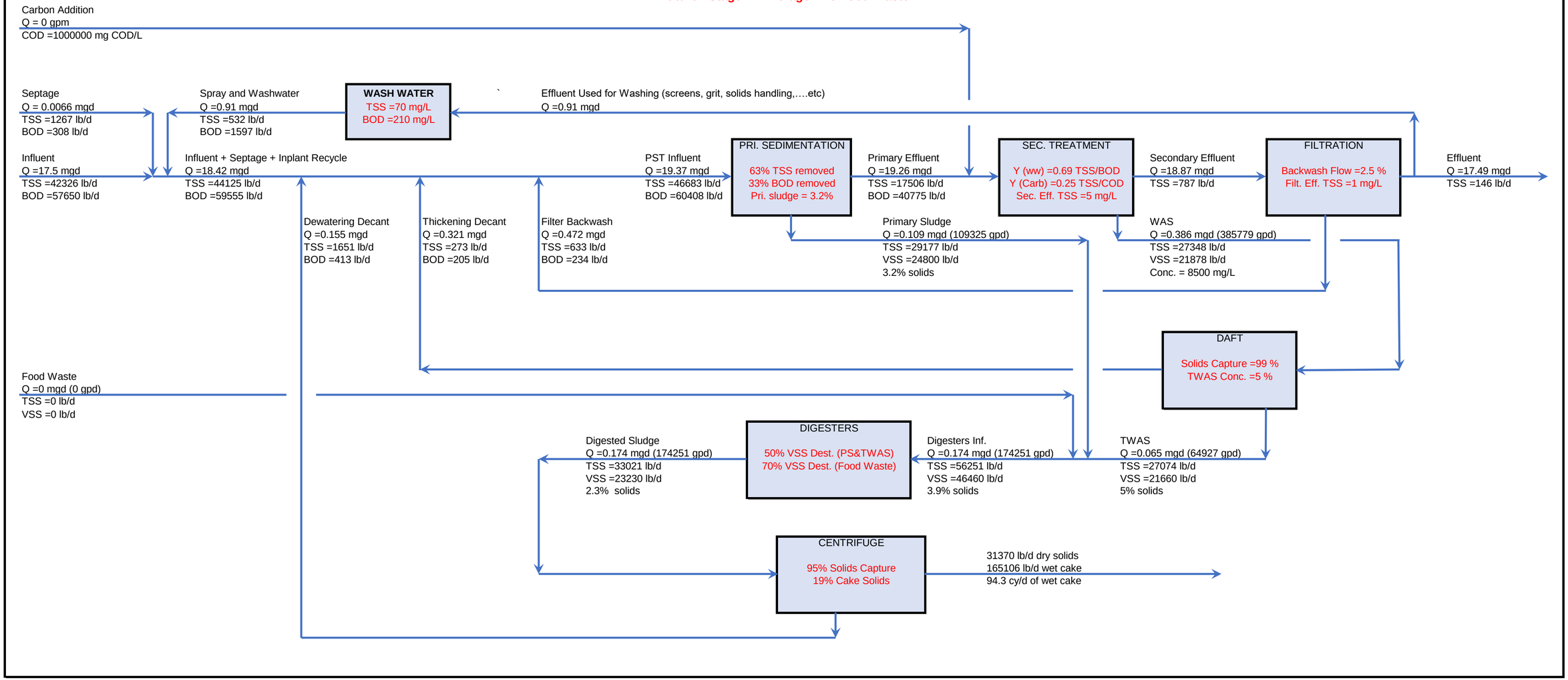
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 1 - Peak Month - with Food Waste



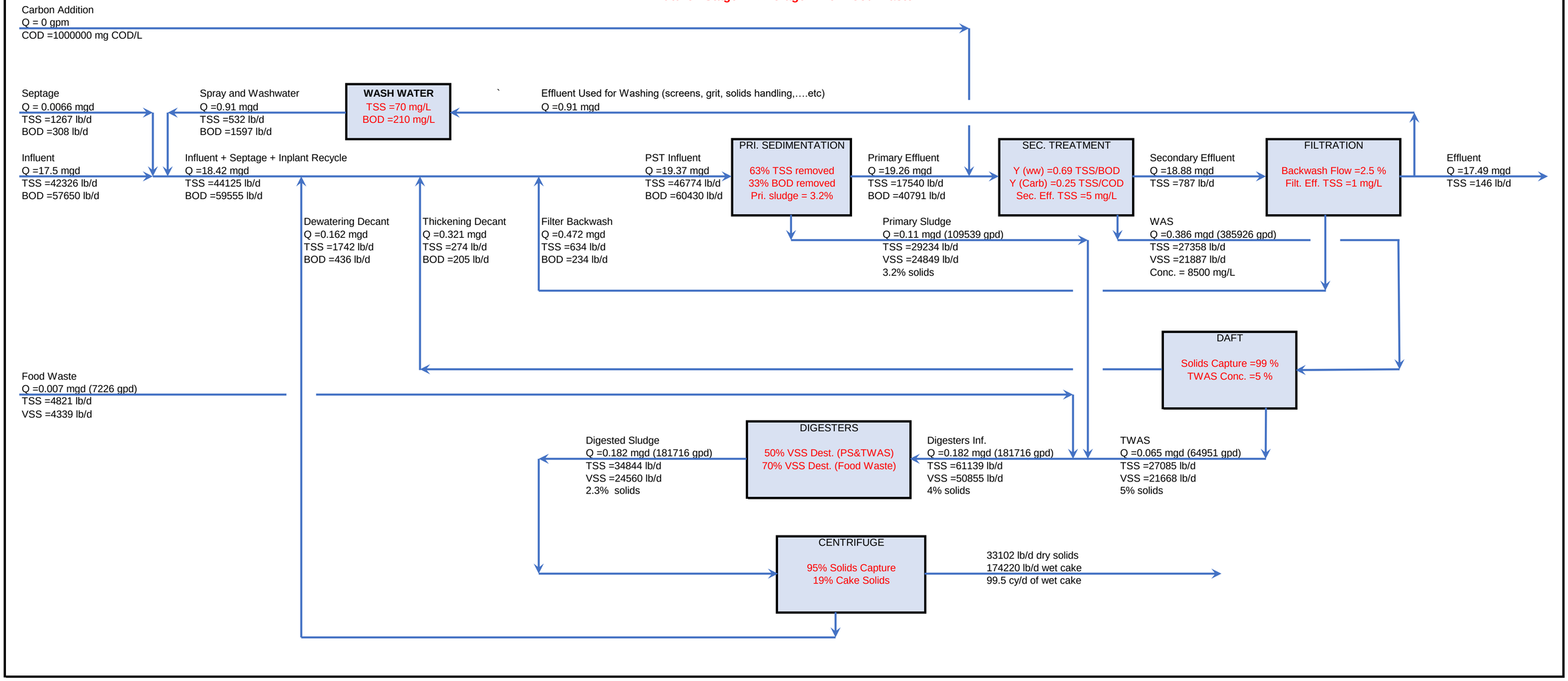
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 2 - Average - No Food Waste



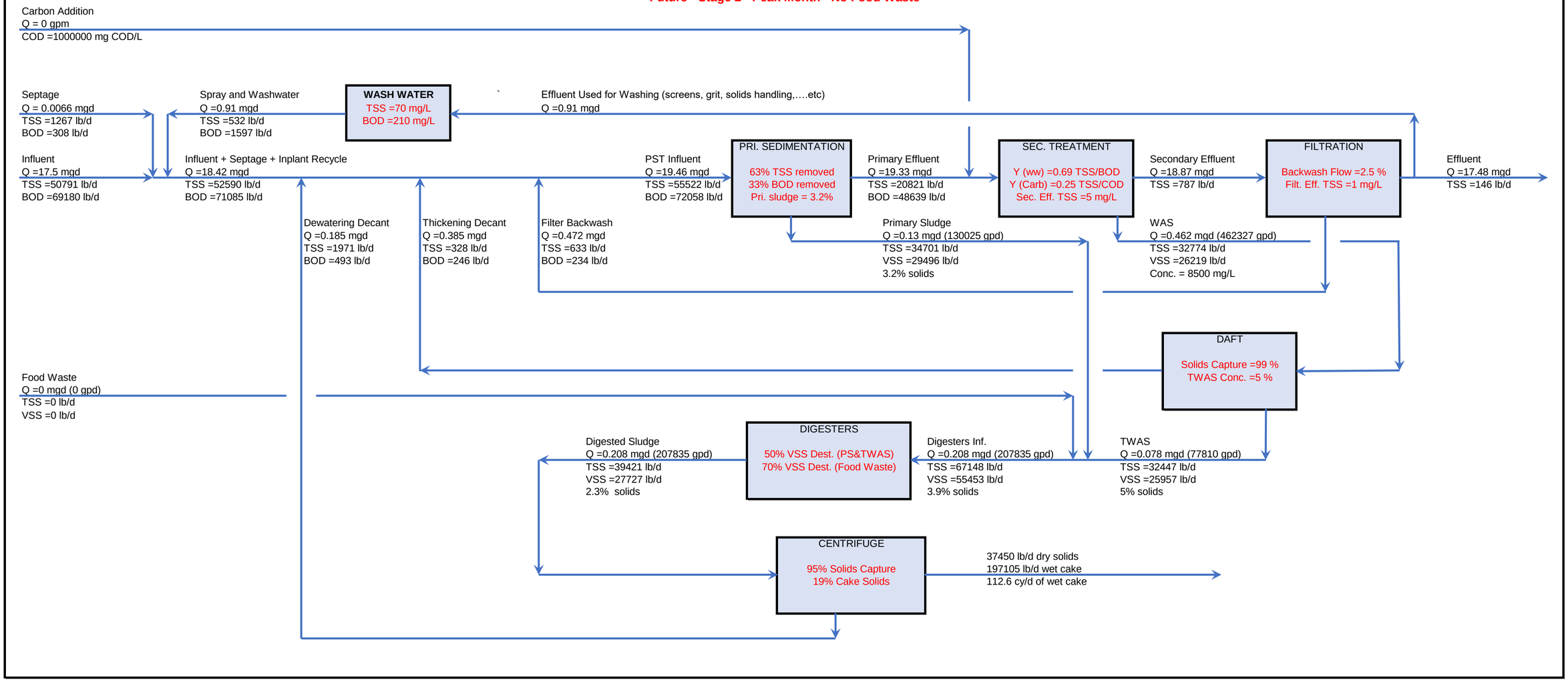
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 2 - Average - with Food Waste



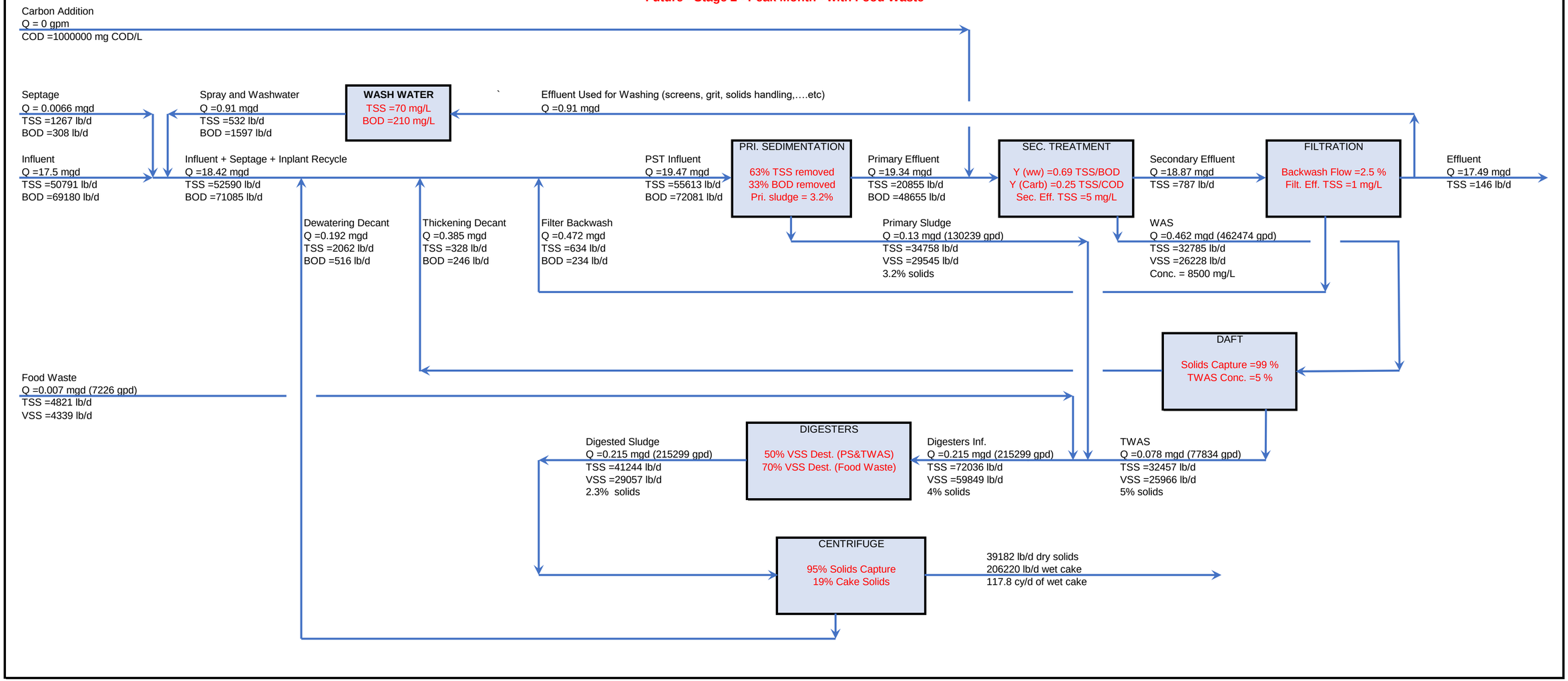
CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 2 - Peak Month - No Food Waste



CITY OF MANTECA WQCF
SOLIDS MASS BALANCE

Future - Stage 2 - Peak Month - with Food Waste



APPENDIX I

2017 Sanitary Sewer Condition Assessment Executive Summary Report

City of Manteca Sanitary Sewer Conditions Assessment

Stantec

Prepared for:
City of Manteca
Public Works Department
1001 West Center Street
STE. E
Manteca, CA 95337

Prepared by:
Stantec Consulting Services Inc.
3875 Atherton Road
Rocklin, CA 95765

August 2017

Stantec

Sign-off Sheet

This document entitled City of Manteca Sanitary Sewer Conditions Assessment was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of City of Manteca (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by _____
(signature)

Noel Guercio, P.E.

Reviewed by _____
(signature)

Steven L. Beck, P.E.

Stantec

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Stantec

1.0 INTRODUCTION

1.1 BACKGROUND

The City of Manteca (City) is currently permitted to operate its sanitary sewer system under Waste Discharge Requirement (WDR) Order No. R5-2015-0026 and National Pollutant Discharge Elimination System (NPDES) Permit CA0081558. The City currently operates and maintains approximately a 257-mile sanitary sewer pipeline system, including 4,292 sanitary sewer manholes. As a requirement of the WDR/NPDES under Special Provision VII.B.5.c, the City is required to prepare a Sewer System Management Plan (SSMP) in accordance with the State Water Resources Control Board (SWRCB) general WDR provisions that requires all publicly-owned wastewater dischargers with a collection system greater than one-mile in length develop a SSMP. In 2014, the City adopted a SSMP which includes, under Section 6.8 (WDR Section D.13.iv.c), development of a rehabilitation and replacement program (Program)to identify and prioritize collection system deficiencies and implement short-term and long-term rehabilitation actions to address each deficiency. This Program includes regular visual and television (TV) inspections of manholes and sewer pipes and a system for ranking the condition of the sewer pipes that are at risk of collapse or prone to more frequent blockages due to pipe defects. Also, the Program should include a capital improvement plan (CIP) that addresses proper management and protection of the sewer collection system assets. This CIP should include a time schedule for implementing the short-term and long-term plans plus a schedule for developing the funds needed for the CIP. The program will also utilize a Computerized Maintenance Management System (CMMS) to schedule preventative maintenance and capture maintenance records in accordance with the SSMP.

1.2 PURPOSE AND OBJECTIVES

The City of Manteca has adopted a proactive strategy with respect to developing the Program for rehabilitation and replacement of defective sewer pipes and manholes. Stantec Consulting Services Inc. (Stantec) was retained to conduct a detailed field investigation to assess the City's sanitary sewer pipes and manholes. Specific sewer assets included for inspection and condition assessment were selected by the City. Pipe cleaning and CCTV inspections were performed by Stantec's subcontractor, Professional Pipe Services (Pro-Pipe), on gravity sewer pipes ranging from 10-inch to 60-inch diameter. Visual inspection of approximately 190 manholes was also performed by Pro-Pipe.

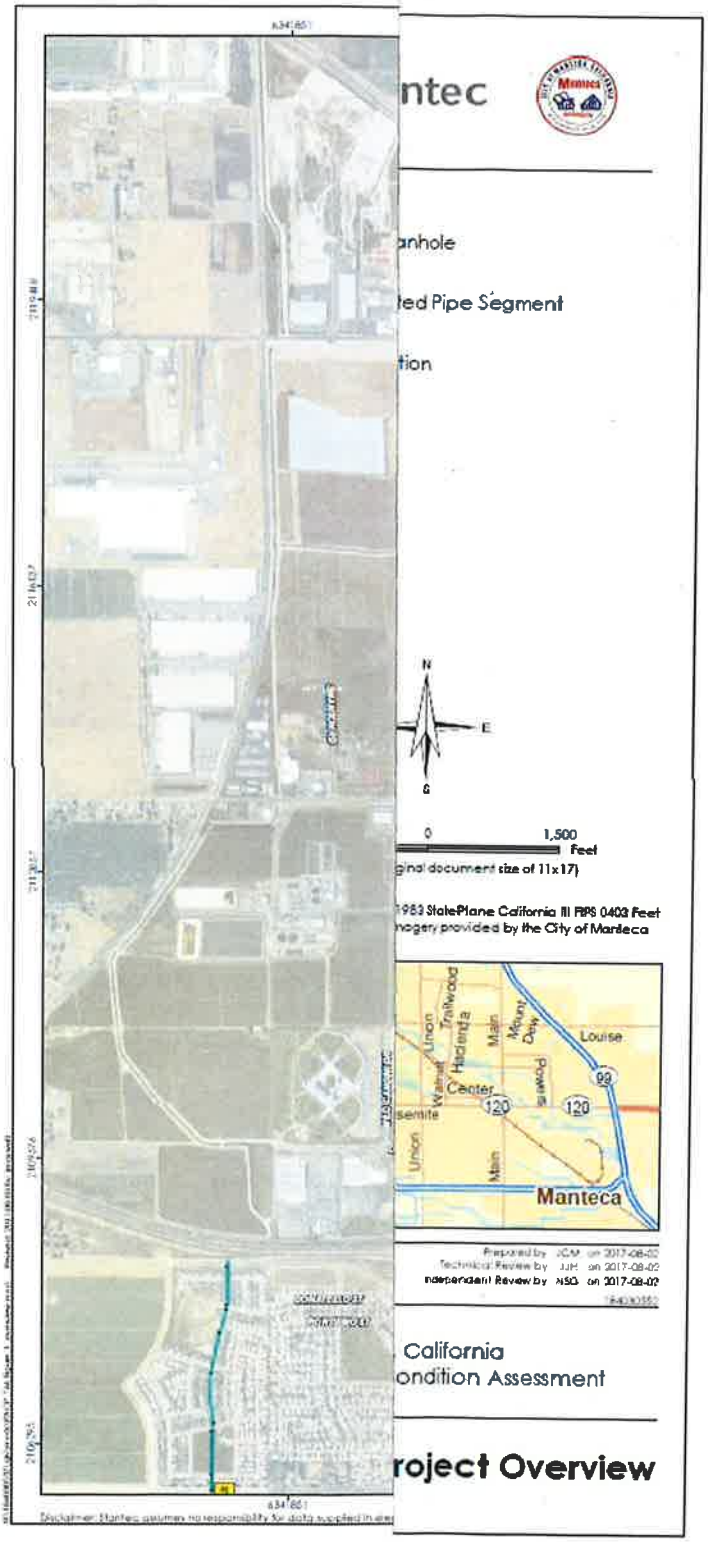
Upon completion of the inspection and condition assessment, Stantec is to prepare detailed recommendations for follow-up actions to address sewer repairs and/or rehabilitations. Additionally, Stantec is to provide cost opinions and priorities for recommended repairs/rehabilitations. Recommendations, cost opinions, and priorities will be used by the City for long-term planning and scheduling of their CIP program and entering a preventative maintenance schedule into their CMMS.

1.3 SCOPE OF WORK

The scope of work includes the assessment of 52,150 lineal feet of sanitary sewer line ranging in size from 10-inch to 60-inch and 187 manholes. **Table 1** lists the project cleaning and inspection quantities. **Figure 1** shows the location of the pipelines and manholes that are included in the scope

Table 1 Cleaning and Inspection Quantities

Item	Quantity
Clean and Inspect 10-inch Sewer Line	16,500 ft.
Clean and Inspect 12-inch Sewer Line	7,150 ft.
Clean and Inspect 15-inch Sewer Line	3,650 ft.
Clean and Inspect 21-inch Sewer Line	1,850 ft.
Clean and Inspect 24-inch Sewer Line	2,850 ft.
Clean and Inspect 30-inch Sewer Line	12,400 ft.
Clean and Inspect 36-inch Sewer Line	5,050 ft.
Clean and Inspect 60-inch Sewer Line	2,700 ft.
Inspect Manhole	187 ea.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Technical Review by JJH on 2017-08-02
Independent Review by NSD on 2017-08-02
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1.3.1 Task 1 –Detailed Work Plan

Prepare a detailed work plan that includes the following:

- Scope of services
- Required permits
- Public agency contacts
- Project team contacts
- Project schedule

1.3.2 Task 2 –Health and Safety Plan

Prepare a Health and Safety Plan (HASP) that includes the following:

- A summary of health and safety measures/activities to be implemented when performing field activities
- Required Personal Protective Equipment
- List of required practices and testing to project workers
- Emergency protocol including contact numbers, addresses, and maps for local emergency crews

1.3.3 Task 3 –Traffic Control Plan

Prepare a Traffic Control Plan (TCP) that conforms to provisions of the CAMUTCD 2014, City of Manteca, and San Joaquin County standards or requirements and that includes the following:

- A summary of traffic control measures/activities required to conduct field activities
- Contact numbers for fire, police and other City or agency departments
- A preliminary implementation schedule
- Maps and figures showing the location of proposed traffic control measures

1.3.4 Task 4 – Sanitary Sewer and Manhole Cleaning and Inspection

Perform sanitary sewer and manhole cleaning and inspection for sewer lines and manholes within the project. The latest version of NASSCO's PACP and MACP shall be used during the inspection of the sanitary sewer lines and manholes.

1.3.5 Task 6 –Sanitary Sewer Conditions Assessment Report

Prepare a Sanitary Sewer Conditions Assessment Report that includes the following:

- Maps, tables, and graphical presentations to demonstrate findings
- Discussion of standards, procedures, materials and methods utilized, including precision and accuracy of findings
- Discussion regarding the components of the systems assessed, including grade/rank of the various components assessed, and a copy of the PACP and MACP Database output forms in the appendices

- Findings regarding deficiencies, defects, observations or potential failures and any conclusions relating to underlying cause of deficiencies, defects and failures
- Recommendations regarding repairs, replacement, operations and maintenance
- A prioritized list and schedule for implementing recommendations
- Itemized estimate of cost to implement each of the proposed recommendations and/or a table showing costs estimates for all recommendations
- A map summarizing the findings shall also be prepared in conjunction with the report.

1.3.6 Task 7 –Present Results at City Council Meeting

Prepare a presentation summarizing the inspection and assessment results and final report in collaboration with City staff and presented to City Council.

1.4 REPORT FORMAT

The report is divided into the following sections:

1. Introduction
2. Field Effort
3. GIS Rectification
4. Pipeline and Manhole Assessment
5. Recommendations

1.5 PROJECT TEAM

Stantec is responsible for all work related to the project including the development and management of project deliverables, reviewing and appending the portion of the City's GIS database related to the project, data compilation and analysis, and performing the condition assessment for the sewer lines and manholes.

Stantec sub-contracted specialty services from Pro-Pipe for sewer line cleaning, sewer line inspection, manhole inspection, and field support.

2.0 FIELD EFFORT

Field activities consisted of pipe and manhole cleaning and inspection. Pro-Pipe completed the pipe line inspection between October 11, 2016 and November 22, 2016 and the manhole inspection between November 30, 2016, and December 14, 2016. A detailed Work Plan, Health and Safety Plan, and Traffic Control Plan were all submitted to the City prior to commencing the work. The following sections outline the equipment and processes used and the deliverables that were received.

2.1 CLEANING AND INSPECTION

2.1.1 Cleaning

2.1.1.1 Equipment

The equipment used for cleaning consisted of a Hydro-Vac Combination Truck, **Figure 2**, equipped with a water tank, hose, fittings and nozzles used for cleaning the sewer by jetting water along the inside of the sewer line and a debris box and vacuum hose mounted on a telescoping boom for collecting debris.

Figure 2 Hydro-Vac Combination Truck

2.1.1.2 Process

Pipe cleaning is performed prior to the inspection of the pipelines. Before inserting the cleaning nozzle in the sewer line, the operator rinses down the inside of the manhole to remove any loose material and/or debris. When the manhole cleaning is complete, the operator inserts a high-pressure jetting hose with nozzle (jetting towards the hydro-vac truck) into the pipe. The hose and nozzle are propelled upstream to the end of the segment. The water pressure is increased as the hose is winched back to the truck pulling all debris to the downstream manhole. The operator uses the vacuum hose to extract the debris from the downstream manhole. Liquids are filtered back

to the sanitary sewer system and the debris contents are then hauled to the approved disposal facility.

2.1.2 Pipeline Inspection

2.1.2.1 Equipment

The IBAK Panoramo 3D Optoscanner (Panoramo), **Figure 3**, was used for the inspection of the sewer lines. The Panoramo unit use of two high-resolution digital cameras in the front and rear sections of the housing, with 185° wide-angle lenses capable of 360° spherical images, and parallel-mounted xenon flashlights. Pictures are taken at definite spatial lengths as the unit passes through the pipe and are digitally recorded. An operator monitors the unit's progress at a monitoring station inside a vehicle located at the entry manhole.

Figure 3 IBAK Panoramo (Digital Scanner)

2.1.2.2 Process

The CCTV operator, in most cases, will occupy the upstream manhole upon completion of the cleaning and will televise the pipeline segment in accordance with National Association of Sewer Service Companies (NASSCO) guidelines. In the event access is compromised at the upstream position (due to location or safety issues), a reverse run (travelling upstream) will be performed.

In the event a new manhole is discovered, it will be added manually to the inspection database using a predefined numbering process. This will also prompt the crew to add the manhole to the manhole inspection scope.

The inspection is digitally recorded and upon completion is submitted to the main office for coding. Coding is performed in accordance with NASSCO guidelines and the final coded video is submitted to the engineer for review.

2.1.2.3 Deliverables

Deliverables include a PACP database, PDF integrated reports including "pipe graph", "picture report" and "tabulation report with scoring" as well as the inspection videos for each line segment.

2.1.3 Manhole Inspection

2.1.3.1 Equipment

The IBAK Panoramo Si, **Figure 4**, was used for the inspection of the manholes. Like the Panoramo 3D Optoscanner, the Panoramo Si unit uses two high-resolution digital cameras except they are mounted on the top and bottom of the unit. Pictures are taken at definite spatial lengths as the unit passes through the manhole and are digitally recorded. An operator monitors the unit's progress at a monitoring station inside a vehicle located at the manhole.

Figure 4 IBAK Panoramo Si

2.1.3.2 Process

Manhole inspections are provided subsequent to mainline inspections. The inspection truck or van pulls over the manhole, temporarily parking with the rear truck bumper positioned within a foot outside of the manhole rim. The lid is lifted and a cone is placed adjacent to the manhole opening. The manhole camera is lowered to the bottom of the manhole during live view to ensure the camera is positioned at the lowest possible point. The camera is then raised at a steady rate (no swing) while the digital images are recorded with a synchronized flash. When the camera is raised to beyond the opening, the system is turned off and the lid placed over the manhole. The operator confirms data capture integrity and visual clarity, then the truck and crew will exit the setup and travel to the next manhole. The manhole inspections are submitted to the main office for coding.

Coding is performed in accordance with NASSCO guidelines and the final coded video is submitted to the engineer for review.

2.1.3.3 Deliverables

Deliverables include a MACP database, PDF integrated manhole reports as well as the inspection videos for each manhole.

2.2 MAP DISCREPANCY TRACKING

Differences between what is shown in the GIS and what is observed in the field can often occur. Mapping discrepancies encountered in the field can necessitate changes in pipe and manholes identification numbers/labels. This can create problems later when trying to integrate field inspection information into the GIS system.

A one-page Map Discrepancy Form (MDF) to track discrepancies between GIS mapping and field observations was used during the project. The form was also used to identify the locations of inspection survey abandonments for reasons such as debris or obstruction in the pipe. All of the MDFs for the project are located in **Appendix I**. Changes made to the GIS as a result of scenarios recorded in the MDFs are discussed further in **Section 3.0 GIS Rectification**.

3.0 GIS RECTIFICATION

Geographic Information System (GIS) data was provided by the City in August 2016. GIS data included: sanitary sewer pipes and manholes, stormwater features, potable water pipes, street center lines, parcel boundaries (no addresses), and aerial imagery. Attribute information for sanitary sewers was provided in a geodatabase that included: upstream and downstream manholes, pipe length, pipe material, and other general physical data. An updated GIS database was provided by the City again after the inspection of all the pipelines was completed. This final GIS database rectified all the discrepancies between what was in the field versus the what was in the City's GIS at the beginning of the project.

Pipes and manholes included in the CCTV inspection database were located in the GIS to verify that a one-to-one match existed. Discrepancies were noted, but have all been successfully resolved. Where the City's GIS data did not accurately match field observations, the City's GIS data was updated. The updates were limited to: correcting pipe connectivity, adding manholes observed in the field that were not present in the GIS, or removing manholes that do not exist.

Table 2 summarizes the changes that were made to the GIS as a result of what was noted during the field activities.

Table 2 GIS Amendments

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Amendment	Amendment Made to GIS
WWGM0249	WWMH1181	WWMH4165	Extra Manhole	Label extra manhole as WWMH4165. Split WWGM0249 in two. Label upstream pipe WWGM0249 and downstream pipe as WWGM5721.
WWGM5208	WWMH4165	WWMH1156	Extra Manhole	Label extra manhole as WWMH4165. Split WWGM0249 in two. Label upstream pipe WWGM0249 and downstream pipe as WWGM5208.
WWGM0097	WWMH1156	WWMH5086	Extra Manhole	Label extra manhole as WWMH5086. Split WWGM0097 in two. Label upstream pipe WWGM0097 and downstream pipe as WWGM5722.
WWGM6024	WWMH5086	WWMH1155	Extra Manhole	Label extra manhole as WWMH5086. Split WWGM0097 in two. Label upstream pipe WWGM0097 and downstream pipe as WWGM6024.
WWGM0094	WWMH1155	WWMH4277	Two assets labeled as WWGM0094.	No change to this asset.

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Amendment	Amendment Made to GIS
WWGM5360	WWMH4277	WWMH0521	Two assets labeled in GIS as WWGM0094.	Change pipe asset ID to WWGM5360.
WWGM5990	WWMH0521	WWMH5073	Extra Manhole	Label extra manhole as WWMH5073. Split WWGM0191 in two. Label upstream pipe WWGM5990 and downstream pipe as WWGM0191.
WWGM0191	WWMH5073	WWMH0323	Extra Manhole	Label extra manhole as WWMH5073. Split WWGM0191 in two. Label upstream pipe WWGM5990 and downstream pipe as WWGM0191.
WWGM0880	WWMH0342	WWMH5062	Extra Manhole	Label extra manhole as WWMH5062. Split WWGM0880 in two. Label upstream pipe WWGM0880 and downstream pipe as WWGM5977.
WWGM5977	WWMH5062	WWMH0369	Extra Manhole	Label extra manhole as WWMH5062. Split WWGM0880 in two. Label upstream pipe WWGM0880 and downstream pipe as WWGM5977.
WWGM0881	WWMH0369	WWMH5063	Extra Manhole	Label extra manhole as WWMH5063. Split WWGM0881 in two. Label upstream pipe WWGM0881 and downstream pipe as WWGM5733.
WWGM5976	WWMH5063	WWMH0368	Extra Manhole	Label extra manhole as WWMH5063. Split WWGM0881 in two. Label upstream pipe WWGM0881 and downstream pipe as WWGM5976.
WWGM6003	WWMH1132	WWMH5090	Extra Manhole	Label extra manhole as WWMH5090. Split WWGM0888 in two. Label upstream pipe WWGM6003 and downstream pipe as WWGM0888.
WWGM0888	WWMH5090	WWMH0373	Extra Manhole	Label extra manhole as WWMH5090. Split WWGM0888 in two. Label upstream pipe WWGM6003 and downstream pipe as WWGM0888.
WWGM5974	WWMH3125	Lift Station WWC-WW06	GIS Incorrect and Extra Manhole	Extra manhole found between manhole WWMH3125 and WWMH2727. Split pipes as follows: WWGM3527- WWMH3125 to Lift Station (WWC-WW06) WWGM5999 - Lift Station (WWC-WW06) to WWMH5080 WWGM3528 – WWMH5080 to WWMH2746

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Amendment	Amendment Made to GIS
WWGM5999	Lift Station WWC-WW06	WWMH5080	GIS Incorrect and Extra Manhole	Extra manhole found between manhole WWMH3125 and WWMH2727. Split pipes as follows: WWGM3527- WWMH3125 to Lift Station (WWC-WW06) WWGM5999 - Lift Station (WWC-WW06) to WWMH5080 WWGM3528 – WWMH5080 to WWMH2746
WWGM3527	WWMH5080	WWMH2746	GIS Incorrect and Extra Manhole	Extra manhole found between manhole WWMH3125 and WWMH2727. Split pipes as follows: WWGM3527- WWMH3125 to Lift Station (WWC-WW06) WWGM5999 - Lift Station (WWC-WW06) to WWMH5080 WWGM3528 – WWMH5080 to WWMH2746
WWGM6022	WWMH1222	WWMH5074	Two Extra Manholes	WWGM6022 (New Pipe ID) - Upstream WWMH1222, Downstream WWMH5074 (New Manhole)
WWGM6023	WWMH5074	WWMH5075	Two Extra Manholes	WWGM6023 (New Pipe ID) - Upstream WWMH5074 (New Manhole), Downstream WWMH5075 (New Manhole)
WWGM1013	WWMH5075	WWMH1221	Two Extra Manholes	WWGM1013 - Upstream WWMH5075 (New Manhole), Downstream WWMH1221
WWGM5998	WWMH1406	WWMH5084	Extra Manhole	Label extra manhole as WWMH5084. Split WWGM1737 in two. Label upstream pipe WWGM5998 and downstream pipe as WWGM1737.
WWGM1737	WWMH5084	WWMH2766	Extra Manhole	Label extra manhole as WWMH5084. Split WWGM1737 in two. Label upstream pipe WWGM5998 and downstream pipe as WWGM1737.
WWGM5997	WWMH1763	WWMH5083	Extra Manhole	Label extra manhole as WWMH5083. Split WWGM3275 in two. Label upstream pipe WWGM5997 and downstream pipe as WWGM3275.
WWGM3275	WWMH5083	WWMH1445	Extra Manhole	Label extra manhole as WWMH5083. Split WWGM3275 in two. Label upstream pipe WWGM5997 and downstream pipe as WWGM3275.
WWGM1518	WWMH0540	WWMH3157	WWMH0969 does not exist.	Remove manhole WWMH0969. Combine WWGM1518 and WWGM3788 and label as WWGM1518.

GIS Rectification
August 2017

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Amendment	Amendment Made to GIS
WWGM4839	WWMH3157	WWMH3954	Two assets labeled as WWGM1515.	Change pipe ID to WWGM4839.
WWGM1515	WWMH3954	WWMH0401	Two assets labeled as WWGM1515.	No change to this asset.
WWGM5985	WWMH0546	WWMH5069	Extra Manhole	Label extra manhole as WWMH5069. Split WWGM0018 in two. Label upstream pipe WWGM5985 and downstream pipe as WWGM0018.
WWGM0018	WWMH5069	WWMH1149	Extra Manhole	Label extra manhole as WWMH5069. Split WWGM0018 in two. Label upstream pipe WWGM5985 and downstream pipe as WWGM0018.
WWGM5995	WWMH3001	WWMH5081	Extra Manhole	Label extra manhole as WWMH5081. Split WWGM0020 in two. Label upstream pipe WWGM5995 and downstream pipe as WWGM0020.
WWGM0416	WWMH1107	WWMH1109	Incorrect connectivity	WWGM0416 connects downstream to manhole WWMH1109 not manhole WWMH1108.
WWGM0020	WWMH5081	WWMH3000	Extra Manhole	Label extra manhole as WWMH5081. Split WWGM0020 in two. Label upstream pipe WWGM5995 and downstream pipe as WWGM0020.
WWGM5363	WWMH1128	WWMH4278	Two assets labeled as WWGM0577.	Change pipe asset ID to WWGM5363.
WWGM0577	WWMH4278	WWMH1127	Two assets labeled as WWGM0577.	No change to this asset.
WWGM0394	WWMH1097	WWMH0352	WWMH3167 does not exist.	Remove manhole WWMH3167. Combine WWGM3806 and WWGM0394 and label as WWGM0394.
WWGM5992	WWMH1985	WWMH5078	Extra Manhole	Label extra manhole as WWMH5078. Split WWGM2754 in two. Label upstream pipe WWGM5992 and downstream pipe as WWGM2754.
WWGM2754	WWMH5078	WWMH1984	Extra Manhole	Label extra manhole as WWMH5078. Split WWGM2754 in two. Label upstream pipe WWGM5992 and downstream pipe as WWGM2754.
WWGM3486	WWMH0575	WWMH3178	WWMH2729 does not exist.	Remove manhole WWMH2729. Combine WWGM3485 and WWGM3486 and label as WWGM3486.

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Amendment	Amendment Made to GIS
WWGM5374	WWMH3178	WWMH2730	WWMH3966 does not exist.	Remove manhole WWMH3966. Combine WWGM3814 and WWGM5374 and label as WWGM5374.
WWGM0473	WWMH1373	WWMH0940	Two assets labeled as WWGM0473 and WWMH3943 does not exist.	Remove manhole WWMH3943. Only require one asset for WWGM0473.
WWGM1292	WWMH0390	WWMH5082	Extra Manhole	Label extra manhole as WWMH5082. Split WWGM1292 in two. Label upstream pipe WWGM1292 and downstream pipe as WWGM5996.
WWGM5996	WWMH5082	WWMH0189	Extra Manhole	Label extra manhole as WWMH5082. Split WWGM1292 in two. Label upstream pipe WWGM1292 and downstream pipe as WWGM5996.
WWGM0553	WWLH0286	WWMH1131	WWMH3162 does not exist and upstream manhole is a lamphole.	Remove manhole WWMH3162. Change upstream manhole to WWLH0286. Combine WWGM0553 and WWGM0804 and label as WWGM0553.
WWGM3874	WWMH3226	Dead End	Downstream manhole is a dead end.	Label downstream manhole Dead End.

4.0 PIPELINE AND MANHOLE ASSESSMENT

The following sections summarize the results of the inspection and the assessment that was completed. Two technical memorandums were prepared that detailed the assessment of the sanitary sewer pipelines and the sanitary sewer manholes. Each memorandum is included as an appendix, **Appendix II** for pipelines and **Appendix III** for manholes.

4.1 INSPECTION RESULTS

4.1.1 Pipelines

Pipe inspection logs, videos, and databases were provided for approximately 48,498 linear feet of CCTV inspections (190 unique pipe segments) completed between October 2016 and November 2016. CCTV inspections were coded in accordance with the Pipeline Assessment Certification Program © (PACP) standards (version 6.0.2) developed by the National Association of Sewer Service Companies (NASSCO). Information collected during the CCTV inspections was documented using the commercially available PipeLogix software (version 6.4.10). PipeLogix is recognized by NASSCO as a PACP-certified software vendor.

A summary of the gravity sewer pipes included in the PACP database is presented in **Table 3**. The PACP database contained thirty-one (31) instances where more than one inspection record was present for a pipe segment. No pipe had more than two inspections present in the database. In all 31 cases of dual inspections, the additional inspection represented a reverse inspection (i.e. inspection of the pipe from the opposite manhole due to an obstruction/debris in the pipe that prevents the CCTV camera/equipment from advancing further in the pipe). No truly duplicate inspections were included in the PACP database and all records in the database were used in the RCT analysis.

Table 3 Pipe Inspection Summary by Length

Pipe Inspections (from PACP database)1		
Total Number of Valid Inspections	221	
Total Number of Unique Pipes	190	
Total Length - All Pipes	55,562 linear feet (LF)	
Total Length Inspected – All Pipes	48,748 LF (87.7%)	
Pipe Summary by Material	**No. of Pipes**	**Length**
Vitrified Clay Pipe (VCP)	104 (54.7%)	28,754 LF (51.8%)
Polyvinyl Chloride (PVC) Pipe	9 (4.7%)	2,774 LF (5.0%)
Reinforced Concrete Pipe (RCP)	52 (27.4%)	18,182 LF (32.7%)
Reinforced Plastic Pipe (Truss Pipe)	1 (0.5%)	381 LF (0.7%)
Lined Pipe	24 (12.6%)	5,471 LF (9.8%)
Pipe Summary by Diameter	**No. of Pipes**	**Length**
10-inch diameter	70 (36.8%)	18,618 LF (33.5%)
12-inch diameter	23 (12.1%)	7,477 LF (13.5%)
15-inch diameter	14 (7.4%)	4,447 LF (8.0%)
18-inch diameter	0 (0.0%)	0 (0.0%)
21-inch diameter	9 (4.7%)	2,330 LF (4.2%)
24-inch diameter	14 (7.4%)	3,376 LF (6.1%)
30-inch diameter	37 (19.5%)	12,645 LF (22.8%)
36-inch diameter	14 (7.4%)	3,999 LF (7.2%)
60-inch diameter	9 (4.7%)	2,670 LF (4.8%)

1. *Unless noted to the contrary, length values in table are based on the total pipe length data field in the pipe inspection database.*

Table 4 provides the pipeline cleaning and inspection cost and time breakdown for the project. Note that the costs and times shown do not include items such as traffic control, hauling, dumping, or permits.

Table 4 Pipeline Cleaning and Inspection Cost and Time Breakdown

Item	Total Footage	Total Cost	Average Cost Per Foot	Total Minutes (Hours)	Minutes (Hours) Per Foot
Cleaning	48,748	$53,244.57	$1.09	7,732 (128.87)	6.3 (0.11)
Inspection	48,748	$58,542.59	$1.20	21,249 (354.15)	2.3 (0.04)
Overall Project	48,748	$111,787.16	$2.29	28,981 (483.02)	8.6 (0.14)

There were four pipe segments that were not inspected. **Table 5** lists each segment along with the respective upstream and downstream manholes and reason for not inspecting.

Table 5 Uninspected Pipe Segments

Pipe Segment ID	Upstream Manhole ID	Downstream Manhole ID	Reason for Not Inspecting
WWGM5977	WWMH5062	WWMH0369	Debris in line.
WWGM6023	WWMH5074	WWMH5075	Debris in line.
WWGM0012	WWMH2991	WWMH2990	Upstream manhole surcharged and downstream manhole has drop with odd angle.
WWGM0317	WWMH0883	WWMH1021	Debris in line.
WWGM5974	WWMH3125	WWC-WW06	Could not inspect pipe into the lift station.

4.1.2 Manholes

Manhole inspection logs, 360-degree photographs, and databases were provided for 186 manholes completed between November 2016 and December 2016. Manhole inspections were coded in accordance with the Manhole Assessment Certification Program © (PACP) standards (version 6.0) developed by the National Association of Sewer Service Companies (NASSCO). MACP Level 2 inspections were performed. Information collected during the manhole inspections was documented using the commercially available PipeLogix software (version 6.4.10). PipeLogix is recognized by NASSCO as a MACP-certified software vendor.

A summary of the manholes included in the MACP database is presented in **Table 6**. The summary provides a breakdown of inspected manholes by depth, diameter, material and cover type.

Table 6 Manhole Inspection Summary by Physical Characteristic

Manholes Inspections (from MACP database)		
Total Number of Manhole Inspections	186	
Total Number of Unique Manhole Inspections	186	
By Wall Material	**Number of Manholes**	**Percent of All Manholes**
Concrete (reinforced)	118	63.4%
Brick	68	36.6%
By Cover Type	**Number of Manholes**	**Percent of All Manholes**
Solid	185	99.5%
Vented	1	0.5%
By Wall Diameter	**Number of Manholes**	**Percent of All Manholes**
Less than 40-inch	0	0.0%
40-inch to 49-inch	167	89.8%
50-inch to 59-inch	14	7.5%
60-inch to 69 inch	3	1.6%
70-inch to 79-inch	0	0.0%
80-inch to 89-inch	0	0.0%
90-inch to 99-inch	2	1.1%
100-inch or greater	0	0.0%
By Depth (Rim to Invert)	**Number of Manholes**	**Percent of All Manholes**
3.0 feet or less[1]	0	0.0%
3.1 feet to 5 feet	9	4.8%
5.1 feet to 10 feet	105	56.5%
10.1 feet to 15 feet	49	26.3%
15.1 feet to 20 feet	19	10.2%
20.1 feet or greater[1]	4	2.2%

1. *Deepest inspected manhole was 21.2 feet (measured from rim to invert).*

Table 7 provides the manhole inspection cost and time breakdown for the project. Note that the costs and times shown do not include items such as traffic control or permits.

Table 7 Manhole Inspection Cost and Time Breakdown

Total Number of Manholes	Total Cost	Cost Per Manhole	Total Minutes (Hours)	Minutes (Hours) Per Manhole
186	$37,200.00	$200	6,938 (115.63)	37.3 (0.62)

There were nine manholes that were not inspected. **Table 8** lists each manhole along with the reason for not inspecting.

Table 8 Uninspected Manholes

Manhole ID	Reason for Not Inspecting
WWMH0263	Located in gated yard (southwest corner of Sandalwood Ln. and Olivewood Ave.).
WWMH1218	Located in field. Ground too soft, truck would get stuck.
WWMH1219	Located in field. Ground too soft, truck would get stuck.
WWMH1220	Located in field. Ground too soft, truck would get stuck.
WWMH1982	Located in field. Ground too soft, truck would get stuck.
WWMH3036	Not Part of Scope
WWMH3506	Could not locate in intersection (Louis Ave. and Main St.).
WWMH5073	Manhole found after inspection services were complete.
WWMH5080	Could not access. Tripod for inspection cannot be setup.
WWMH5086	Paved over.
WWMH5090	Paved over.

4.2 PIPELINE AND MANHOLE REPAIR, RENOVATION AND REPLACEMENT

Selecting the appropriate measure to address defects in pipelines and manholes is critical to ensure that budget and life cycle goals are met. Pipe repair, renovation and replacement techniques are evaluated to restore or upgrade the performance of the existing utility system. Pipe and manhole repair is applied to address localized defects. Renovation of pipe or manhole is considered when numerous defects are present and/or the structural integrity of asset is in question. Full replacement of the asset is implemented when the extent of the defects is extreme, the structural integrity of the asset has been compromised and/or system upgrades are required.

Several construction techniques are available within each category. The following is a list of some of the items that should be considered when selecting a technique:

- Pipe application
- Number and types of defects
- Structural condition of existing asset
- Asset location and physical environment
- Site access
- Asset age
- Asset material
- Asset physical dimensions
- Existing repairs
- Soil condition
- Existing utilities
- Budget requirements
- Life cycle requirements
- System upgrades
- Reduction of capacity from applied repair or renovation
- Service connections
- Permitted service interruption
- Providing service during construction
- Social impacts
- Environmental impacts
- Availability of qualified contractors

Evaluation of these considerations will assist in the selection of the technique and provide for a better means of reaching system budget and life cycle goals. The following tables summarize the some of the techniques that are available for pipeline defect and joint repair, renovation, and replacement.

Table 9 Pipeline Defect and Joint Repair

Technology	Description	Advantages	Disadvantages
Dig and Replace Point Repair	Repair of pipe defects using trenching techniques.	• Can install new pipe. • Availability of experienced contractors. • Have ability to install fully structural repair. • Can repair alignment and grade issues. • Can be used in all soil conditions.	• Longer construction schedule. • Larger construction footprint. • Requires excavation. • Significant amount of surface disruption. • Disruption to existing utilities. • Potential for high social and economic costs.
Chemical Grouting	Leaking joints and defects are repaired by inject grout into the gap using an inflatable packer. Grout enters the soil behind the pipe and fills the gap in the pipe, forming a seal.	• Short installation period. • Can be used on a variety of pipe materials.	• Cannot correct alignment and grade issues. • Cannot be installed in live flow conditions. • Nonstructural repair. • Cannot repair all defects. • Potential for ground water contamination.
Internal Joint Seals	Leaking joints are sealed by applying grout to the joint to make it flush with the internal pipe surface. A seal is placed over top of the joint, spanning the gap and held in place with stainless steel retaining bands.	• Short installation period. • Relatively inexpensive.	• Cannot correct alignment and grade issues. • Cannot be installed during live flow conditions. • Only addresses joint issues.

Table 10 Pipeline Renovation

Technology	Description	Advantages	Disadvantages
Sprayed Coating and Liner Systems	Application of cement mortar, epoxy or polyurethane liner using a high speed rotating nozzle that is pulled through the pipe.	• Short installation period. • Can be installed around bends.	• Cannot correct alignment and grade issues. • Cannot be installed in live flow conditions. • Nonstructural repair. • Short life cycle.
Cured-in-Place Pipe (CIPP)	Insertion of a resin impregnated liner into the existing pipe by either inversion or pulling in place. The liner is inflated using water pressure or air pressure to fit closely to the existing pipe. It is then cured using hot water, steam or ultraviolet light.	• Installation of a new pipe. • Installed in most pipe types. • Short installation period. • Minimal loss of cross-sectional capacity. • Usually improves friction coefficient. • Can provide full structural integrity. • One continuous pipe without joints. • Can be installed around bends. • Able to reinstate connections internally. • Widely used technique	• Cannot correct alignment and grade issues. • Requires liner manufactured specifically for pipe being rehabilitated. • Cannot be installed in live flow conditions. • May require special disposal of construction water used during curing process. • Shrinkage can occur after installation.
Spiral-Wound Liners	Installation of strips of thermoplastic material by winding the strip and interlocking the edges together. As the strip is wound together it advances through the existing pipe.	• Installation of a new pipe. • Installed in most pipe types. • Short installation period. • Usually improves friction coefficient. • Can provide full structural integrity.	• Cannot correct alignment and grade issues. • Requires excavation for the connection of lateral and service connections. • Can only be used on gradual bends. • Cannot be installed in live flow conditions.
Close-Fit Liners	Insertion of a thermoplastic tube inside the existing pipe. The thermoplastic tube is deformed by tension or compression, effectively reducing the diameter of the pipe for insertion. Once inserted, it is returned to its original shape for a close fit to the existing pipe.	• Installation of a new pipe. • Installed in most pipe types. • Short installation period. • Minimal loss of cross-sectional capacity. • Usually improves friction coefficient. • Can provide full structural integrity. •	• Cannot correct alignment and grade issues. • Cannot be installed in live flow conditions.

Technology	Description	Advantages	Disadvantages
Panel and Section Insert Linings	Installation of panels or sections of material inside an existing pipe to form a continuous liner.	• Installation of a new pipe. • Specialized equipment is not required. • Installed in most pipe types. • Usually improves friction coefficient. • Can provide full structural integrity.	• Cannot correct alignment and grade issues. • Requires man entry. Only suitable for large diameter pipe. • Larger loss of cross-sectional capacity. • Cannot be installed in live flow conditions.
Sliplining	Insertion of a new pipe inside the existing pipe by either pulling or pushing the new pipe through the existing pipe. The annular space between the existing pipe and new pipe is filled with grout.	• Installation of a new pipe • Specialized equipment is not required. • Installed in most pipe types. • Usually improves the friction coefficient. • Can be installed during live flow conditions. • Can provide full structural integrity.	• Larger loss of cross-sectional capacity. • Cannot correct alignment and grade issues. • Entry and exit pits required. • Requires excavation for the connection of lateral and service connections. • Can only rehabilitate straight segments. • Used only for straight pipe sections.
Grout-In-Place (GIP) Liners	A plastic liner with a smooth side facing inward and a studded side facing outward is inserted into the existing pipe. The annular space between the plastic liner and the existing pipe is filled with grout. With the studs from the liner secured inside the grout, the grout fixes the liner permanently in place and fills any defects present in the pipe.	• Usually improves friction coefficient. • Can provide full structural integrity. • Specialized equipment is not required.	• Cannot correct alignment and grade issues. • Cannot be installed in live flow conditions. • Requires man entry. Only suitable for large diameter pipe. • Larger loss of cross-sectional capacity.
Pipe Bursting	Installation of a new pipe in the corridor of the existing pipe by pulling in the new pipe behind a bursting head. As the bursting head passes through the existing pipe, the existing pipe is broken into pieces that are then displaced into the surrounding soil and the new pipe is pulled into place.	• Installation of a new pipe. • Can install larger pipe diameter than the existing pipe. • Does not require the removal of the existing pipe.	• Cannot correct alignment and grade issues. • Requires excavation for the connection of lateral and service connections. • Used only for straight pipe sections. • Potential for surface heave. • Difficult to use around small bends and cannot be used on large bends. • Entry and exit pits required.

Table 11 Pipeline Replacement

Technology	Description	Advantages	Disadvantages
Open Cut	Installation of a new pipe using trenching techniques.	• Installation of a new pipe. • Does not rely on an existing pipeline corridor. • Availability of experienced contractors. • Can be used in all soil conditions.	• Longer construction schedule. • Larger construction footprint. • Large amount of excavation. • Significant amount of surface disruption. • Disruption to existing utilities. • Potential for high social and economic costs.
Horizontal Directional Drilling	Installation of a new pipe by drilling a hole horizontally through the ground. The drilling operation utilizes a sonde and tracker system to steer the drill head through the soil to the exit point. Shallow bends can be made along the alignment. Once the drill head reaches the exit point, the new pipe is attached to the drill string and pulled through the ground from the exit point to the entry point. The hole can be enlarged by pulling a reamer through prior to installation of the new pipe if necessary.	• Installation of a new pipe. • Does not rely on an existing pipeline corridor. • Suitable for a variety soil conditions.	• Not as accurate for grade and alignment as other trenchless techniques. • Requires disposal of drilling fluid. • Can only install gradual bends.
Micro-Tunneling	Installation of a new pipe through the use of a laser guided remotely controlled micro-tunnel boring machine (MTBM). The MTBM is advanced through the soil and new pipe is installed by pushing or jacking the pipe in behind the MTBM as it moves forward. The MTBM is equipped with a rotating cutting head to excavate the soil and slurry system to remove the cuttings from the excavation.	• Installation of a new pipe. • Does not rely on an existing pipeline corridor. • Very accurate. • Suitable for a variety soil conditions.	• Expensive. • Used only for straight pipe sections. • Requires a large jacking and exit pit. • Specialty engineer and contractor.

Technology	Description	Advantages	Disadvantages
Axis Guided Boring System	Installation of a new pipe by drilling a hole horizontally through the ground from an entry pit to an exit pit. The drilling operation utilizes a laser guide system to assist in maintaining grade during the drilling operation. Once the drill head reaches the exit pit, the new pipe is attached to the drill string and pulled through the ground from the exit pit to the entry pit. The hole can be enlarged by pulling a reamer through prior to installation of the new pipe if necessary.	• Installation of a new pipe. • Does not rely on an existing pipeline corridor. • Very accurate. • Suitable for a variety soil conditions.	• Newer technology with limited availability. • Used only for straight pipe sections. • Requires entry and exit pits. • Limited to 12" to 18" diameter pipe. • Requires disposal of drilling fluid.

For the purposes of this assessment the following is recommended for the pipeline segments:

1. Dig and replace is recommended for all point repairs because it will address all types of point repairs, it provides for a 50-year design life, and there are a number of contractors available.
2. Cure-in-place pipe is recommended for renovation of existing pipelines because it provides a 50-year design life, there is a minimal reduction of the inside diameter of the pipeline, and there are a number of contractors available.
3. Open cut is recommended for all pipeline replacement because it is the least costly between the available pipeline replacement techniques that would be considered, it provides a 50-year design life, and there are a number of contractors available.

Unlike pipes, manholes consist of multiple parts that are addressed separately when considering repair, renovation, or replacement. A typical manhole, depicted in **Figure 5**, has a frame and cover, grade rings/chimney, cone, barrel and base.

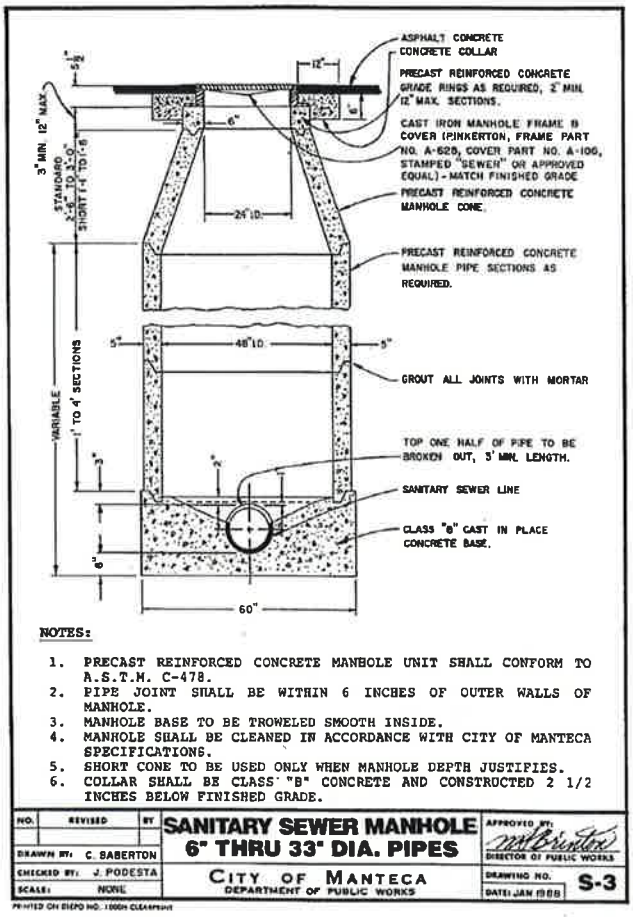

Figure 5 Typical Manhole Detail

There are a variety of products, vendors, and contractors that are available for manhole repair or renovation. The available techniques fall under the following categories: sliplining products, poured-in-place concrete liners, cured-in-place liners, cementitious or polymer based coatings that are sprayed, pumped or troweled on, and mechanical inserts. For the purposes of this assessment the following is recommended for the manholes:

1. Frame and cover defects will be addressed by replacing the frame and cover. Renovation or repair techniques are not typically used for the frame and cover.
2. Grade rings/chimney defects will be addressed by installing a chimney seal/liner. This is the least invasive option for renovation or repair.
3. Cone, barrel and base defects will be addressed with full-depth rehabilitation if not considered severe or full manhole replacement if it is considered severe. It is recommended a polymer based coating be used for full-depth rehabilitation.

Further investigation during detail design is recommended to refine the recommended technique to use for pipeline and manhole repair, renovation, and replacement.

4.3 ASSESSMENT RESULTS

4.3.1 Rehabilitation Costing Tool

Stantec utilized a Rehabilitation Costing Tool (RCT) that they developed to aid in financial planning and programming. The Tool applies a customizable decision support system, based on rehabilitation industry "rules of thumb" and local preferences, to generate preliminary rehabilitation recommendations from the PACP and MACP inspection databases. The Tool integrates defect filtering techniques and is linked with local rehabilitation unit cost data to generate budgetary cost estimates for sewer rehabilitation. Output from the Tool includes a detailed schedule of recommended repairs/rehabilitations and a detailed summary of estimated capital construction costs for each pipe segment.

Filtered defects and preliminary rehabilitation recommendations from the RCT are stored in an Access-compatible database that can be linked to City's GIS sewer attribute data.

Rehabilitation recommendations and cost opinions developed by the RCT should be considered budgetary, suitable for planning or as a preliminary screening tool to expedite engineering review/design. Results from the RCT should not replace detailed engineering design, as the RCT considers only pipe condition information included in the CCTV inspection databases. Site constraints (such as sewer proximity to buildings, disruption to high traffic routes, impact to emergency/critical facilities, and other design factors) are not considered by the RCT.

The methodology used for the assessment along with the rehabilitation preferences, unit costs analysis, and defect summary are detailed for both the pipeline assessment and manhole assessment in **Appendix II** and **Appendix III** respectively. The following section provides the results of the analysis.

4.3.2 Pipelines

4.3.2.1 Rehabilitation Recommendations

A summary of preliminary rehabilitation recommendations from the RCT analysis is presented in **Table 12**. Recommendations in the table are based on the "triggers" described in **Section 5.5** of **Appendix II**. Recommendations based only on addressing the PACP Grade 4 and Grade 5 defects (i.e. ignoring the recommendations triggered solely from exceeding the Rehabilitation Threshold Score) are also included in the table.

Table 12 Preliminary Rehabilitation Recommendations

All Pipes	
Total No. of Unique Pipes	190
Total Length of Inspected Pipes	55,562 LF
All PACP Defect Grades	
No. of Point Repairs	36 (25 pipes)[1]
Length of CIPP Liner Installation	3,544 LF (10 pipes)
Length of Open Cut Replacement	5,693 LF (17 pipes)
PACP Grade 4 and Grade 5 Defects Only	
No. of Point Repairs	21 (15 pipes)[1]
Length of CIPP Liner Installation	2,838 LF (8 pipes)
Length of Open Cut Replacement	4,620 LF (14 pipes)

1. *Includes pipes where only a point repair is recommended and pipes where both a point repair and a CIPP liner installation is recommended.*

A map illustrating those pipes recommended for point repair, open cut replacement, or installation of a CIPP liner is presented in **Appendix E** of **Appendix II**. Pipes evaluated by the RCT, but where no improvement is recommended, are also shown. Pipes in which inspection information was not provided are shown as gray lines.

A map illustrating those pipes recommended for point repair, open cut replacement, or installation of a CIPP liner that are based only on addressing PACP Grade 4 and Grade 5 defects is presented in **Appendix F** of **Appendix II**. The map in **Appendix F** does not include pipe improvement recommendations triggered solely from exceeding the Rehabilitation Threshold Score.

4.3.2.2 Rehabilitation Costs

Preliminary capital construction cost opinions for the rehabilitation recommendations presented in **Section 6.4** of **Appendix II** are summarized in **Table 13**. Cost opinions are based on the unit rates presented in **Appendix A** of **Appendix II** and the methodology discussed in **Section 4.2** of **Appendix II**.

Table 13 Budgetary Rehabilitation Cost Opinions

All Pipes	
Total No. of Unique Pipes	190
Total Length of Inspected Pipes	55,562 LF
All PACP Defect Grades	
Point Repairs	$149,594[1]
CIPP Liner Installation	$249,557[2]
Open Cut Replacement	$819,978
Total Cost (with Traffic Control, Surface Restoration, & Contingency)	$1,932,048
PACP Grade 4 and 5 Defects Only	
Point Repairs	$100,229[1]
CIPP Liner Installation	$199,857[2]
Open Cut Replacement	$666,999
Total Cost (with Traffic Control, Surface Restoration, & Contingency)	$1,532,581

1. *Cost is for pipes where only a point repair is recommended.*
2. *Includes the cost of any point repair(s) on pipe recommended in conjunction with CIPP liner.*

4.3.3 Manholes

4.3.3.1 Rehabilitation Recommendations

A summary of preliminary rehabilitation recommendations from the RCT analysis is presented in **Table 14**. Recommendations in the table are based on the "triggers" described in **Section 4** of **Appendix III**.

Table 14 Preliminary Rehabilitation Recommendations

All Pipes	
Total No. of Inspected Manholes	186
No Manhole Rehab/Renewal Recommended	45 (24.2%)
Replace Frame/Cover[1]	2 (1.1%)
Install Chimney Seal/Lining	2 (1.1%)
Full-Depth Rehabilitation	118 (63.4%)
Full-Depth Rehabilitation and Replace Frame/Cover	8 (4.3%)
Replace Manhole	11 (5.9%)

1. *Does not include manholes that full-depth rehabilitation is also recommended.*

A map illustrating the location of manhole recommendations is presented in **Appendix E** of **Appendix III**. Manholes evaluated by the RCT, but where no improvement is recommended, are also shown. Manholes in which inspection information was not provided are colored gray.

4.3.3.2 Rehabilitation Costs

Preliminary capital construction cost opinions for the rehabilitation recommendations presented in **Section 6.5** of **Appendix III** are summarized in **Table 15**. Cost opinions are based on the unit rates presented in **Appendix A** of **Appendix III** and the methodology discussed in **Section 4.2** of **Appendix III**.

Table 15 Budgetary Rehabilitation Cost Opinions

All Pipes	
Total No. of Inspected Manholes	186
Replace Frame/Cover[1]	$1,634
Install Chimney Seal/Lining	$1,500
Full-Depth Rehabilitation	$295,000
Full-Depth Rehabilitation and Replace Frame/Cover	$26,536
Replace Manhole	$66,000
Total Cost (All Manhole Improvements)	$390,670

1. *Does not include cost for manholes where full-depth rehabilitation is also recommended.*

5.0 RECOMMENDATIONS

The RCT looks at each individual line segment and each manhole and provides a recommendation for repair, rehabilitation, or replacement based on the defects that are present in the respective asset. It is beneficial to for planning purposes to bundle these recommendations into various areas to develop projects that can be included in a Capital Improvement Program. The project has been divided into 14 areas (essentially along each street).

1. Hearthsong Drive
2. UPRR Right of Way and Alley Between Center Street and Yosemite Avenue
3. Alley Between Yosemite Avenue and Nevada Street
4. Center Street
5. Moffat Boulevard and Main Street
6. North Street and Elm Avenue Parallel Lines
7. Oak Street
8. Sequoia Avenue
9. Tidewater Bike Path
10. Walnut Avenue
11. North of Yosemite Avenue in Golf Course and Field
12. Louise Avenue
13. St Dominic's Drive
14. Union Road

Appendix IV contains tables that list the pipe segment ID along with the respective upstream and downstream ID, pipe material, diameter, segment length, recommendation for the pipe repair/rehabilitation and cost of the recommended repair/rehabilitation. **Appendix V** contains tables that list the manholes along the manhole material, type of lining or coating, recommendation for the manhole repair/rehabilitation, and cost of the recommended repair/rehabilitation. Maps showing the final recommendations for all pipes and manholes are in **Appendix VI**. A description of each area along with as summary of the recommendations is provided in the following sections.

The recommendations from the RCT are being followed for the majority of the pipelines. Significant degradation as a result of hydrogen sulfide gas induced sulfuric acid corrosion has been observed for the pipelines that are constructed of Reinforced Concrete Pipe (RCP). Therefore, to supplement the results of the RCT analysis, it is recommended that all line segments that are constructed of RCP be rehabilitated with cured-in-place pipe. Cured-in-place pipeline rehabilitation is being selected as the preferred rehabilitation method because it provides for the least reduction in inside diameter when compared to other alternatives such a sliplining.

Like the RCP pipelines, degradation has been observed for unlined concrete manholes and the mortar joints of brick manholes as a result of hydrogen sulfide gas induced sulfuric acid corrosion. It is recommended, in addition to the recommendations from the RCT, that all manholes be rehabilitated with a polymer based coating to help prevent further degradation.

5.1 OPERATION AND MAINTENANCE

Regular inspection and maintenance of the sanitary sewer system is necessary to avoid critical failures and costly emergency repairs and fines. As part of the City of Manteca's permit, the Central Valley Regional Water Quality Control Board approved the City of Manteca, Sewer System Management Plan (SSMP), dated April 4, 2014. This SSMP outlines recommendations for the maintenance and operation of the sanitary sewer system in conformance with the permit. Section 6.8 of the SSMP specifically recommends the implementation of a Conditions Assessment Program. It recommends inspection and cleaning of the sanitary sewer at a rate of at least 5% and 10% per year (14 and 27 miles per year), respectively. Inspections should be conducted with a camera capable of a full 360-degree view to provide the opportunity to access and identify conditions early that could lead to interruption of service or incipient failures. The SSMP also recommends regular inspection of the sanitary sewer manholes for deficiencies and damage, with more frequent inspections where flow inconsistencies or indications of incipient failure may be present. Manholes should be inspected at a rate of at least 5% per year (215 manholes per year). Additionally, the SSMP recommends a standard set of specifications for pre-cleaning, identification, inspection, and CCTV documentation be implemented. For additional recommendations and details please refer to the SSMP.

5.2 HEARTHSONG DRIVE

5.2.1 Description

Location: Hearthsong Drive between Woodward Avenue and Highway 120

Pipe Material: T-Lock Lined RCP

Diameter: 60-inch

Approximate Length: 2,700 feet

Number of Manholes: 9

Manhole Material: T-Lock Lined Concrete

5.2.2 Recommendation

This is a newer sewer line that has yet to be placed in service. No significant defects where noted during the inspection and the pipelines and manholes are T-Lock lined to help prevent hydrogen sulfide gas induced sulfuric acid corrosion. Therefore, no action is recommended for repair, rehabilitation, or replacement.

5.3 UPRR RIGHT OF WAY AND ALLEY BETWEEN CENTER STREET AND YOSEMITE AVENUE

5.3.1 Description

Location: Alley between Center Street and Yosemite Avenue From west of Sherman Avenue toe the intersection of the UPRR right of way and Center Street.

Pipe Material: Vitrified Clay

Diameter: 12-inch

Approximate Length: 2,750 feet

Number of Manholes: 9

Manhole Material: Unlined Concrete and Brick

5.3.2 Recommendation

Pipeline: 4 segments with Point Repairs, 3 segments for Dig and Replace, and no segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 9 manholes to be rehabilitated, and no manholes to be replaced.

Table 16 UPRR Right of Way and Alley Between Center Street and Yosemite Avenue Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$157,363.30	$22,500.00	$179,863.30	$8,993.17	$8,993.17	$53,958.99	$251,808.62

5.4 ALLEY BETWEEN YOSEMITE AVENUE AND NEVADA STREET

5.4.1 Description

Location: Alley between Yosemite Avenue and Nevada Street between Willow Venue and Walnut Avenue.

Pipe Material: Vitrified Clay

Diameter: 10-inch

Approximate Length: 2,400 feet

Number of Manholes: 10

Manhole Material: Unlined Concrete and Brick

5.4.2 Recommendation

Pipeline: 3 segments with Point Repairs, 3 segments for Dig and Replace, and 1 segment for CIPP.

Manhole: no manholes with Frame/Cover replacements, 10 manholes to be rehabilitated, and no manholes to be replaced.

Table 17 Alley Between Yosemite Avenue and Nevada Street Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$200,388.05	$25,000.00	$225,388.05	$11,269.40	$11,269.40	$67,616.42	$315,543.27

5.5 CENTER STREET

5.5.1 Description

Location: Center Street from the intersection of the UPRR right of way to just west of Union Road.

Pipe Material: Vitrified Clay

Diameter: 12-inch and 15-inch

Approximate Length: 3,950 feet

Number of Manholes: 16

Manhole Material: Unlined Concrete and Brick

5.5.2 Recommendation

Pipeline: 1 segment with Point Repairs, no segments for Dig and Replace, and no segments for CIPP.

Manhole: 1 manhole with Frame/Cover replacement, 15 manholes to be rehabilitated, and 1 manhole to be replaced.

Table 18 Center Street Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$3,500.00	$44,317.00	$47,817.00	$9,563.40	$2,390.85	$14,345.10	$74,116.35

5.6 MOFFAT BOULEVARD AND MAIN STREET

5.6.1 Description

Location: Main Street from Garfield Avenue to Main Street then along Main Street to the alley north of Yosemite Avenue.

Pipe Material: Vitrified Clay and one segment of Truss Pipe

Diameter: 10-inch

Approximate Length: 2,900 feet

Number of Manholes: 10

Manhole Material: Unlined Concrete and Brick

5.6.2 Recommendation

Pipeline: no segments with Point Repairs, 3 segments for Dig and Replace, and 5 segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 10 manholes to be rehabilitated, and no manholes to be replaced.

Table 19 Moffat Boulevard and Main Street Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$314,261.23	$25,000.00	$339,261.23	$67,852.25	$16,963.06	$101,778.37	$525,854.91

5.7 NORTH STREET AND ELM AVENUE PARALLEL LINES

5.7.1 Description

Location: North Street from Roosevelt Avenue to Elm Avenue then along Elm Avenue to Center Street.

Pipe Material: Vitrified Clay

Diameter: 10-inch

Approximate Length: 7,150 feet

Number of Manholes: 34

Manhole Material: Unlined Concrete and Brick

5.7.2 Recommendation

Pipeline: 1 segments with Point Repairs, 4 segments for Dig and Replace, and 3 segments for CIPP.

Manhole: 2 manholes with Frame/Cover replacements, 33 manholes to be rehabilitated, and 1 manholes to be replaced.

Table 20 North Street and Elm Avenue Parallel Lines Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$218,606.33	$90,134.00	$308,740.33	$61,748.07	$15,437.02	$92,622.10	$478,547.51

5.8 OAK STREET

5.8.1 Description

Location: Oak Street from Main Street to Willow Avenue.

Pipe Material: Vitrified Clay

Diameter: 10-inch

Approximate Length: 1,600 feet

Number of Manholes: 7

Manhole Material: Unlined Concrete and Brick

5.8.2 Recommendation

Pipeline: 4 segments with Point Repairs, no segments for Dig and Replace, and no segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 7 manholes to be rehabilitated, and no manholes to be replaced.

Table 21 Oak Street Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$15,000.00	$17,500.00	$32,500.00	$6,500.00	$1,625.00	$9,750.00	$50,375.00

5.9 SEQUOIA AVENUE

5.9.1 Description

Location: Sequoia Avenue from Oregon Street to the alley north of Nevada Street.

Pipe Material: Vitrified Clay

Diameter: 10-inch

Approximate Length: 1,000 feet

Number of Manholes: 3

Manhole Material: Brick

5.9.2 Recommendation

Pipeline: 1 segments with Point Repairs, no segments for Dig and Replace, and no segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 1 manhole to be rehabilitated, and 2 manholes to be replaced.

Table 22 Sequoia Avenue Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$3,000.00	$14,500.00	$17,500.00	$3,500.00	$875.00	$5,250.00	$27,125.00

5.10 TIDEWATER BIKE PATH

5.10.1 Description

Location: Along Tidewater Bike Path from Sandalwood Lane to Louis Avenue.

Pipe Material: Vitrified Clay

Diameter: 12-inch

Approximate Length: 3,150 feet

Number of Manholes: 9

Manhole Material: Unlined Concrete

5.10.2 Recommendation

Pipeline: 1 segment with Point Repairs, 2 segments for Dig and Replace, and no segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 9 manholes to be rehabilitated, and no manholes to be replaced.

Table 23 Tidewater Bike Path Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$105,249.70	$22,500.00	$127,749.70	$6,387.49	$6,387.49	$38,324.91	$178,849.58

5.11 WALNUT AVENUE

5.11.1 Description

Location: Walnut Avenue from the alley north of Nevada Street to the UPRR right of way.

Pipe Material: Vitrified Clay

Diameter: 10-inch

Approximate Length: 1,900 feet

Number of Manholes: 7 and 1 Lamphole

Manhole Material: Unlined Concrete and Brick

5.11.2 Recommendation

Pipeline: 3 segments with Point Repairs, 1 segment for Dig and Replace, and 1 segment for CIPP.

Manhole: 2 manholes with Frame/Cover replacements, 7 manholes to be rehabilitated, and no manholes to be replaced.

Table 24 Walnut Avenue Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$73,624.27	$19,134.00	$92,758.27	$18,551.65	$4,637.91	$27,827.48	$143,775.31

5.12 NORTH OF YOSEMITE AVENUE IN GOLF COURSE AND FIELD

5.12.1 Description

Location: From the golf course maintenance yard located west of Union Road, north or Center Street, to 1,300 feet north of Yosemite Avenue, just west of Airport Way.

Pipe Material: Reinforce Concrete and Spiral Wound Lined Pipe.

Diameter: 30-inch and 36-inch

Approximate Length: 5,200 feet

Number of Manholes: 16

Manhole Material: Unlined Concrete

5.12.2 Recommendation

Pipeline: 3 segments with Point Repairs, no segments for Dig and Replace, and 13 segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 11 manholes to be rehabilitated, and 5 manholes to be replaced.

Table 25 North of Yosemite Avenue in Golf Course and Field Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$1,054,642.64	$57,500.00	$1,112,142.64	$55,607.13	$55,607.13	$333,642.79	$1,556,999.70

5.13 LOUISE AVENUE

5.13.1 Description

Location: Louise Avenue from Highway 99 to Union Road.

Pipe Material: Polyvinyl Chloride, Cured-in-Place Lined Pipe, and Reinforced Concrete

Diameter: 21-inch, 24-inch, and 30-inch

Approximate Length: 8,900 feet

Number of Manholes: 33

Manhole Material: Unlined Concrete

5.13.2 Recommendation

Pipeline: no segments with Point Repairs, no segments for Dig and Replace, and 10 segments for CIPP.

Manhole: 3 manholes with Frame/Cover replacements, 33 manholes to be rehabilitated, and no manholes to be replaced.

Table 26 Louise Avenue Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$610,354.00	$84,951.00	$695,305.00	$139,061.00	$34,765.25	$208,591.50	$1,077,722.75

5.14 ST DOMINIC'S DRIVE

5.14.1 Description

Location: Saint Dominic's Drive from just north of Yosemite Avenue to just south of the golf course.

Pipe Material: Polyvinyl Chloride

Diameter: 12-inch

Approximate Length: 1,000 feet

Number of Manholes: 4

Manhole Material: Unlined Concrete

5.14.2 Recommendation

Pipeline: no segments with Point Repairs, no segments for Dig and Replace, and no segments for CIPP.

Manhole: no manholes with Frame/Cover replacements, 4 manholes to be rehabilitated, and no manholes to be replaced.

Table 27 St Dominic's Drive Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$0.00	$10,000.00	$10,000.00	$2,000.00	$500.00	$3,000.00	$15,500.00

5.15 UNION ROAD

5.15.1 Description

Location: Union Road from Wawona Street to Louise Avenue.

Pipe Material: Vitrified Clay and Reinforced Concrete

Diameter: 30-inch

Approximate Length: 8,100 feet

Number of Manholes: 28

Manhole Material: Brick and Unlined Concrete

5.15.2 Recommendation

There have been several emergency repairs completed on sections of RCP within the Union Road sewer line because of collapses that occurred in February of 2017, after the assessment was complete. As was previously stated, it is also recommended that these segments of RCP sewer line, along with the other segments of RCP located in Union Road, be rehabilitated with cured-in-place pipe to prevent degradation as a result of hydrogen sulfide gas induced sulfuric acid corrosion. The estimated cost of the repairs that were completed in February of 2017 have been left in the report so the report provides a complete assessment of the results of the inspection.

Pipeline: 3 segments with Point Repairs, 1 segments for Dig and Replace, and 25 segments for CIPP.

Manhole: 1 manhole with Frame/Cover replacements, 27 manholes to be rehabilitated, and 1 manhole to be replaced.

Table 28 Union Road Repair/Rehab/Replacement Costs

Pipe Repair/Rehab/ Replace Cost	Manhole Repair/Rehab/ Replace Cost	Subtotal	Surface Restoration	Traffic Control	Contingency	Total
$1,319,484.00	$74,317.00	$1,393,801.00	$278,760.20	$69,690.05	$418,140.30	$2,160,391.55

5.16 SUMMARY OF RECOMMENDATIONS

Table 29 summarizes the combined pipeline and manhole repair, rehabilitation, and replacement costs for each area of the project. It is recommended to start improvements on Union Road, North of Yosemite Avenue in Golf Course and Field, and Louise Avenue and continue with the remaining system.

In addition to the improvements to the existing areas, the City should continue inspecting the remainder of their system. Recommendation from their Sewer System Management Plan should be implemented to continue cleaning and inspecting the pipelines and manholes within their system at a rate of approximately 5% and 10% per year, respectively.

Table 29 Summary of Project Repair/Rehab/Replacement Costs

Location	Total Repair/Rehab/ Replace Cost
Hearthsong Drive	$0.00
UPRR Right of Way and Alley Between Center Street and Yosemite Avenue	$251,808.62
Alley Between Yosemite Avenue and Nevada Street	$315,543.27
Center Street	$74,116.35
Moffat Boulevard and Main Street	$525,854.91
North Street and Elm Avenue Parallel Lines	$478,547.51
Oak Street	$50,375.00
Sequoia Avenue	$27,125.00
Tidewater Bike Path	$178,849.58
Walnut Avenue	$143,775.31
North of Yosemite Avenue in Golf Course and Field	$1,556,999.70
Louise Avenue	$1,077,722.75
St Dominic's Drive	$15,500.00
Union Road	$2,160,391.55
TOTAL	**$6,856,609.55**

APPENDIX J

25 Year CIP Schedule and Costs

CIP Project No.	Project Name	Planning and Design	Construction	CM and Admin	Total	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41	41/42	42/43	43/44	44/45	45/46	46/47	Total
WCS-01	W. Center Street Trunk	$434,000	$3,615,000	$831,000	$4,880,000										$4,880,000																**$4,880,000**
WCS-02	Elm/West North Street Trunk	$451,000	$3,760,000	$869,000	$5,080,000										$5,080,000																**$5,080,000**
WCS-03	Upsize Existing 10-inch East North Street Trunk	$147,000	$1,223,000	$290,000	$1,660,000										$1,660,000																**$1,660,000**
WCS-04	Upsize Existing 8-inch East North Street Trunk	$45,000	$374,000	$91,000	$510,000										$510,000																**$510,000**
WCS-05	South Woodward Trunk Extension	$1,123,000	$9,360,000	$2,157,000	$12,640,000										$12,640,000																**$12,640,000**
WCS-06	Central Union Road Trunk Extension	$1,437,000	$11,972,000	$2,761,000	$16,170,000		$2,000,000	$7,500,000	$3,335,000	$3,335,000																					**$16,170,000**
WCS-07	North Trunk Extension on Airport Way	$3,052,000	$25,433,000	$5,855,000	$34,340,000												$11,446,667	$11,446,667	$11,446,667												**$34,340,000**
WCS-08	S. Main Trunk to Evans	$638,000	$5,313,000	$1,229,000	$7,180,000											$7,180,000															**$7,180,000**
WCS-09	S. Airport Way and Yosemite Ave. (Fishback)	$275,000	$2,292,000	$533,000	$3,100,000											$3,100,000															**$3,100,000**
WCS-10	S. Airport Way Roberts Estates to Daniels	$155,000	$1,295,000	$300,000	$1,750,000											$1,750,000															**$1,750,000**
WCS-11	Yosemite Square Lift Station and Improvements	$1,144,000	$9,537,000	$2,199,000	$12,880,000											$12,880,000															**$12,880,000**
WCS-12	Austin Road Industrial Area Trunk	$1,849,000	$15,410,000	$3,551,000	$20,810,000												$1,849,000	$9,480,500	$9,480,500												**$20,810,000**
WCS-13	South Austin Road - Industrial Area	$513,000	$4,278,000	$989,000	$5,780,000														$2,890,000	$2,890,000											**$5,780,000**
WCS-14	Yosemite Square Service Area	$376,000	$3,136,000	$728,000	$4,240,000															$2,120,000	$2,120,000										**$4,240,000**
WCS-15	Oleander Avenue Extension/ S. Airport Way Sewer	$592,000	$4,932,000	$1,136,000	$6,660,000														$592,000	$6,068,000											**$6,660,000**
WCS-16	Highway 99 Crossing at Northland Road	$827,000	$6,894,000	$1,589,000	$9,310,000																$4,655,000	$4,655,000									**$9,310,000**
WCS-17	East Lathrop Road Trunk	$1,072,000	$8,930,000	$2,058,000	$12,060,000																	$4,020,000	$4,020,000	$4,020,000							**$12,060,000**
WCS-18	Northland Road Trunk	$589,000	$4,910,000	$1,131,000	$6,630,000																	$3,315,000	$3,315,000								**$6,630,000**
WCS-19	Northland Road Branches	$564,000	$4,703,000	$1,083,000	$6,350,000																		$3,175,000	$3,175,000							**$6,350,000**
WCS-20	Louise/ Nehemiah Branches	$458,000	$3,818,000	$884,000	$5,160,000																			$5,160,000							**$5,160,000**
WCS-21	South Union Road Extension	$408,000	$3,397,000	$785,000	$4,590,000																				$4,590,000						**$4,590,000**
WCS-22	Cottage Avenue	$273,000	$2,279,000	$528,000	$3,080,000																				$1,540,000	$1,540,000					**$3,080,000**
WCS-23	North Shed Union Road Trunk	$1,167,000	$9,723,000	$2,240,000	$13,130,000																					$6,565,000	$6,565,000				**$13,130,000**
WCS-24	Manteca Junction Trunk	$331,000	$2,757,000	$642,000	$3,730,000																							$3,730,000			**$3,730,000**
WCS-25	Lovelace Road - 99 Crossing	$1,608,000	$13,398,000	$3,084,000	$18,090,000																						$9,045,000	$9,045,000			**$18,090,000**
WCS-26	UPRR Right of Way and Ally Between Center Street and Yosemite	$43,000	$362,000	$84,000	$489,000			$489,000																							**$489,000**
WCS-27	Moffat Boulevard and Main Street	$91,000	$757,000	$174,000	$1,022,000			$1,022,000																							**$1,022,000**
WCS-28	Oak Street from Main Street to Willow Avenue	$9,000	$73,000	$16,000	$98,000			$98,000																							**$98,000**
WCS-29	Sequoia Avenue from Oregon Street to Alley north of Nevada Street	$5,000	$39,000	$9,000	$53,000			$53,000																							**$53,000**
WCS-30	Tidewater Bike Path from Sandalwood Lane to Louis Avenue	$31,000	$258,000	$59,000	$348,000			$348,000																							**$348,000**
WCS-31	Walnut Avenue from the alley north of Nevada Street to the UPRR	$25,000	$207,000	$47,000	$279,000			$279,000																							**$279,000**
WCS-32	St. Dominic's Drive from north of Yosemite Avenue to Golf Course	$3,000	$21,000	$5,000	$29,000			$29,000																							**$29,000**
	TOTAL	**$19,735,000**	**$164,456,000**	**$37,937,000**	**$222,128,000**	**$0**	**$2,000,000**	**$9,818,000**	**$3,335,000**	**$3,335,000**	**$0**	**$0**	**$0**	**$0**	**$24,770,000**	**$24,910,000**	**$13,295,667**	**$20,927,167**	**$24,409,167**	**$11,078,000**	**$6,775,000**	**$11,990,000**	**$10,510,000**	**$12,355,000**	**$6,130,000**	**$8,105,000**	**$15,610,000**	**$12,775,000**	**$0**	**$0**	**$222,128,000**

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Figure J-1
WCS 25 Year CIP Schedule and Cost

CIP Project No.	Project Name	Planning and Design	Construction	CM and Admin	Total	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41	41/42	42/43	43/44	44/45	45/46	46/47	Total
WQCF-01	North and South Plant WAS Pump Replacement Project	$251,000	$2,094,000	$482,000	$2,827,000	$251,000	$1,000,000	$1,576,000																							**$2,827,000**
WQCF-02	South Plant RAS Pump Replacement Project	$147,000	$1,224,000	$281,000	$1,652,000	$147,000	$500,000	$1,005,000																							**$1,652,000**
WQCF-03	North and South Plant Aeration Basins Improvements	$1,040,000	$8,664,000	$1,992,000	$11,696,000	$1,040,000	$1,000,000	$4,328,000	$5,328,000																						**$11,696,000**
WQCF-04	Sidestream Treatment System	$1,796,000	$14,967,000	$3,442,000	$20,205,000				$1,796,000	$6,136,333	$6,136,333	$6,136,333																			**$20,205,000**
WQCF-05	Add Centrifuge No. 3	$456,000	$3,800,000	$874,000	$5,130,000		$300,000	$156,000	$2,337,000	$2,337,000																					**$5,130,000**
WQCF-06	Add DAFT No. 3	$349,000	$2,911,000	$670,000	$3,930,000		$200,000	$149,000	$1,790,500	$1,790,500																					**$3,930,000**
WQCF-07	I&E Core Supervisory Control and Data Acquisition (SCADA) System	$100,000	$835,000	$192,000	$1,127,000					$1,127,000																					**$1,127,000**
WQCF-08	I&E Remote Site Process Logic Controller (PLC) Upgrades	$153,000	$1,279,000	$295,000	$1,727,000					$1,727,000																					**$1,727,000**
WQCF-09	I&E PLC and Operator Interfaced Terminal (OIT) Replacement	$122,000	$1,018,000	$234,000	$1,374,000								$1,374,000																		**$1,374,000**
WQCF-10	I&E Switchgear PLC Upgrades	$11,000	$94,000	$22,000	$127,000						$127,000																				**$127,000**
WQCF-11	Add Influent Pump No. 5	$93,000	$776,000	$179,000	$1,048,000			$1,048,000																							**$1,048,000**
WQCF-12	Lightweight Covers for Process Basins	$515,000	$4,290,000	$987,000	$5,792,000								$5,792,000																		**$5,792,000**
WQCF-13	Headworks, IPS and Biofilter Improvements	$185,000	$1,541,000	$354,000	$2,080,000			$185,000	$947,500	$947,500																					**$2,080,000**
WQCF-14	UV Disinfection System Upgrade	$1,385,000	$11,543,000	$2,655,000	$15,583,000			$1,385,000	$7,099,000	$7,099,000																					**$15,583,000**
WQCF-15	Plant Water System Piping Modifications	$57,000	$471,000	$108,000	$636,000			$636,000																							**$636,000**
WQCF-16	Replace Secondary Effluent Equalization Pond Liner	$187,000	$1,556,000	$358,000	$2,101,000			$2,101,000																							**$2,101,000**
WQCF-17	Headworks Screen No. 3	$80,000	$667,000	$153,000	$900,000						$900,000																				**$900,000**
WQCF-18	FOG Receiving Station Screening System	$18,000	$148,000	$34,000	$200,000			$200,000																							**$200,000**
WQCF-19	Bulk Ferric Chloride Solution Tanks	$31,000	$260,000	$60,000	$351,000			$351,000																							**$351,000**
WQCF-20	Digesters No. 1 and 2 Overflow Boxes	$63,000	$523,000	$120,000	$706,000			$706,000																							**$706,000**
WQCF-21	Digester Pressure Relief Valves Platform & Handrailing	$18,000	$152,000	$35,000	$205,000			$205,000																							**$205,000**
WQCF-22	Install New Waste Heat Radiator	$18,000	$147,000	$33,000	$198,000			$198,000																							**$198,000**
WQCF-23	WQCF Phase IV Stage 1 Expansion Project	$13,005,000	$108,375,000	$24,926,000	$146,306,000					$13,005,000	$33,325,250	$33,325,250	$33,325,250	$33,325,250																	**$146,306,000**
WQCF-24	WQCF Phase IV Stage 2 Expansion Project	$6,274,000	$52,287,000	$12,026,000	$70,587,000																						$6,274,000	$21,437,667	$21,437,667	$21,437,667	**$70,587,000**
	TOTAL	**$26,354,000**	**$219,622,000**	**$50,512,000**	**$296,488,000**	**$1,438,000**	**$3,000,000**	**$14,229,000**	**$19,298,000**	**$34,169,333**	**$40,488,583**	**$39,461,583**	**$40,491,250**	**$33,325,250**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$6,274,000**	**$21,437,667**	**$21,437,667**	**$21,437,667**	**$296,488,000**

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Figure J-2
WQCF 25 Year CIP Schedule and Cost

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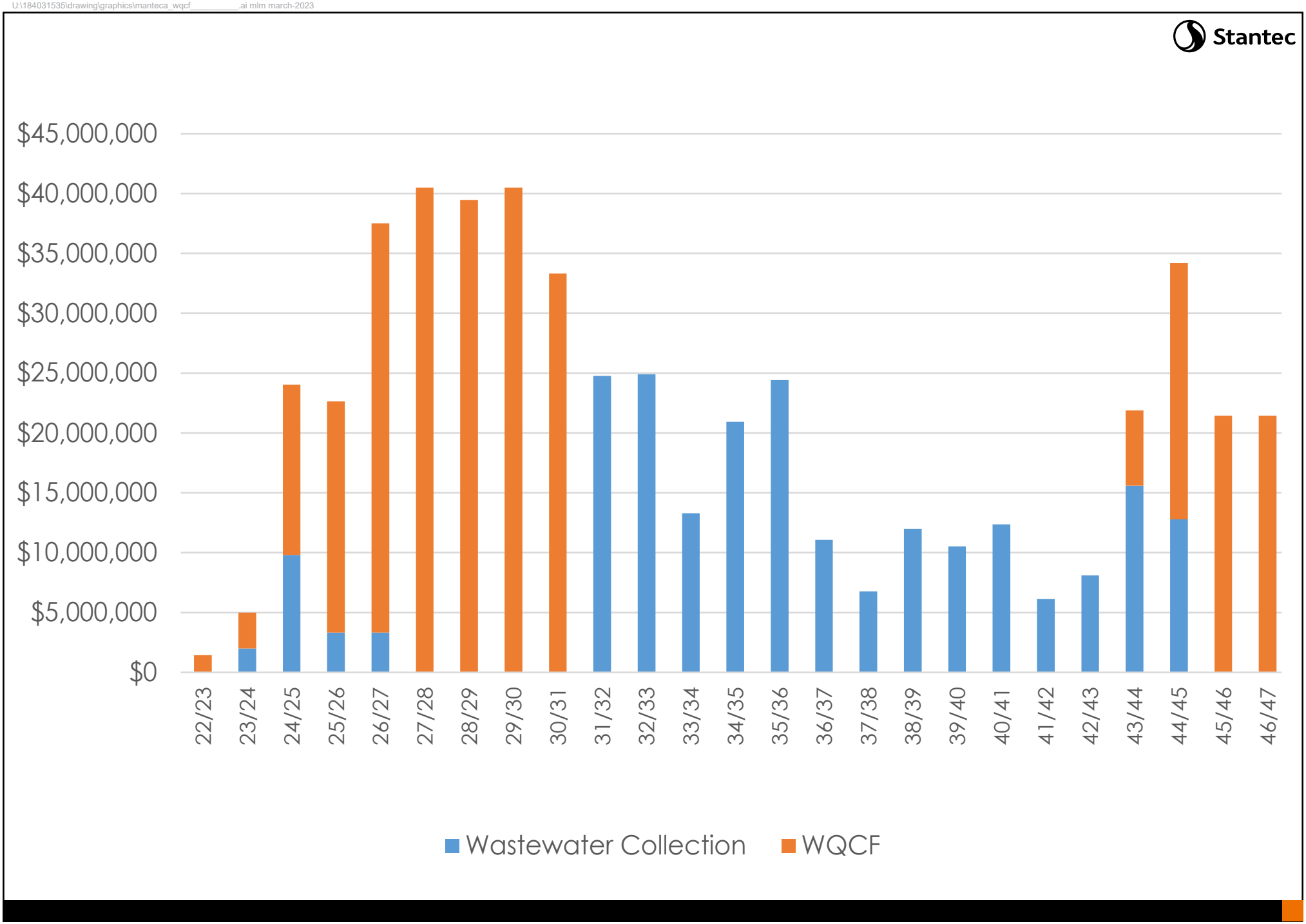
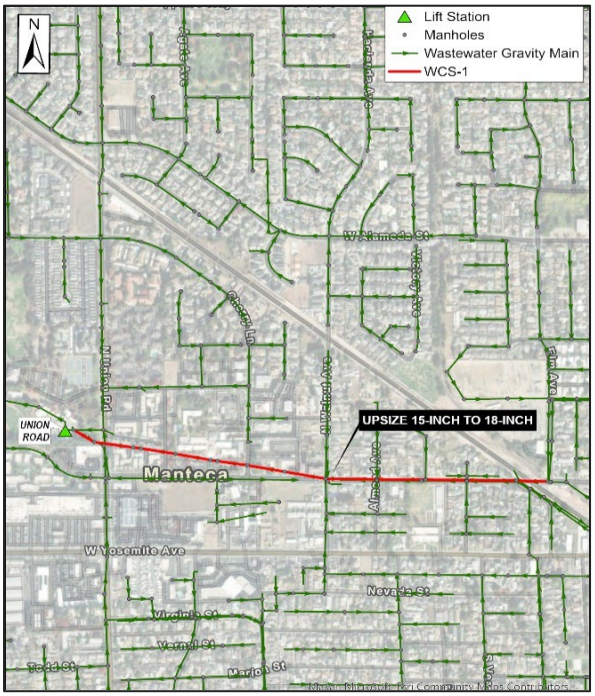


Figure J-3
Wasterwater CIP Expenditure

Project: WCS-1
Name: W Center Street Trunk
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
Stantec
November 2023



CIP Description:

1 Upsize existing 15-inch sewer to 18-inches.
2 Consider WCS-6 connection at downstream end of Project and decommissioning of Union Road LS.
3 Consider WCS-2 at upstream end of Project.
4 Average pipe slope to match existing (0.0012 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM0560	WWMH0344	WWMH0342	404	11.5	18	$ 745	$ 300,964
WWGM0564	WWMH0341	WWMH0344	386	11.0	18	$ 745	$ 287,555
WWGM0565	WWMH0346	WWMH0341	325	11.0	18	$ 696	$ 226,357
WWGM0570	WWMH0348	WWMH0346	392	12.5	18	$ 793	$ 311,028
WWGM0572	WWMH0349	WWMH0348	250	13.9	18	$ 890	$ 222,598
WWGM0880	WWMH0342	WWMH5062	330	12.0	18	$ 745	$ 245,837
WWGM0881	WWMH0369	WWMH5063	238	8.6	18	$ 648	$ 154,226
WWGM0883	WWMH0368	WWMH0370	279	8.9	18	$ 648	$ 180,794
WWGM0884	WWMH0370	WWMH1132	278	8.2	18	$ 648	$ 180,146
WWGM0888	WWMH5090	WWMH0373	310	8.7	18	$ 648	$ 200,882
WWGM0889	WWMH0373	WWMH3125	189	13.9	18	$ 890	$ 168,284
WWGM5976	WWMH5063	WWMH0368	57	8.8	18	$ 648	$ 36,936
WWGM5977	WWMH5062	WWMH0369	301	11.0	18	$ 745	$ 224,233
WWGM6003	WWMH1132	WWMH5090	63	8.3	18	$ 648	$ 40,824
		Total Length:	3,802			**Base Construction Costs:**	**$ 2,781,000**
						Construction Estimating Contingency @ 30%	$ 834,000
						Total Construction Costs:	**$ 3,615,000**
						Engineering, CM, and Admin @ 35%	$ 1,265,000
						Total Project Costs:	**$ 4,880,000**

Project: WCS-2
Name: Elm/West North Street Trunk
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
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CIP Description:

1 Upsize existing 10-inch sewer to 15-inches.
2 WCS-1 is downstream of the project and WCS-2 is upstream of the project.
3 Average pipe slope to match existing (0.0012 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM0317	WWMH0883	WWMH1021	17	7.5	15	$ 603	$ 10,259
WWGM0339	WWMH1021	WWMH0477	424	8.6	15	$ 603	$ 255,879
WWGM0340	WWMH0477	WWMH0473	243	8.2	15	$ 603	$ 146,648
WWGM0341	WWMH0473	WWMH0480	218	9.3	15	$ 603	$ 131,560
WWGM0367	WWMH1112	WWMH1115	169	11.1	15	$ 675	$ 114,028
WWGM0368	WWMH1109	WWMH1112	171	12.4	15	$ 710	$ 121,467
WWGM0413	WWMH0479	WWMH3168	169	10.0	15	$ 639	$ 108,008
WWGM0414	WWMH0445	WWMH0446	220	12.5	15	$ 710	$ 156,274
WWGM0415	WWMH0446	WWMH1107	159	12.4	15	$ 710	$ 112,943
WWGM0416	WWMH1107	WWMH1109	175	12.4	15	$ 710	$ 124,309
WWGM0422	WWMH1118	WWMH1121	168	9.8	15	$ 603	$ 101,386
WWGM0423	WWMH1119	WWMH1118	167	10.9	15	$ 639	$ 106,730
WWGM0424	WWMH1115	WWMH1119	173	11.1	15	$ 675	$ 116,726
WWGM0575	WWMH1127	WWMH0349	348	11.3	15	$ 675	$ 234,802
WWGM0577	WWMH4278	WWMH1127	326	8.8	15	$ 603	$ 196,737
WWGM0580	WWMH1121	WWMH1123	158	10.0	15	$ 639	$ 100,978
WWGM0581	WWMH1123	WWMH1125	221	9.8	15	$ 603	$ 133,371
WWGM0582	WWMH1125	WWMH1128	221	9.2	15	$ 603	$ 133,371
WWGM1537	WWMH0480	WWMH0478	182	9.7	15	$ 603	$ 109,835
WWGM1538	WWMH0478	WWMH0479	190	9.4	15	$ 603	$ 114,663
WWGM3808	WWMH3168	WWMH0445	366	11.4	15	$ 675	$ 246,947
WWGM5363	WWMH1128	WWMH4278	25	9.1	15	$ 603	$ 15,087
		Total Length:	4,510			**Base Construction Costs:**	**$ 2,892,000**
						Construction Estimating Contingency @ 30%	$ 868,000
						Total Construction Costs:	**$ 3,760,000**
						Engineering, CM, and Admin @ 35%	$ 1,316,000
						Total Project Costs:	**$ 5,080,000**

Project: WCS-3
Name: 10-inch East North Street Trunk
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
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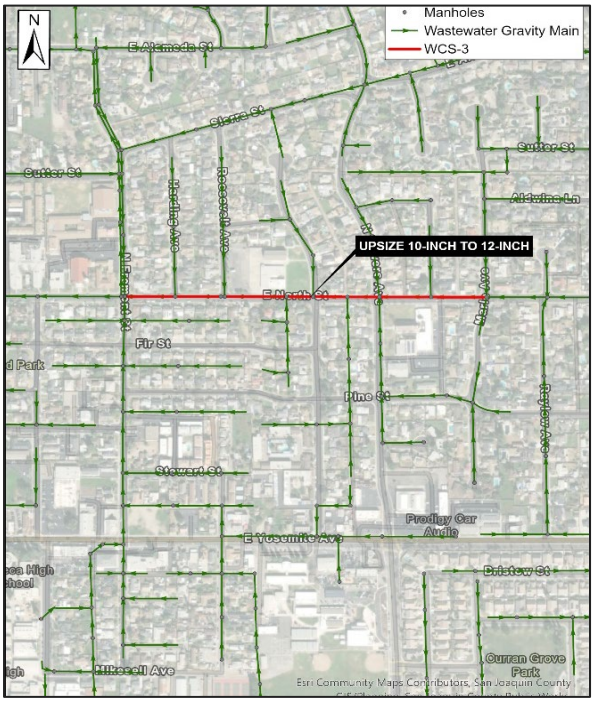
November 2023



CIP Description:

1 Upsize existing 10-inch sewer to 12-inches.
2 WCS-2 is downstream of the project and WCS-4 is further upstream of the project.
3 Evaluate upstream pipe segments condition.
4 Average pipe slope to match existing (0.0015 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM1992	WWMH0885	WWMH0883	255	6.0	12	$ 514	$ 131,184
WWGM1995	WWMH3060	WWMH0885	231	7.1	12	$ 514	$ 118,838
WWGM1996	WWMH0884	WWMH3060	19	6.5	12	$ 514	$ 9,775
WWGM2007	WWMH0844	WWMH0747	261	6.4	12	$ 514	$ 134,271
WWGM2009	WWMH0901	WWMH0844	281	6.6	12	$ 514	$ 144,560
WWGM2036	WWMH0747	WWMH0755	162	6.3	12	$ 514	$ 83,341
WWGM2128	WWMH0757	WWMH0884	312	5.2	12	$ 514	$ 160,508
WWGM2129	WWMH0442	WWMH0757	136	7.1	12	$ 514	$ 69,965
WWGM2130	WWMH0755	WWMH0442	173	7.5	12	$ 514	$ 89,000
		Total Length:	1,830			**Base Construction Costs:**	**$ 941,000**
						Construction Estimating Contingency @ 30%	$ 282,000
						Total Construction Costs:	**$ 1,223,000**
						Engineering, CM, and Admin @ 35%	$ 428,000
						Total Project Costs:	**$ 1,660,000**

Project: WCS-4
Name: 8-inch East North Street Trunk
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
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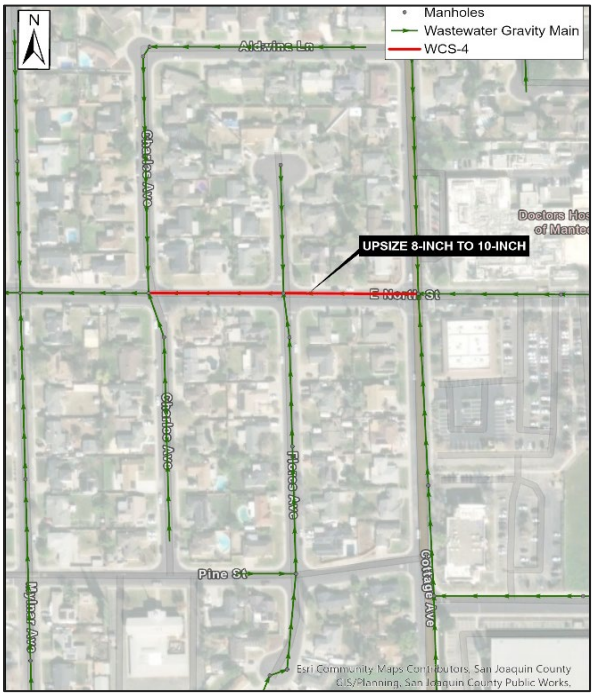

CIP Description:

1 Upsize existing 8-inch sewer to 10-inches.
2 Evaluate pipe segments between WCS-3 and WCS-4 for replacement and addition to project.
3 Average pipe slope to match existing (0.0015 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
WWGM2025	WWMH1433	WWMH0896	280	7.1	10	$ 514	$ 144,046
WWGM2027	WWMH1432	WWMH1433	280	7.3	10	$ 514	$ 144,046
		Total Length:	560			**Base Construction Costs:**	**$ 288,000**
						Construction Estimating Contingency @ 30%	$ 86,000
						Total Construction Costs:	**$ 374,000**
						Engineering, CM, and Admin @ 35%	$ 131,000
						Total Project Costs:	**$ 510,000**

Project: WCS-5
Name: South Woodward Trunk Extension
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
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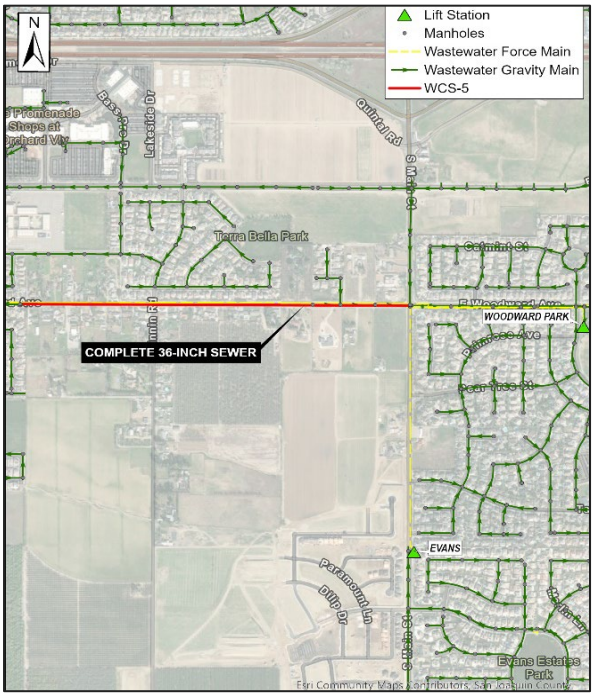

CIP Description:

1 New 36-inch sewer to be constructed.
2 Tie into upstream and downstream 36-inch sewers to complete South Trunk gravity sewer.
3 Decommission Woodward Park Lift Station.
4 New 36-inch sewer slope = 0.00064 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC5_1	WWMH0481	BOSSMH9	2,653	21.2	36	$ 1,819	$ 4,827,062
BOC5_2	BOSSMH9	WWMH4162	1,377	18.4	36	$ 1,724	$ 2,372,526
		Total Length:	4,030			**Base Construction Costs:**	**$ 7,200,000**
						Construction Estimating Contingency @ 30%	$ 2,160,000
						Total Construction Costs:	**$ 9,360,000**
						Engineering, CM, and Admin @ 35%	$ 3,276,000
						Total Project Costs:	**$12,640,000**

Project: WCS-6
Name: Central Union Road Trunk Extension
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 New 36-inch sewer to be constructed.
2 Refer to 320 Airport Way Subdivision plans for detailed alignment.
3 Decommission Union Road Lift Station.
4 Consider upstream improvements (WCS-1).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_1	WWMH3125	SSMH2	2,788	20.2	36	$ 1,786	$ 4,979,469
BOC4_28	SSMH2	SSMH-13	2,242	23.4	36	$ 1,887	$ 4,229,959
		Total Length:	5,031			**Base Construction Costs:**	**$ 9,209,000**
						Construction Estimating Contingency @ 30%	$ 2,763,000
						Total Construction Costs:	**$11,972,000**
						Engineering, CM, and Admin @ 35%	$ 4,190,000
						Total Project Costs:	**$16,170,000**

Project: WCS-7A
Name: Central Union Road Trunk Extension
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
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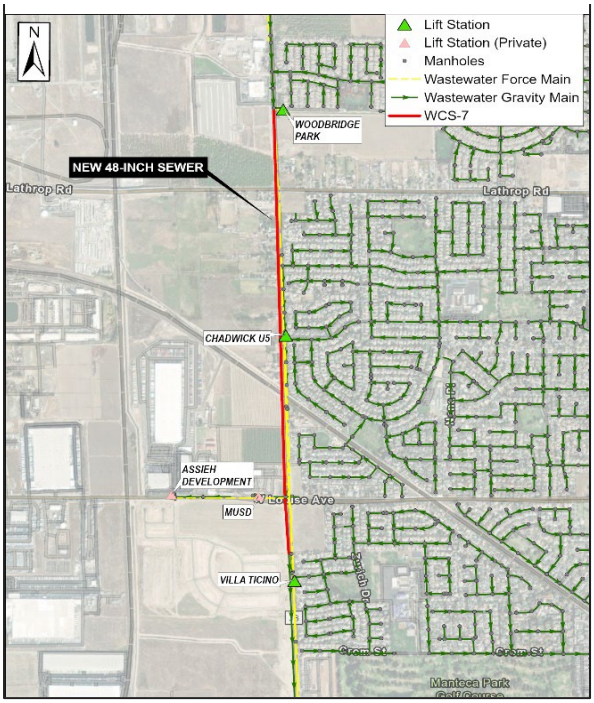

CIP Description:

1. New 48-inch sewer to be constructed.
2. Decommission and tie in existing lift stations (Woodbridge Park, Chadwick U5, Villa Ticino).
3. Tie into upstream 48-inch sewer and downstream 36-inch sewer.
4. New 48-inch sewer slope = 0.0005 ft/ft or greater.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC16_1	SSMH1	73	952	24.9	48	$ 2,721	$ 2,591,359
BOC16_6	WWMH3392	BOSSMH92	3,851	21.2	48	$ 2,503	$ 9,638,820
BOC16_8	BOSSMH92	BOSSMH93	134	22.3	48	$ 2,557	$ 342,779
BOC16_9	BOSSMH93	SSMH1	2,734	22.9	48	$ 2,557	$ 6,991,119
		Total Length:	7,671			**Base Construction Costs:**	**$19,564,000**
						Construction Estimating Contingency @ 30%	$ 5,869,000
						Total Construction Costs:	**$25,433,000**
						Engineering, CM, and Admin @ 35%	$ 8,902,000
						Total Project Costs:	**$34,340,000**

Project: WCS-8
Name: S. Main Trunk to Evans
ENRCCI: 13,176 (March 2023)

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Wastewater Master Plan
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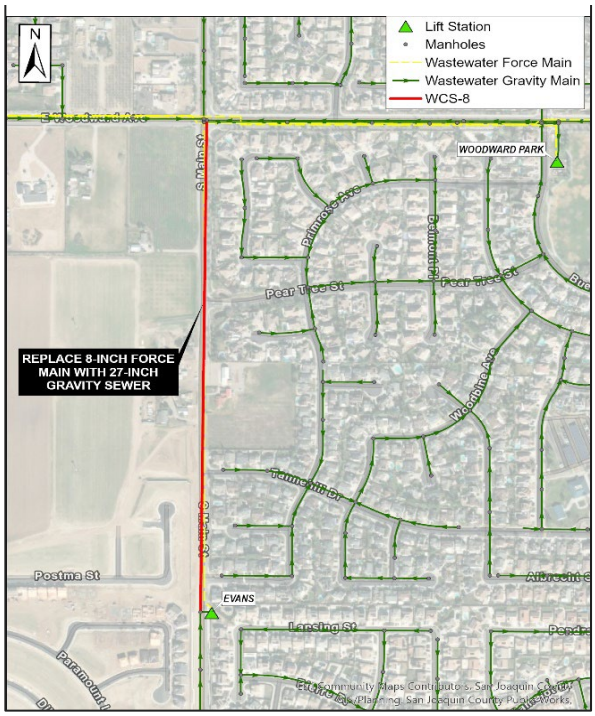

CIP Description:

1 New 27-inch sewer to be constructed.
2 Tie into Evans Lift Station and new 36-inch sewer downstream (WCS-5).
3 Decommission Evans Lift Station.
4 New 27-inch sewer slope = 0.0008 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
1	WWMH5022	WWMH0481	2,688	23.3	27	$ 1,521	$ 4,087,094
		Total Length:	2,688			**Base Construction Costs:**	**$ 4,087,000**
						Construction Estimating Contingency @ 30%	$ 1,226,000
						Total Construction Costs:	**$ 5,313,000**
						Engineering, CM, and Admin @ 35%	$ 1,860,000
						Total Project Costs:	**$ 7,180,000**

Project: WCS-9
Name: S. Airport Way and Yosemite Ave.
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
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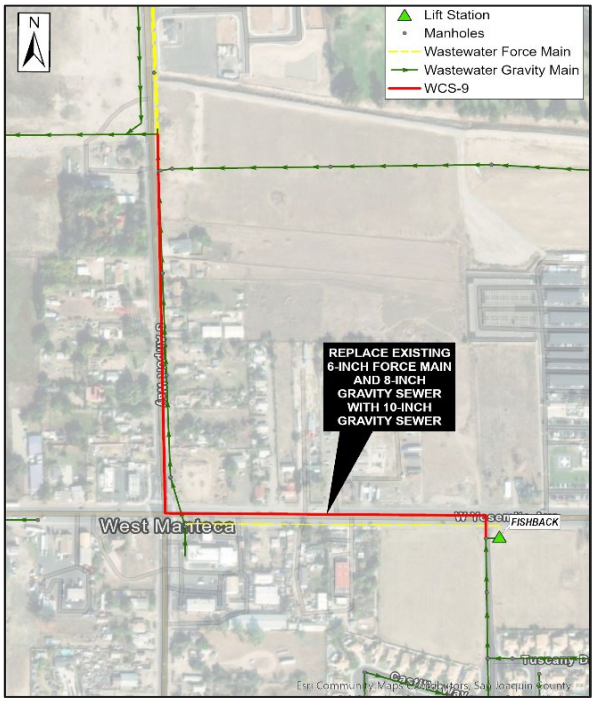

CIP Description:

1 New 10-inch sewer to be constructed.
2 Tie into Fishback Lift Station sewer shed and downstream 36-inch sewer.
3 Review 320 Airport Way Subdivision plans.
4 10-inch sewer at standard slope (0.0025 ft/ft).
5 Decommission Fishback Lift Station.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_12	10	SSMH-13	1,490	18.2	10	$ 747	$ 1,113,278
2_14	BOSSMH400	10	1,179	10.9	10	$ 551	$ 649,450
		Total Length:	2,669			**Base Construction Costs:**	**$ 1,763,000**
						Construction Estimating Contingency @ 30%	$ 529,000
						Total Construction Costs:	**$ 2,292,000**
						Engineering, CM, and Admin @ 35%	$ 802,000
						Total Project Costs:	**$ 3,100,000**

Project: WCS-10
Name: S. Airport Way Roberts Estates
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 New 10-inch sewer to be constructed.
2 Tie into Robert's Estates Lift Station and existing 15-inch sewer in Daniels Street.
3 Decommission Roberts Estates Lift Station.
4 10-inch sewer at standard slope (0.0025 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_11	WWMH2754	WWMH2321	1,317	19.5	10	$ 757	$ 996,427
		Total Length:	1,317			**Base Construction Costs:**	**$ 996,000**
						Construction Estimating Contingency @ 30%	$ 299,000
						Total Construction Costs:	**$ 1,295,000**
						Engineering, CM, and Admin @ 35%	$ 453,000
						Total Project Costs:	**$ 1,750,000**

Project: WCS-11
Name: Yosemite Square Lift Station
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

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CIP Description:

1 New 2.4 Mgal/d pump station to be constructed.
2 New 8-inch force main to be routed through the existing 18-inch highway crossing.
3 New 15-inch sewer tributary to LS to be constructed.
4 New 15-inch sewer extension in Woodward Drive to be constructed with steepest possible slope.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
12_2	24	50	205	12.8	8	$ 221	$ 45,195
12_4	50	51	354	12.8	8	$ 221	$ 78,202
12_5	51	20	188	14.6	8	$ 221	$ 41,584
8	49	29	321	11.1	8	$ 221	$ 70,842
8_11	29	24	645	12.9	8	$ 221	$ 142,532
13	20	WWMH3342	1,425	16.5	15	$ 820	$ 1,168,426
2	BOSSMH41	BOSSMH45	1,315	8.1	15	$ 603	$ 793,454
BOC6_1	BOSSMH45	12	1,919	10.3	15	$ 639	$ 1,226,201
Lift Station							$ 2,900,000
Force Main			3,143		8	$ 221	$ 870,000
		Total Length:	9,514			**Base Construction Costs:**	**$ 7,336,000**
						Construction Estimating Contingency @ 30%	$ 2,201,000
						Total Construction Costs:	**$ 9,537,000**
						Engineering, CM, and Admin @ 35%	$ 3,338,000
						Total Project Costs:	**$12,880,000**

Project: WCS-12
Name: Austin Road Industrial Area Trunk
ENRCCI: 13,176 (March 2023)

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Wastewater Master Plan
CIP Budgetary Cost Estimate
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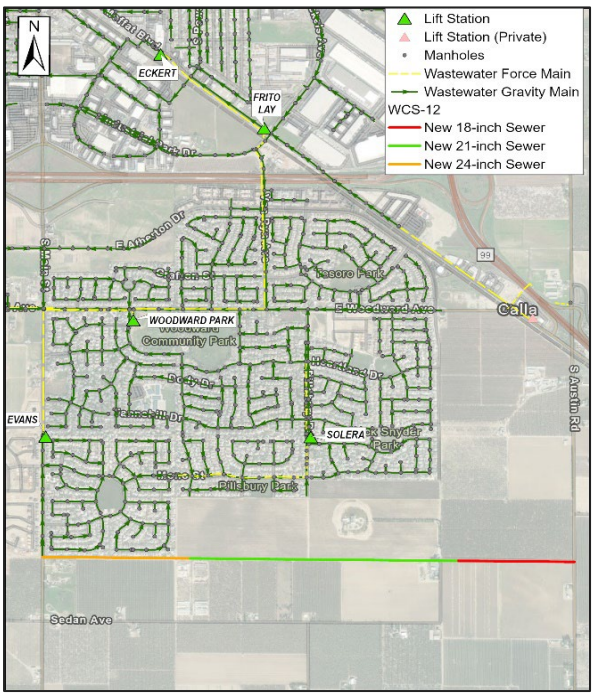

CIP Description:

1 New 24-, 21-, and 18-inch sewer to be constructed.
2 To be constructed at the following slopes: 24-inch & 21-inch = 0.0012 ft/ft, 18-inch = 0.0015 ft/ft.
3 Tie into existing 24-inch trunk in S. Main Street.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC7_1	BOSSMH23	BOSSMH32	589	19.4	18	$ 984	$ 579,171
BOC7_10	BOSSMH6	BOSSMH31	589	17.0	18	$ 937	$ 551,710
BOC7_11	BOSSMH31	BOSSMH23	589	18.4	18	$ 968	$ 570,017
BOC7_12	BOSSMH32	BOSSMH24	589	19.6	18	$ 984	$ 579,171
BOC7_13	BOSSMH33	BOSSMH25	589	17.6	21	$ 1,076	$ 633,260
BOC7_14	BOSSMH34	BOSSMH26	589	17.7	21	$ 1,076	$ 633,260
BOC7_15	BOSSMH35	BOSSMH27	589	19.0	21	$ 1,124	$ 661,553
BOC7_16	BOSSMH36	BOSSMH28	589	19.8	21	$ 1,124	$ 661,553
BOC7_2	BOSSMH24	BOSSMH33	589	19.1	21	$ 1,124	$ 661,553
BOC7_3	BOSSMH25	BOSSMH34	589	17.3	21	$ 1,076	$ 633,260
BOC7_4	BOSSMH26	BOSSMH35	589	18.1	21	$ 1,100	$ 647,406
BOC7_5	BOSSMH27	BOSSMH36	589	19.7	21	$ 1,124	$ 661,553
BOC7_6	BOSSMH28	BOSSMH37	589	19.5	21	$ 1,124	$ 661,553
BOC7_17	BOSSMH37	BOSSMH29	589	19.3	24	$ 1,273	$ 749,344
BOC7_18	BOSSMH38	BOSSMH30	589	18.7	24	$ 1,249	$ 735,613
BOC7_19	BOSSMH39	BOSSMH8	589	19.3	24	$ 1,273	$ 749,344
BOC7_7	BOSSMH29	BOSSMH38	589	19.1	24	$ 1,273	$ 749,344
BOC7_8	BOSSMH30	BOSSMH39	589	18.8	24	$ 1,249	$ 735,613
		Total Length:	10,598		**Base Construction Costs:**		**$11,854,000**
					Construction Estimating Contingency @ 30%		$ 3,556,000
					Total Construction Costs:		**$15,410,000**
					Engineering, CM, and Admin @ 35%		$ 5,394,000
					Total Project Costs:		**$20,810,000**

Project: WCS-13
Name: South Austin Road - Industrial Area
ENRCCI: 13,176 (March 2023)

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CIP Budgetary Cost Estimate
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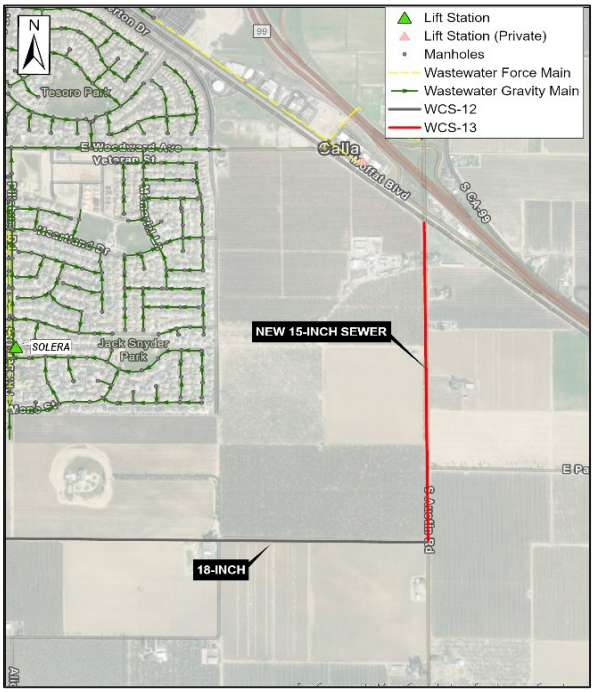
CIP Description:

1 New 15-inch sewer to be constructed.
2 Tie into new 18-inch sewer in Sedan Ave (WCS-12).
3 New 15-inch sewer at standard slope = 0.0015 ft/ft.



Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
12_1	BOSSMH54	BOSSMH6	1,444	17.6	15	$ 832	$ 1,202,375
BOC6_12	BOSSMH50	BOSSMH51	722	10.0	15	$ 639	$ 461,493
BOC6_13	BOSSMH51	BOSSMH52	722	11.1	15	$ 675	$ 487,223
BOC6_15	BOSSMH53	BOSSMH54	722	17.0	15	$ 820	$ 591,967
BOC6_25	42	BOSSMH53	497	14.0	15	$ 782	$ 388,780
BOC6_7	BOSSMH52	42	225	12.1	15	$ 710	$ 159,610
		Total Length:	4,333			**Base Construction Costs:**	**$ 3,291,000**
						Construction Estimating Contingency @ 30%	$ 987,000
						Total Construction Costs:	**$ 4,278,000**
						Engineering, CM, and Admin @ 35%	$ 1,497,000
						Total Project Costs:	**$ 5,780,000**

Project: WCS-14
Name: Yosemite Square Service Area
ENRCCI: 13,176 (March 2023)

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Wastewater Master Plan
CIP Budgetary Cost Estimate
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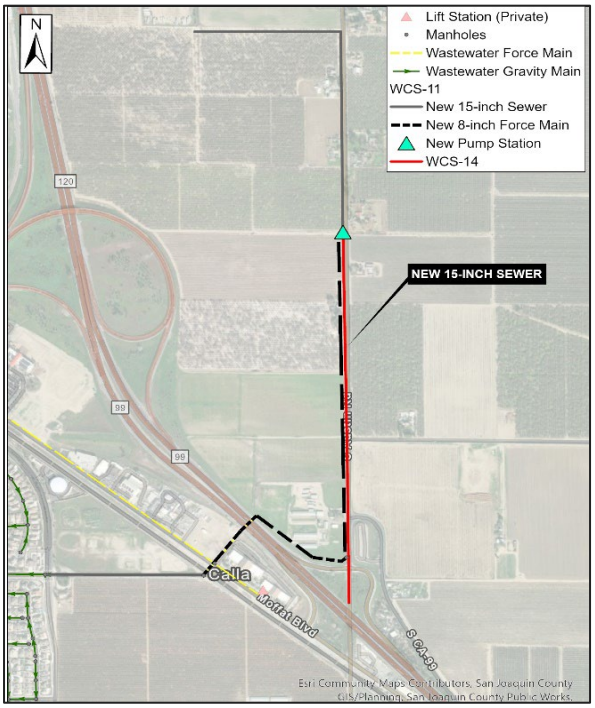

CIP Description:

1 New 15-inch sewer to be constructed.
2 Tie into pump station to expand Yosemite Square service area.
3 New 15-inch sewer at standard slope = 0.0015 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC6_10	BOSSMH49	BOSSMH48	722	8.3	15	$ 603	$ 435,753
BOC6_11	BOSSMH47	12	2,132	12.5	15	$ 710	$ 1,514,541
BOC6_9	BOSSMH48	BOSSMH47	722	10.3	15	$ 639	$ 461,457
		Total Length:	3,576			**Base Construction Costs:**	**$ 2,412,000**
						Construction Estimating Contingency @ 30%	$ 724,000
						Total Construction Costs:	**$ 3,136,000**
						Engineering, CM, and Admin @ 35%	$ 1,098,000
						Total Project Costs:	**$ 4,240,000**

Project: WCS-15
Name: Yosemite Square Service Area
ENRCCI: 13,176 (March 2023)

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CIP Budgetary Cost Estimate
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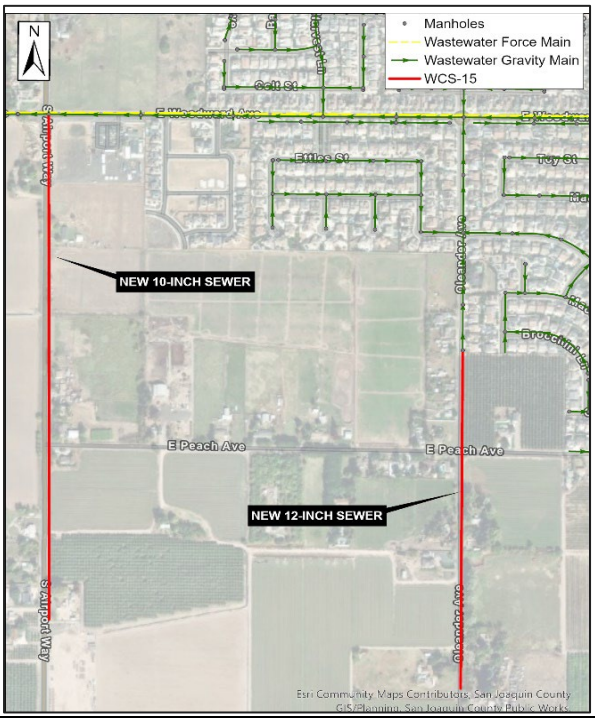

CIP Description:

1 New 10- and 12-inch sewers to be constructed.
2 New 10-inch sewer in Airport Way and extension of 12-inch sewer in Oleander Avenue.
3 Sewers to be constructed at standard slopes.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC20_1	BOSSMH21	BOSSMH56	561	12.0	10	$ 624	$ 350,025
BOC20_2	BOSSMH56	BOSSMH57	561	10.9	10	$ 551	$ 308,976
BOC20_3	BOSSMH57	BOSSMH58	561	12.1	10	$ 624	$ 350,025
BOC20_4	BOSSMH58	BOSSMH59	561	13.5	10	$ 697	$ 391,074
BOC20_5	BOSSMH59	BOSSMH60	561	15.3	10	$ 717	$ 402,168
BOC20_6	BOSSMH60	WWMH4149	561	17.6	10	$ 737	$ 413,263
BOC18_15	77	78	451	17.5	12	$ 737	$ 332,068
BOC18_16	78	79	451	15.2	12	$ 717	$ 323,154
BOC18_17	79	WWMH4922	451	12.6	12	$ 624	$ 281,255
BOC18_2	BOSSMH19	25	451	13.6	12	$ 697	$ 314,239
BOC18_3	25	77	451	16.6	12	$ 727	$ 327,611
		Total Length:	5,617		**Base Construction Costs:**		**$ 3,794,000**
					Construction Estimating Contingency @ 30%		$ 1,138,000
					Total Construction Costs:		**$ 4,932,000**
					Engineering, CM, and Admin @ 35%		$ 1,726,000
					Total Project Costs:		**$ 6,660,000**

Project: WCS-16
Name: Highway 99 Crossing At Northland Road
ENRCCI: 13,176 (March 2023)

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CIP Budgetary Cost Estimate
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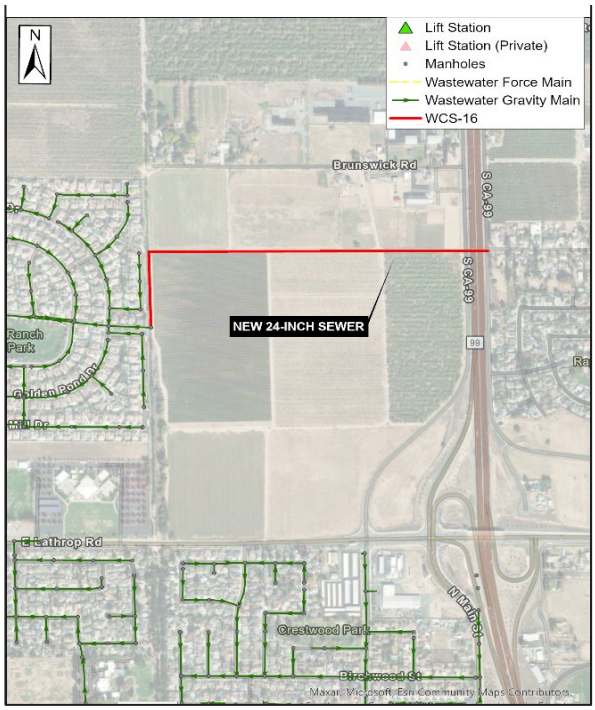

CIP Description:

1 New 24-inch sewer to be constructed.
2 Upstream end includes highway crossing, downstream end to tie into existing 36-inch sewer.
3 24-inch sewer slope = 0.0011 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_10	9	BOSSMH108	662	25.6	24	$ 1,537	$ 1,017,578
2_15	BOSSMH020	6	184	25.0	24	$ 1,454	$ 268,004
2_7	6	7	662	25.2	24	$ 1,496	$ 990,282
2_8	7	8	662	25.5	24	$ 1,496	$ 990,282
2_9	8	9	662	25.9	24	$ 1,537	$ 1,017,578
BOC25	BOSSMH108	WWMH3470	682	25.3	24	$ 1,496	$ 1,019,541
		Total Length:	3,515			**Base Construction Costs:**	**$ 5,303,000**
						Construction Estimating Contingency @ 30%	$ 1,591,000
						Total Construction Costs:	**$ 6,894,000**
						Engineering, CM, and Admin @ 35%	$ 2,413,000
						Total Project Costs:	**$ 9,310,000**

Project: WCS-17
Name: East Lathrop Road Trunk
ENRCCI: 13,176 (March 2023)

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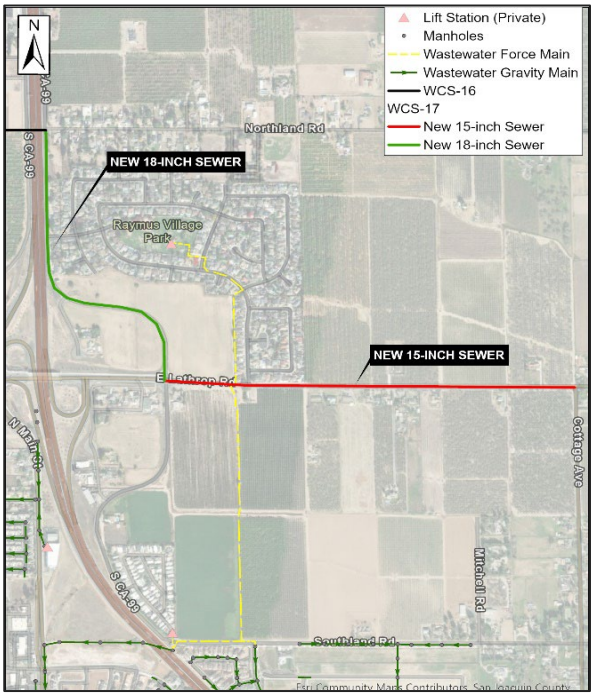

CIP Description:

1 New 18- and 15-inch sewers to be constructed.
2 Tie into new 24-inch sewer downstream (WCS-16).

3 New 18- and 15-inch sewer slope = 0.0015 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
10	18	19	366	21.5	18	$ 1,024	$ 375,175
11	19	BOSSMH020	1,098	23.3	18	$ 1,073	$ 1,178,417
14	11	34	457	22.0	15	$ 891	$ 407,718
3_2	23	BOMH00012	796	20.6	15	$ 871	$ 693,378
3_4	34	35	457	19.2	15	$ 858	$ 392,397
3_5	35	36	457	18.2	15	$ 845	$ 386,579
3_6	36	37	457	17.9	15	$ 832	$ 380,761
3_7	37	38	457	17.9	15	$ 832	$ 380,761
3_8	38	39	457	19.0	15	$ 858	$ 392,397
3_9	39	23	457	21.2	15	$ 891	$ 407,718
4	BOMH00012	13	397	19.4	18	$ 984	$ 390,919
5	13	14	205	20.4	18	$ 999	$ 204,842
6	14	15	193	20.6	18	$ 999	$ 192,729
7	15	16	208	20.7	18	$ 999	$ 207,531
8_1	16	21	353	20.8	18	$ 999	$ 352,769
8_3	21	22	180	20.9	18	$ 999	$ 180,060
8_4	22	17	159	21.0	18	$ 1,024	$ 162,805
9	17	18	178	21.1	18	$ 1,024	$ 182,168
		Total Length:	7,336		**Base Construction Costs:**		**$ 6,869,000**
					Construction Estimating Contingency @ 30%		$ 2,061,000
					Total Construction Costs:		**$ 8,930,000**
					Engineering, CM, and Admin @ 35%		$ 3,126,000
					Total Project Costs:		**$12,060,000**

Project: WCS-18
Name: Northland Road Trunk
ENRCCI: 13,176 (March 2023)

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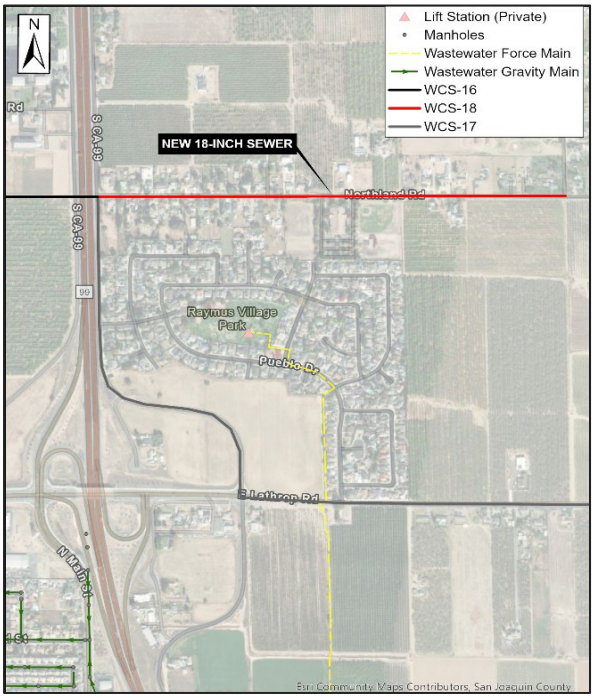

CIP Description:

1 New 18-inch sewer to be constructed.
2 Tie into new 24-inch sewer downstream (WCS-16) with drop manhole (~ 5 ft) to reduce sewer depth.
3 New 18-inch sewer slope = 0.0012 ft/ft.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_1	BOSSMH89	1	662	20.7	18	$ 999	$ 661,644
2_13	5	BOSSMH020	478	20.5	18	$ 999	$ 477,505
2_2	1	2	662	20.6	18	$ 999	$ 661,644
2_3	2	3	662	21.9	18	$ 1,024	$ 678,021
2_4	3	4	662	21.3	18	$ 1,024	$ 678,021
2_5	4	5	662	17.0	18	$ 937	$ 620,467
		Total Length:	3,789			**Base Construction Costs:**	**$ 3,777,000**
						Construction Estimating Contingency @ 30%	$ 1,133,000
						Total Construction Costs:	**$ 4,910,000**
						Engineering, CM, and Admin @ 35%	$ 1,719,000
						Total Project Costs:	**$ 6,630,000**

Project: WCS-19
Name: Northland Road Branches
ENRCCI: 13,176 (March 2023)

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Wastewater Master Plan
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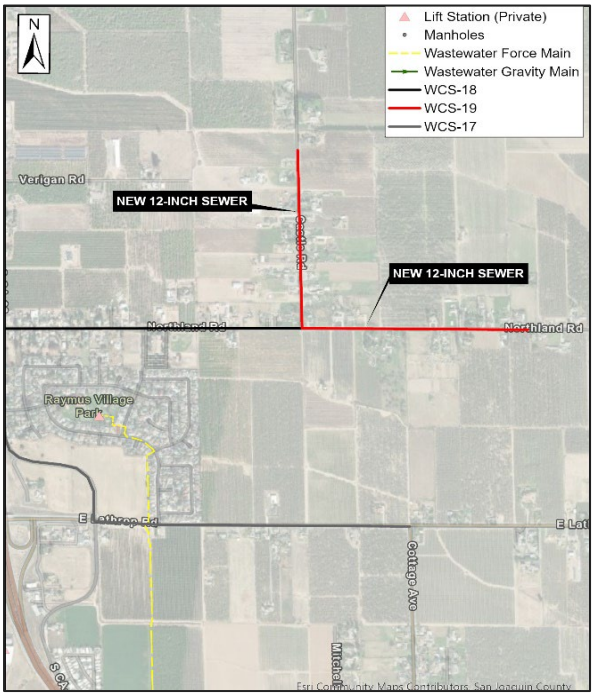

CIP Description:

1 New 12-inch sewers to be constructed.
2 Tie into new 18-inch sewer at downstream (WCS-18).
3 12-inch sewers at standard slopes (0.002 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC18_10	BOSSMH169	BOSSMH170	476	12.5	12	$ 624	$ 297,390
BOC18_11	BOSSMH170	BOSSMH171	476	13.6	12	$ 697	$ 332,265
BOC18_12	BOSSMH171	BOSSMH172	476	14.8	12	$ 707	$ 336,978
BOC18_13	BOSSMH172	BOSSMH173	476	16.1	12	$ 727	$ 346,404
BOC18_14	BOSSMH173	BOSSMH89	476	17.9	12	$ 737	$ 351,117
BOC18_9	BOSSMH168	BOSSMH169	476	12.2	12	$ 624	$ 297,389
BOC19_7	BOSSMH178	BOSSMH177	479	11.5	12	$ 588	$ 281,612
BOC19_8	BOSSMH177	BOSSMH89	1,917	15.4	12	$ 717	$ 1,374,998
		Total Length:	5,255			**Base Construction Costs:**	**$ 3,618,000**
						Construction Estimating Contingency @ 30%	$ 1,085,000
						Total Construction Costs:	**$ 4,703,000**
						Engineering, CM, and Admin @ 35%	$ 1,646,000
						Total Project Costs:	**$ 6,350,000**

Project: WCS-20
Name: Louise/ Nehemiah Branches
ENRCCI: 13,176 (March 2023)

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Wastewater Master Plan
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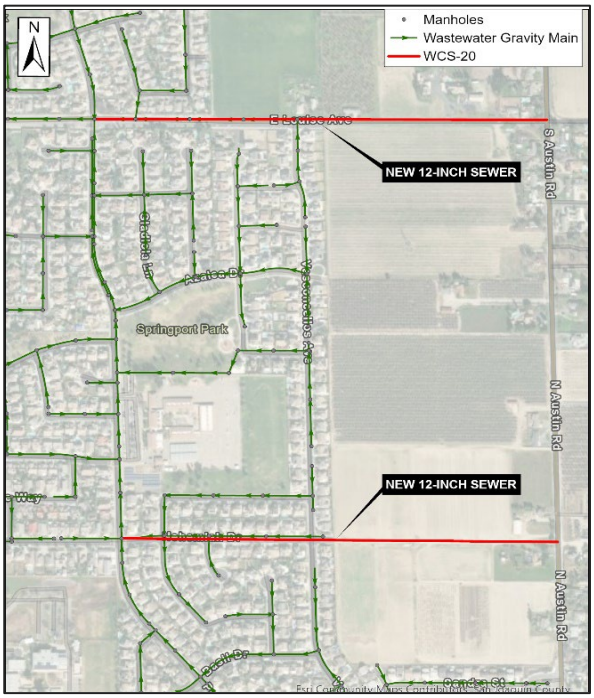

CIP Description:

1 New 12-inch sewers to be constructed.
2 Tie into existing 18-inch sewer in Louise Avenue and Nehemiah Drive at Pestana Avenue.
3 New 12-inch sewers at standard slopes (0.002 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_31	BOSSMH99	53	535	13.7	12	$ 697	$ 372,885
2_32	53	54	535	11.7	12	$ 588	$ 314,176
2_33	54	55	535	11.9	12	$ 588	$ 314,176
2_34	55	56	535	11.6	12	$ 588	$ 314,176
2_35	56	WWMH2114	535	10.4	12	$ 551	$ 294,606
BOC3_2	BOSSMH3	WWMH1430	2,579	10.0	12	$ 514	$ 1,326,509
		Total Length:	5,252			**Base Construction Costs:**	**$ 2,937,000**
						Construction Estimating Contingency @ 30%	$ 881,000
						Total Construction Costs:	**$ 3,818,000**
						Engineering, CM, and Admin @ 35%	$ 1,336,000
						Total Project Costs:	**$ 5,160,000**

Project: WCS-21
Name: South Union Road Extension
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
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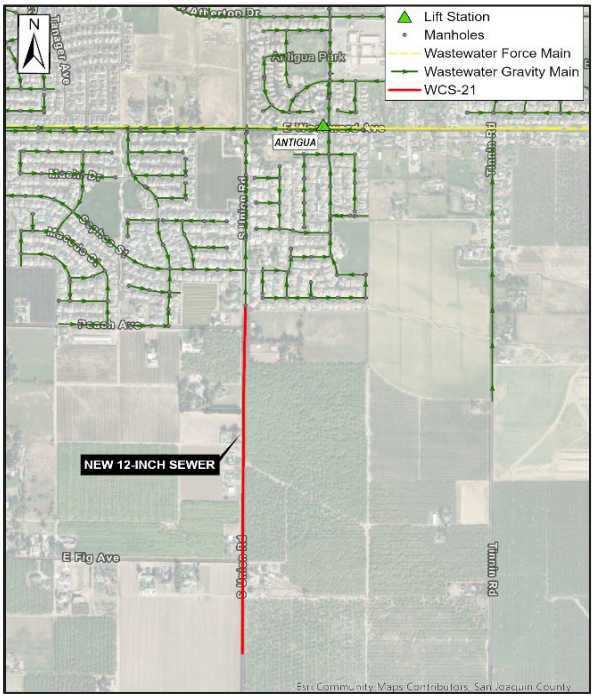

CIP Description:

1 New 12-inch sewer to be constructed.
2 Tie into existing sewer in South Union Road to extend sewer south.
3 New 12-inch sewer at standard slope (0.002 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
15_2	BOSSMH20	27	475	9.7	12	$ 514	$ 244,293
15_3	27	28	475	12.8	12	$ 624	$ 296,440
15_4	28	74	475	14.3	12	$ 707	$ 335,903
15_5	74	75	475	13.6	12	$ 697	$ 331,205
15_6	75	76	475	13.3	12	$ 661	$ 313,823
15_7	76	26	475	13.6	12	$ 697	$ 331,205
BOC17_1	26	WWMH4954	1,090	13.6	12	$ 697	$ 760,054
		Total Length:	3,939			**Base Construction Costs:**	**$ 2,613,000**
						Construction Estimating Contingency @ 30%	$ 784,000
						Total Construction Costs:	**$ 3,397,000**
						Engineering, CM, and Admin @ 35%	$ 1,189,000
						Total Project Costs:	**$ 4,590,000**

Project: WCS-22
Name: Cottage Avenue
ENRCCI: 13,176 (March 2023)

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
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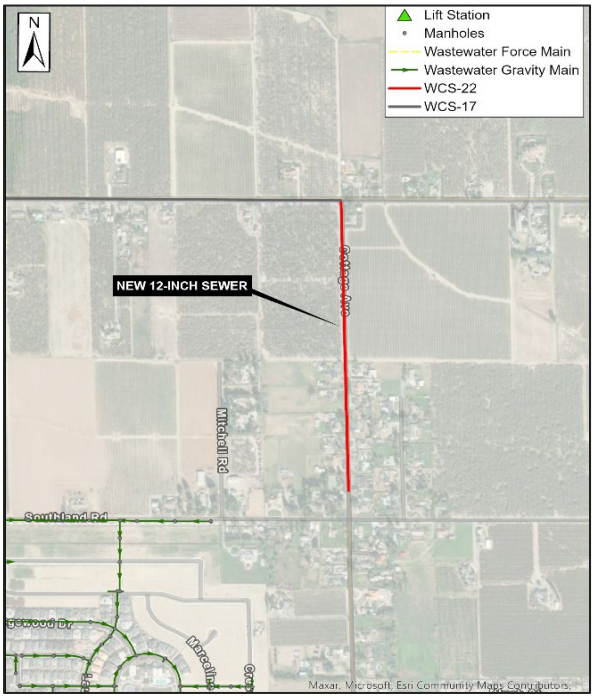

CIP Description:

1 New 12-inch sewer to be constructed.
2 Ties into new 15-inch sewer in East Lathrop Road (WCS-17).
3 New 12-inch sewer at standard slope (0.002 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
2_21	BOMH00029	30	482	13.0	12	$ 661	$ 318,278
2_22	30	BOMH00031	482	13.7	12	$ 697	$ 335,907
2_23	BOMH00031	32	482	15.3	12	$ 717	$ 345,437
2_24	32	33	482	18.9	12	$ 747	$ 359,731
2_25	33	11	482	22.3	12	$ 818	$ 394,036
		Total Length:	2,408			**Base Construction Costs:**	**$ 1,753,000**
						Construction Estimating Contingency @ 30%	$ 526,000
						Total Construction Costs:	**$ 2,279,000**
						Engineering, CM, and Admin @ 35%	$ 798,000
						Total Project Costs:	**$ 3,080,000**

Project: WCS-23
Name: North Shed Union Road Trunk
ENRCCI: 13,176 (March 2023)

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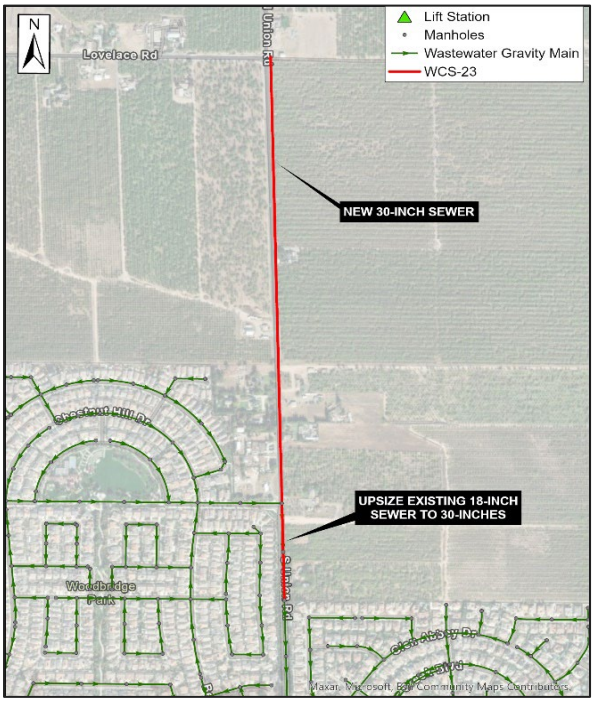

CIP Description:

1 New 30-inch sewer to be constructed.
2 Existing 18-inch sewer in North Union Road to be upsized to 30-inches.
3 New 30-inch sewer slope = 0.0006 ft/ft or greater.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_13	BOSSMH18	BOSSMH205	469	20.7	30	$ 1,533	$ 719,386
BOC4_14	BOSSMH205	BOSSMH206	469	20.6	30	$ 1,533	$ 719,511
BOC4_15	BOSSMH206	BOSSMH207	469	21.3	30	$ 1,567	$ 735,294
BOC4_16	BOSSMH207	BOSSMH208	469	22.1	30	$ 1,601	$ 751,079
BOC4_17	BOSSMH208	BOSSMH209	469	22.9	30	$ 1,601	$ 751,077
BOC4_18	BOSSMH209	BOSSMH210	469	23.4	30	$ 1,634	$ 766,861
BOC4_19	BOSSMH210	BOSSMH211	469	23.6	30	$ 1,634	$ 766,860
BOC4_20	BOSSMH211	BOSSMH212	469	23.7	30	$ 1,634	$ 766,861
BOC4_21	BOSSMH212	WWMH3784_	100	23.6	30	$ 1,634	$ 164,252
BOC4_21.5	WWMH3784_	BOSSMH213	369	23.7	30	$ 1,634	$ 602,608
BOC4_22	BOSSMH213	WWMH3782	469	21.6	30	$ 1,567	$ 735,426
		Total Length:	4,692			**Base Construction Costs:**	**$ 7,479,000**
						Construction Estimating Contingency @ 30%	$ 2,244,000
						Total Construction Costs:	**$ 9,723,000**
						Engineering, CM, and Admin @ 35%	$ 3,403,000
						Total Project Costs:	**$13,130,000**

Project: WCS-24
Name: Manteca Junction Trunk
ENRCCI: 13,176 (March 2023)

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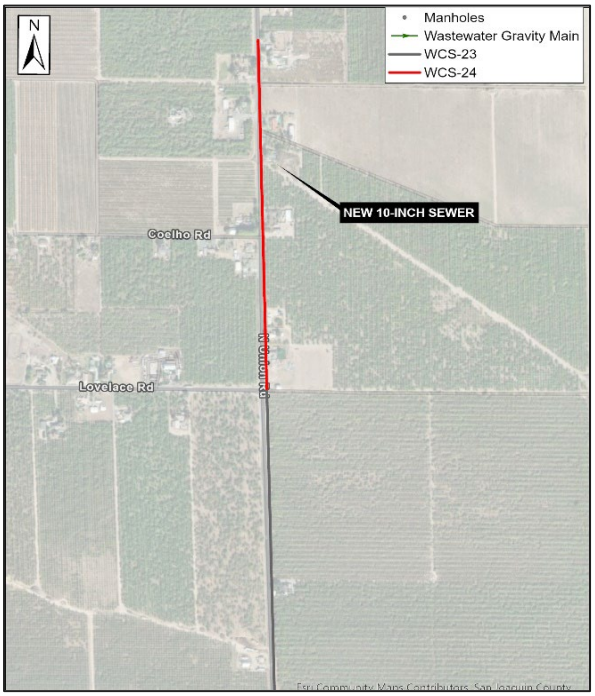

CIP Description:

1 New 10-inch sewer to be constructed.
2 New 10-inch sewer to tie into new 30-inch sewer (WCS-23).
3 New 10-inch sewer at standard slope (0.0025 ft/ft).

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC4_2	BOSSMH4	BOSSMH214	501	12.2	10	$ 624	$ 312,961
BOC4_23	BOSSMH214	BOSSMH215	501	13.7	10	$ 697	$ 349,703
BOC4_24	BOSSMH215	BOSSMH216	501	14.8	10	$ 707	$ 354,662
BOC4_25	BOSSMH216	BOSSMH217	501	15.8	10	$ 717	$ 359,623
BOC4_26	BOSSMH217	BOSSMH218	501	16.9	10	$ 727	$ 364,583
BOC4_27	BOSSMH218	BOSSMH18	501	19.2	10	$ 757	$ 379,506
		Total Length:	3,008			**Base Construction Costs:**	**$ 2,121,000**
						Construction Estimating Contingency @ 30%	$ 636,000
						Total Construction Costs:	**$ 2,757,000**
						Engineering, CM, and Admin @ 35%	$ 965,000
						Total Project Costs:	**$ 3,730,000**

Project: WCS-25
Name: Lovelace Road - 99 Crossing
ENRCCI: 13,176 (March 2023)

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CIP Budgetary Cost Estimate
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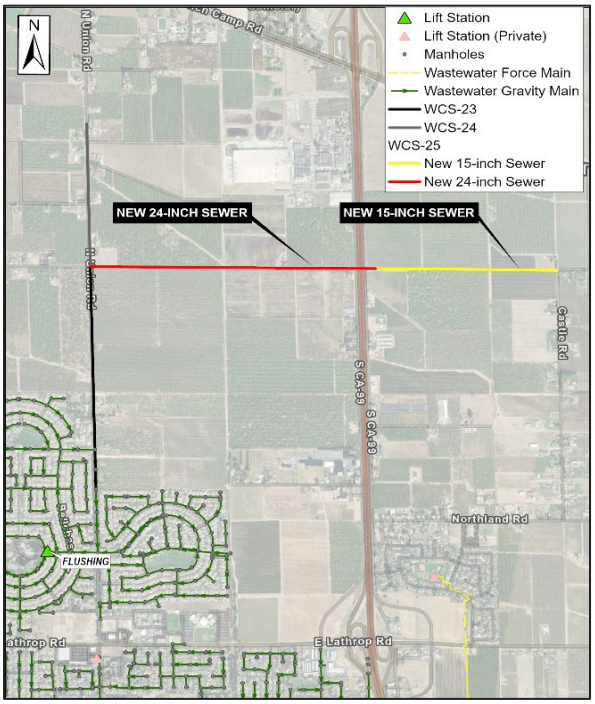

CIP Description:

1 New 24- and 15-inch sewers to be constructed.
2 New 24-inch sewer slope = 0.0008 ft/ft, New 15-inch sewer slope = 0.0015 ft/ft.
3 New 24-inch highway crossing along alignment.

Pipeline ID	Upstream Manhole	Downstream Manhole	Total Length (LF)	Average Depth (ft)	Pipe Size (in)	Unit Cost ($/LF)	Pipe Segment Cost
BOC17_10	BOSSMH192	BOSSMH193	471	21.1	24	$ 1,328	$ 625,246
BOC17_11	BOSSMH193	BOSSMH194	471	20.4	24	$ 1,296	$ 610,337
BOC17_12	BOSSMH194	BOSSMH195	471	19.6	24	$ 1,273	$ 599,355
BOC17_13	BOSSMH195	BOSSMH196	471	19.2	24	$ 1,273	$ 599,355
BOC17_14	BOSSMH196	BOSSMH197	471	19.0	24	$ 1,273	$ 599,355
BOC17_15	BOSSMH197	BOSSMH198	471	19.2	24	$ 1,273	$ 599,355
BOC17_16	BOSSMH198	BOSSMH199	471	19.6	24	$ 1,273	$ 599,355
BOC17_17	BOSSMH199	BOSSMH200	471	19.6	24	$ 1,273	$ 599,355
BOC17_18	BOSSMH200	BOSSMH201	471	19.6	24	$ 1,273	$ 599,354
BOC17_19	BOSSMH201	BOSSMH18	471	20.3	24	$ 1,296	$ 610,337
BOC17_6	BOSSMH87	BOSSMH189	471	19.2	15	$ 858	$ 404,007
BOC17_7	BOSSMH189	BOSSMH190	471	20.3	15	$ 871	$ 409,998
BOC17_8	BOSSMH190	BOSSMH191	471	21.2	24	$ 1,328	$ 625,245
BOC17_9	BOSSMH191	BOSSMH192	471	21.4	24	$ 1,328	$ 625,248
BOC20_10	BOSSMH186	BOSSMH187	444	17.1	15	$ 832	$ 369,563
BOC20_11	BOSSMH187	BOSSMH188	444	17.8	15	$ 832	$ 369,563
BOC20_12	BOSSMH188	BOSSMH87	444	18.5	15	$ 845	$ 375,209
BOC20_7	BOSSMH88	BOSSMH184	444	15.2	15	$ 807	$ 358,269
BOC20_8	BOSSMH184	BOSSMH185	444	16.1	15	$ 820	$ 363,916
BOC20_9	BOSSMH185	BOSSMH186	444	16.7	15	$ 820	$ 363,916
		Total Length:	9,257			**Base Construction Costs:**	**$10,306,000**
						Construction Estimating Contingency @ 30%	$ 3,092,000
						Total Construction Costs:	**$13,398,000**
						Engineering, CM, and Admin @ 35%	$ 4,689,000
						Total Project Costs:	**$18,090,000**

Project: WQCF-1
Name: North and South Plant WAS Pump Replacement Project
ENRCCI: 13,176 (March 2023)

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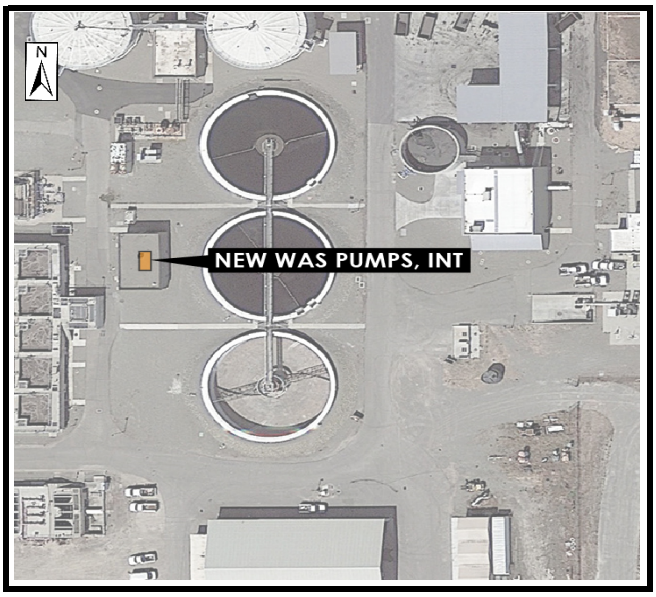

CIP Description:

1 Replace the waste activated sludge (WAS) pumps in both the Northside and Southside Plants

Total Construction Costs:	**$**	**2,094,000**
Engineering, Construction Management and Administration (35%)	$	733,000
Total Project Costs:	**$**	**2,827,000**

(1) Construction costs obtained from the bids received for the City of Manteca North and South Plant WAS Pump Replacement Project. Since these costs were obtained from an actual bid, a construction contingency was not included.

Project: WQCF-2
Name: South Plant RAS Pump Replacement Project
ENRCCI: 13,176 (March 2023)

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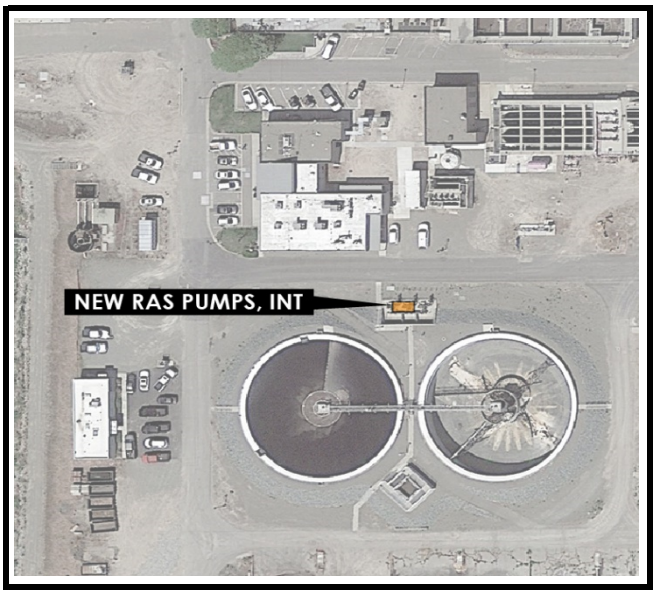

CIP Description:

1 Replace the Return Activated Sludge (RAS) pumps in the Southside Plant.

Total Construction Costs:	**$**	**1,224,000**
Engineering, Construction Management and Administration (35%)	$	428,000
Total Project Costs:	**$**	**1,652,000**

(1) Construction costs obtained from the bids received for the City of Manteca South Plant RAS Pump Replacement Project. Since these costs were obtained from an actual bid, a construction contingency was not included.

Project: WQCF-3
Name: North and South Plant Aeration Basins Improvements
ENRCCI: 13,176 (March 2023)

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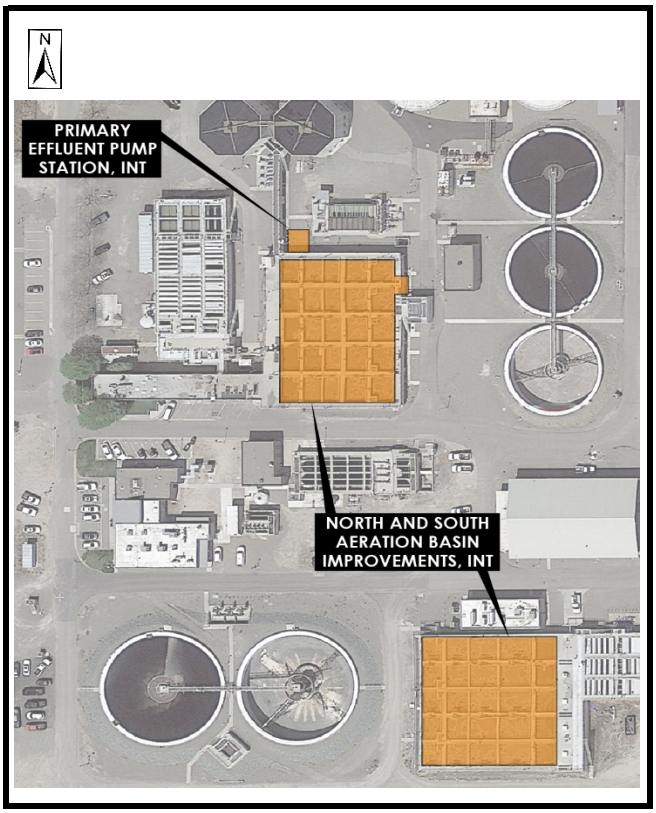

CIP Description:

1 Northside Plant Improvements:
- -Increase the volume of the aeration basins 22 percent by raising the water depth and reconfiguring the biological treatment zones so the first and fourth zones are anoxic.
- -Remove cyclic aeration in the second zone.
- -Install a new Internal Recycle Pump Station (IRPS).
- -Install a new Primary Effluent Pump Station (PEPS).
- -Modify the existing Influent Channel to accommodate a two-train operation to replace the existing five parallel trains.

2 Southside Plant Improvements:
- -Reconfigure the biological treatment zones so the first and fourth zones are anoxic.
- -Remove cyclic aeration in the second zone.
- -Install a new Internal Recycle Pump Station (IRPS).

Total Construction Costs:	**$**	**8,664,000**
Engineering, Construction Management and Administration (35%)	$	3,032,000
Total Project Costs:	**$**	**11,696,000**

(1) Construction costs obtained from the City of Manteca WQCF Capacity Improvements 50% Basis of Design Report (Pace, August 2023). Construction contingency was assumed to be included and therefore was not added here.

Project: WQCF-4
Name: Sidestream Treatment System
ENRCCI: 13,176 (March 2023)

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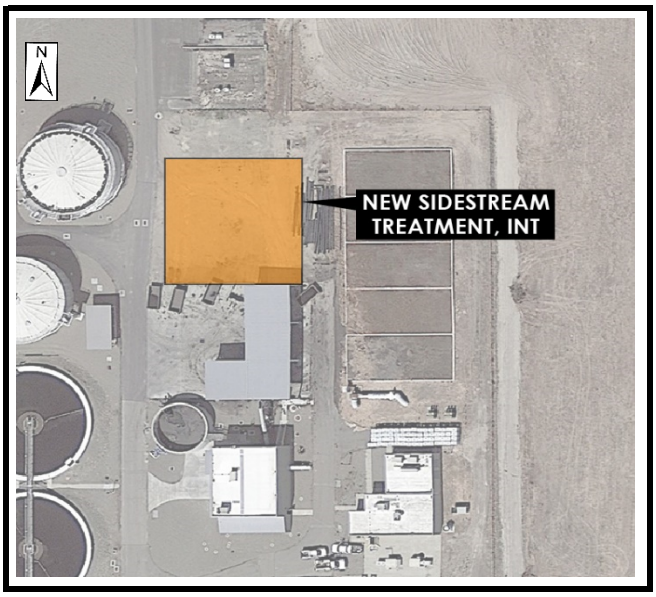

CIP Description:

1 Add sidestream treatment for sludge dewatering return flows.

Base Construction Costs:	**$**	**11,513,000**
Estimating Contingency (30%)	$	3,454,000
Total Construction Costs:	**$**	**14,967,000**
Engineering, Construction Management and Administration (35%)	$	5,238,000
Total Project Costs:	**$**	**20,205,000**

(1) Costs escalated from WQCF 2021 Capacity Assessment.

Project: WQCF-5
Name: Add Centrifuge No. 3
ENRCCI: 13,176 (March 2023)

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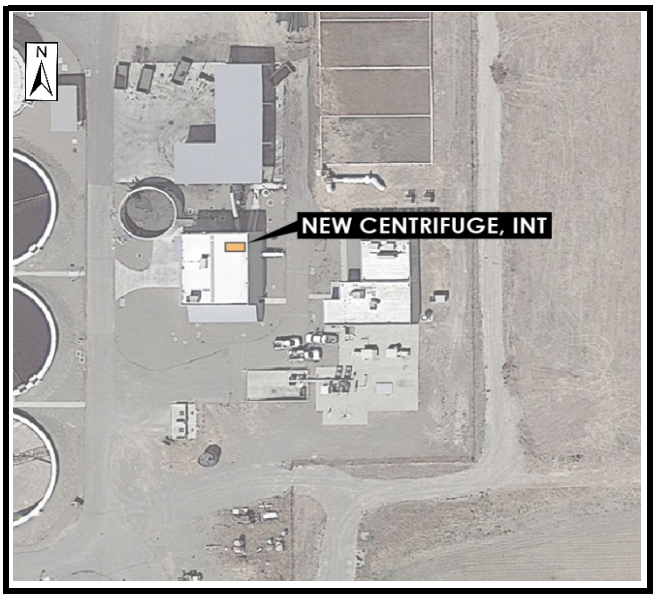

CIP Description:

1 Add a third centrifuge, new sludge feed pump, and new polymer blending unit.

Base Construction Costs:	**$**	**2,923,000**
Estimating Contingency (30%)	$	877,000
Total Construction Costs:	**$**	**3,800,000**
Engineering, Construction Management and Administration (35%)	$	1,330,000
Total Project Costs:	**$**	**5,130,000**

(1) Costs escalated from WQCF 2021 Capacity Assessment.

Project: WQCF-6
Name: Add DAFT No. 3
ENRCCI: 13,176 (March 2023)

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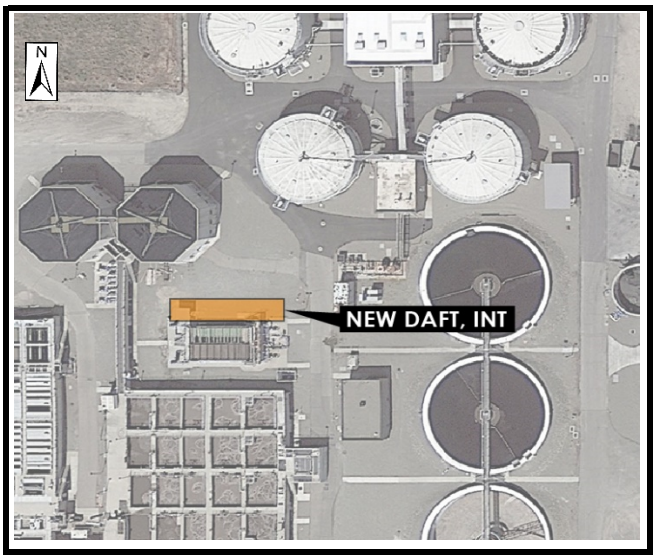

CIP Description:

1 Add DAFT No. 3.

Base Construction Costs:	**$**	**2,239,000**
Estimating Contingency (30%)	$	672,000
Total Construction Costs:	**$**	**2,911,000**
Engineering, Construction Management and Administration (35%)	$	1,019,000
Total Project Costs:	**$**	**3,930,000**

(1) Costs escalated from WQCF 2021 Capacity Assessment.

Project: WQCF-7
Name: Core Supervisory Control and Data Acquisition (SCADA) System
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 Provide new core SCADA server and network system migrating to Ignition SCADA HMI software.

Base Construction Costs:	**$**	**642,000**
Estimating Contingency (30%)	$	193,000
Total Construction Costs:	**$**	**835,000**
Engineering, Construction Management and Administration (35%)	$	292,000
Total Project Costs:	**$**	**1,127,000**

(1) Costs escalated from the report, City of Manteca WQCF SCADA Master Plan – Technology Drive Solutions for Safe and Reliable Water Quality (Carollo Engineers, Inc., April 2020).

Project: WQCF-8
Name: Remote Site Process Logic Controller (PLC) Upgrades
ENRCCI: 13,176 (March 2023)

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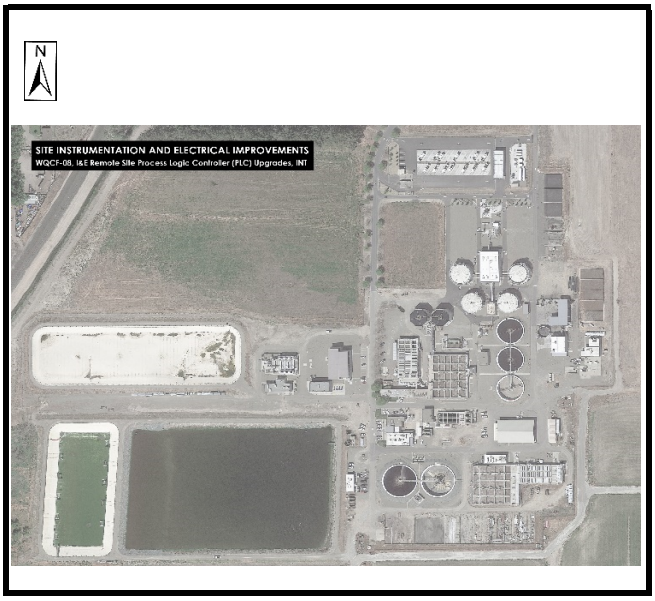

CIP Description:

1 Provide remote site PLC upgrades for sewer and stormwater lift stations.

Base Construction Costs:	**$**	**984,000**
Estimating Contingency (30%)	$	295,000
Total Construction Costs:	**$**	**1,279,000**
Engineering, Construction Management and Administration (35%)	$	448,000
Total Project Costs:	**$**	**1,727,000**

(1) Costs escalated from the report, City of Manteca WQCF SCADA Master Plan – Technology Drive Solutions for Safe and Reliable Water Quality (Carollo Engineers, Inc., April 2020).

Project: WQCF-9
Name: Process Logic Controller (PLC) and Operator Interfaced Terminal (OIT) Replacement
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 Replace existing WQCF legacy PLC systems and associated network hardware as well as the operator interfaced terminals (OITs).

Base Construction Costs:	**$**	**783,000**
Estimating Contingency (30%)	$	235,000
Total Construction Costs:	**$**	**1,018,000**
Engineering, Construction Management and Administration (35%)	$	356,000
Total Project Costs:	**$**	**1,374,000**

(1) Costs escalated from the report, City of Manteca WQCF SCADA Master Plan – Technology Drive Solutions for Safe and Reliable Water Quality (Carollo Engineers, Inc., April 2020).

Project: WQCF-10
Name: Switchgear PLC Upgrades
ENRCCI: 13,176 (March 2023)

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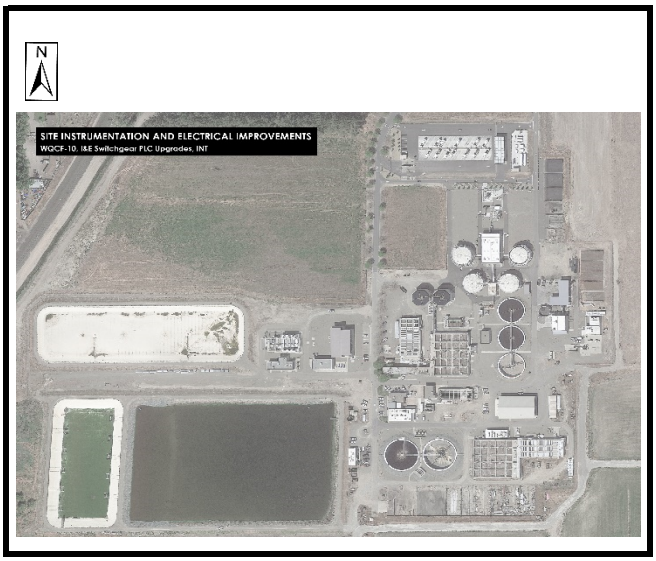

CIP Description:

1 Upgrade switchgear and power systems PLCs to latest supported model.

Base Construction Costs:	**$**	**72,000**
Estimating Contingency (30%)	$	22,000
Total Construction Costs:	**$**	**94,000**
Engineering, Construction Management and Administration (35%)	$	33,000
Total Project Costs:	**$**	**127,000**

(1) Costs escalated from the report, City of Manteca WQCF SCADA Master Plan – Technology Drive Solutions for Safe and Reliable Water Quality (Carollo Engineers, Inc., April 2020).

Project: WQCF-11
Name: Add Influent Pump No. 5
ENRCCI: 13,176 (March 2023)

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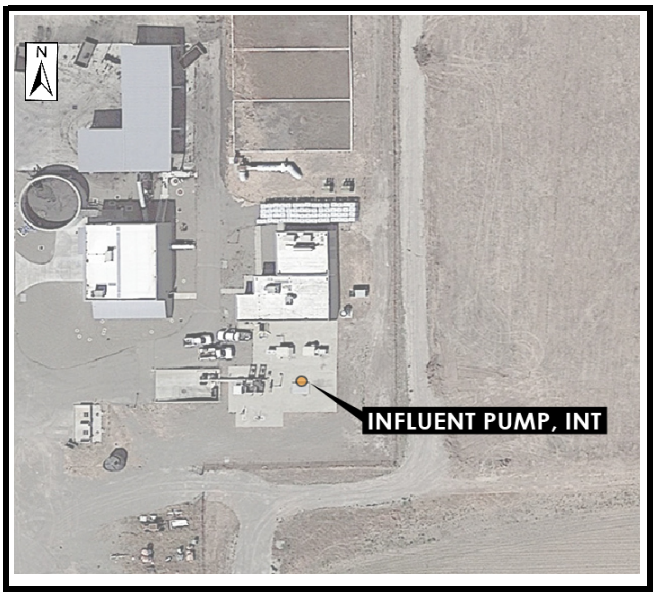

CIP Description:

1 Add Influent Pump No. 5 in the Influent Pump Station.

Base Construction Costs:	**$**	**597,000**
Estimating Contingency (30%)	$	179,000
Total Construction Costs:	**$**	**776,000**
Engineering, Construction Management and Administration (35%)	$	272,000
Total Project Costs:	**$**	**1,048,000**

Project: WQCF-12
Name: Lightweight Covers for Process Basins
ENRCCI: 13,176 (March 2023)

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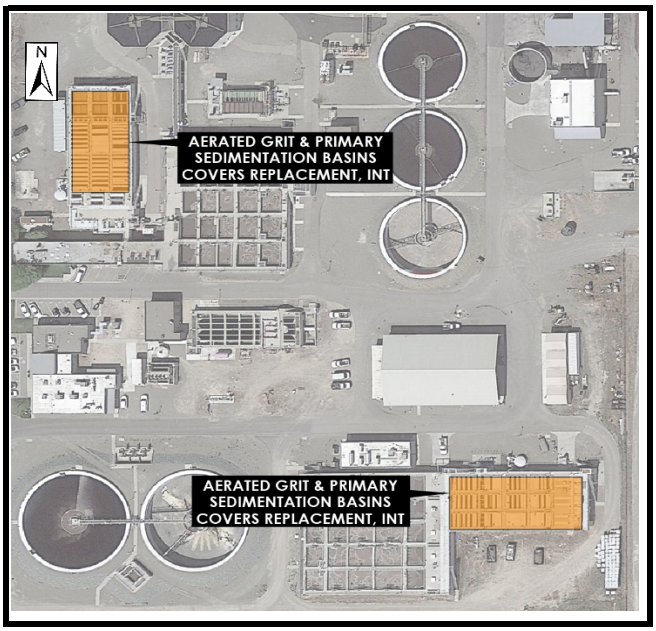

CIP Description:

1 Add lightweight covers for the aerated grit tanks, primary sedimentation basins, and chlorine contact tank.

Base Construction Costs:	**$**	**3,300,000**
Estimating Contingency (30%)	$	990,000
Total Construction Costs:	**$**	**4,290,000**
Engineering, Construction Management and Administration (35%)	$	1,502,000
Total Project Costs:	**$**	**5,792,000**

Project: WQCF-13
Name: Headworks, IPS and Biofilter Improvements
ENRCCI: 13,176 (March 2023)

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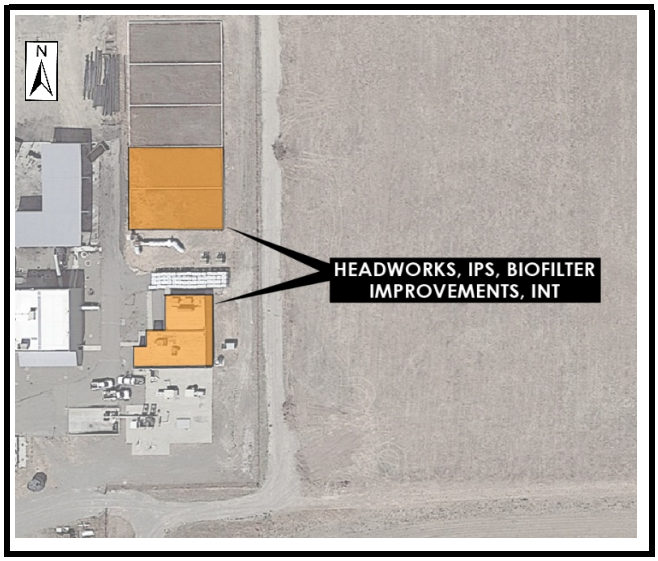

CIP Description:

1 Provide a new ventilation where foul air from the junction structure, covered channels and room air will be exhausted to the biofilter for treatment.
2 Ventilate the operating space at 5,500 cfm (12 air changes per hour) to the upgraded biofilter for treatment.
3 Replace existing exhaust ductwork in the Influent Junction Structure, Screen Room and Wet Well. Provide a new exhaust ductwork system for the operating space. All ductwork should be provided with air balancing/isolation dampers for all pickup points.
4 Replace existing odor control fan with a spark and corrosion resistant, FRP unit
5 Replace lava rock media in the biofilter with inorganic media provided by Biorem©, ECS or equivalent
6 The biofilter media cells (2 total) should be provided with a cover system
7 Reconfigure the exhaust duct from the odor control fan downstream of the existing grease/particulate filter. Specifically, the ductwork should be routed above grade to feed the two biofilter cells that will be refurbished and provided with an accessible balancing isolation damper.

Base Construction Costs:	**$**	**1,185,000**
Estimating Contingency (30%)	$	356,000
Total Construction Costs:	**$**	**1,541,000**
Engineering, Construction Management and Administration (35%)	$	539,000
Total Project Costs:	**$**	**2,080,000**

(1) Cost escalated from the technical memo, Manteca WQCF Biofilter Evaluation (HERWIT and Stantec, February 2015).

Project: WQCF-14
Name: UV Disinfection System Upgrade
ENRCCI: 13,176 (March 2023)

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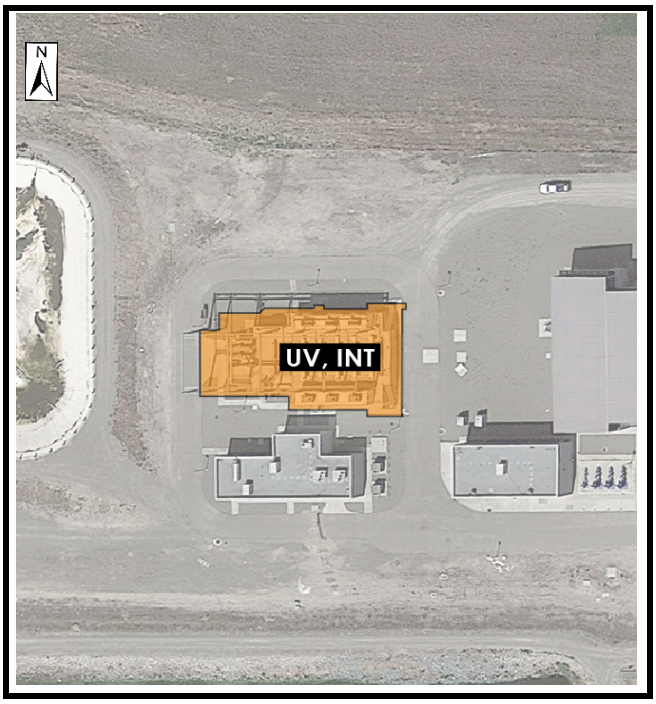

CIP Description:

1 Split the two existing channels into four channels
2 Increase the depth of the existing channels
3 Install the Duron 8 equipment
4 Replace the existing shipping containers and the enclosures inside them with freestanding Type 4X stainless steel ballast enclosures each with a side mounted AC unit for internal cooling.
5 Construct a wall on the south side to block sun exposure to the ballast panels.

Base Construction Costs:	**$**	**8,879,000**
Estimating Contingency (30%)	$	2,664,000
Total Construction Costs:	**$**	**11,543,000**
Engineering, Construction Management and Administration (35%)	$	4,040,000
Total Project Costs:	**$**	**15,583,000**

Project: WQCF-15
Name: Plant Water System Piping Modifications
ENRCCI: 13,176 (March 2023)

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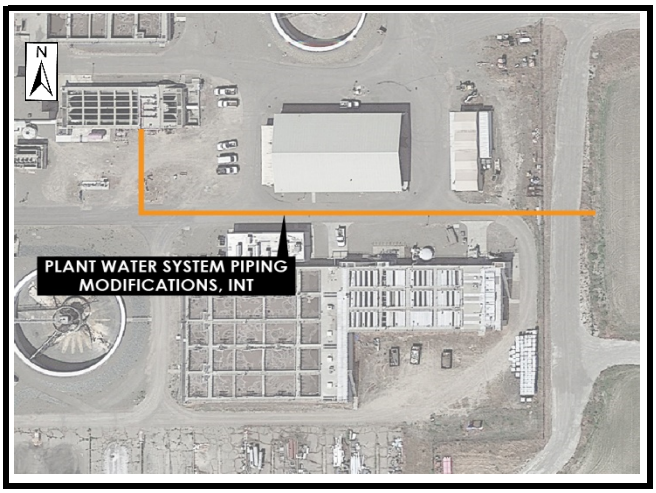

CIP Description:

1 Separate the in-plant water system piping from the pipeline going off site by installing a forcemain to connect the effluent pumps to the forcemain going to Great Wolf Lodge.

Base Construction Costs:	**$**	**362,000**
Estimating Contingency (30%)	$	109,000
Total Construction Costs:	**$**	**471,000**
Engineering, Construction Management and Administration (35%)	$	165,000
Total Project Costs:	**$**	**636,000**

Project: WQCF-16
Name: Replace Secondary Effluent Equalization Pond Liner
ENRCCI: 13,176 (March 2023)

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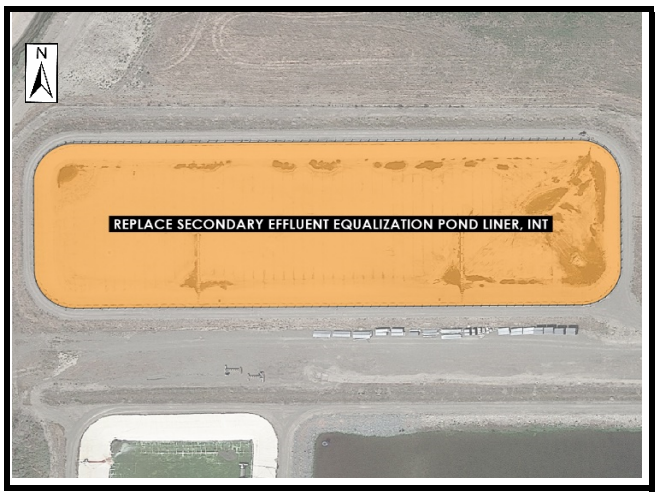

CIP Description:

1 Replace the Secondary Effluent Equalization Pond Liner

Base Construction Costs:	**$**	**1,197,000**
Estimating Contingency (30%)	$	359,000
Total Construction Costs:	**$**	**1,556,000**
Engineering, Construction Management and Administration (35%)	$	545,000
Total Project Costs:	**$**	**2,101,000**

Project: WQCF-17
Name: Headworks Screen No. 3
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 Replace Headworks Screen No. 3.

Base Construction Costs:	**$**	**513,000**
Estimating Contingency (30%)	$	154,000
Total Construction Costs:	**$**	**667,000**
Engineering, Construction Management and Administration (35%)	$	233,000
Total Project Costs:	**$**	**900,000**

(1) Cost obtained from the recent project, WQCF Bar Screen Project, which was started up in October 2022.

Project: WQCF-18
Name: FOG Receiving Station Screening System
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 Replace the FOG Receiving Station Screening System

Base Construction Costs:	**$**	**114,000**
Estimating Contingency (30%)	$	34,000
Total Construction Costs:	**$**	**148,000**
Engineering, Construction Management and Administration (35%)	$	52,000
Total Project Costs:	**$**	**200,000**

Project: WQCF-19
Name: Bulk Ferric Chloride Solution Tanks
ENRCCI: 13,176 (March 2023)

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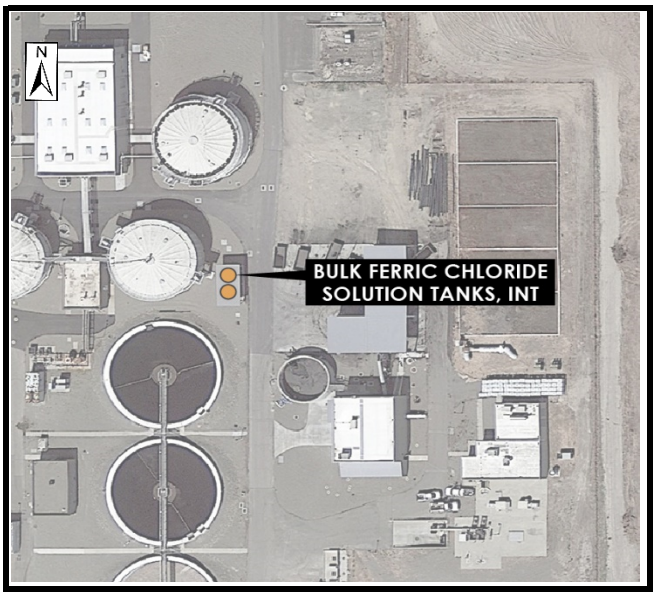

CIP Description:

1 Replace the two 1,500-gallon chemical tanks with two 2,700-gallon chemical tanks

Base Construction Costs:	**$**	**200,000**
Estimating Contingency (30%)	$	60,000
Total Construction Costs:	**$**	**260,000**
Engineering, Construction Management and Administration (35%)	$	91,000
Total Project Costs:	**$**	**351,000**

Project: WQCF-20
Name: Digesters No. 1 and 2 Overflow Boxes
ENRCCI: 13,176 (March 2023)

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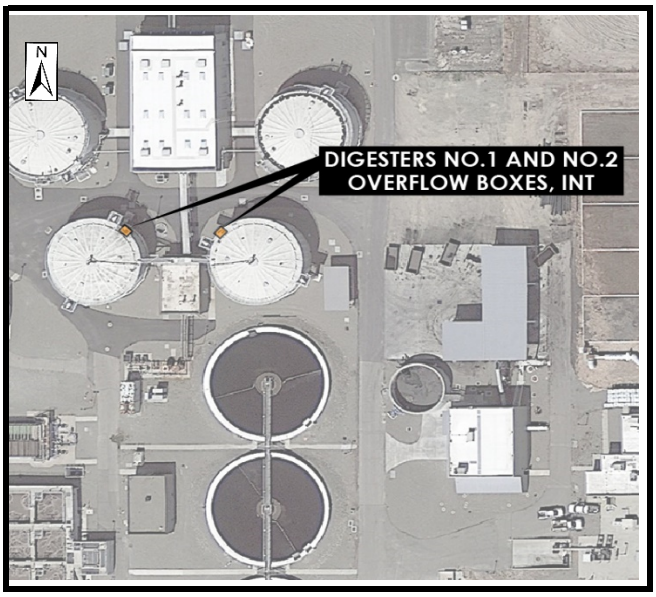

CIP Description:

1 Construct new overflow boxes and piping for Digesters No. 1 and 2

Base Construction Costs:	**$**	**402,000**
Estimating Contingency (30%)	$	121,000
Total Construction Costs:	**$**	**523,000**
Engineering, Construction Management and Administration (35%)	$	183,000
Total Project Costs:	**$**	**706,000**

Project: WQCF-21
Name: Digester Pressure Relief Valves Platform & Handrailing
ENRCCI: 13,176 (March 2023)

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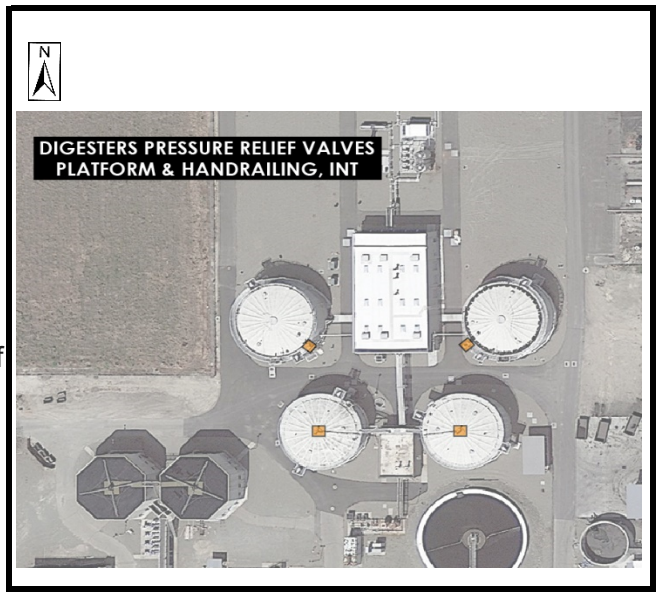

CIP Description:

1 Provide platform and handrail for gas pressure relief valves at all digesters

Base Construction Costs:	**$**	**117,000**
Estimating Contingency (30%)	$	35,000
Total Construction Costs:	**$**	**152,000**
Engineering, Construction Management and Administration (35%)	$	53,000
Total Project Costs:	**$**	**205,000**

Project: WQCF-22
Name: Install New Waste Heat Radiator
ENRCCI: 13,176 (March 2023)

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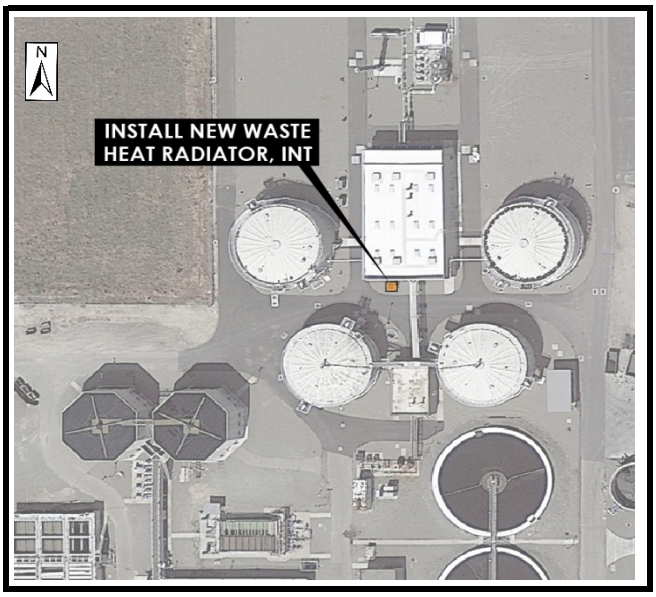

CIP Description:

1 Install new (larger) waste heat radiator.

Base Construction Costs:	**$**	**113,000**
Estimating Contingency (30%)	$	34,000
Total Construction Costs:	**$**	**147,000**
Engineering, Construction Management and Administration (35%)	$	51,000
Total Project Costs:	**$**	**198,000**

Project: WQCF-23
Name: WQCF Phase IV Stage 1 Expansion Project
ENRCCI: 13,176 (March 2023)

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CIP Description:

1 Install two new flow meters upstream of the return of the in-plant recycle streams (one on both the north and south sanitary sewer trunks)
2 Install Influent Pump No. 6
3 Construct 2 new aerated grit tanks
4 Construct 2 new Primary Sedimentation Basins
5 Convert Southside aeration basin zone B to an anoxic zone and increase the aerobic volume by extending the Southside aeration basins to the west about 20 ft.
6 Construct Splitter Structure
7 Add Fine Screen No. 1 and 2
8 Add 2 MBR trains and 4 membrane tanks
9 Construct MBR Blower Building and install blowers
10 Modify Effluent Pump Station and install Effluent Pump No. 3
11 Construct Cooling Effluent Basin
12 Complete a new River Temperature Study and depending on the outcomes of the study, construct Effluent Cooling Towers No. 1 through 4
13 Construct Cooling Basin Effluent Pump Station and install Cooling Basin Effluent Pumps No. 1 through 3
14 Add DAFT No. 4
15 Demolish the Biotowers and Biotower Pump
16 Add Anaerobic Digester No. 5
17 Expand the Digester Control Building and add new sludge pump, hot water pump with a 3-way valve, and grinder.
18 Replace existing centrifuge with larger centrifuge
19 Construct a Municipal Utilities Building as well as an asphalt paved parking lot and automated road access gates on the entrance road
20 Construct biosolids drying facilities

Description	Project Cost
Influent Flow Meter	$896,000
Influent Pump	$597,000
Aerated Grit Tanks at Southside Plant	$1,055,000
Primary Sedimentation Basins at Southside Plant	$4,611,000
Extend Aeration Basins at Southside Plant	$936,000
Splitter Structure	$468,000
Fine Screens for MBRs	$2,802,000
Membrane Bioreactors (MBRs) Structure & Equipment	$15,399,000
MBR Blower Building and Equipment	$1,878,000
Effluent Pump Station Expansion & Pumps	$806,000
Cooling Effluent Basin	$2,013,000
Effluent Cooling Towers	$11,835,000
Cooling Basin Effluent Pump Station	$2,658,000
DAFTs	$2,240,000
Biotower Demolition	$500,000
Anaerobic Digester	$2,660,000
Digester Control Building Extension & Equipment	$1,095,000
Centrifuge and Ancillary Equipment	$2,923,000
Municipal Utilities Building and Entrance Road	$10,685,000
Biosolids Drying Facilities	$17,308,000
Base Construction Costs:	**$ 83,365,000**
Estimating Contingency (30%)	$ 25,010,000
Total Construction Costs:	**$ 108,375,000**
Engineering, Construction Management and Administration (35%)	$ 37,931,000
Total Project Costs:	**$ 146,306,000**

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60" NORTH INFLUENT FLOW METERING MANHOLE, S1

NEW ACCESS ROAD AT INTERSECTION OF W YOSEMITE & SWANSON RD, S1

ROAD DEMO, S1

PARKING AREA, S1

MUNICIPAL UTILITIES BUILDING, S1

NEW GATES

COOLING TOWERS 1-4, S1

COOLING EFFLUENT BASIN, S1

MCC, S1

BIOSOLIDS DRYING FACILITY, S1

DIGESTER CONTROL BUILDING, S1

DIGESTER, S1

BIO TOWERS DEMO, S1

NEW DAFT, S1

NEW CENTRIFUGE, S1

INFLUENT PUMP, S1

COOLING BASIN EFFLUENT PUMP STATION, S1

EFFLUENT PUMP, S1

CHECK VALVE, S1

SPLITTER STRUCTURE, S1

AERATION BASINS, S1

PSB, S1

AERATED GRIT TANKS, S1

BLOWER AND EQUIPMENT BUILDING, S1

MBR, S1

FINE SCREENS, S1

60" SOUTH INFLUENT FLOW METERING MANHOLE, S1

N

0 80 160 240 320 400 FEET

LEGEND

- Interim Project Completed
- S1 Stage 1 - 12.87 MGD

NOTE:
ONLY NEW INTERIM STRUCTURES ARE SHOWN NOT IMPROVEMENTS TO EXISTING STRUCTURES.

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WQCF-23

WQCF Phase IV Stage 1 Expansion Project

Project: WQCF-24
Name: WQCF Phase IV Stage 2 Expansion Project
ENRCCI: 13,176 (March 2023)

SEE IMAGE ON NEXT SHEET

CITY OF MANTECA

Wastewater Master Plan
CIP Budgetary Cost Estimate
Stantec
November 2023

CIP Description:

1 Install Influent Pump No. 7 and a parallel force main to the Southside plant
2 Construct 2 new aerated grit tanks
3 Construct 2 new Primary Sedimentation Basins
4 Expand Splitter Structure
5 Add Fine Screen No. 3
6 Add 2 MBR trains and 4 membrane tanks
7 Expand MBR Blower Building and install blowers
8 Install Effluent Pump No. 4
9 Construct Effluent Cooling Tower No. 5 (depending on the outcome of the River Temperature Study)
10 Add Anaerobic Digester No. 6
11 Add Cooling Basin Effluent Pump No. 4
12 Add new sludge pump, hot water pump with a 3-way valve, and grinder.
13 Replace existing centrifuge with larger centrifuge
14 Construct biosolids drying facilities

Description	Project Cost
Influent Pump	$989,000
Aerated Grit Tanks at Southside Plant	$1,055,000
Primary Sedimentation Basins at Southside Plant	$4,611,000
Splitter Structure Piping	$63,000
Fine Screen for MBR	$900,000
Membrane Bioreactors (MBRs) Structure & Equipment	$15,399,000
MBR Blower Building and Equipment	$1,878,000
Effluent Pump Station Pump	$582,000
Effluent Cooling Towers	$2,555,000
Cooling Basin Effluent Pump Station Pump	$582,000
Anaerobic Digester	$2,660,000
Digester Control Building Equipment	$255,000
Centrifuge and Ancillary Equipment	$2,923,000
Biosolids Drying Facilities	$5,769,000
Base Construction Costs:	**$ 40,221,000**
Estimating Contingency (30%)	$ 12,066,000
Total Construction Costs:	**$ 52,287,000**
Engineering, Construction Management and Administration (35%)	$ 18,300,000
Total Project Costs:	**$ 70,587,000**

Stantec

COOLING TOWER 5, S2

BIOSOLIDS DRYING FACILITY, S2

NEW GATES

DIGESTER, S2

COOLING BASIN EFFLUENT PUMP 4, S2

NEW CENTRIFUGE, S2

INFLUENT PUMP, S2

EFFLUENT PUMP, S2

PSB, S2

AERATED GRIT TANKS, S2

FINE SCREENS, S2

BLOWER AND EQUIPMENT BUILDING, S2

MBR, S2

N

0 80 160 240 320 400 FEET

LEGEND

- Interim Project Completed
- Stage 1 - 12.87 MGD Completed
- S2 Stage 2 - 17.5 MGD

NOTE:
ONLY NEW INTERIM AND STAGE 1 STRUCTURES ARE SHOWN NOT IMPROVEMENTS TO EXISTING STRUCTURES.

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WQCF-24

WQCF Phase IV Stage 2 Expansion Project