

AIM NORMAN

Area & Infrastructure Master Plan

Wastewater Utility

Baseline Development Technical Memorandum

City of Norman
Norman, Oklahoma



Prepared by:



In Partnership with:



DRAFT
April 2024

Garver Project No.: 22W02320
Norman Project No.: WW0179



Table of Contents

Table of Contents2

List of Figures2

List of Tables3

List of Maps3

List of Appendices3

List of Acronyms4

1.0 Introduction5

 1.1 Wastewater System Overview5

 1.2 Operations and Management5

 1.3 Related Documents7

 1.4 Historical Data Collection7

2.0 Wastewater Service Area7

 2.1 Land Use8

3.0 Historical Population and Wastewater Flow8

 3.1 Historical Wastewater Service Population8

 3.2 Historical Water Reclamation Facility Flows9

 3.3 Per Capita Wastewater Flows12

 3.4 Single-Family Equivalents12

 3.5 Wastewater Flows by Land Use13

4.0 Flow Metering Data Analysis14

5.0 Wastewater Flow Projections23

6.0 Wastewater System Evaluation Criteria24

 6.1 Wastewater Treatment Evaluations and Planning25

7.0 Future Work26

List of Figures

Figure 3.1: Historical Influent Flows to WRF for January 2015 to January 202410

Figure 3.2: Historical Minimum Monthly Average (left) and Annual Average (right) Influent Flows to WRF by year for 2015–202311





Figure 3.3: Historical Monthly Rainfall July 2002 to February 202411

Figure 3.4: Historical Single Family Detached Loading Rates by Lot Size14

Figure 4.1: Flow Meter Schematic16

Figure 4.2: Example Dry-Weather Diurnal Patterns17

Figure 4.3: Example RDII Flow20

Figure 4.4: 5-Year Storm Peaking Factors and Peak Flow Calibration Errors22

Figure 5.1: Projected Wastewater Flows24

List of Tables

Table 1.1: Related Documents7

Table 3.1: Historical Wastewater Service Population Estimates9

Table 3.2: Historic ADF Per Capita12

Table 3.3: Single-Family Equivalent Projection13

Table 3.4: Historical Loading Rates by Customer Class13

Table 3.5: Single Family Detached Historical and Projected Loading Rates by Lot Size14

Table 4.1: Dry-Weather Flows18

Table 4.2: Wet-Weather Events19

Table 4.3: Design Storm Rain Volume20

Table 4.4: Temporary Flow Meters Wet-Weather Flows21

Table 4.5: Basin Peaking Factor Summary for 2-Year, 5-Year, and 10-Year Design Storms22

Table 4.6: Permanent Flow Meters Wet-Weather Flows23

Table 5.1: Projected Wastewater Flows24

Table 6.1: Wastewater System Evaluation Criteria25

List of Maps

Map 1.1: Wastewater System Overview Map6

Map 2.1: Wastewater Service Area Overview8

Map 4.1: Flow Monitoring Basin Map15

List of Appendices

- Appendix A: Flow Meter and Rain Gauge Site Sheets
- Appendix B: Flow Monitoring Hydrographs



List of Acronyms

ADF	average daily flows
ADWF	average dry weather flows
AIM Norman	Area & Infrastructure Master Plan
CIP	Capital Improvement Plan
City	City of Norman
DMR	discharge monitoring reports
GARR	gauge-adjusted radar rainfall
gpcd	gallons per capita per day
IPR	indirect potable reuse
MGD	million gallons per day
MOR	monthly operating reports
NOAA	National Oceanic and Atmospheric Administration
NUA	Norman Utilities Authority
OAC	Oklahoma Administrative Code
ODEQ	Oklahoma Department of Environmental Quality
OPDES	Oklahoma Pollutant Discharge Elimination System
OU	University of Oklahoma
RDII	rainfall-derived infiltration and inflow
SFE	single-family equivalent
TM	technical memorandum
WEF	Water Environment Federation
WRF	Water Reclamation Facility
WWSA	wastewater service area

1.0 Introduction

The City of Norman (City) and the Norman Utilities Authority (NUA) are developing an Area & Infrastructure Master Plan (AIM Norman) that will cover a wide spectrum of city planning aspects including land use, transportation, stormwater management, water infrastructure, wastewater infrastructure, parks, and housing. The AIM Norman effort includes updates to related master plans for the City's infrastructure including transportation, stormwater, water, and wastewater. This technical memorandum (TM) is the first in a series of TMs that will be incorporated into the Wastewater Master Plan Report. The purpose of this TM is to establish a baseline for upcoming wastewater system evaluations that will be used to identify future capital improvements. This TM will cover the following:

- Summary of previous wastewater planning documents
- Analysis of recent wastewater collection system flow monitoring data
- Analysis of historical wastewater flows
- Projections of future wastewater flows

1.1 Wastewater System Overview

The NUA wastewater system serves the urban area within the city limits. The wastewater system includes two primary components:

- Wastewater Collection System – The gravity sewers, lift stations, and force mains that collect sewage from each customer and convey it to the treatment facility.
- Water Reclamation Facility (WRF) – The treatment facility that treats sewage received from the collection system and returns highly-treated water to the Canadian River.

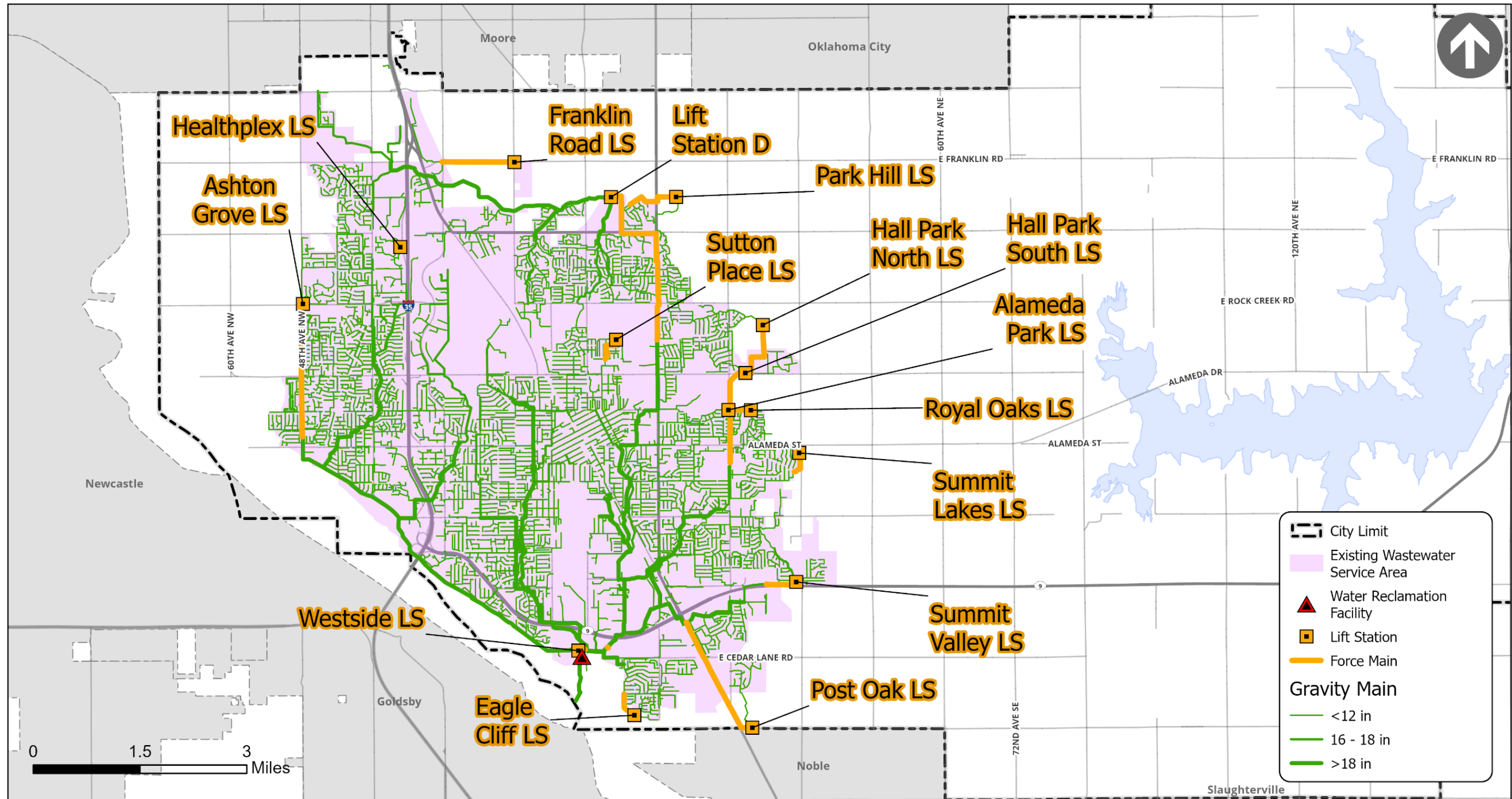
NUA's current wastewater service area (WWSA) extends from 48th Avenue West to 36th Avenue East as shown below in Map 1.1.

1.2 Operations and Management

The NUA is a public trust that oversees policy and financial authorizations as they relate to City-managed utilities. The elected mayor and City Council members also serve as the Board of Trustees for NUA. Three of the Norman Utilities Department Divisions administer and operate the water utility: Administration & Engineering, Water Treatment, and Line Maintenance. The Utilities Department has adopted the following Mission Statement:

Providing environmentally sound, efficient utility service to our customers in a professional, safe manner at sustainable rates through six divisions.

Map 1.1: Wastewater System Overview Map





1.3 Related Documents

Table 1.1 summarizes the previous work by others that used in this baseline development. The reference names listed in the table are used throughout this report to refer to each document.

Table 1.1: Related Documents			
Document	Author/Agency	Date	Reference Name
Wastewater Systems Master Plan	CDM Smith	2001	2001 WWMP
WRF Phase II Improvements Engineering Report	Garver, Carollo	2011	WRF Phase 2 ER
Wastewater Flow Monitoring & Modeling Report	HDR	2013	2013 WW Modeling Report
Wastewater Flow Monitoring & Modeling Report	HDR	2018	2018 WW Modeling Report
North Water Reclamation Facility Engineering Report	HDR	2018	2018 North WRF ER
AIM Norman Area & Infrastructure Master Plan - Norman Today	RDG	2024	Norman Today

1.4 Historical Data Collection

The following data was provided by NUA for use in the creation of this baseline development:

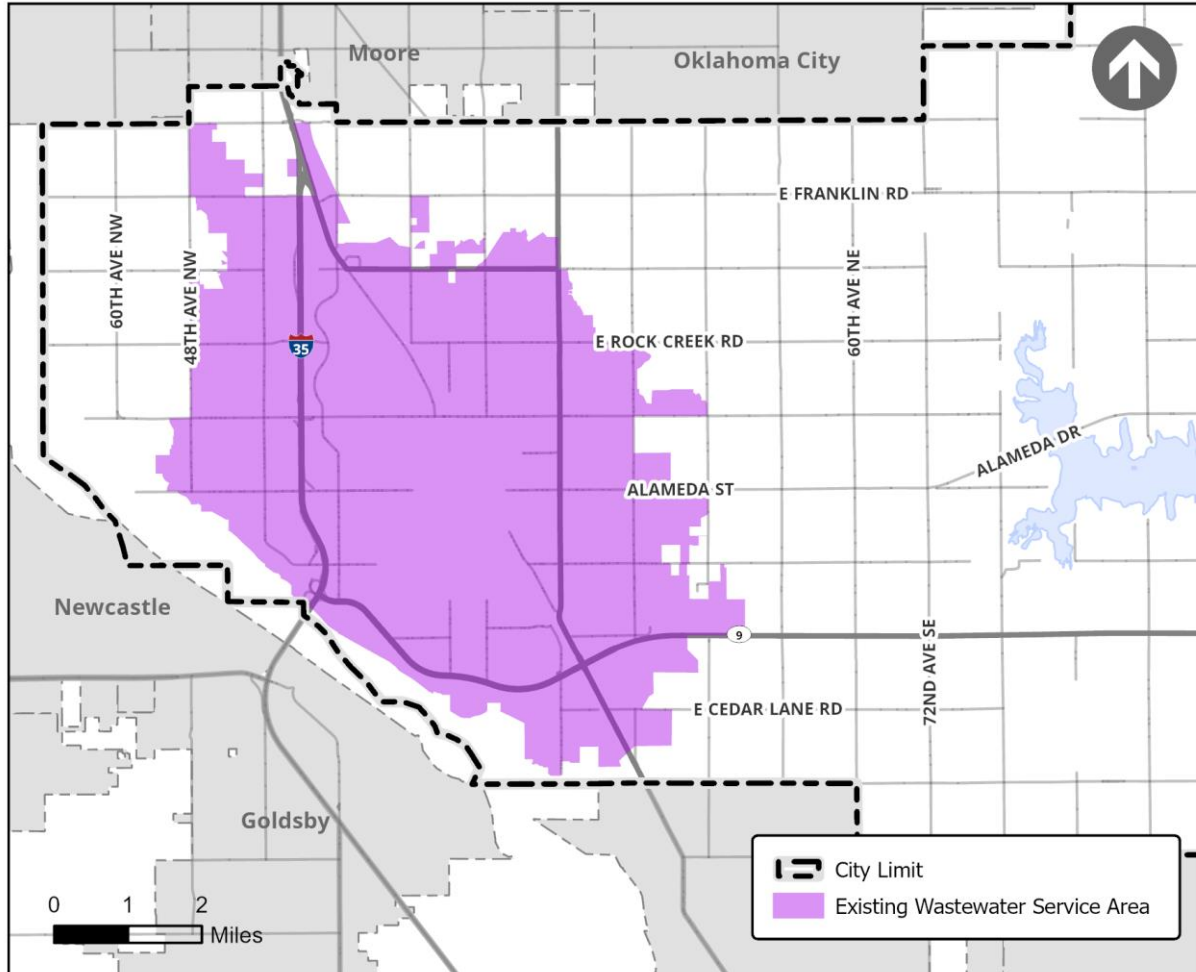
- WRF monthly operating reports (MOR) (2015–January 2024)
- Discharge monitoring reports (DMR) (2021–2023)
- GIS files with wastewater infrastructure information
- Rain and flow metering data from April 2023 to August 2023

2.0 Wastewater Service Area

The existing NUA wastewater collection system serves the urban portion of the area within the city limits. Slightly less than 90% of the City's population resides within the WWSA. Residents outside the WWSA boundary are served by private septic systems. The WWSA is illustrated in Map 2.1. The current boundary extends from 48th Avenue West to 36th Avenue East as shown below. Future WWSA expansion will be based on future urban expansion related to future land use and will be discussed further in the *Norman Tomorrow: Vision & Future Land Use* report.



Map 2.1: Wastewater Service Area Overview



2.1 Land Use

Existing land use for the purpose of this report was derived from the Norman Today report and was used to predict future development loading rates based on land use classification and historical billing data. Future land use is being developed as part of the *Norman Tomorrow: Vision & Future Land Use* report and will be discussed in a future TM.

3.0 Historical Population and Wastewater Flow

3.1 Historical Wastewater Service Population

Historically, the water service population has been approximately 88% of the City's total population. As discussed in the *Water Utility Baseline Development Technical Memorandum*, previous population projections have been



based on the assumption that the NUA service population will be about 90% of the City's total population by 2025. Based on recent GIS data, approximately 450 properties with water connections do not have connections to the City's wastewater collection system. The majority of these properties are residential. Assuming an average of 2.3 persons per household per the 2020 US Census, the wastewater system currently serves approximately 1,000 fewer people than the water system, which is equivalent to nearly 1% less of the City's total population. For the purposes of this analysis, Garver will use a historical wastewater service population of 87% of the City's total population, which will be assumed to increase to 89% of the City's total population by 2025. The historical estimated WWSA service population is summarized in Table 3.1.

Table 3.1: Historical Wastewater Service Population Estimates

Year	Service Population	Percent of Total City Population
2015	104,042	87%
2016	105,426	87%
2017	106,810	87%
2018	108,194	87%
2019	109,579	87%
2020	111,383	87%
2021	111,444	87%
2022	112,775	87%

3.2 Historical Water Reclamation Facility Flows

Figure 3.1 illustrates the historical influent flow to the Norman WRF spanning from January 2015 to January 2024. The figure includes daily data points along with lines representing the annual and monthly averages. Rolling averages are taken on a 30-day (monthly) and a 365-day (annual) basis for the influent flow data. Peaking factors are calculated according to the equation below. Here, the monthly average influent flow is divided by the annual average influent flow at a specific date to calculate the peaking factor. A peaking factor represents a peak month condition when the facility receives maximum flow and potentially maximum contaminant loadings over the course of a consecutive 30-day period. The identified peaking factor(s) can be utilized in establishing the proper maximum month conditions when the facility receives maximum levels of loadings over a month.

$$\text{Peaking Factor (Date)} = \frac{\text{30-day Average Flow (Date)}}{\text{365-day Average Flow (Date)}}$$

Figure 3.2 shows the historical minimum monthly average and the annual average influent flows to the WRF by year for 2015–2023. The minimum monthly flows during dry-weather periods gradually increased over this period, while the annual average has fluctuated due to the variability in storm events.

The data from 2015 indicates a period of elevated flows, with daily rates reaching up to 36 million gallons per day (MGD). However, the subsequent timeframe demonstrates a more consistent flow pattern. May 2015 experienced record rainfall (23.4-inches), leading to exceptionally high flows. While the methodology employed does not allow for an exact calculation of the mid-2015 annual average flow, it is estimated that the peak flow observed in 2015 had a peaking factor of nearly 2. This peak significantly exceeds the peaking factors recorded in subsequent years



and surpasses the typical peaking factors for a municipal treatment facility of comparable size. Figure 3.3 summarizes the historical rainfall from 2002 to 2024 and showcases the level of intensity of the May 2015 rainfall relative to other years.

Between 2016 and January 2024, monthly average peaks fluctuated within an estimated range of 13.0 to 16.6 MGD. Although there has been a slight increase in the annual average flow since 2018, it has remained relatively stable, hovering around 11 to 12 MGD. A peaking factor of 1.4 is recommended to be used for treatment capacity planning purposes within this project. It must be noted that the assessment of the treatment capacity requirement at the existing and potential future Norman WRF(s) will also be considering maximum month contaminant loadings which will be documented in the upcoming Treatment and Reuse TM.

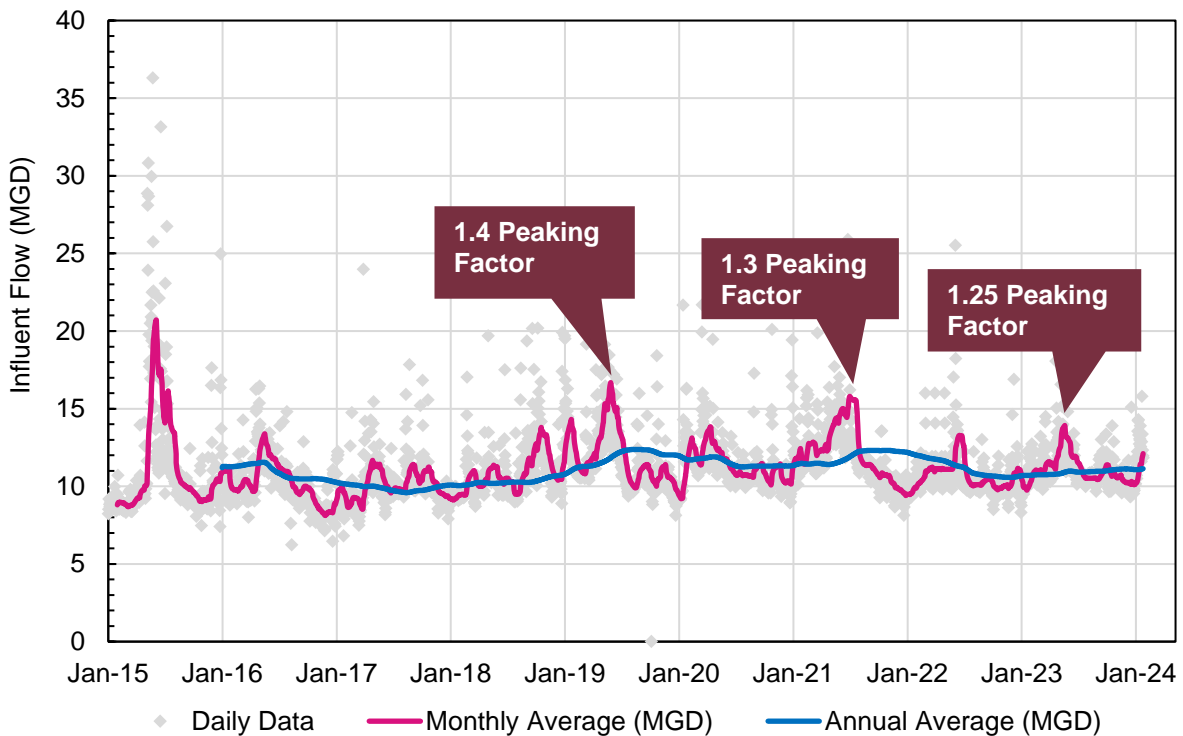


Figure 3.1: Historical Influent Flows to WRF for January 2015 to January 2024

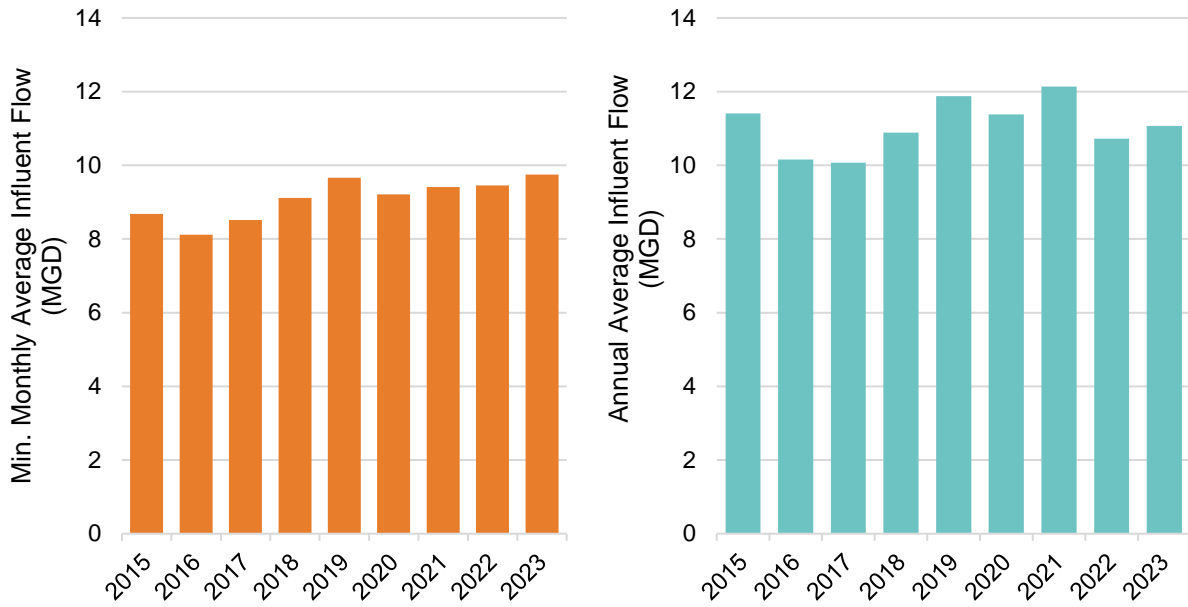


Figure 3.2: Historical Minimum Monthly Average (left) and Annual Average (right) Influent Flows to WRF by year for 2015–2023

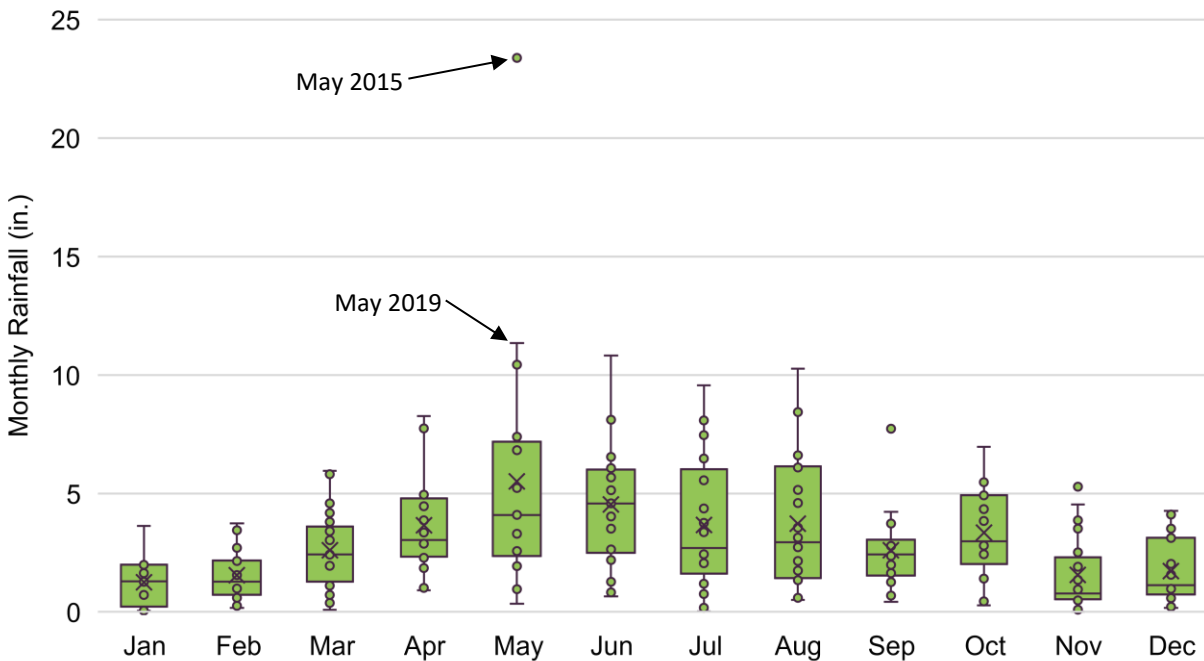


Figure 3.3: Historical Monthly Rainfall July 2002 to February 2024



3.3 Per Capita Wastewater Flows

Garver evaluated per capita average daily flows (ADF) using historical service population data and annual average WRF flows. Table 3.2 summarizes the historical ADF per capita. A value of 100 gallons per capita per day (gpcd) will be used to project future flows based on population projections. This value is slightly higher than recent ADF per capita and aligns with the Oklahoma Department of Environmental Quality (ODEQ) ADF design requirement of 100 gpcd.

Table 3.2: Historic ADF Per Capita

Year	Service Population	ADF (MGD)	ADF Per Capita (gpcd)
2015	104,042	11.20	94
2016	105,426	10.16	84
2017	106,810	10.08	82
2018	108,194	10.88	88
2019	109,579	11.88	94
2020	111,383	11.38	89
2021	111,444	12.16	95
2022	112,775	10.72	83

3.4 Single-Family Equivalent

A single-family equivalent (SFE) value was determined using historical billed water consumption data provided by NUA. SFE values are used to compare water system demands for other customer classes and the system overall to the flows for a typical single-family detached dwelling. Single family residential flows are often used as the benchmark for flow planning because they tend to represent the majority of system flows, and remain more stable over time compared to other benchmarks. Multi-family, industrial, and commercial flows tend to vary significantly, and changes in these types of flows over time can cause variability in a collection system's per capita flows. Once the SFE value is determined, it can be used to express the system capacity as the number of single-family customer connections the collection system can serve currently or in the future.

Garver used historical consumption data to determine the SFE value for the wastewater collection system. The 2022 single-family water demand was determined using the total consumption from November to February for all meters classified as single-family with a diameter of 1-inch or less. The total demand was then divided by the total number of single-family meters within the system. Historically, the winter water demands have been approximately equal to the wastewater ADF. A summary of the data used to determine the SFE value is presented in Table 3.3.



Table 3.3: Single-Family Equivalent Projection

Total Single-Family Winter Water Demand		Number of Meters	ADF SFE Value (gpd/SFE)
(MG)	(MGD)		
828.1	6.9	33,641	205

3.5 Wastewater Flows by Land Use

Garver used historical water consumption data from November 2022 to February 2023 and GIS data to determine historical land use loading rates. A GIS analysis was completed to determine the lot size and the existing land use associated with each geolocated meter by extracting data for the nearest parcel. Table 3.4 summarizes the loading rate by land use category. The projected loading rate values will be used to determine future wastewater flows for new developments, which will be discussed in more detail in the upcoming Collection System Modeling and Evaluation TM. For single-family residential developments, the residential area will be assumed to be about 80% of the total development area for high-density developments and 70% for low-density developments to account for the area of streets, detention ponds, and other open spaces. The actual development area will be used to determine loading rates for the new developments.

Table 3.4: Historical Loading Rates by Customer Class

Customer Class	Customer Sub Class	Winter Water Demand (MG)	Total Area (acre)	Historical Loading Rate (gpd/acre)	Projected Loading Rate (gpd/acre)
Residential	Residential - Multi-Family	2,155	700	2,567	2,600
	Residential - Single Family Attached	621	311	1,664	1,700
	Residential - Single Family Detached	7,576	7,575	833	See Table 3.5
Industrial	Light Industrial	270	293	768	800
	Heavy Industrial	117	94	1,035	1,100
Commercial	Commercial	1,622	1,745	775	800
	Office	870	403	1,802	1,800

Residential users make up a large percentage of users with a majority of residential users being classified as single family detached. Due to the large percentage of single family detached users, further analysis was completed to determine the varied flows based on lot size. An analysis was completed to determine the correlation between lot size and flows to better predict future loading rates for new subdivision developments. Table 3.5 and Figure 3.4 summarize the differences in flows related to differing lot sizes.

Table 3.5: Single Family Detached Historical and Projected Loading Rates by Lot Size

Lot Size (acre)	Winter Water Demand (MG)	Total Area (acre)	Historical Loading (gpd/acre)	Projected Loading Rate (gpd/acre)	Historical Loading (gpd/connection)
<0.14	560	358	1,304	1,300	146
0.15 - 0.25	4,301	3,557	1,008	1,000	173
0.26 - 0.50	2,114	1,925	915	900	243
0.51 - 1.00	331	366	754	800	371
>1.00	270	1,041	216	250	379

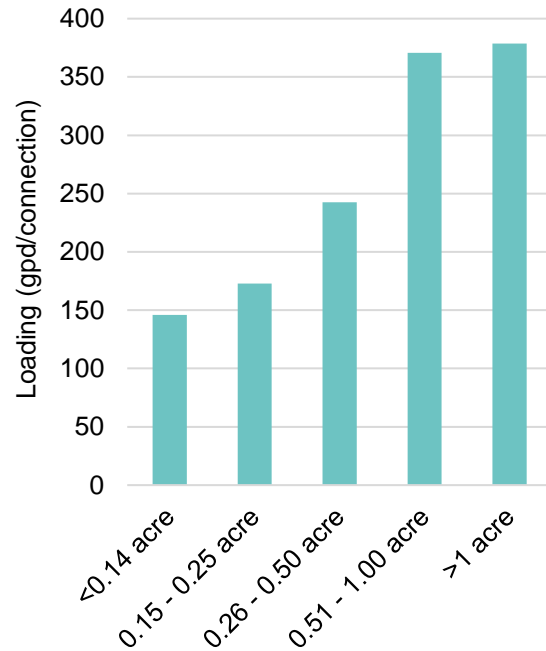
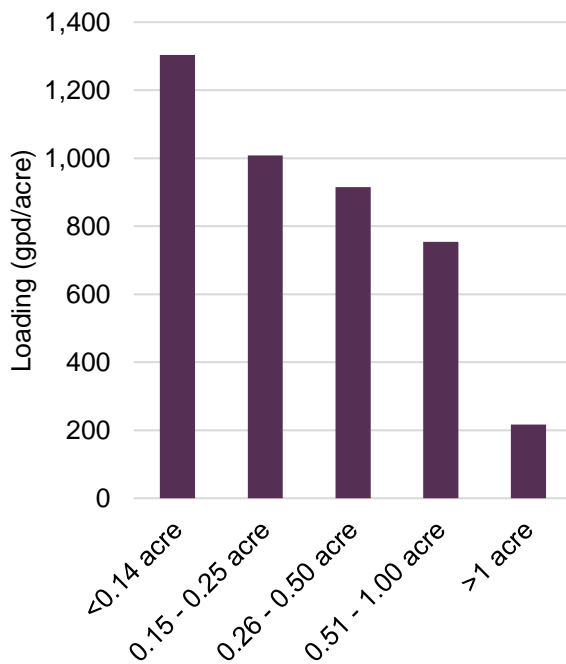
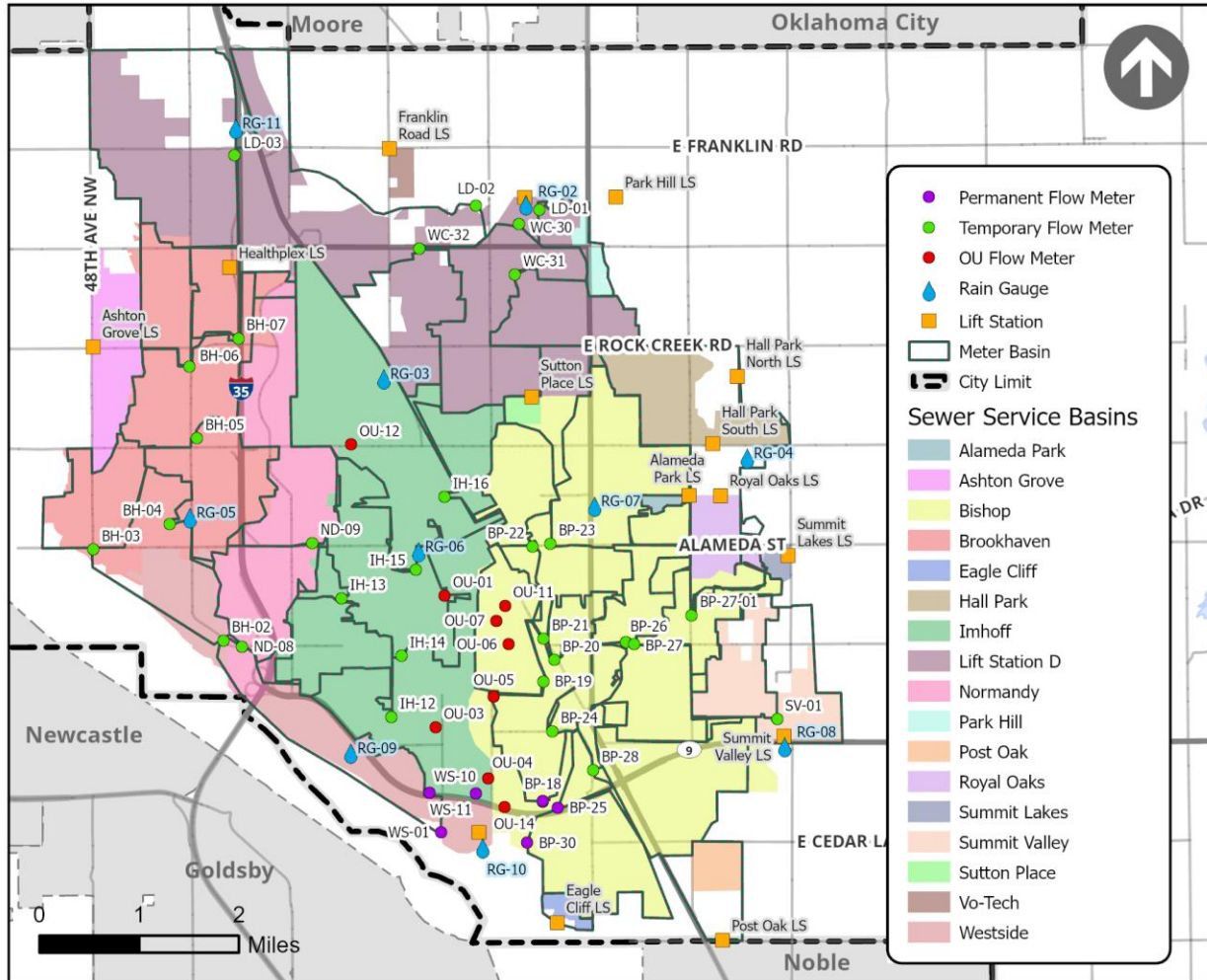


Figure 3.4: Historical Single Family Detached Loading Rates by Lot Size

4.0 Flow Metering Data Analysis

Flow meter data was collected to assess existing dry- and wet-weather flows in the collection system. Thirty-one temporary flow meters and ten temporary rain gauges were installed throughout the collection system. Temporary flow metering data was supplemented by six permanent flow meters that are installed just upstream of the WRF. A map of the flow metering basins is shown in Map 4.1. Flow metering and rainfall data were collected on 5- to 15-minute increments between April 20, 2023 and August 1, 2023. Site sheets showing detailed location and hydraulic information for the flow meter and rain gauge sites are provided in Appendix A. The flow monitoring hydrographs are included in Appendix B.

Map 4.1: Flow Monitoring Basin Map



Note: The OU flow meters included in the above figure were not used for the purpose of the flow metering data analysis.

Flow meter analysis involved determination of average dry-weather flows (ADWF) and diurnal patterns, as well as rainfall-derived infiltration and inflow (RDII) during wet-weather events. Figure 4.1 shows a schematic of the flow network of all the metered basins.

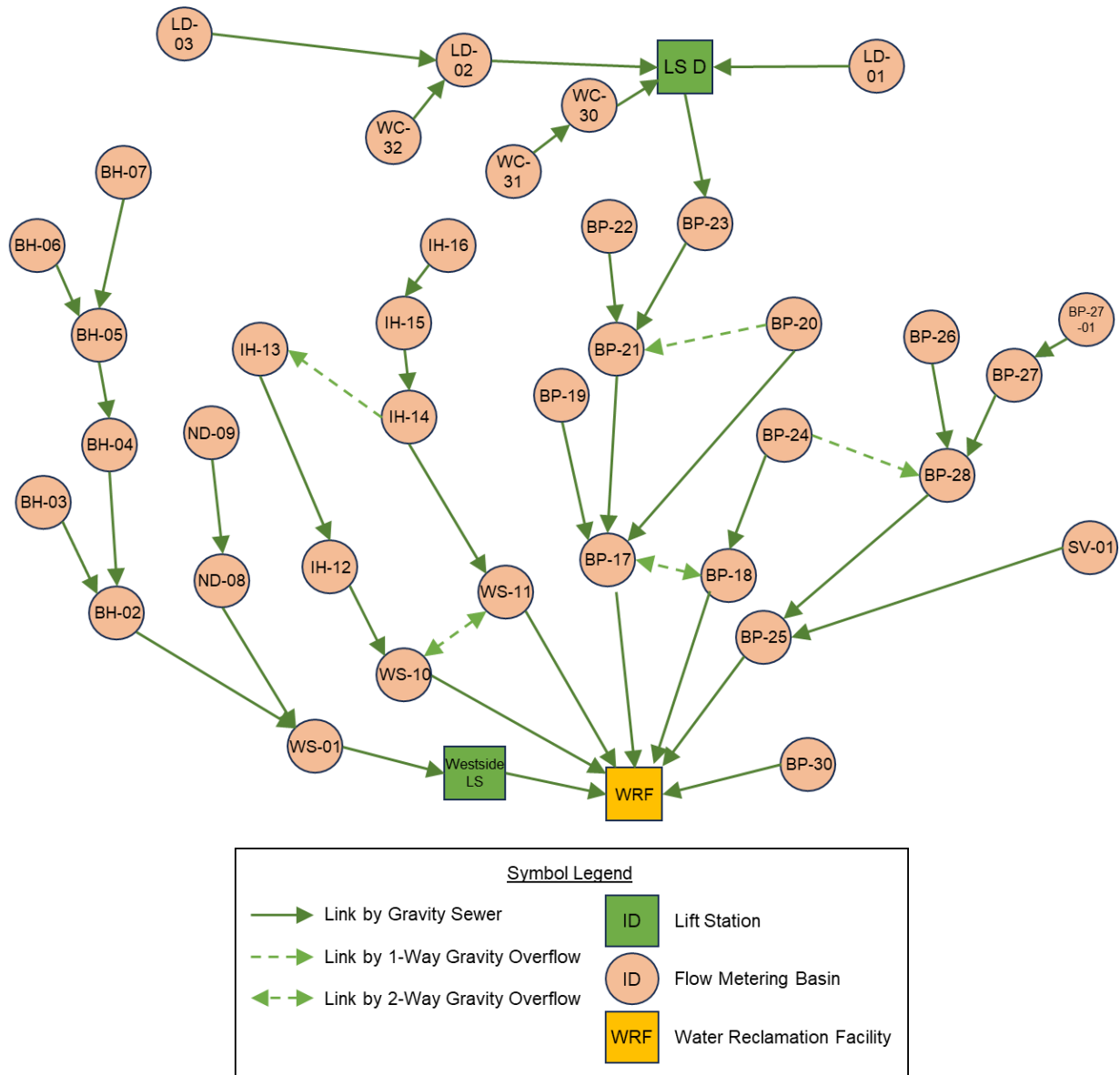


Figure 4.1: Flow Meter Schematic

Dry-weather flow days were used for calculation of ADWF and diurnal patterns. A dry-weather flow day was considered to be any day in the flow metering period that had five or more days without rainfall preceding it.

Depending on the rain gauge associated with the metered basin, as many as 18 to 30 dry-weather days were used to determine dry-weather flow conditions. Table 4.1 shows the ADWF and the dry-weather flow peaking factor for each basin. The values shown are for the total metered flow at each flow meter, without upstream flows subtracted out. The dry-weather flow peaking factor is the ratio of the peak hour dry-weather flow to the ADWF. The dry-weather flow peaking factors range from 1.16 to 1.5, and the average dry-weather peaking factor is 1.29 as shown in Figure 4.2.

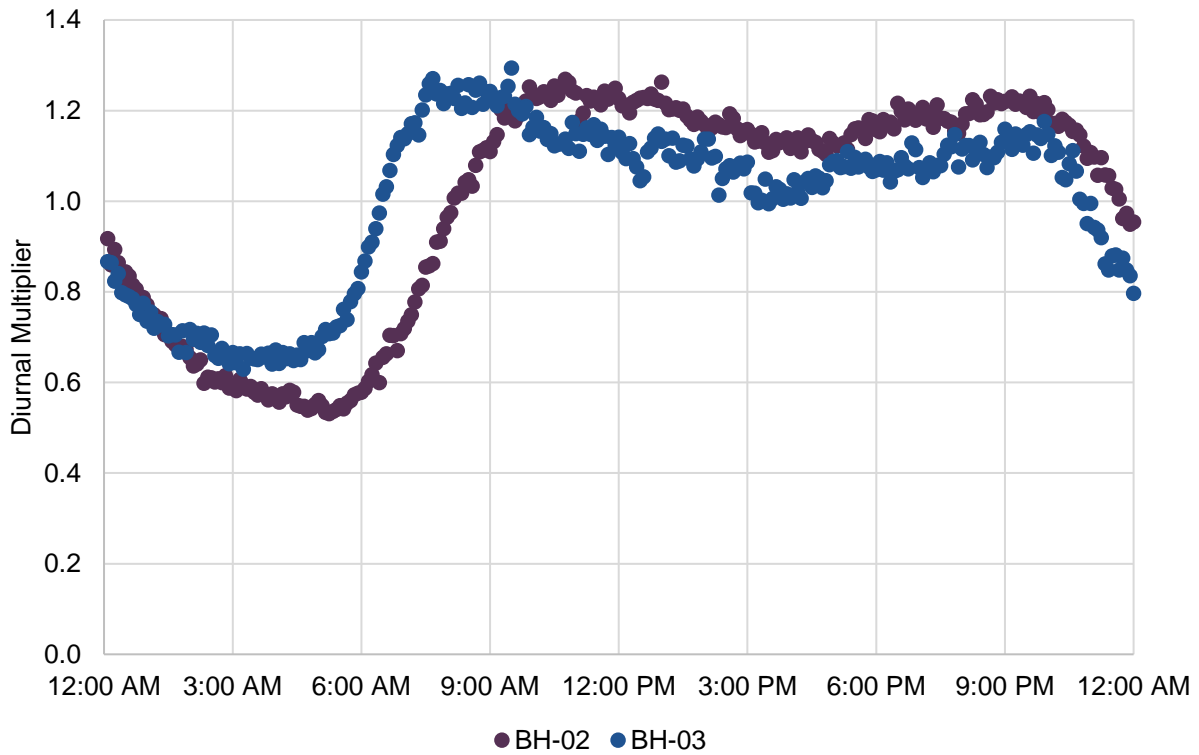


Figure 4.2: Example Dry-Weather Diurnal Patterns



Table 4.1: Dry-Weather Flows

Flow Meter	Average Dry-Weather Flow (MGD)	Peak Hour Dry-Weather Flow (MGD)	Dry-Weather Flow Peaking Factor
BH-02	1.85	2.37	1.28
BH-03	0.39	0.51	1.30
BH-04	1.39	1.72	1.24
BH-05	0.81	1.06	1.32
BH-06	0.23	0.30	1.29
BH-07	0.19	0.27	1.45
BP-17	3.47	4.01	1.16
BP-18	0.41	0.49	1.20
BP-19	0.55	0.66	1.20
BP-20	0.16	0.21	1.32
BP-21	2.70	3.28	1.21
BP-22	0.34	0.42	1.22
BP-23	2.45	2.92	1.19
BP-24	0.30	0.39	1.32
BP-25	2.09	2.62	1.25
BP-26	0.62	0.80	1.28
BP-27	0.57	0.76	1.33
BP-27-01	0.46	0.69	1.50
BP-28	0.69	0.89	1.29
BP-30	0.28	0.42	1.48
IH-13	0.24	0.30	1.28
IH-14	1.14	1.50	1.31
IH-15	0.60	0.74	1.22
IH-16	0.39	0.46	1.18
LD-02	0.81	1.01	1.25
LD-03	0.25	0.33	1.30
ND-08	0.70	0.92	1.31
ND-09	0.65	0.84	1.29
SV-01	0.10	0.15	1.43
WC-30	0.69	0.90	1.31
WC-31	0.28	0.38	1.35
WC-32	0.20	0.29	1.44
WS-01	2.70	3.42	1.27
WS-10	0.64	0.81	1.27
WS-11	1.25	1.52	1.21

Each flow meter is associated to the nearest rain gauge in the rainfall monitoring network. Wet-weather events were determined for each rain gauge, and the wet-weather events were used as analysis periods for wet weather flows. Wet-weather events were considered to be rainfall events in which 24-hour rainfall totals exceed 0.9 inches. This 24-hour rainfall total was selected so that multiple qualifying wet-weather events could be evaluated at each flow meter, while ensuring that only significant rainfall events were analyzed. Several rain gauges did not have multiple events that met this criteria, in which case the wet-weather event criteria was lowered to 0.5 inches of





rainfall in a 24-hour period. A summary of the rainfall experienced at each of the rain gauges during the monitoring period is shown in Table 4.2. This table also shows an estimate of the maximum 24-hour and 1-hour frequency storms experienced during the monitoring period (according to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency-duration curves).

Table 4.2: Wet-Weather Events

Rain Gauge	Associated Flow Meters	Number of Wet-Weather Events	Maximum 24-hour Rainfall (in)	Equivalent 24-hour Frequency Storm	Maximum 1-hour Rainfall (in)	Equivalent 1-hour Frequency Storm
RG-02	LD-02, WC-30, WC-31, WC-32	4	2.36	< 1-year	0.78	< 1-year
RG-04	BP-18, BP-22, BP-23, BP-26, BP-27-01, BP-28, IH-14	4	3.91	2-year	2.90	10-year
RG-05	BH-02, BH-03, BH-04, BH-05, BH-06, BH-07, ND-08	4	3.77	2-year	2.57	10-year
RG-06	IH-13, IH-15, IH-16, ND-09	3	3.50	1-year	2.36	5-year
RG-07	BP-19, BP-20, BP-21, BP-24, BP-27	3	5.41	5-year	3.52	25-year
RG-08	SV-01	4	4.08	2-year	2.99	10-year
RG-09	WS-10	4	1.04	<1-year	0.62	<1-year
RG-10	BP-25, BP-30, WS-01, WS-11, BP-17	2	3.83	2-year	2.73	10-year
RG-11	LD-03	3	2.36	<1-year	0.78	<1-year

The RDII was calculated at each basin for each wet-weather event. RDII was calculated as the difference between the wet-weather event flow and the typical dry-weather flow of the basin. Figure 4.3 shows an example of the wet-weather (combined dry-weather and RDII flow), RDII, and dry-weather flow for flow meter basin BH-03.



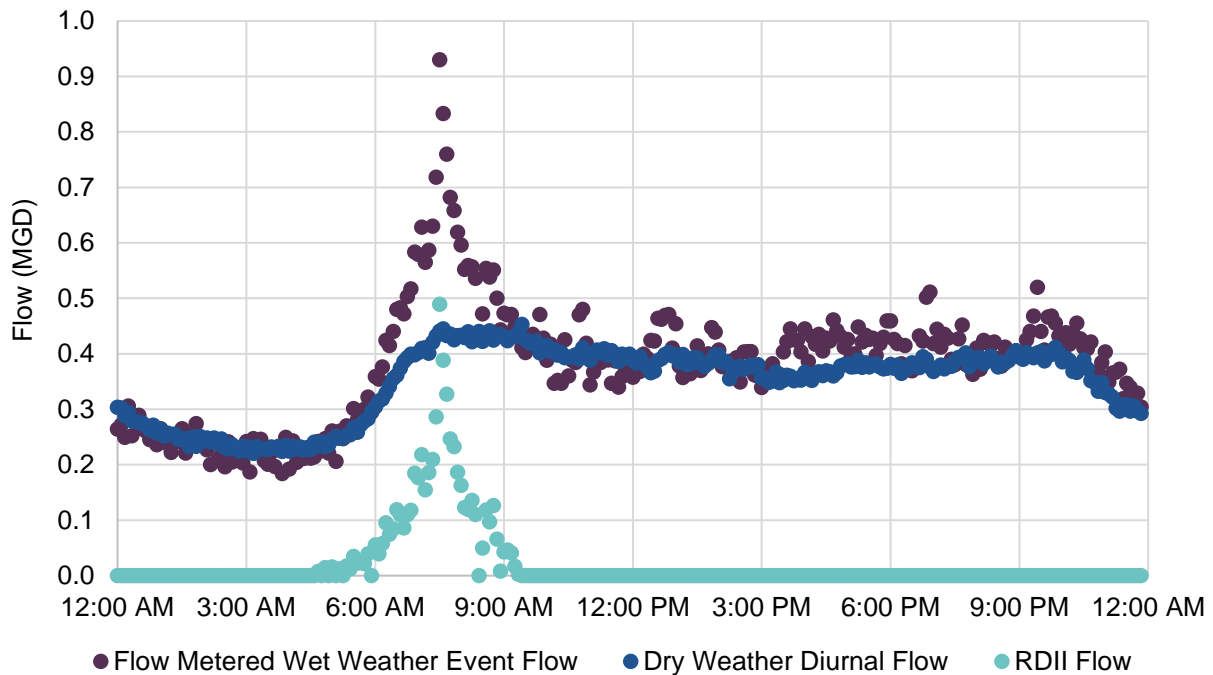


Figure 4.3: Example RDII Flow

For each wet-weather event, the RDII flow was modeled using the RTK method. The RTK method is a parameterization of RDII flow that estimates flow by defining three separate unit hydrographs (the hypothetical flow response to a unit of rainfall). The three hydrographs represent inflow, short-term infiltration, and long-term infiltration of rainwater into the wastewater system after a rainfall event. The RTK parameters were generated with a genetic algorithm that selects parameters with the goal of minimizing average peak flows and volume errors for each wet-weather event in the monitoring period. The RTK parameters are then used to simulate wet-weather flows for the 2-year, 5-year, and 10-year 24-hour design storms. The design storm volumes were taken from the NOAA Atlas 14 precipitation frequency-duration tables. The design storm volumes were distributed over 24-hours using the SCS Type II rainfall distribution. The rain volumes and the maximum 1-hour rainfall intensities used for the design storms are shown in Table 4.3.

Table 4.3: Design Storm Rain Volume

Design Storm	Rain Volume (inch)	Maximum 1-hour Intensity (inch/hour)
2-year	3.77	1.71
5-year	4.67	2.12
10-year	5.53	2.51



Table 4.4 shows the resulting peaking factors and design peak flows. This table also shows the average peak flow error the selected RTK parameters result in for the monitored wet-weather events. Figure 4.4 shows a graphical representation of the 5-year wet-weather peaking factor and the RTK calibration peak flow errors. The peak flow error represents the average overestimation (positive error) or underestimation (negative error) of RDII peak flow for each wet-weather event. There are several basins that have high peak flow errors. This is typically caused by inconsistent wet-weather responses in the flow metering data, often as a result of the influence of lift station pumping on the flow patterns or due to high geospatial variability in the rainfall data. The calibration of these basins can be revisited with more sophisticated methods, including the use of gauge-adjusted radar rainfall (GARR) for more precise definition of wet-weather events. Additionally, basins with large amounts of pumped flow can be further calibrated during hydraulic model development. The wet-weather analysis in this report was conducted on total flows at each flow meter, without upstream flows subtracted out. Discrete dry- and wet-weather flows will be assessed during model development and calibration and discussed in the Collection System Modeling and Evaluation TM.

Table 4.4: Temporary Flow Meters Wet-Weather Flows

Flow Meter	Peaking Factors			Design Storm Peak Flows (MGD)			Average Event Peak Flow Error (%)
	2 Year Storm	5 Year Storm	10 Year Storm	2 Year Storm	5 Year Storm	10 Year Storm	
BH-02	9.33	11.25	13.06	17.28	20.83	24.19	7%
BH-03	8.60	10.33	11.97	3.35	4.02	4.66	0%
BH-04	4.88	5.75	6.57	6.79	8.00	9.14	0%
BH-05	11.80	14.30	16.65	9.54	11.55	13.46	13%
BH-06	9.66	11.65	13.54	2.23	2.69	3.12	0%
BH-07	8.28	9.91	11.45	1.56	1.87	2.16	10%
BP-19	10.28	12.44	14.48	5.65	6.84	7.96	48%
BP-20	8.68	10.44	12.09	1.39	1.68	1.94	-3%
BP-21	4.68	5.51	6.29	12.64	14.87	16.97	1%
BP-22	10.44	12.63	14.70	3.58	4.33	5.04	-3%
BP-23	6.55	7.82	9.03	16.06	19.19	22.14	111%
BP-24	9.33	11.24	13.04	2.79	3.36	3.89	8%
BP-26	15.15	18.45	21.57	9.46	11.52	13.47	50%
BP-27	5.17	6.08	6.95	2.94	3.46	3.95	0%
BP-27-01	18.55	22.61	26.45	8.58	10.45	12.23	1%
BP-28	6.03	7.16	8.22	4.16	4.94	5.67	-3%
IH-13	5.83	6.91	7.94	1.37	1.63	1.87	-4%
IH-14	5.12	6.02	6.88	5.83	6.86	7.84	-5%
IH-15	12.75	15.49	18.09	7.66	9.31	10.86	15%
IH-16	9.04	10.91	12.68	3.49	4.22	4.90	2%
LD-02	15.77	19.23	22.50	12.76	15.56	18.20	10%
LD-03	8.49	10.20	11.82	2.12	2.55	2.95	9%
ND-08	5.68	6.72	7.71	3.98	4.71	5.40	15%
ND-09	5.67	6.71	7.69	3.68	4.36	5.00	1%
SV-01	12.67	15.34	17.87	1.28	1.55	1.81	12%
WC-30	11.59	14.04	16.35	8.00	9.69	11.28	12%



Flow Meter	Peaking Factors			Design Storm Peak Flows (MGD)			Average Event Peak Flow Error (%)
	2 Year Storm	5 Year Storm	10 Year Storm	2 Year Storm	5 Year Storm	10 Year Storm	
WC-31	8.87	10.66	12.35	2.50	3.01	3.48	-9%
WC-32	15.23	18.52	21.62	3.09	3.76	4.39	19%

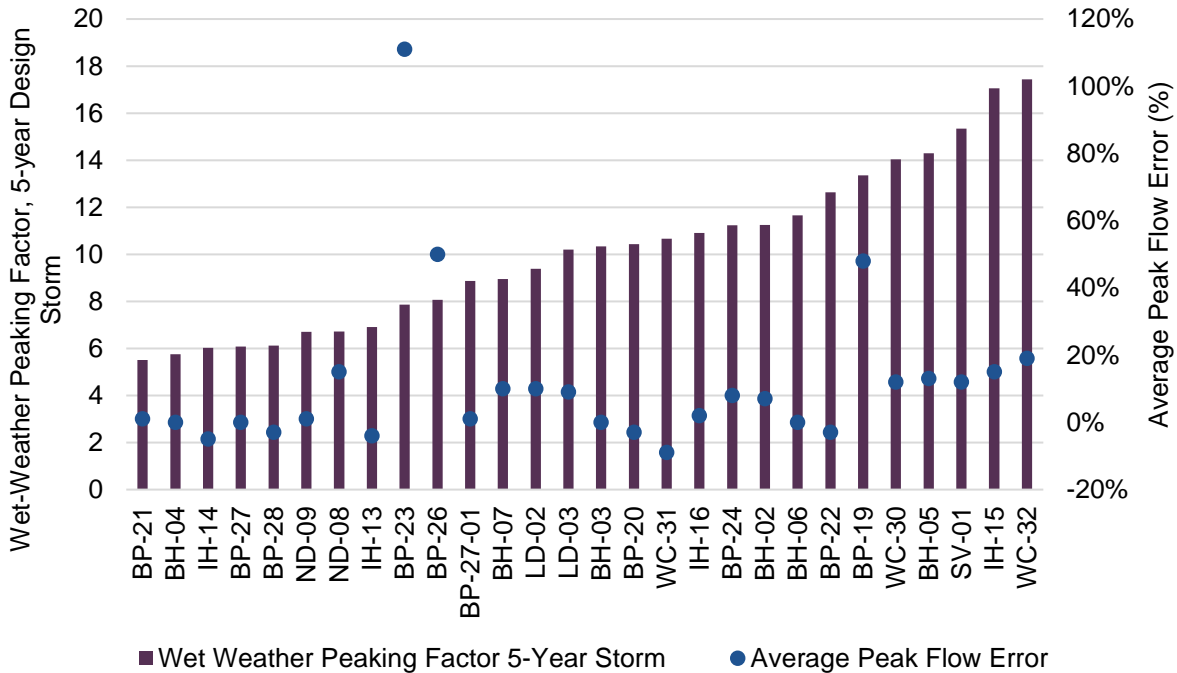


Figure 4.4: 5-Year Storm Peaking Factors and Peak Flow Calibration Errors

Table 4.5 shows the statistics of the basin peaking factors for the 2-year, 5-year, and 10-year design storms. The median peaking factor for the 2-year storm is 8.5. The median peaking factor for the 5-year storm is 10.3, and the median peaking factor for the 10-year storm is 11.9. These peaking factors represent the impact of RDII on collection system flows. Actual peak flows experienced at the WRF and at other locations in the system will depend on travel time, flow attenuation, and storage as water is conveyed through the collection system. The peak influent flows to the WRF will be evaluated in hydraulic modeling scenarios.

Table 4.5: Basin Peaking Factor Summary for 2-Year, 5-Year, and 10-Year Design Storms

Design Storm	Minimum Peaking Factor	Median Peaking Factor	Maximum Peaking Factor
2-year	4.7	8.5	14.4
5-year	5.5	10.3	17.4
10-year	6.3	11.9	20.3

Note: Peaking factors shown represent 5-minute peak flows divided by ADWF to be used for collection system infrastructure capacity evaluations.



The six permanent flow meters were not included in the wet-weather analysis. These flow meters are located on interceptors at the downstream end of the collection system, just upstream of the outfall to the WRF. These meters were not included in the evaluation because they are located on interceptors that are designed to surcharge, store water, and attenuate peak flow rates through diversions to other interceptors. The wet weather response of these basins will be investigated during wet-weather calibration for the upcoming Collection System Modeling and Evaluation TM. The permanent flow meters and their maximum observed flows reported during the flow metering period are shown in Table 4.6.

Table 4.6: Permanent Flow Meters Wet-Weather Flows

Flow Meter	Maximum Observed Flow (MGD)
BP-17	11.15
BP-18	9.02
BP-25	7.55
BP-30	1.32
WS-01	12.57
WS-10	2.00
WS-11	12.74

5.0 Wastewater Flow Projections

As discussed in Section 3.3, the wastewater flow rate projections are calculated based on the anticipated service population and an ADF per capita of 100 gpcd. Garver used the 1.5% annual growth rate projection included in the Norman Today report as the basis of the population projections through the year 2045. It was assumed that the service population would be approximately 90% of the city's population, and the growth rate percentage was applied independently to both the city population and the service population. The projected service population and ADF are shown below in Table 5.1 and Figure 5.1 for the WWSA throughout the planning period. Projections through the year 2045 will be used for the purpose of the capital improvement plan (CIP) development. The projections through buildout will be determined based off the land use capacity of the service area and will be used to determine the sizing of proposed wastewater infrastructure.

In addition to the flow calculated based on population growth, a reserve capacity of 10% was included to remain consistent with the reserve capacity projected for the water system. Garver recommends the inclusion of a reserve capacity to mitigate any potential changes to per capita flows as a result of new industrial flows, unanticipated growth, or severe weather events.

Previous wastewater flow projection efforts have focused on buildout flows based on the future WWSA anticipated at the time of their development. The 2001 WWMP predicted that the buildout ADF would be 20.5 MGD and the ADF plus planning capacity would be 21.5 MGD. The 2013 WW Modeling Report buildout projections, which is also referenced in the 2018 WW Modeling Report, predicted that the ADF would be 17.1 MGD and the ADF plus planning capacity would be 18.0 MGD.



Table 5.1: Projected Wastewater Flows

Year	Service Population	ADF (MGD)	ADF Reserve Capacity (MGD)	ADF Total (MGD)	SFE ¹
2025	119,990	12.00	1.20	13.20	58,532
2030	129,264	12.93	1.29	14.22	63,055
2035	139,254	13.93	1.39	15.32	67,929
2040	150,016	15.00	1.50	16.50	73,178
2045	161,610	16.16	1.62	17.78	78,834

Notes:

¹Based on projected ADF with reserve capacity and value of 205 gpd/SFE discussed in Section 3.4.

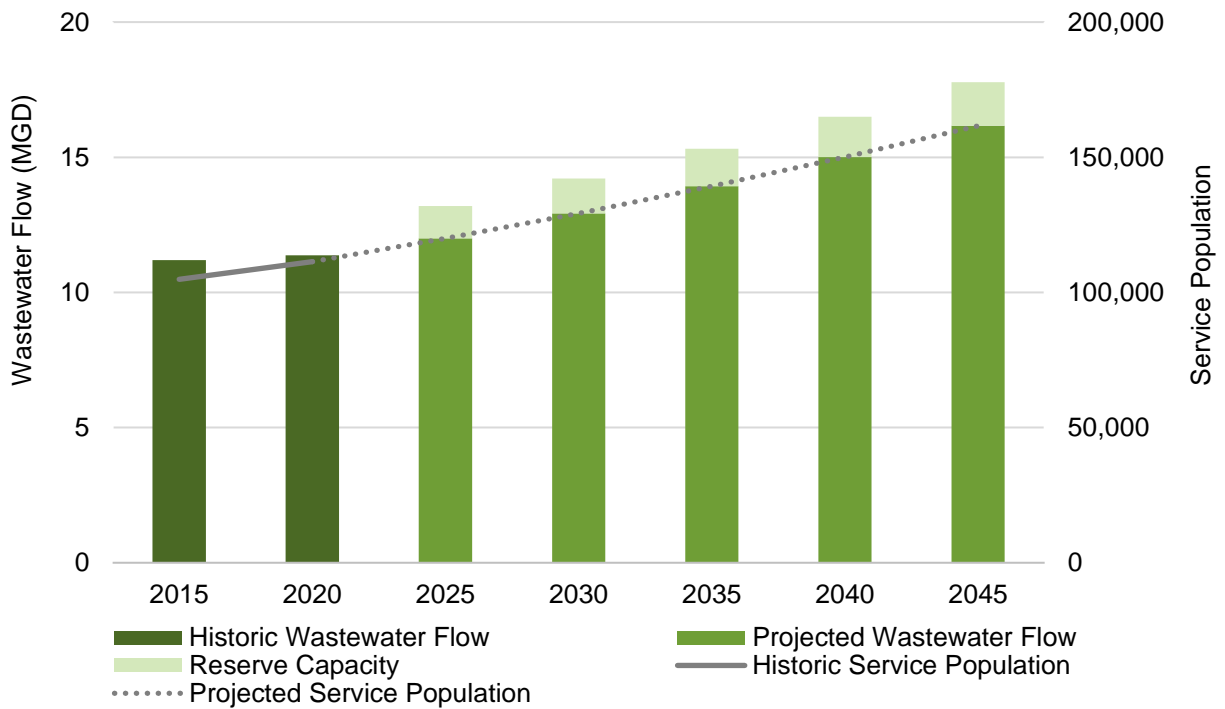


Figure 5.1: Projected Wastewater Flows

6.0 Wastewater System Evaluation Criteria

Design criteria and regulatory requirements from a variety of sources were assembled to develop the evaluation criteria for analysis of the wastewater system. Specifically, documents from the following sources were reviewed:

- Oklahoma Department of Environmental Quality (ODEQ)



- City of Norman 2023 Engineering Design Criteria and Standard Specifications (Norman EDC)
- Water Environment Federation's Manual of Practice (WEF MOP 8)

Table 6.1 summarizes the evaluation criteria that will be used to evaluate the wastewater system's performance and identify potential capital improvement projects. The table also includes NUA system-specific goals/criteria recommended by Garver for evaluating the existing collection system.

Table 6.1: Wastewater System Evaluation Criteria

Criteria	Limiting Source	Description
Treatment Plant Design Life	ODEQ	Design sewage treatment plants for an estimated 20-year population projection. Construction may occur in phases.
Gravity Sewer Sizing	Norman EDC	No public gravity sewer should be less than 8 inches in diameter.
Gravity Pipe Velocity	ODEQ	Gravity pipes should obtain a velocity of 2 ft/s.
Minimum Gravity Pipe Slope	Norman EDC	Minimum pipe grade by diameter as presented in the 2023 Norman EDC.
Gravity Sewer Hydraulic Capacity	Industry Standard	A "d/D" ratio of 0.75 will be used to determine the sizing of future infrastructure. The d/D ratio is defined as the depth of water in the gravity main during peak flow conditions divided by the inside diameter.
Maximum Surge	NUA system performance target	Existing gravity mains should surcharge no more than 1 foot above the crown of pipe.
Minimum Freeboard	NUA system performance criteria	Existing gravity mains should surcharge to no more than 3 feet below the manhole rim elevation.
Lift Station Capacity	ODEQ	All lift stations shall have a minimum of two pumping units. With any pump out of service the remaining pump(s) shall be capable of providing the maximum sewage flows of the system.
Force Main Velocity	ODEQ	Force mains should obtain a velocity of 2 ft/s.
Force Main Maximum Flow Velocity	Industry Standard	Force mains should not experience a maximum flow velocity of 6 ft/s. (Note: Guideline is not a regulatory requirement)

6.1 Wastewater Treatment Evaluations and Planning

The assessment of the wastewater treatment system will be conducted in accordance with the Oklahoma Department of Environmental Quality (ODEQ) standards for the design of water pollution control facilities,





alongside the treatment specifications required by the Norman WRF to comply with the facility's Oklahoma Pollutant Discharge Elimination System (OPDES) permit limits. Additionally, the industry-recommended practices outlined in the Water Environment Federation's Manual of Practice (WEF MOP 8) for municipal water reclamation facilities will also be taken into consideration. This assessment of the existing wastewater treatment system and further discussion of the WRF will be detailed in the upcoming Treatment and Reuse TM.

The CIP improvements for the Norman WRF will be designed based on a 20-year planning horizon, extending to the year 2045. These CIP enhancements aim to provide sufficient capacity to manage and treat this average wastewater flow rate. However, the implementation of CIP improvements can adopt a trigger-based approach, meaning they will only be executed once the projected wastewater flows are observed in the future.

If all or a portion of the treated effluent from the existing WRF or a potential greenfield WRF is planned to be discharged to Lake Thunderbird, the findings of the 2022 Indirect Potable Reuse (IPR) Pilot Study together with the Oklahoma Administrative Code § 252:628 (OAC) Requirements for IPR in a Reservoir will be used to determine the scope of improvements required to reach the treatment limits established for IPR.

Regarding capacity expansions, Garver's approach assumes that once the facility reaches 75% of its rated capacity, planning, and design phases for the next phase of capacity expansion must begin. This 75% capacity level acts as the trigger for initiating the planning and design process. Additionally, when the facility hits 90% of its rated capacity, construction to implement the designed improvements must be initiated. Anticipated construction timelines will be evaluated and considered in development of final triggers for recommended projects.

7.0 Future Work

The City's population projections and future land use plan are being developed in parallel with the baseline development for the wastewater system. Once the future land use plan is finalized, Garver will update the wastewater baseline development presented in this TM and move forward with the following future wastewater system evaluations:

- Collection System Modeling and Evaluation
- Treatment and Reuse Evaluation
- Capital Improvement Plan

Each evaluation will be documented in an upcoming TM that will be incorporated in the Wastewater Master Plan Report.



Appendix A: Flow Meter and Rain Gauge Site Sheets



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-02

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:24 AM

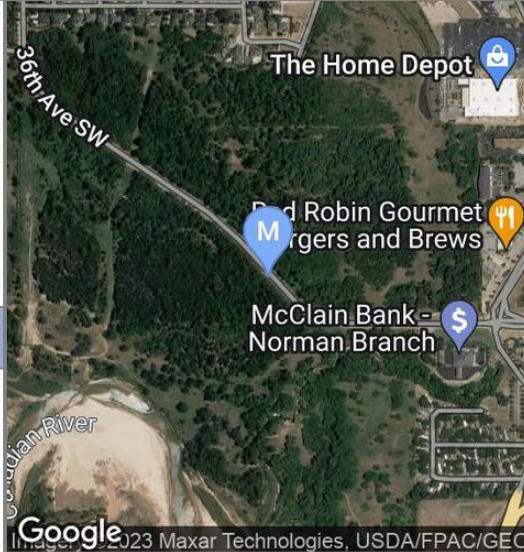
30-3984-00

T

System Information

Target Pipe Dia. (in) 43.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 253006
 U/S Connecting MH I.D 253005
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 600-672 36th Ave SW
 Site Access Off-Road
 Longitude -97.48880000
 Latitude 35.20480000
 MH Type Precast Concrete
 Manhole Depth (ft) 13.90
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 42.50
 Pipe Width (in) 42.50
 Pipe Type Other
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



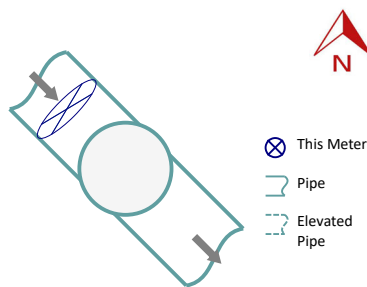
Hydraulic Characteristics

Installation Notes

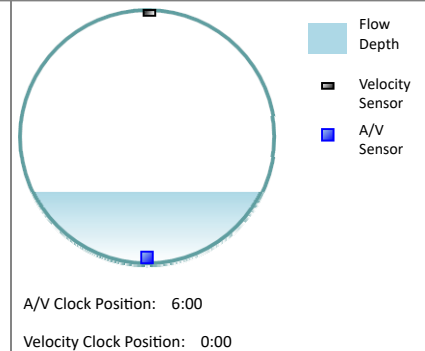
Hydraulic Information

Flow Depth (in) 12.00
 Instant Velocity (fps) 1.84
 Surge Evidence (ft) 13.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-03

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 7:15 PM

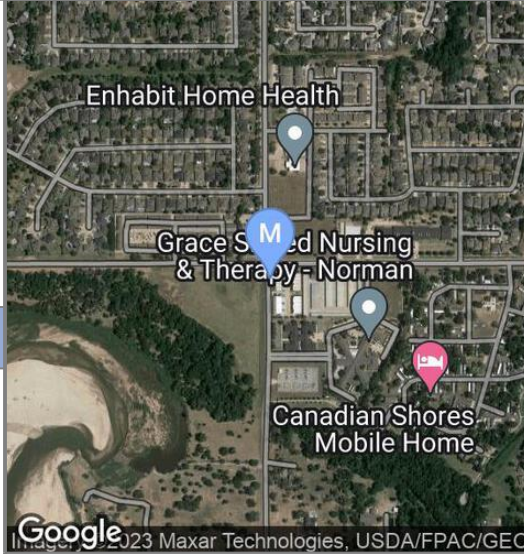
30-3984-00

T

System Information

Target Pipe Dia. (in) 22.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 235001
 U/S Connecting MH I.D 204039
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 4746 W Main St
 Site Access Sidewalk
 Longitude -97.51180000
 Latitude 35.21810000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.00
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 22.00
 Pipe Width (in) 22.00
 Pipe Type Other
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



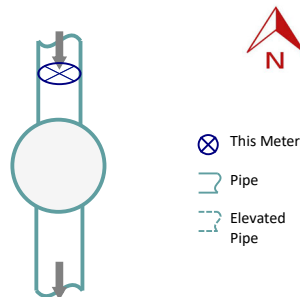
Hydraulic Information

Flow Depth (in) 4.00
 Instant Velocity (fps) 2.02
 Surge Evidence (ft) 5.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

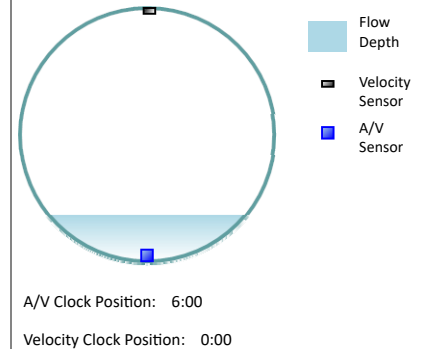
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-04

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:41 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 205071
 U/S Connecting MH I.D 205063
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3837 Cedar Ridge Dr
 Site Access Off-Road
 Longitude -97.49820000
 Latitude 35.22180000
 MH Type Precast Concrete
 Manhole Depth (ft) 25.00
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.0
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



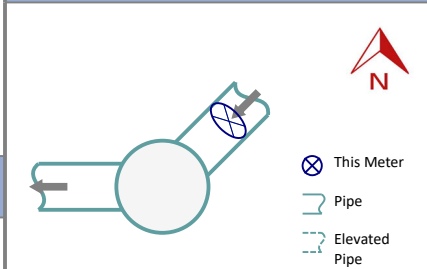
Hydraulic Information

Flow Depth (in) 10.00
 Instant Velocity (fps) 1.78
 Surge Evidence (ft) 13.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Fair

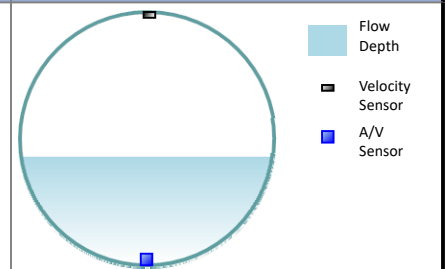
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-05

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:12 PM

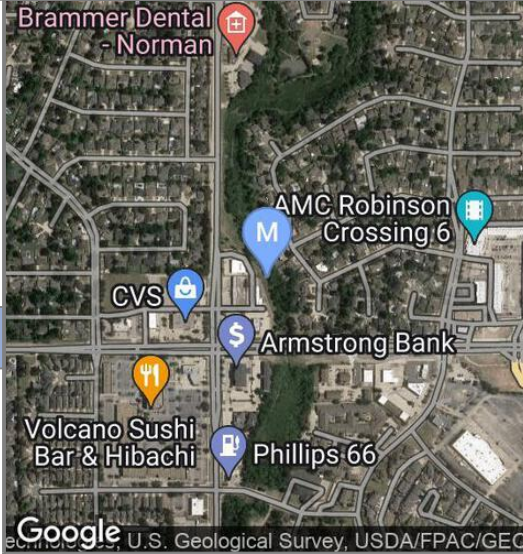
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 158106
 U/S Connecting MH I.D 158105
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1219 36th Ave NW
 Site Access Off-Road
 Longitude -97.49330000
 Latitude 35.23420000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.0
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



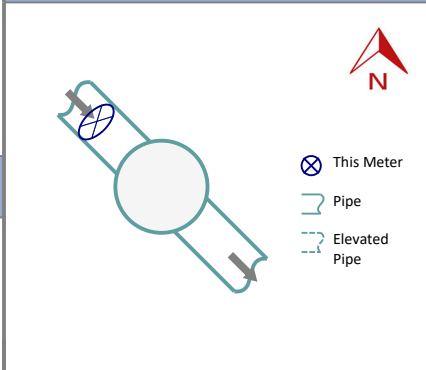
Hydraulic Information

Flow Depth (in) 7.50
 Instant Velocity (fps) 2.24
 Surge Evidence (ft) 10.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

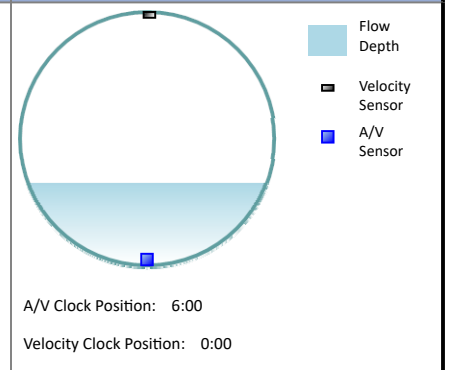
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-06

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:49 PM

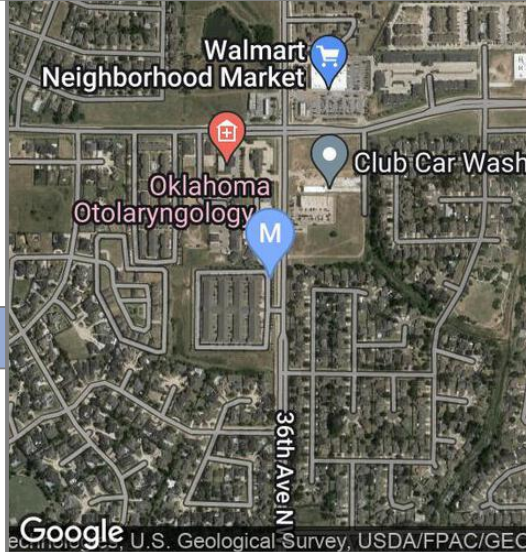
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 143107
 U/S Connecting MH I.D 143106
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2252 36th Ave NW
 Site Access Off-Road
 Longitude -97.49460000
 Latitude 35.24470000
 MH Type Precast Concrete
 Manhole Depth (ft) 18.80
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 17.50
 Pipe Width (in) 17.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



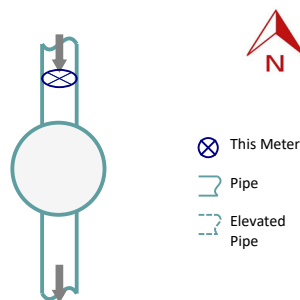
Hydraulic Information

Flow Depth (in) 3.50
 Instant Velocity (fps) 2.31
 Surge Evidence (ft) 8.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

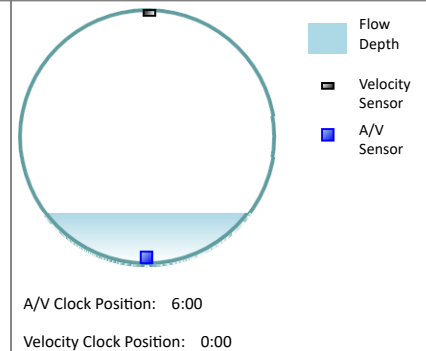
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BH-07

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 4/4/2023 3:18 PM

30-3984-00

T

System Information

Target Pipe Dia. (in)

Municipality Norman

District

Assigned Rain Gauge

Client Manhole # 113038

U/S Connecting MH I.D 113036

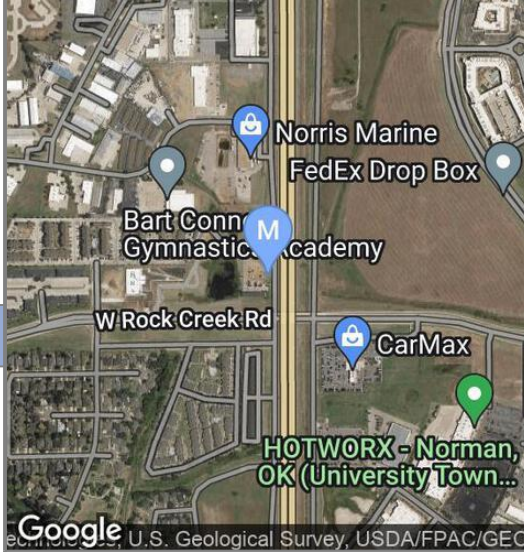
System Characteristics:

Residential - Commercial - Industrial -

P/S Influence No

WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3050 Yarbrough Way

Site Access Off-Road

Longitude -97.48590000

Latitude 35.24870000

MH Type Precast Concrete

Manhole Depth (ft) 12.30

Manhole Width (ft) 4.0

Elevated MH No

Height Elevated (ft)

Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 16.50

Pipe Width (in) 16.50

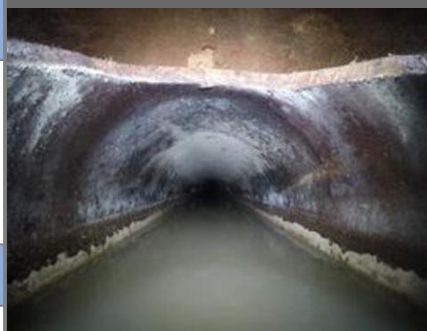
Pipe Type Polyvinyl Chloride

Pipe Shape Circular

O2 20.9 LEL % 0.0

H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



Hydraulic Information

Flow Depth (in) 6.00

Instant Velocity (fps) 0.40

Surcharge Evidence (ft) 1.00

Silt Type Fine

Silt Depth (in) 2.00

Needs Cleaning No

Backwater No

Flow Path Straight

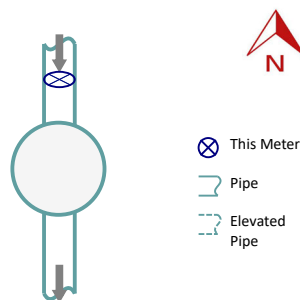
Drop Inlet No

Hydraulic Rating Good

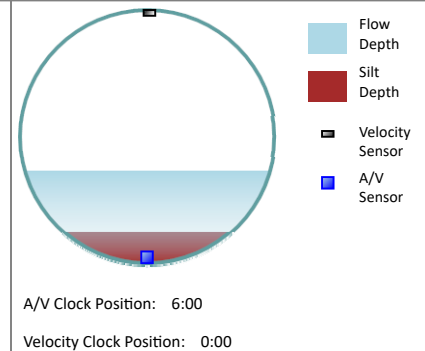
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0

Location from Manhole

Sensors Pressure, Velocity, and Ultra

Antenna Surface Non-Paved Surface

Signal Strength

Post Installation Notes

Meter Type -

Telemetry Type

Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name

BP-17

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 12/10/2014 12:48 PM

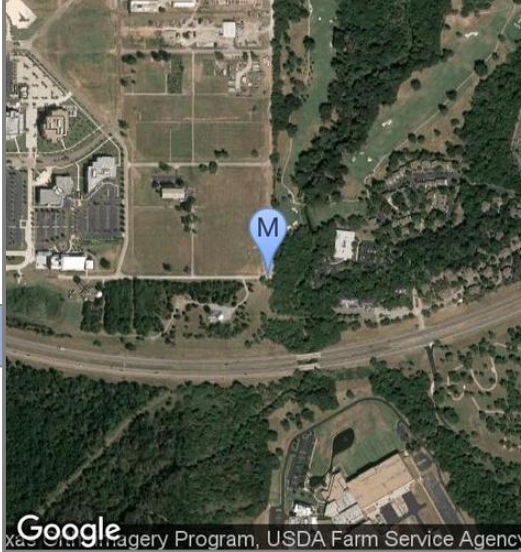
30-3884-00

T

System Information

Target Pipe Dia. (in) 33.5
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-04
 Client Manhole # 329011
 U/S Connecting MH I.D 329012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 500 E Constellation St
 Site Access Off-Road
 Longitude -97.43244600
 Latitude 35.18106800
 MH Type Poured Concrete
 Manhole Depth (ft) 17.60
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.3
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 32.94
 Pipe Width (in) 33.98
 Pipe Type Concrete
 Pipe Shape Elliptical
 O2 LEL %
 H2S CO

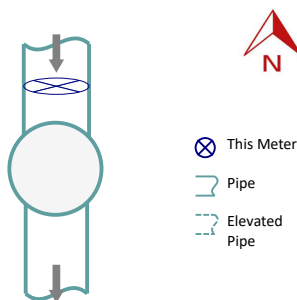
Hydraulic Information

Flow Depth (in) 20.00
 Instant Velocity (fps) 2.74
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

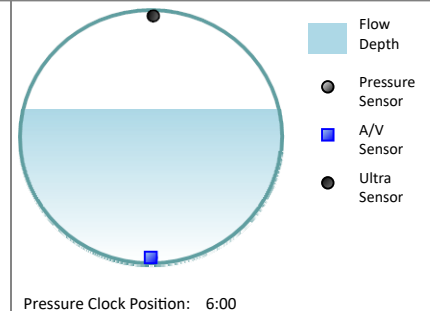
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Non-Paved Surface
 Signal Strength 75

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 1/8/2015

Approvals

Recommended by FSP
 Yes

Client Approval
 Yes



Norman,OK
Norman Utilities Authority

Site Name

BP-18

Inspected By RJNGROUP\Kgarrett

Project No.

Site Code

Inspected Date/Time 6/17/2014 5:23 PM

30-3884-00

T

System Information

Target Pipe Dia. (in) 36.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-04
Client Manhole # 329010
U/S Connecting MH I.D 329002
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 500 E Constellation St
Site Access Off-Road
Longitude -97.43236400
Latitude 35.18122300
MH Type Precast Concrete
Manhole Depth (ft) 16.50
Manhole Width (ft) 4.0
Elevated MH No
Height Elevated (ft)
Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 36.88
Pipe Width (in) 36.88
Pipe Type Vitrified Clay
Pipe Shape Circular
O2 LEL %
H2S CO

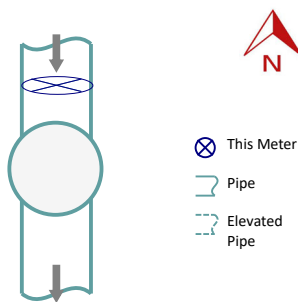
Hydraulic Characteristics

Installation Notes

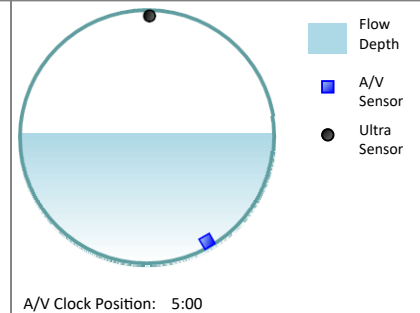
Hydraulic Information

Flow Depth (in) 19.00
Instant Velocity (fps) 0.60
Surcharge Evidence (ft)
Silt Type None
Silt Depth (in) 0.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 100

Post Installation Notes

Approvals

Meter Type
Telemetry Type
Installation Date 5/7/2015

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-19

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:04 PM

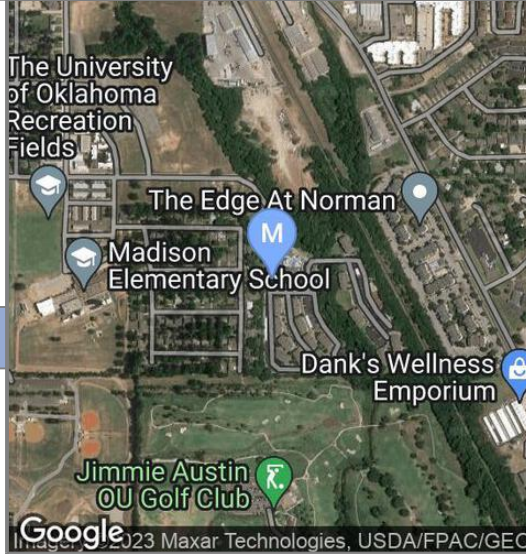
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 286085
 U/S Connecting MH I.D 286084
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 730 Stinson St
 Site Access Sidewalk
 Longitude -97.43220000
 Latitude 35.19860000
 MH Type Precast Concrete
 Manhole Depth (ft) 12.50
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 29.50
 Pipe Width (in) 29.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



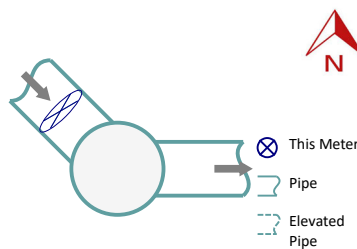
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 1.30
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

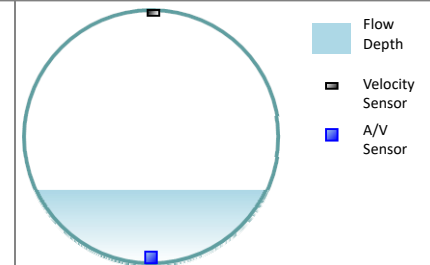
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00
 Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-20

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:25 PM

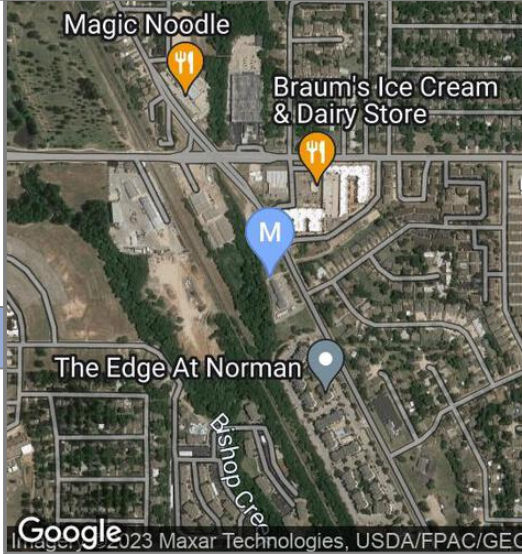
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 286013
 U/S Connecting MH I.D 286012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2100 Classen Blvd
 Site Access Other
 Longitude -97.43020000
 Latitude 35.20170000
 MH Type Brick
 Manhole Depth (ft) 6.20
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes Parking lot of carwash

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 18.50
 Pipe Width (in) 18.50
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

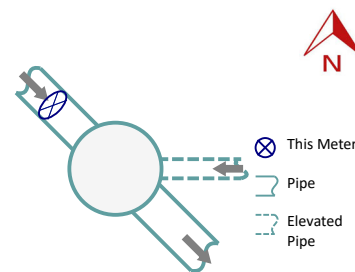
Hydraulic Characteristics

Installation Notes

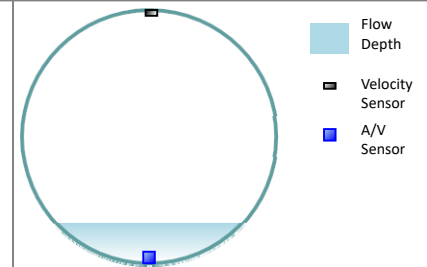
Hydraulic Information

Flow Depth (in) 3.00
 Instant Velocity (fps) 0.75
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00
Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-21

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:44 PM

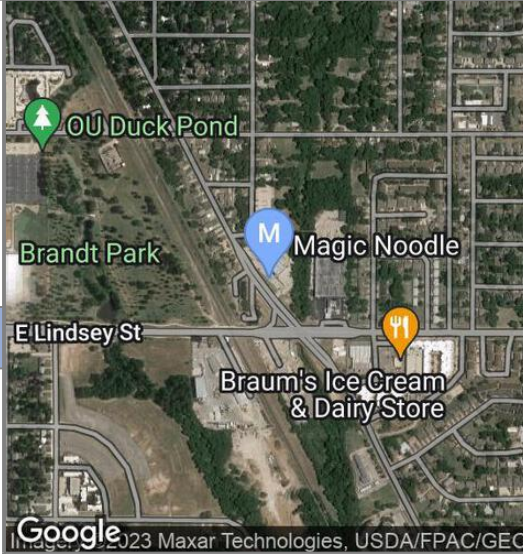
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 260116
 U/S Connecting MH I.D 260117
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address Suite 115 1915
 Site Access Off-Road
 Longitude -97.43210000
 Latitude 35.20480000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 29.75
 Pipe Width (in) 28.75
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



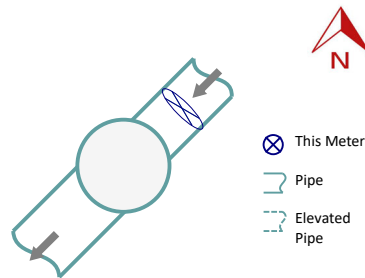
Hydraulic Information

Flow Depth (in) 1.00
 Instant Velocity (fps) 1.50
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

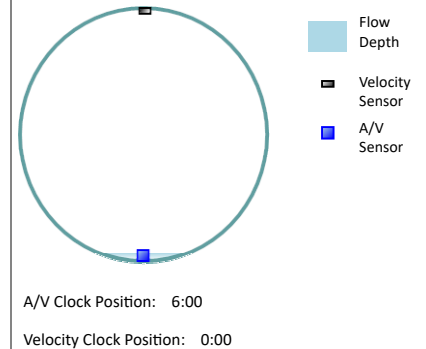
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-22

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:23 AM

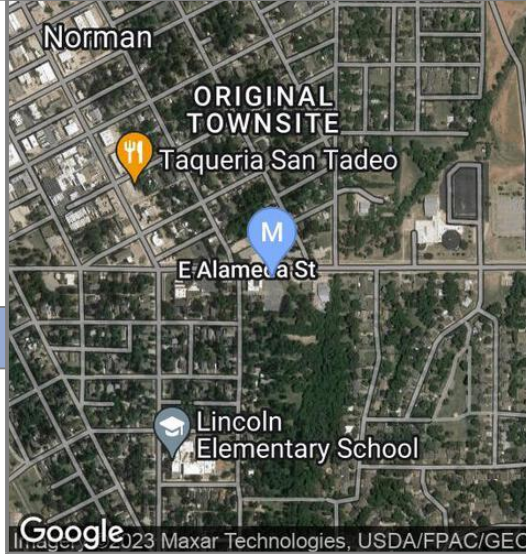
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 243054
 U/S Connecting MH I.D 212067
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 500 E Alameda St
 Site Access Sidewalk
 Longitude -97.43390000
 Latitude 35.21820000
 MH Type Precast Concrete
 Manhole Depth (ft) 14.70
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 16.50
 Pipe Width (in) 17.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



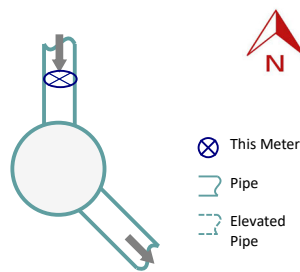
Hydraulic Information

Flow Depth (in) 4.80
 Instant Velocity (fps) 0.75
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

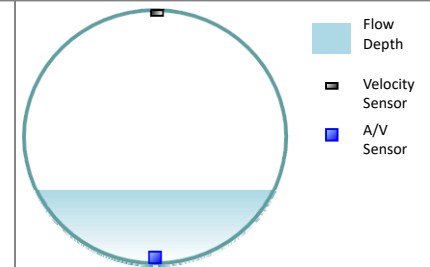
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00
Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-23

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:01 PM

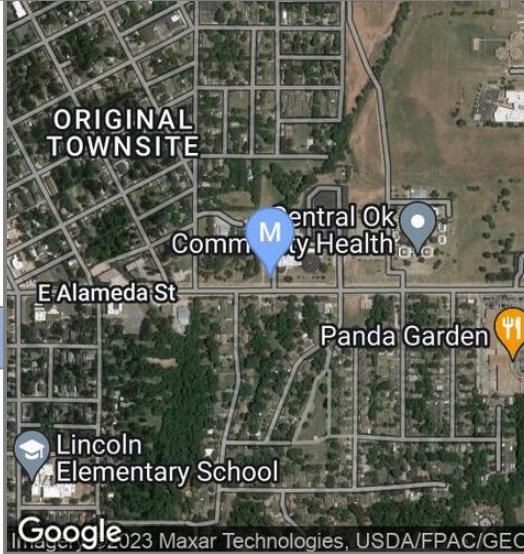
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 213051
 U/S Connecting MH I.D 213035
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 801 E Alameda St
 Site Access Sidewalk
 Longitude -97.43080000
 Latitude 35.21860000
 MH Type Poured Concrete
 Manhole Depth (ft) 12.10
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 23.50
 Pipe Width (in) 25.00
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

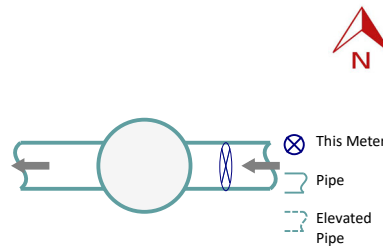
Hydraulic Characteristics

Installation Notes

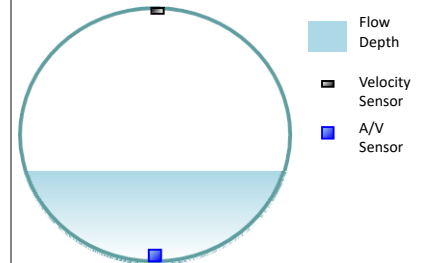
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 2.40
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-24

Inspected By zanders

Project No.

Site Code

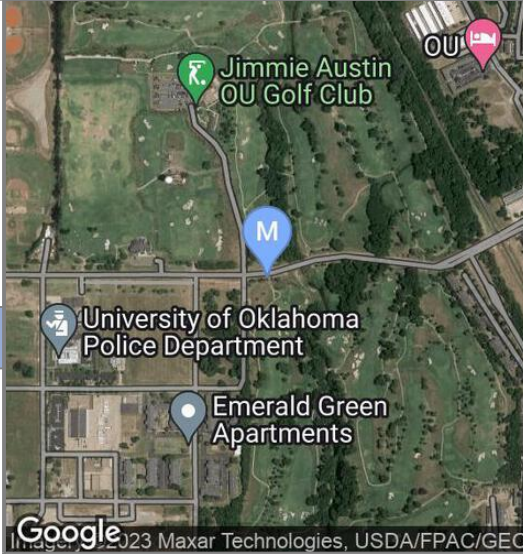
Inspected Date/Time 3/21/2023 3:35 PM

30-3984-00

System Information

Target Pipe Dia. (in) 19.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 297022
 U/S Connecting MH I.D 297099
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 720 E Constitution St
 Site Access Off-Road
 Longitude -97.43060000
 Latitude 35.19130000
 MH Type Brick
 Manhole Depth (ft) 17.60
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 3.0
 Structural Integrity Safe

Top View Picture



Access Notes Need 9 foot tripod

Site Information

Pipe Height (in) 19.00
 Pipe Width (in) 18.50
 Pipe Type Lined
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



Hydraulic Information

Flow Depth (in) 3.60
 Instant Velocity (fps) 2.10
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

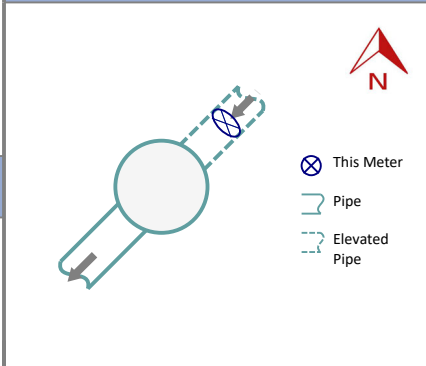
Hydraulic Characteristics

Installation Notes

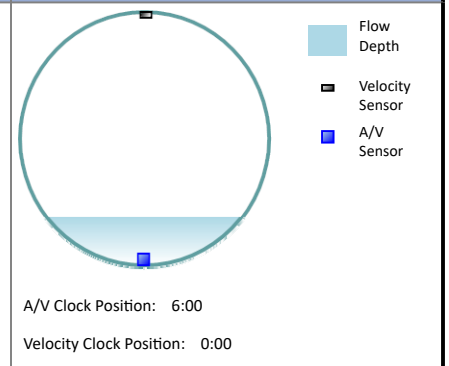
Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Install Plan Sketch



Install Cross-Section Sketch



Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name

BP-25

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 10:38 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 36.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-04
Client Manhole # 330006
U/S Connecting MH I.D 330030
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3240 Marshall Ave
Site Access Other
Longitude -97.42970000
Latitude 35.18020000
MH Type Poured Concrete
Manhole Depth (ft) 8.57
Manhole Width (ft) 5.0
Elevated MH No
Height Elevated (ft)
Structural Integrity Safe

Access Notes In island

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 35.75
Pipe Width (in) 35.75
Pipe Type Concrete
Pipe Shape Circular
O2 LEL %
H2S CO

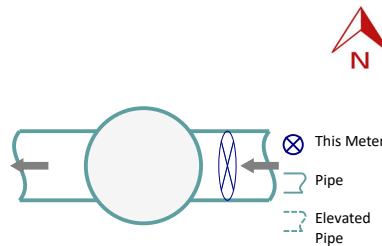
Hydraulic Characteristics

Installation Notes

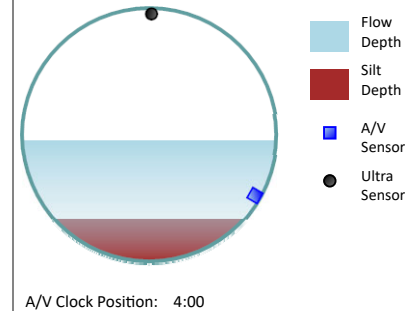
Hydraulic Information

Flow Depth (in) 17.06
Instant Velocity (fps) 1.41
Surcharge Evidence (ft)
Silt Type Fine
Silt Depth (in) 6.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 75

Post Installation Notes

Approvals

Meter Type
Telemetry Type
Installation Date 11/5/2014

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-26

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:04 PM

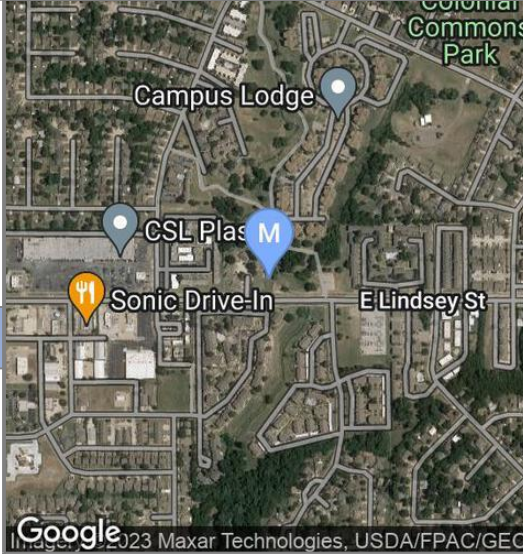
30-3984-00

T

System Information

Target Pipe Dia. (in) 15.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 261088
 U/S Connecting MH I.D 261058
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 1531 E Lindsey St
 Site Access Other
 Longitude -97.41750000
 Latitude 35.20420000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Access Notes Park, inside drop influenced by water park

Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 15.62
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



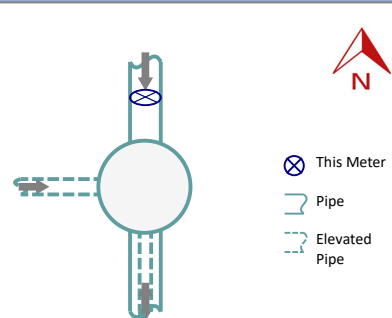
Hydraulic Information

Flow Depth (in) 7.20
 Instant Velocity (fps) 0.80
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet Yes
 Hydraulic Rating Good

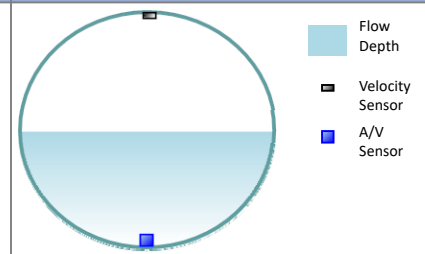
Hydraulic Characteristics

Installation Notes Flow picked up as we were finishing, may be a pump near by, heights and flow speed both increases

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00
Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-27

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:21 PM

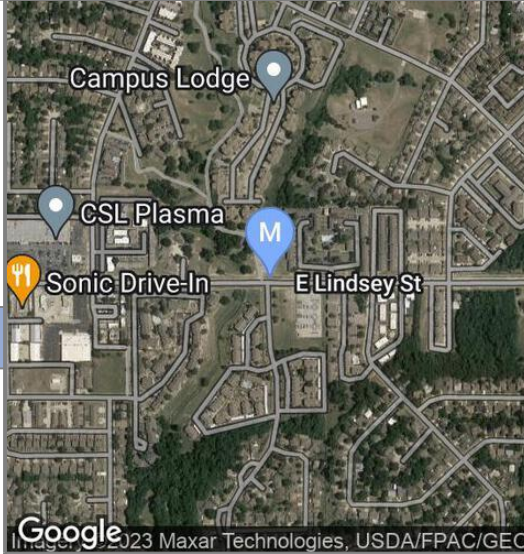
30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 261092
 U/S Connecting MH I.D 262109
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1699 E Lindsey St
 Site Access Sidewalk
 Longitude -97.41610000
 Latitude 35.20390000
 MH Type Brick
 Manhole Depth (ft) 10.90
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 20.25
 Pipe Width (in) 20.25
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



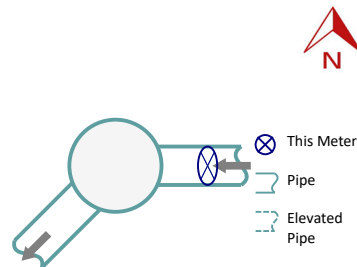
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 1.10
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

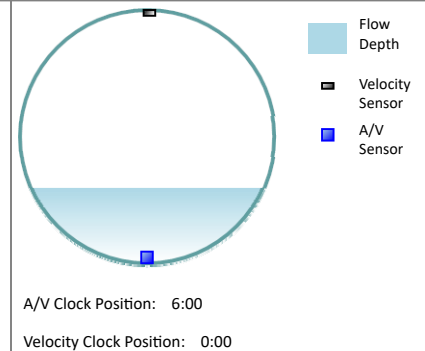
Hydraulic Characteristics

Installation Notes Flow rates vary up and down from 6 to 9 inches

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-27-01

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:41 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 263060
 U/S Connecting MH I.D 263059
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence Yes
 WWTP Influence

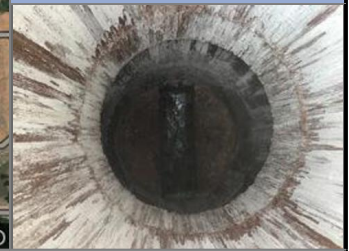
Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 769 24th Ave SE
 Site Access Off-Road
 Longitude -97.40580000
 Latitude 35.20810000
 MH Type Precast Concrete
 Manhole Depth (ft) 13.90
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 16.94
 Pipe Width (in) 17.25
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Hydraulic Characteristics

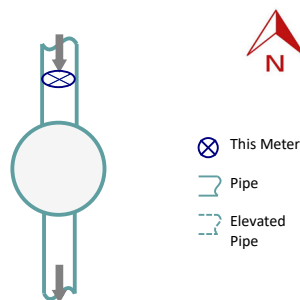
Installation Notes

Flow fluctuates from 1.5 to 4.5 inches, when flow is at its lowest, the av sensor is no longer submerged.

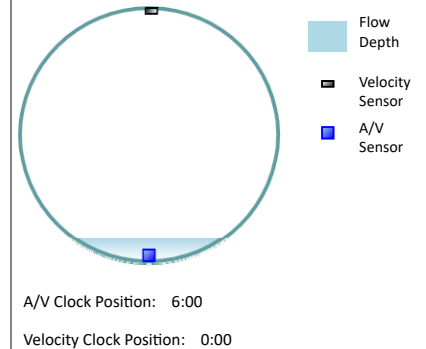
Hydraulic Information

Flow Depth (in) 1.50
 Instant Velocity (fps) 0.60
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

BP-28

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:51 PM

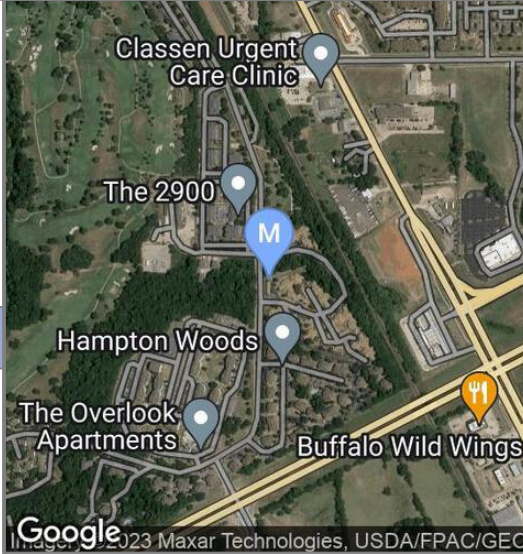
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 322001
 U/S Connecting MH I.D 322070
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

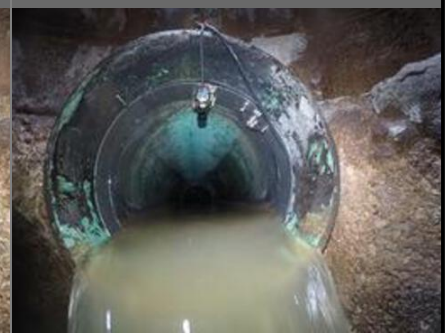
Site Address 700 Oak Tree Ave
 Site Access Off-Road
 Longitude -97.42340000
 Latitude 35.18560000
 MH Type Precast Concrete
 Manhole Depth (ft) 14.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes Gate was open during investigation, #1590 gate code

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 23.50
 Pipe Width (in) 23.81
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

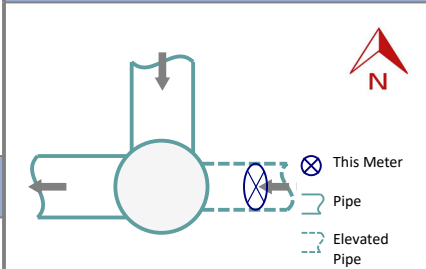
Hydraulic Characteristics

Installation Notes Flow changes from 4.5 to 6 inches variably

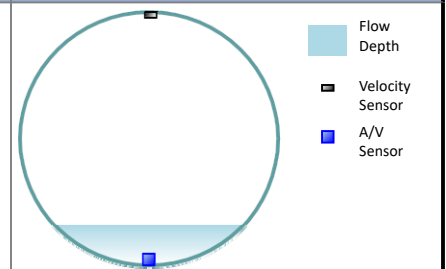
Hydraulic Information

Flow Depth (in) 3.70
 Instant Velocity (fps) 2.00
 Surge Evidence (ft) 9.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

A/V Clock Position: 6:00
Velocity Clock Position: 0:00

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP Client Approval



Norman,OK
Norman Utilities Authority

Site Name

BP-30

Inspected By r_bass

Project No.

Site Code

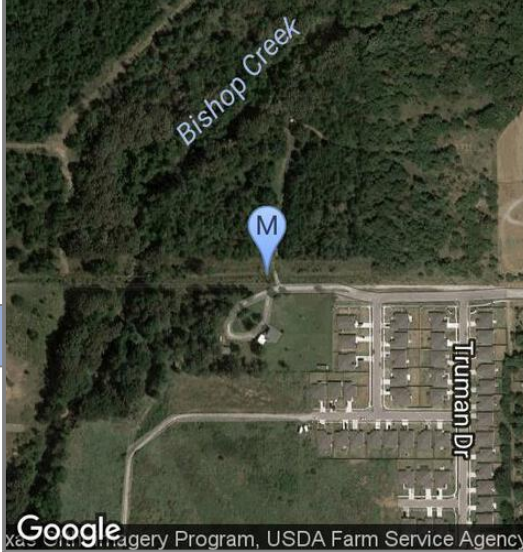
Inspected Date/Time 10/7/2014 3:07 PM

30-3884-00

System Information

Target Pipe Dia. (in) 24.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-10
Client Manhole # 329087
U/S Connecting MH I.D 329051
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Location Information

Site Address 400 East Cedar Ln
Site Access Fenced In
Longitude -97.43520000
Latitude 35.17520000
MH Type Precast Concrete
Manhole Depth (ft) 14.48
Manhole Width (ft) 5.0
Elevated MH Yes
Height Elevated (ft) 1.7
Structural Integrity Safe

Top View Picture



Access Notes

Enter through red gate at end of East Cedar Lane, (RJN owned lock on gate)
Follow fence line to the west, pass black iron gate...MH located next to gate

Site Information

Pipe Height (in) 23.06
Pipe Width (in) 23.31
Pipe Type Polyvinyl Chloride
Pipe Shape Circular
O2 LEL %
H2S CO

Investigation Photo



Installation Photo



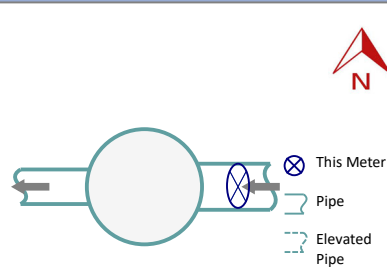
Hydraulic Information

Flow Depth (in) 3.50
Instant Velocity (fps) 0.70
Surcharge Evidence (ft)
Silt Type None
Silt Depth (in) 0.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating No Flow

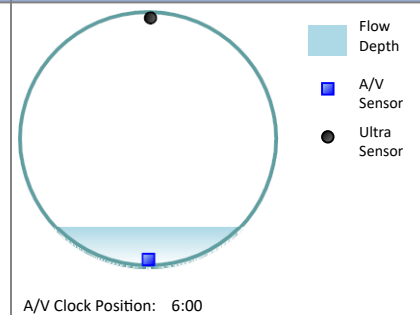
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 75

Post Installation Notes

Meter Type
Telemetry Type
Installation Date 11/7/2014

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

IH-12

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:51 AM

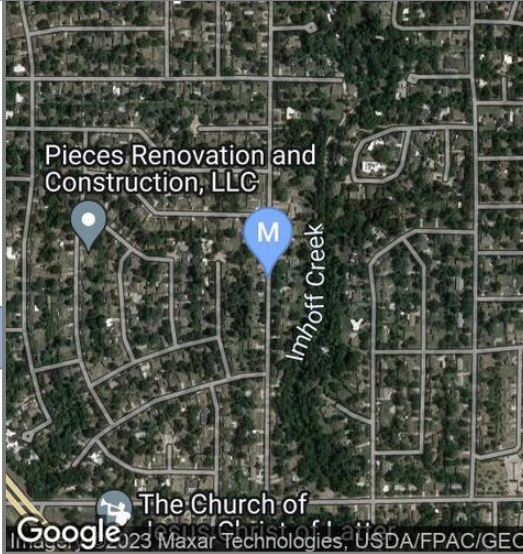
30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 293010
 U/S Connecting MH I.D 293009
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2522 S Berry Rd
 Site Access Roadway, Low Traffic
 Longitude -97.45910000
 Latitude 35.19350000
 MH Type Precast Concrete
 Manhole Depth (ft) 11.70
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 22.12
 Pipe Width (in) 22.25
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

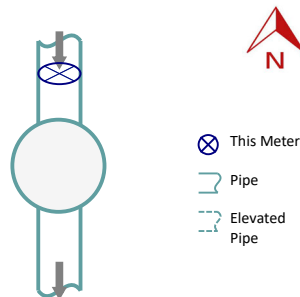
Hydraulic Characteristics

Installation Notes

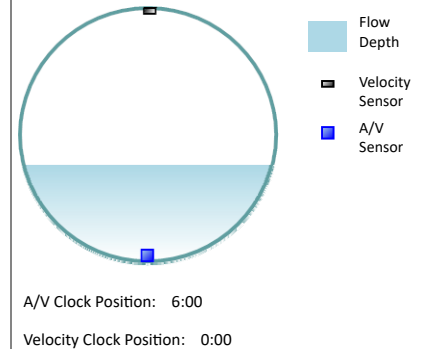
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 0.50
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

IH-13

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:22 AM

30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 255052
 U/S Connecting MH I.D 239129
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 708 McGee Dr
 Site Access Roadway, Low Traffic
 Longitude -97.46780000
 Latitude 35.21080000
 MH Type Brick
 Manhole Depth (ft) 16.80
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 18.00
 Pipe Width (in) 18.00
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

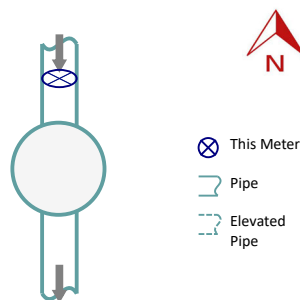
Hydraulic Characteristics

Installation Notes

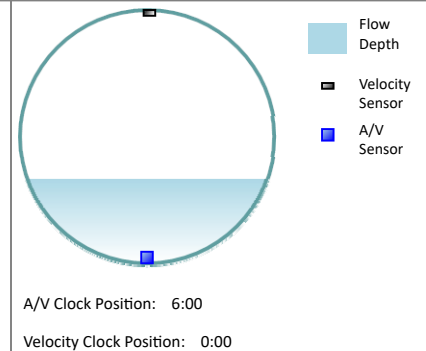
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 0.88
 Surge Evidence (ft) 11.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

IH-14

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:44 AM

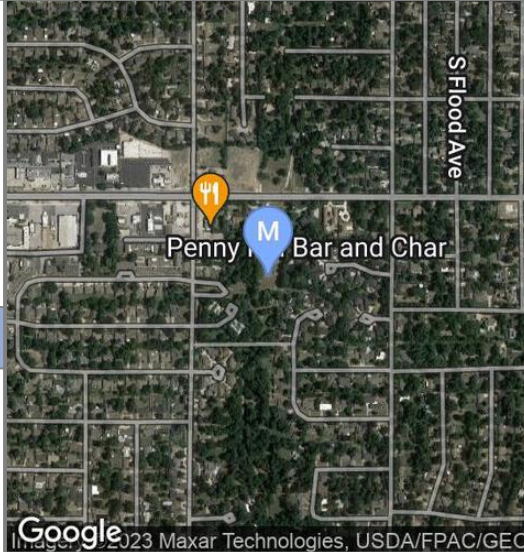
30-3984-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 283007
 U/S Connecting MH I.D 283003
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1101 Cherrystone Cir
 Site Access Off-Road
 Longitude -97.45730000
 Latitude 35.20240000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.60
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 34.00
 Pipe Width (in) 35.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



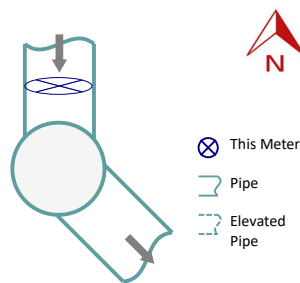
Hydraulic Information

Flow Depth (in) 7.50
 Instant Velocity (fps) 1.98
 Surge Evidence (ft) 11.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

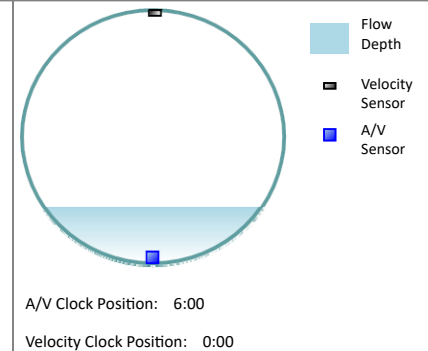
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

IH-15

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:24 AM

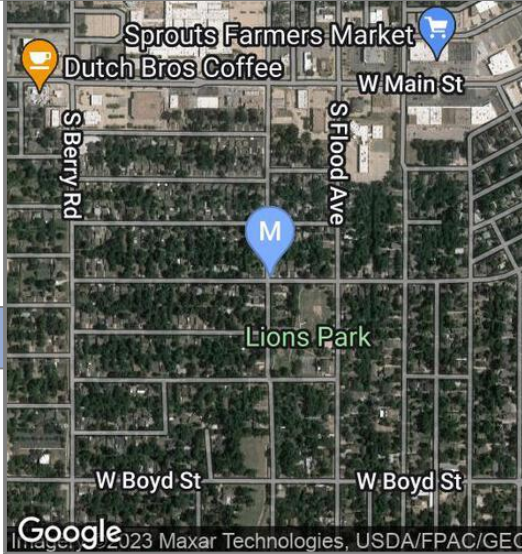
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 241027
 U/S Connecting MH I.D 241020
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 949 W Symmes St
 Site Access Sidewalk
 Longitude -97.45460000
 Latitude 35.21490000
 MH Type Precast Concrete
 Manhole Depth (ft) 12.80
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

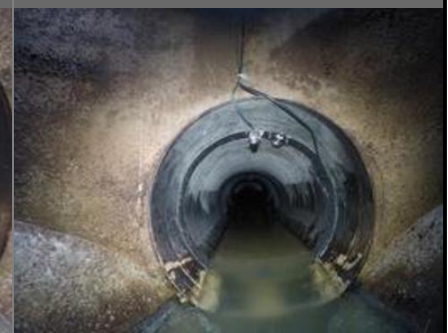
Site Information

Pipe Height (in) 29.00
 Pipe Width (in) 30.25
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



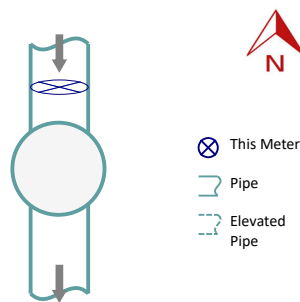
Hydraulic Information

Flow Depth (in) 3.60
 Instant Velocity (fps) 1.80
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

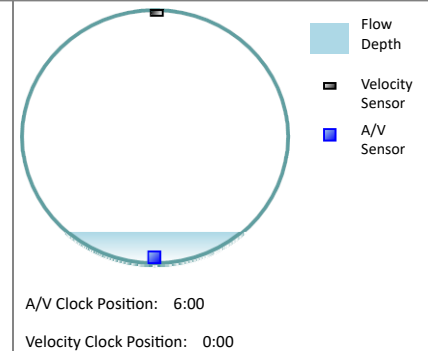
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

2023 Norman Temporary Flow Monitoring

Site Name

IH-16

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:47 AM

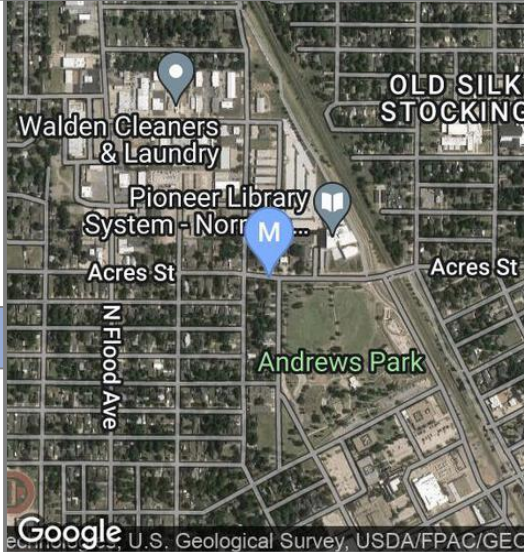
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 211076
 U/S Connecting MH I.D 211077
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 301 W Acres St
 Site Access Roadway, Low Traffic
 Longitude -97.44950000
 Latitude 35.22550000
 MH Type Precast Concrete
 Manhole Depth (ft) 17.20
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 17.44
 Pipe Width (in) 17.44
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



Hydraulic Information

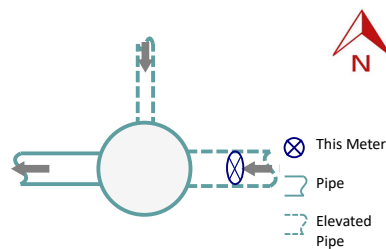
Flow Depth (in) 3.00
 Instant Velocity (fps) 1.70
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Hydraulic Characteristics

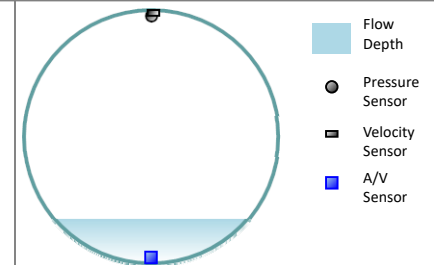
Installation Notes

Flow fluctuates between 3 and 4 inches during calibration, speed also 2 to 3 fms

Install Plan Sketch



Install Cross-Section Sketch



Pressure Clock Position: 0:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

LD-01

Inspected By mjaurez

Project No.

Site Code

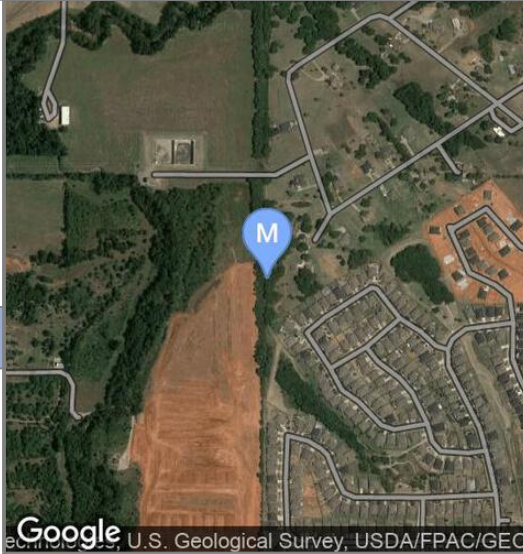
Inspected Date/Time 3/21/2023 3:16 PM

30-3984-00

System Information

Target Pipe Dia. (in) 10.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 79023
 U/S Connecting MH I.D 79022
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 4011 8th Ave Cir NE
 Site Access Off-Road
 Longitude -97.43240000
 Latitude 35.26720000
 MH Type Poured Concrete
 Manhole Depth (ft) 3.80
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.5
 Structural Integrity Safe

Top View Picture



Access Notes

Through drainage ditch off of road that goes to the treatment plant. Drive through the easement.

Site Information

Pipe Height (in) 9.75
 Pipe Width (in) 9.75
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



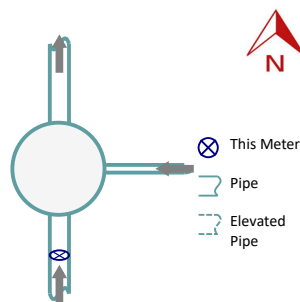
Hydraulic Information

Flow Depth (in) 1.00
 Instant Velocity (fps) 2.13
 Surge Evidence (ft) 3.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

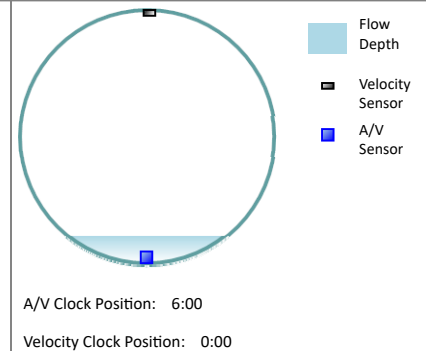
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

LD-02

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:30 PM

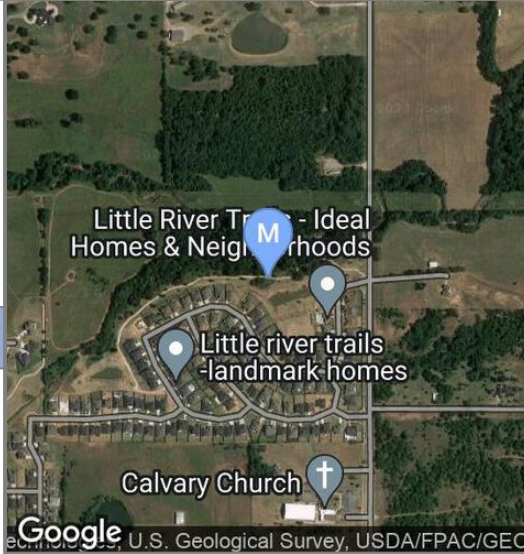
30-3984-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 78009
 U/S Connecting MH I.D 78008
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

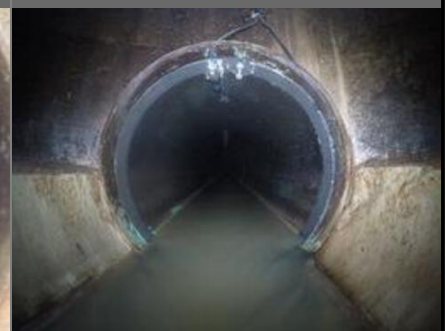
Site Address 301 Sonora Ln
 Site Access Off-Road
 Longitude -97.44360000
 Latitude 35.26790000
 MH Type Lined
 Manhole Depth (ft) 16.70
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes Access On walking trail off of N porter and Bandera Trail.

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 35.50
 Pipe Width (in) 36.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

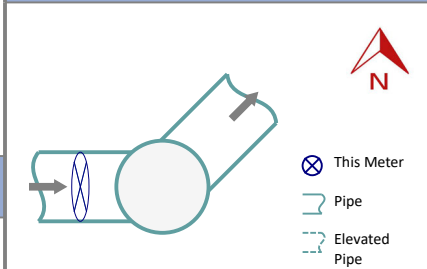
Hydraulic Characteristics

Installation Notes

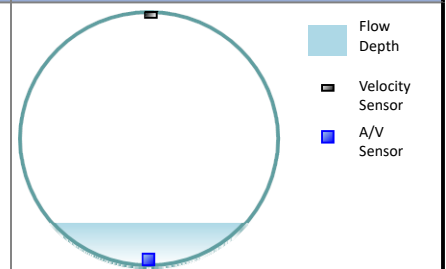
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 1.25
 Surge Evidence (ft) 9.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/24/2023

Approvals

Recommended by FSP
 Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

LD-03

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 12:29 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 69012
 U/S Connecting MH I.D 69011
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 7GG7+5F Norman
 Site Access Off-Road
 Longitude -97.48640000
 Latitude 35.27540000
 MH Type Lined
 Manhole Depth (ft) 12.60
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 22.00
 Pipe Width (in) 23.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



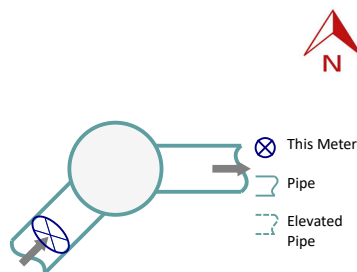
Hydraulic Information

Flow Depth (in) 4.00
 Instant Velocity (fps) 0.76
 Surge Evidence (ft) 7.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

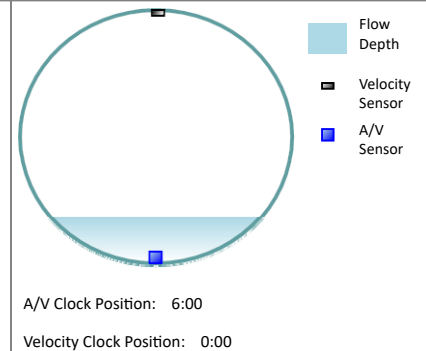
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

ND-08

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:41 AM

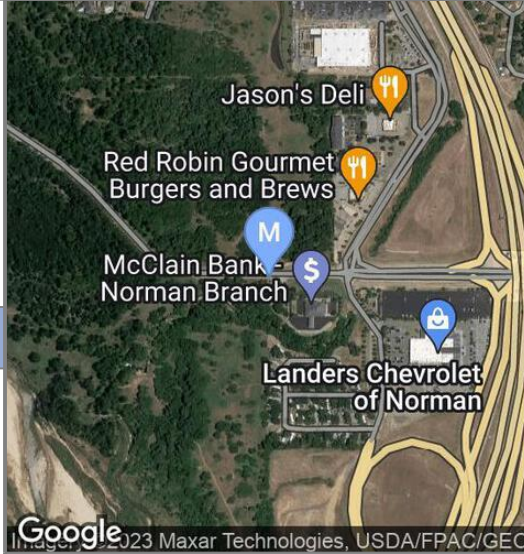
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 279003
 U/S Connecting MH I.D 254073
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 2900 W Lindsey St
 Site Access Off-Road
 Longitude -97.48550000
 Latitude 35.20390000
 MH Type Poured Concrete
 Manhole Depth (ft) 12.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 24.00
 Pipe Width (in) 24.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



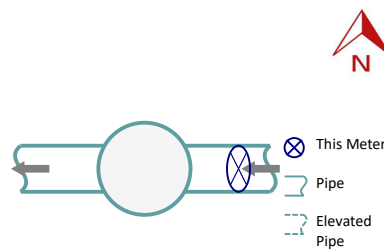
Hydraulic Information

Flow Depth (in) 8.00
 Instant Velocity (fps) 1.43
 Surge Evidence (ft) 5.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

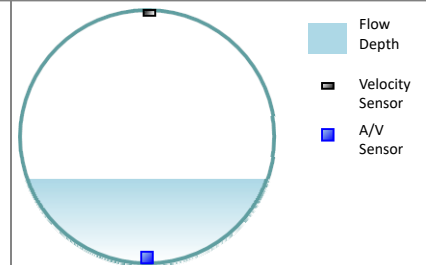
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

ND-09

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:00 AM

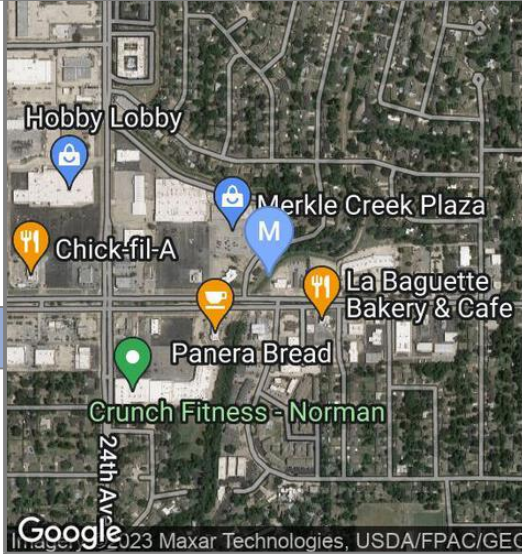
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 208122
 U/S Connecting MH I.D 208121
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2121 W Main St
 Site Access Off-Road
 Longitude -97.47300000
 Latitude 35.21890000
 MH Type Poured Concrete
 Manhole Depth (ft) 14.30
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.5
 Structural Integrity Questionable

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 17.00
 Pipe Width (in) 17.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

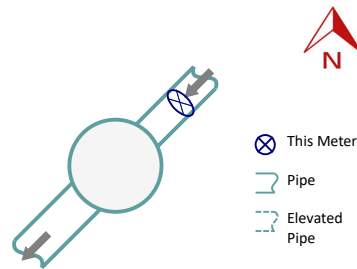
Hydraulic Characteristics

Installation Notes

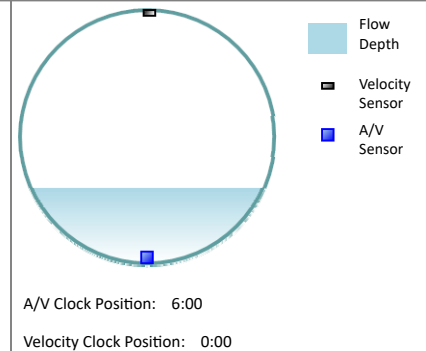
Hydraulic Information

Flow Depth (in) 5.00
 Instant Velocity (fps) 2.14
 Surge Evidence (ft) 8.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

SV-01

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:22 PM

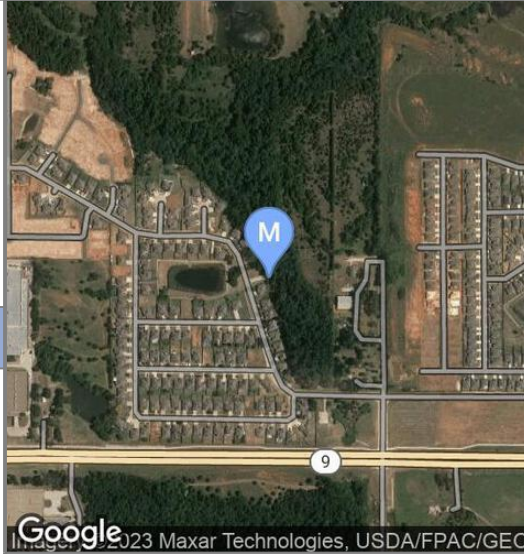
30-3984-00

T

System Information

Target Pipe Dia. (in) 8.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 301022
 U/S Connecting MH I.D 301038
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3301 Wood Valley Rd
 Site Access Off-Road
 Longitude -97.39080000
 Latitude 35.19290000
 MH Type Precast Concrete
 Manhole Depth (ft) 7.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 14.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

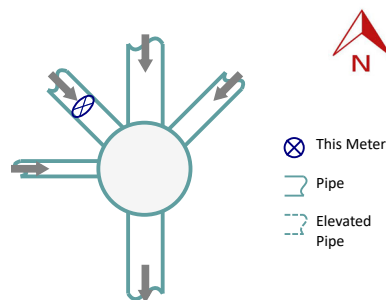
Hydraulic Characteristics

Installation Notes

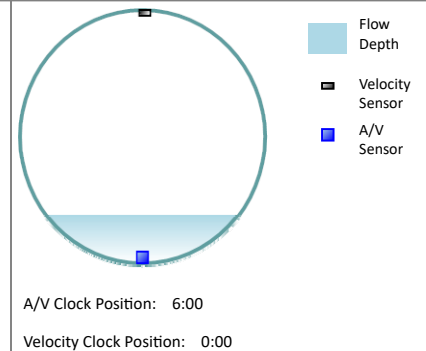
Hydraulic Information

Flow Depth (in) 2.75
 Instant Velocity (fps) 1.00
 Surge Evidence (ft) 1.50
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

WC-30

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:58 PM

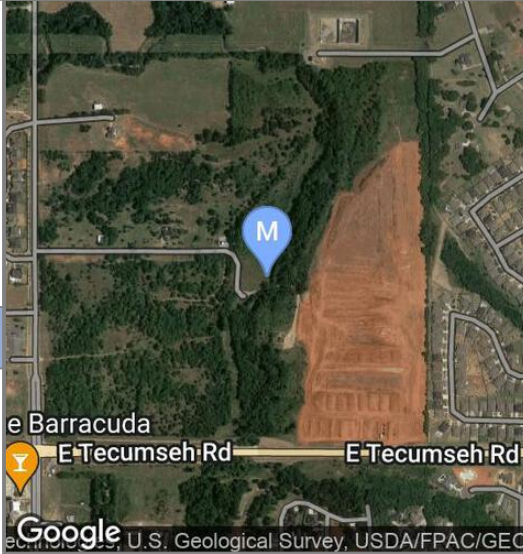
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 79037
 U/S Connecting MH I.D 79036
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 7H87+2H Norman
 Site Access Off-Road
 Longitude -97.43610000
 Latitude 35.26510000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.90
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

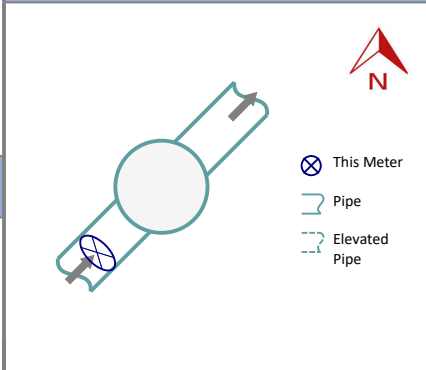
Hydraulic Characteristics

Installation Notes

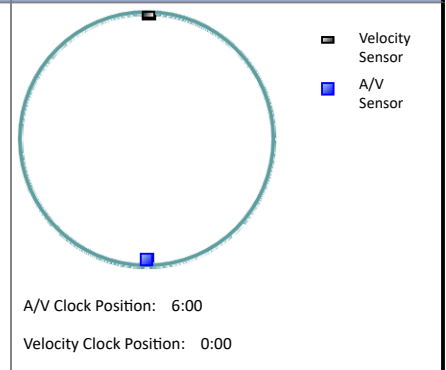
Hydraulic Information

Flow Depth (in)
 Instant Velocity (fps) 2.12
 Surge Evidence (ft) 2.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

WC-31

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:13 PM

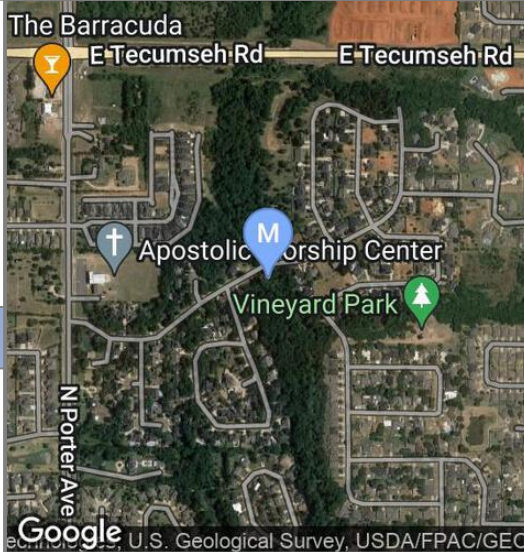
30-3984-00

T

System Information

Target Pipe Dia. (in) 15.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 105128
 U/S Connecting MH I.D 105025
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 400 Nantucket Blvd
 Site Access Off-Road
 Longitude -97.43680000
 Latitude 35.25780000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.00
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 15.00
 Pipe Type Iron
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



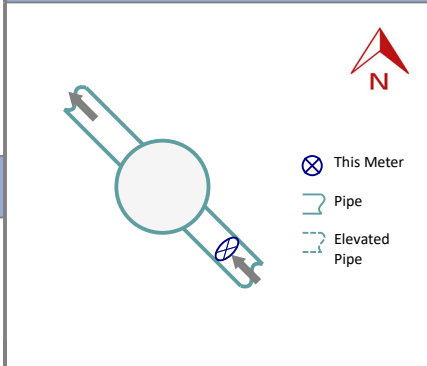
Hydraulic Information

Flow Depth (in) 4.50
 Instant Velocity (fps) 1.39
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

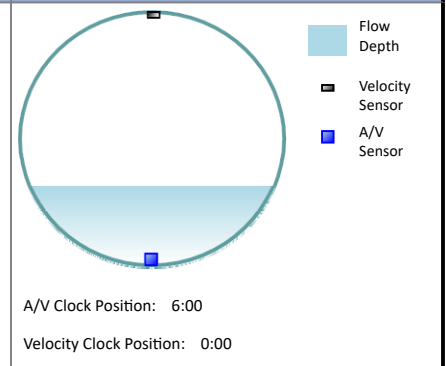
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

2023 Norman Temporary Flow Monitoring

WC-32

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:26 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 103013
 U/S Connecting MH I.D 103012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 796 W Tecumseh Rd
 Site Access Off-Road
 Longitude -97.45370000
 Latitude 35.26170000
 MH Type Precast Concrete
 Manhole Depth (ft) 18.30
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Top View Picture



Access Notes

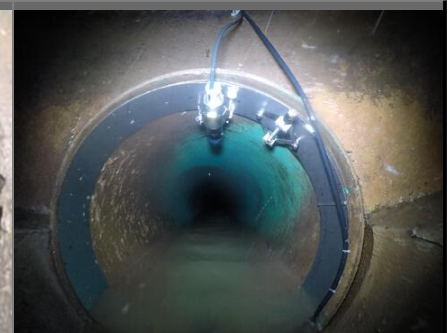
Site Information

Pipe Height (in) 20.50
 Pipe Width (in) 20.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



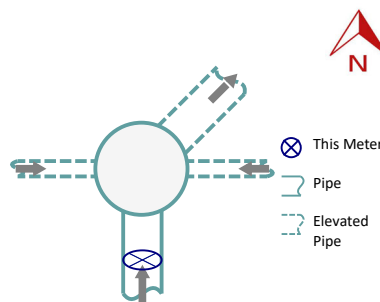
Hydraulic Information

Flow Depth (in) 3.00
 Instant Velocity (fps) 1.02
 Surge Evidence (ft) 16.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

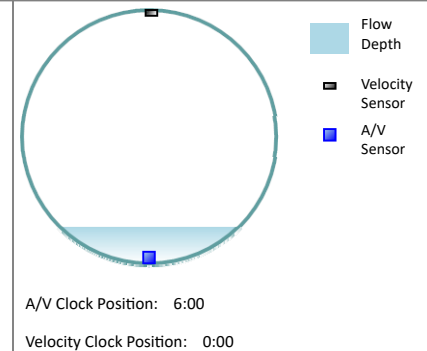
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name

WS-01

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 9:12 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 42.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-03
Client Manhole # 327074
U/S Connecting MH I.D 327075
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence Yes

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3901 Chautauqua Ave, Norman, OK 73072
Site Access Off-Road
Longitude -97.45040000
Latitude 35.17670000
MH Type Poured Concrete
Manhole Depth (ft) 13.00
Manhole Width (ft) 5.8
Elevated MH Yes
Height Elevated (ft) 0.8
Structural Integrity Safe

Access Notes By cattle gate on Chatauqua

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 41.62
Pipe Width (in) 41.69
Pipe Type Polyvinyl Chloride
Pipe Shape Circular
O2 LEL %
H2S CO

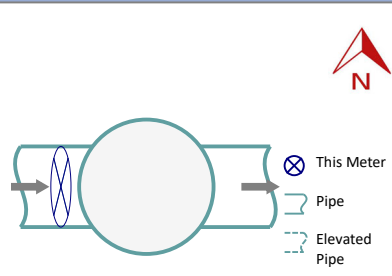
Hydraulic Characteristics

Installation Notes

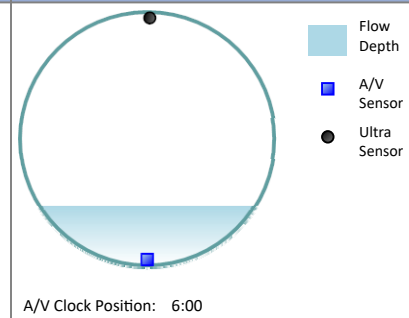
Hydraulic Information

Flow Depth (in) 9.62
Instant Velocity (fps) 2.13
Surcharge Evidence (ft)
Silt Type None
Silt Depth (in) 0.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Paved Surface
Signal Strength 75

Post Installation Notes

Meter Type
Telemetry Type
Installation Date 3/2/2017

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK
Norman Utilities Authority

Site Name

WS-10

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 9:45 AM

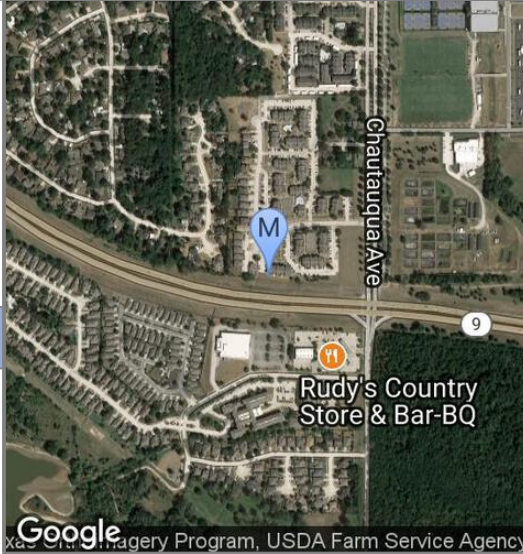
30-3884-00

T

System Information

Target Pipe Dia. (in) 22.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-03
Client Manhole # 318010
U/S Connecting MH I.D 318011
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3204 Ridgecrest Cir
Site Access Off-Road
Longitude -97.45240000
Latitude 35.18250000
MH Type Brick
Manhole Depth (ft) 8.06
Manhole Width (ft) 5.0
Elevated MH Yes
Height Elevated (ft) 0.3
Structural Integrity Safe

Access Notes South of Post Oak apartments.

Site Information

Pipe Height (in) 22.62
Pipe Width (in) 22.88
Pipe Type Vitrified Clay
Pipe Shape Circular
O2 LEL %
H2S CO

Investigation Photo



Installation Photo



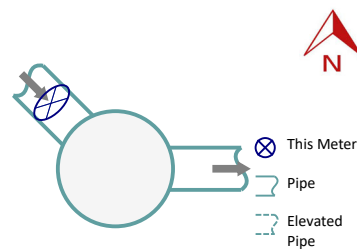
Hydraulic Information

Flow Depth (in) 8.44
Instant Velocity (fps) 1.62
Surcharge Evidence (ft)
Silt Type None
Silt Depth (in) 0.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

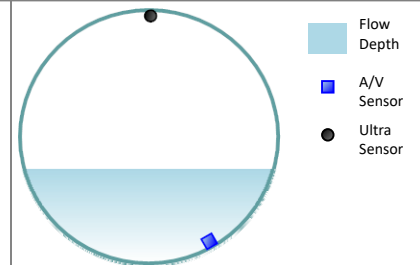
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 5:00

Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 75

Post Installation Notes

Meter Type
Telemetry Type
Installation Date 10/7/2014

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK
Norman Utilities Authority

Site Name

WS-11

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/8/2015 10:01 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 42.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-03
Client Manhole # 328046
U/S Connecting MH I.D 328045
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3428 Jenkins Ave Norman, OK 73072
Site Access Other
Longitude -97.44420000
Latitude 35.18230000
MH Type Poured Concrete
Manhole Depth (ft) 22.60
Manhole Width (ft) 5.0
Elevated MH Yes
Height Elevated (ft) 0.4
Structural Integrity Safe

Access Notes ROTC training ground

Site Information

Pipe Height (in) 41.25
Pipe Width (in) 41.13
Pipe Type Polyvinyl Chloride
Pipe Shape Circular
O2 LEL %
H2S CO

Investigation Photo



Installation Photo



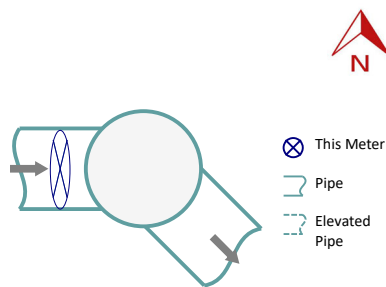
Hydraulic Information

Flow Depth (in) 26.13
Instant Velocity (fps) 0.78
Surcharge Evidence (ft)
Silt Type Fine
Silt Depth (in) 9.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

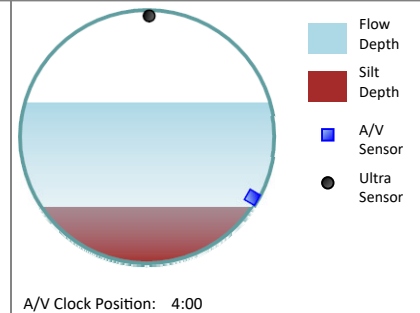
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 75

Post Installation Notes

Approvals

Meter Type
Telemetry Type
Installation Date 6/9/2017

Recommended by FSP
Yes

Client Approval
Yes

Monitor Site

Monitor Site: RG-02

Monitor Location: D Pump station

Metadata

Date	Mar 22 2023 12:10PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.2693105, -97.434748]

Location

Facility Name	D Pump station
Location Description	7H98+MG Norman

Investigation

Arrival Time	Mar 22 2023 11:07AM
Departure Time	Mar 22 2023 11:20AM
Setup Conditions	Standard

Access and Safety

Contact Name	N/A
Phone Number	329-0703
Contact Title	N/A

Review

Recommended for Installation Yes



Location



Area



Area



Area

Monitor Site

Monitor Site: RG-03

Monitor Location: Norman City Yard

Metadata

Date	Jun 4 2021 12:48PM
Creator	Blangdon
Coordinates	[35.244104, -97.460121]

Location

Facility Name	Norman City Yard
Location Description	1301 Da Vinci St

Investigation

Arrival Time	Jun 4 2021 11:46AM
Departure Time	Jun 4 2021 11:53AM
Setup Conditions	Standard

Access and Safety

Contact Name	City
Phone Number	NA
Contact Title	Yard
Access Instructions	Access through South East part of the city building. Use permanent black ladder that is attached to the building, rain gauge is right up on the roof there.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-04

Monitor Location: Vernon Campbell Water Treatment Plant

Metadata

Date	Sep 11 2015 10:46AM
Creator	mhuska
Coordinates	[35.232275, -97.395774]

Location

Facility Name	Vernon Campbell Water Treatment Plant
Location Description	3000 East robinson St

Investigation

Arrival Time	Sep 11 2015 10:46AM
Setup Conditions	Standard

Access and Safety

Contact Name	Jared Mattern
Phone Number	405-329-0703
Contact Title	Utility Supervisor
Access Instructions	Coordinate with City

Review

Recommended for Installation	Yes
------------------------------	-----

Location



Monitor Site

Monitor Site: RG-05

Monitor Location: Millenium Medical

Metadata

Date	May 2 2023 3:07PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.22404, -97.494612]

Location

Facility Name	Millenium Medical
Location Description	448 36th Ave NW

Investigation

Arrival Time	May 2 2023 2:05PM
Departure Time	May 2 2023 2:18PM
Setup Conditions	Standard

Access and Safety

Contact Name	Owner
Phone Number	4055739905
Contact Title	Owner
Access Instructions	On top of the NE part of the roof by the front corner of building.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-06

Monitor Location: Taco Casa

Metadata

Date	May 2 2023 2:02PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.218927, -97.454122]

Location

Facility Name	Taco Casa
Location Description	731 W Main St

Investigation

Arrival Time	May 2 2023 12:57PM
Departure Time	May 2 2023 1:06PM
Setup Conditions	Standard

Access and Safety

Contact Name	Manager
Phone Number	4058014104
Contact Title	Manager
Access Instructions	On top of small NE corner building in the back.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-07

Monitor Location: Folks Auto Machine

Metadata

Date	May 2 2023 2:15PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.225407, -97.422871]

Location

Facility Name	Folks Auto Machine
Location Description	541 12th Ave NE

Investigation

Arrival Time	May 2 2023 1:14PM
Departure Time	May 2 2023 1:21PM
Setup Conditions	Standard

Access and Safety

Contact Name	Owner
Phone Number	4053292287
Contact Title	Owner
Access Instructions	On top of NE vehicle awning.

Review

Recommended for Installation	Yes
------------------------------	-----



Location



Area

Monitor Site

Monitor Site: RG-08

Monitor Location: Summit Valley L/S

Metadata

Date	May 11 2023 9:34AM
Creator	danglemartin
Coordinates	[35.1902413, -97.389453]

Location

Facility Name	Summit Valley L/S
Location Description	Wood Valley Road\n

Investigation

Arrival Time	Apr 25 2023 10:40AM
---------------------	---------------------

Review

Recommended for Installation	Yes
-------------------------------------	-----

Location



Monitor Site

Monitor Site: RG-09

Monitor Location: St Michael's Episcopal Church

Metadata

Date	May 11 2023 9:46AM
Creator	danglemartin
Coordinates	[35.1896856, -97.466331]

Location

Location

Facility Name	St Michael's Episcopal Church
Location Description	1601 W Imhoff RD\n



Investigation

Arrival Time	Apr 26 2023 10:30AM
--------------	---------------------

Review

Recommended for Installation	Yes
------------------------------	-----

Monitor Site

Monitor Site: RG-10

Monitor Location: City of Norman Water Reclamation Facility

Metadata

Date	Sep 11 2015 10:46AM
Creator	mhuska
Coordinates	[35.1757793, -97.443034]

Location



Location

Facility Name	City of Norman Water Reclamation Facility
Location Description	3500 Jenkins ave

Investigation

Arrival Time	Sep 11 2015 11:46AM
Departure Time	Sep 11 2015 12:46PM
Setup Conditions	Standard

Access and Safety

Contact Name	Jared Mattern
Phone Number	405-329-0703
Contact Title	Utility Supervisor
Access Instructions	Norman waste water treatment plant on top of chlorine building.

Review

Recommended for Installation	Yes
-------------------------------------	-----

Monitor Site

Monitor Site: RG-11

Monitor Location: Community Christian School Athletics

Metadata

Date	Mar 22 2023 11:42AM
Crew	S. Gentry; Z. Sanders
Coordinates	[35.280651, -97.486143]

Location

Facility Name	Community Christian School Athleti
Location Description	5336 N Interstate Dr

Investigation

Arrival Time	Mar 22 2023 10:41AM
Departure Time	Mar 22 2023 11:46AM
Setup Conditions	Standard

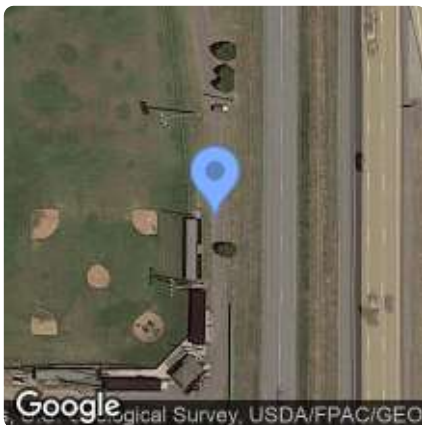
Access and Safety

Contact Name	Kerry Filmore
Phone Number	4056205487
Contact Title	Maintenance

Review

Installation Instructions On the dugout closest to the road, at the field south of the parking lot, or on a bleacher awning

Recommended for Installation Yes



Location



Area



Area



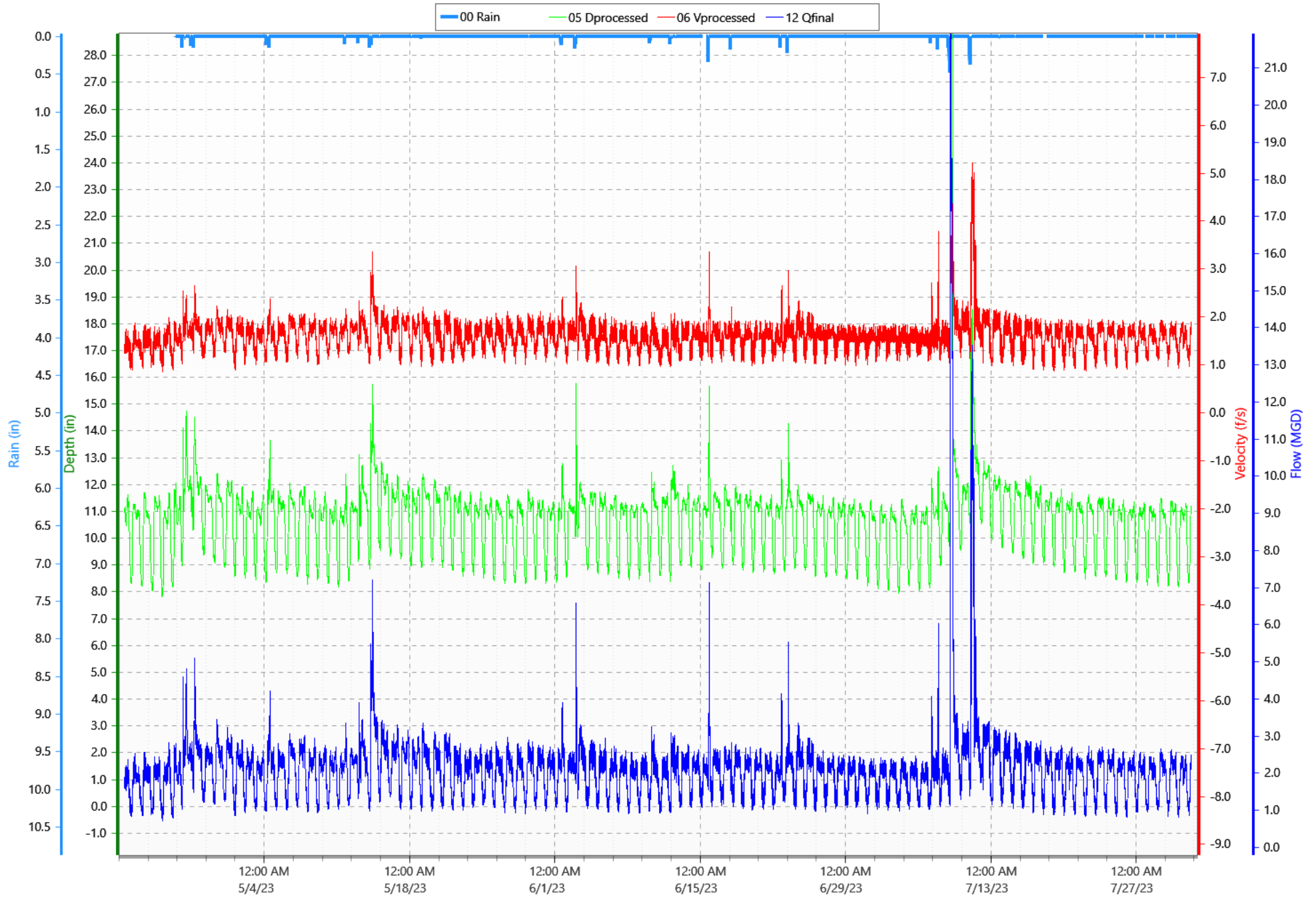
Area



Appendix B: Flow Monitoring Hydrographs

BH-02 (4/20/2023 to 8/2/2023)

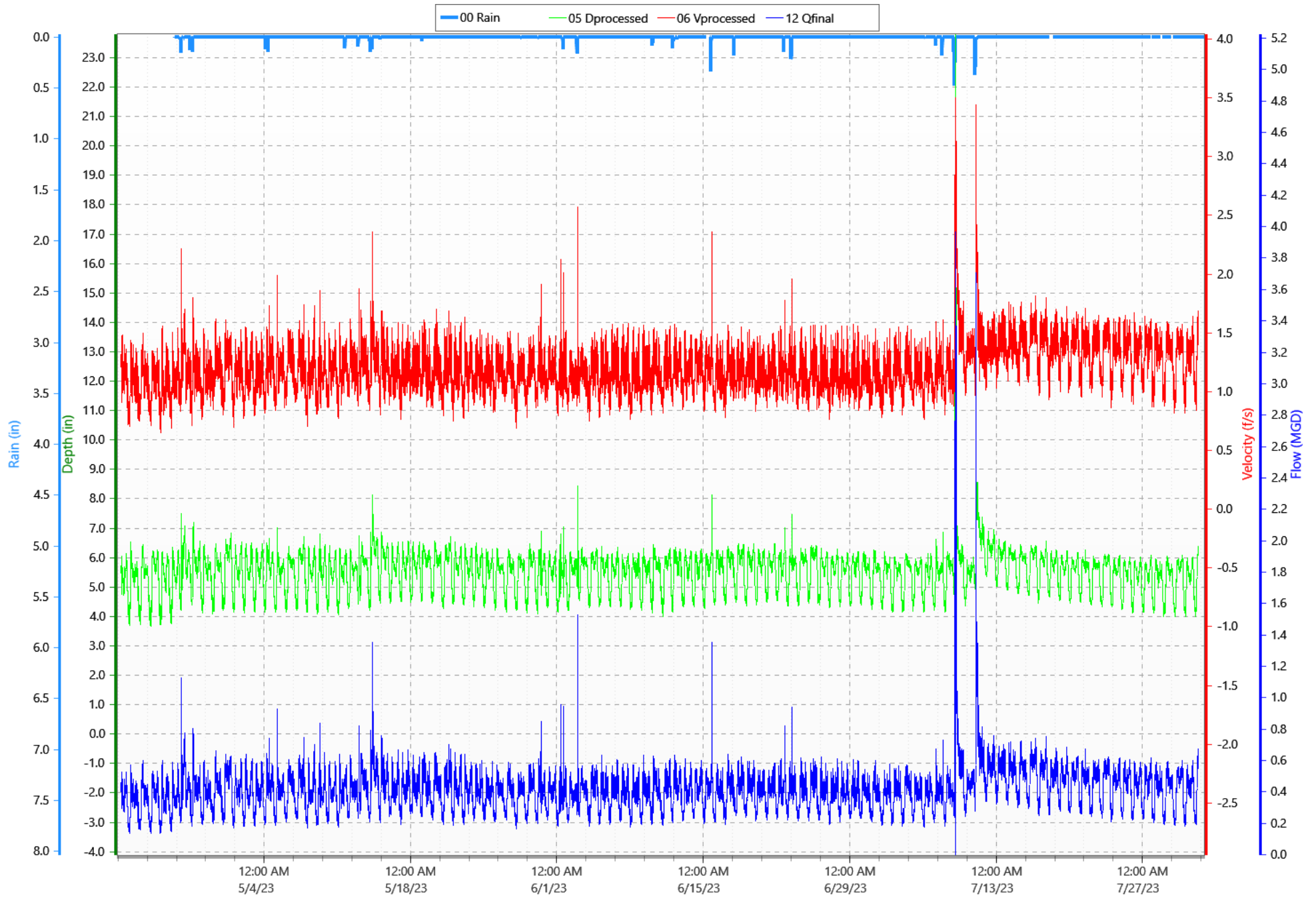
DVQ with Rain - Pipe Dia: 42.50 in.



Print Date: 10/12/2023 11:39:15 AM

BH-03 (4/20/2023 to 8/2/2023)

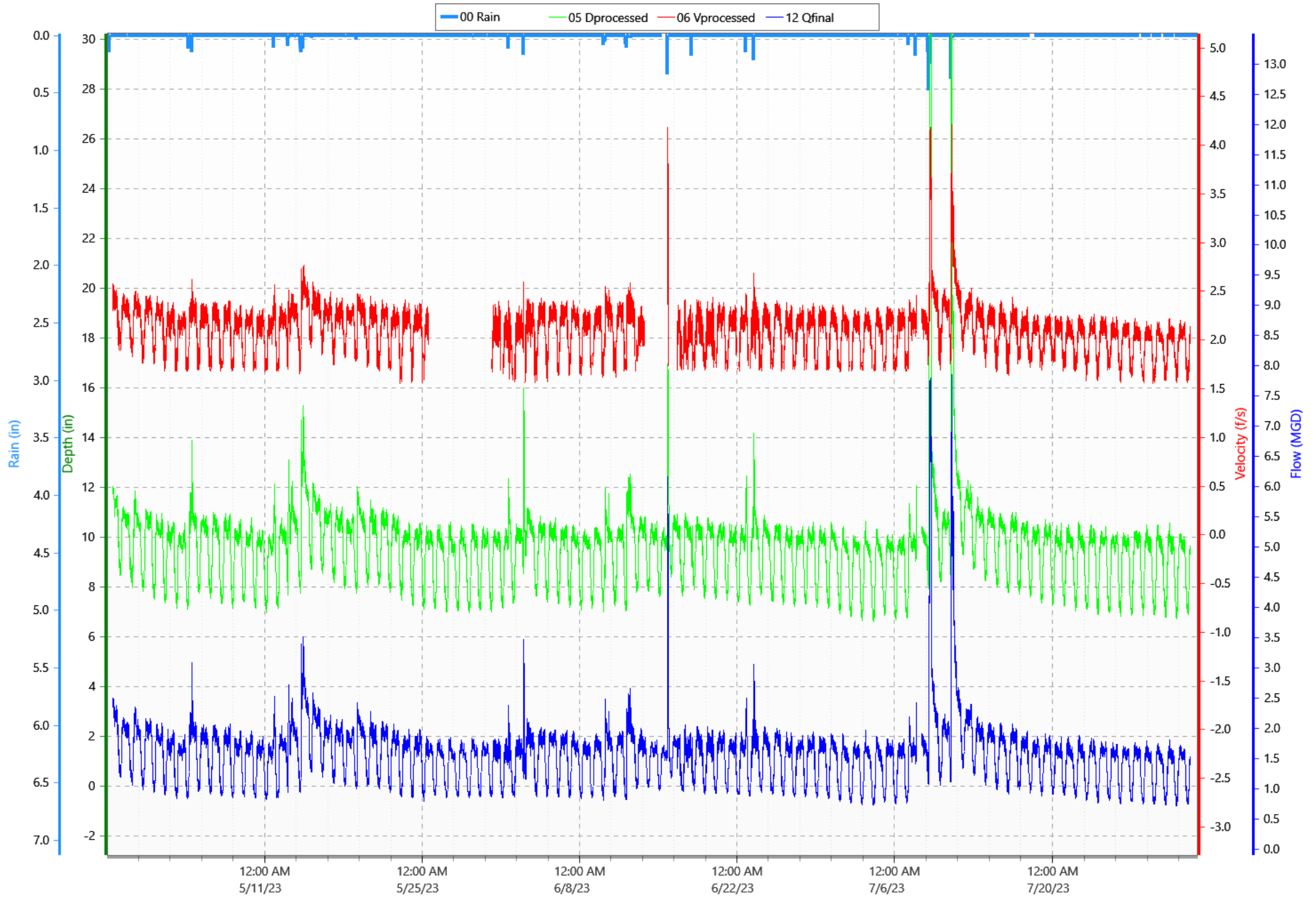
DVQ with Rain - Pipe Dia: 22.00 in.



Print Date: 10/12/2023 11:46:53 AM

BH-04 (4/27/2023 to 8/2/2023)

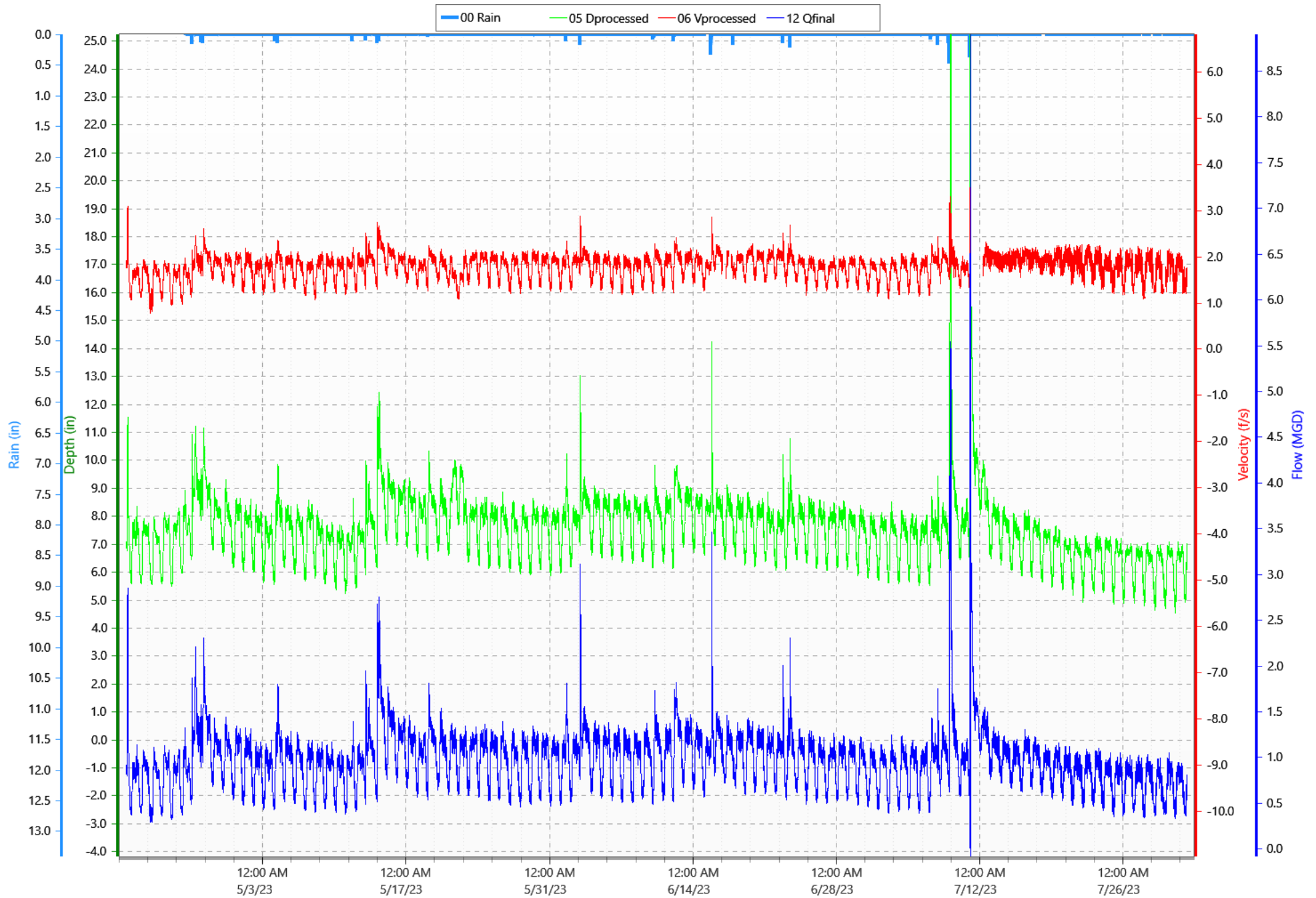
DVQ with Rain - Pipe Dia: 23.00 in.



Print Date: 10/12/2023 10:19:30 AM

BH-05 (4/19/2023 to 8/2/2023)

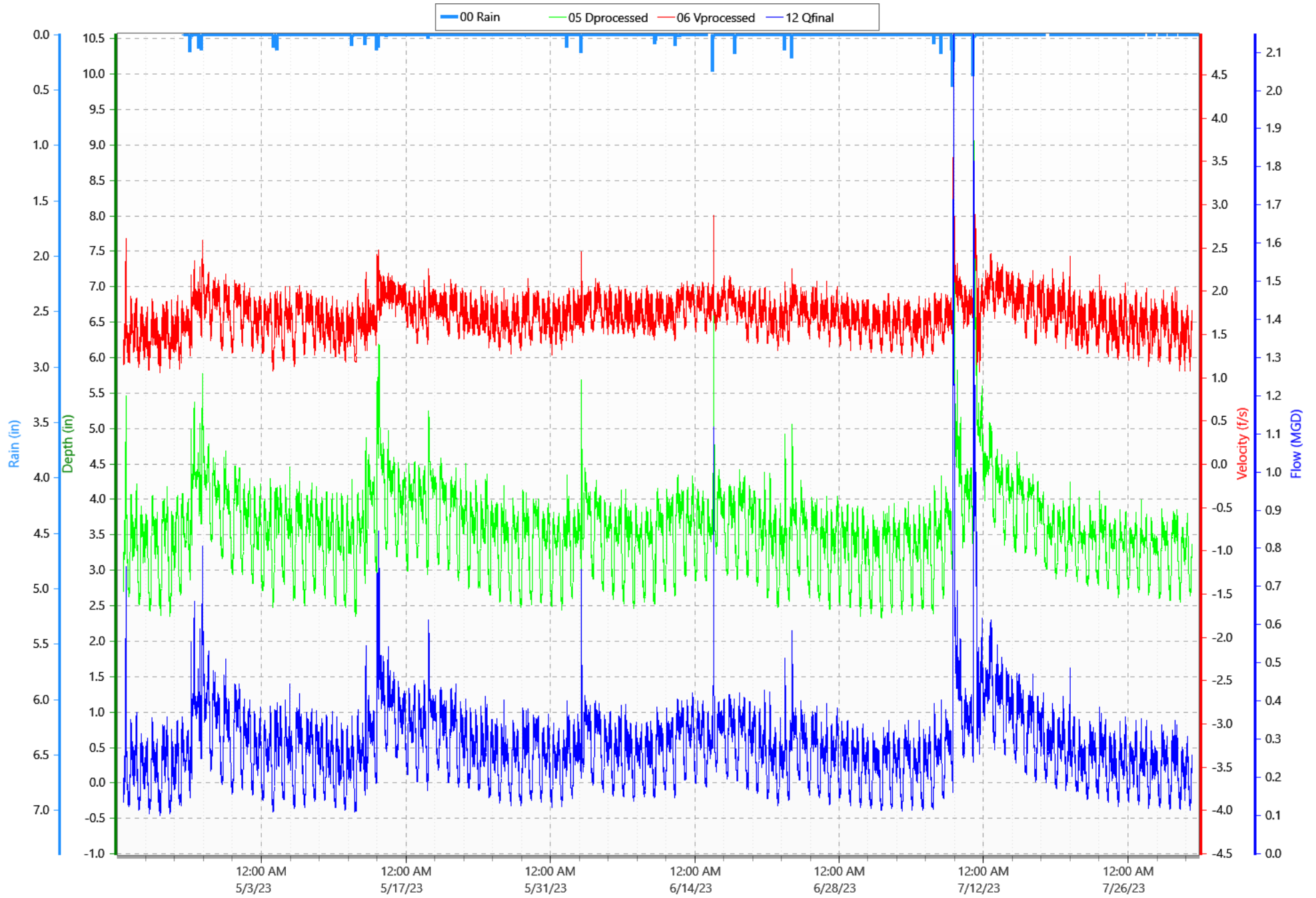
DVQ with Rain - Pipe Dia: 23.00 in.



Print Date: 10/12/2023 12:12:58 PM

BH-06 (4/19/2023 to 8/2/2023)

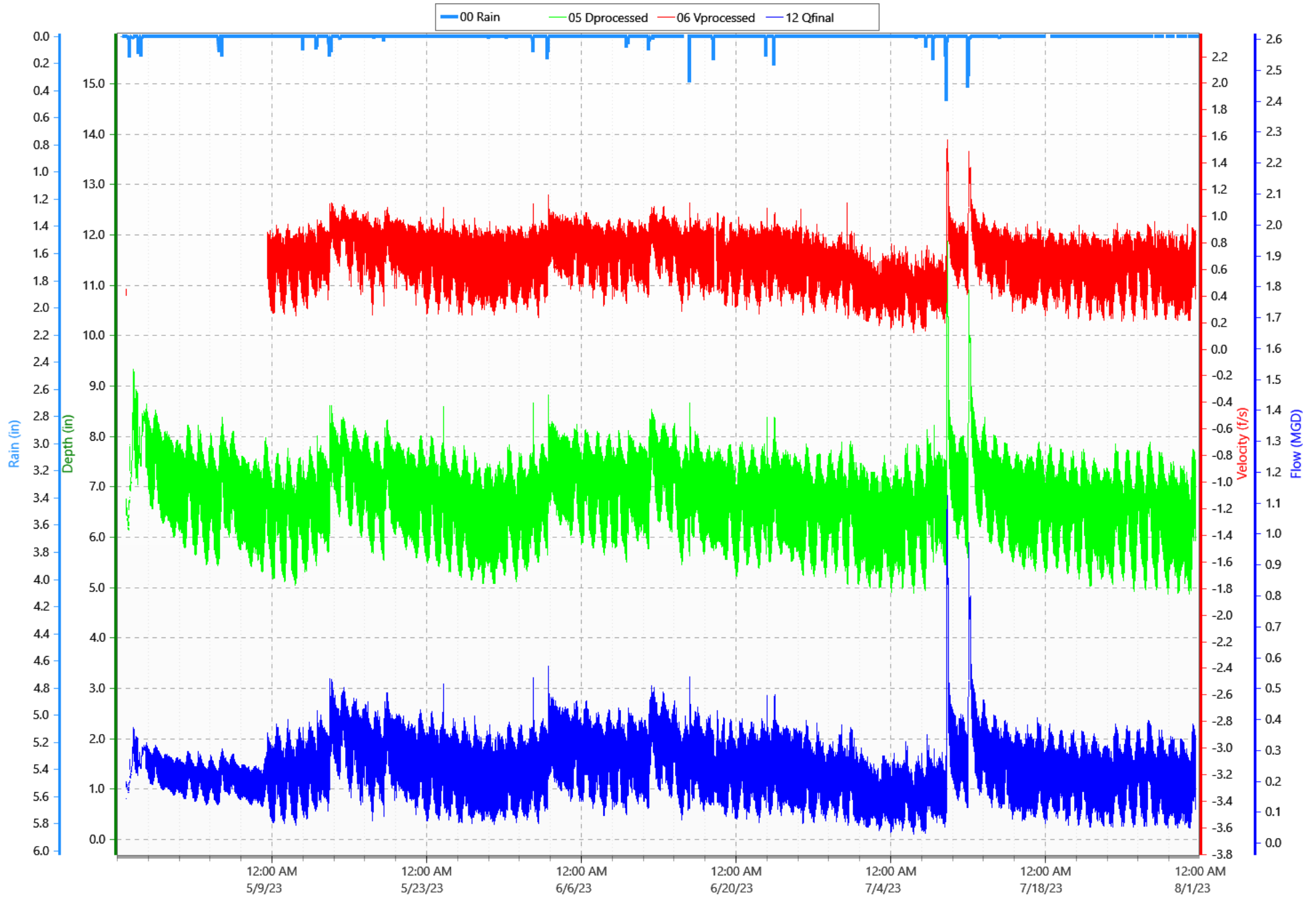
DVQ with Rain - Pipe Dia: 17.5 in.



Print Date: 10/12/2023 10:20:57 AM

BH-07 (4/25/2023 to 8/1/2023)

DVQ with Rain - Pipe Dia: 16.50 in.



Print Date: 10/12/2023 10:21:51 AM

BP-17 (4/19/2023 to 8/2/2023)

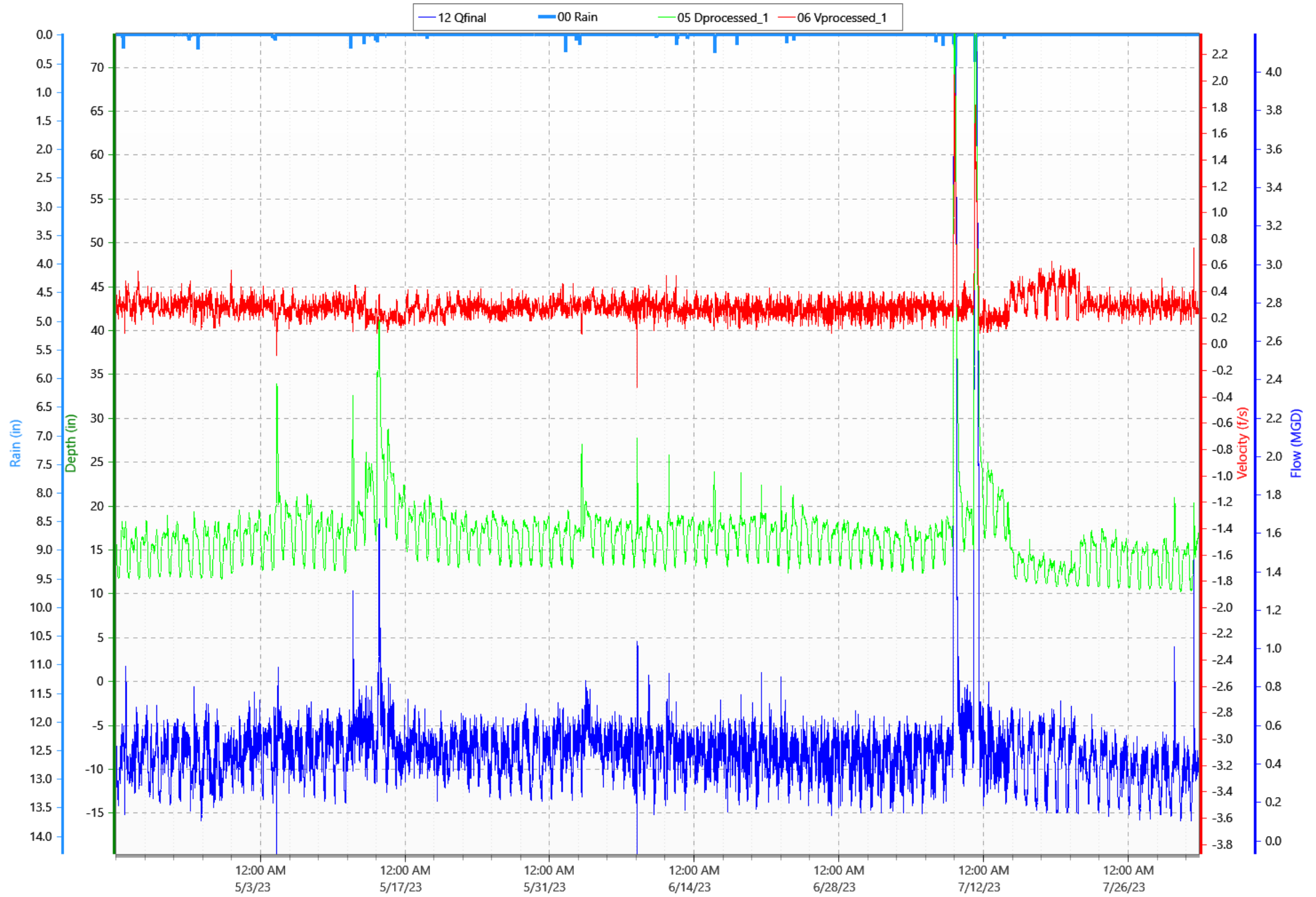
DVQ with Rain - Pipe Dia: 32.94 x 33.98 in.



Print Date: 10/12/2023 12:14:56 PM

BP-18 (4/19/2023 to 8/2/2023)

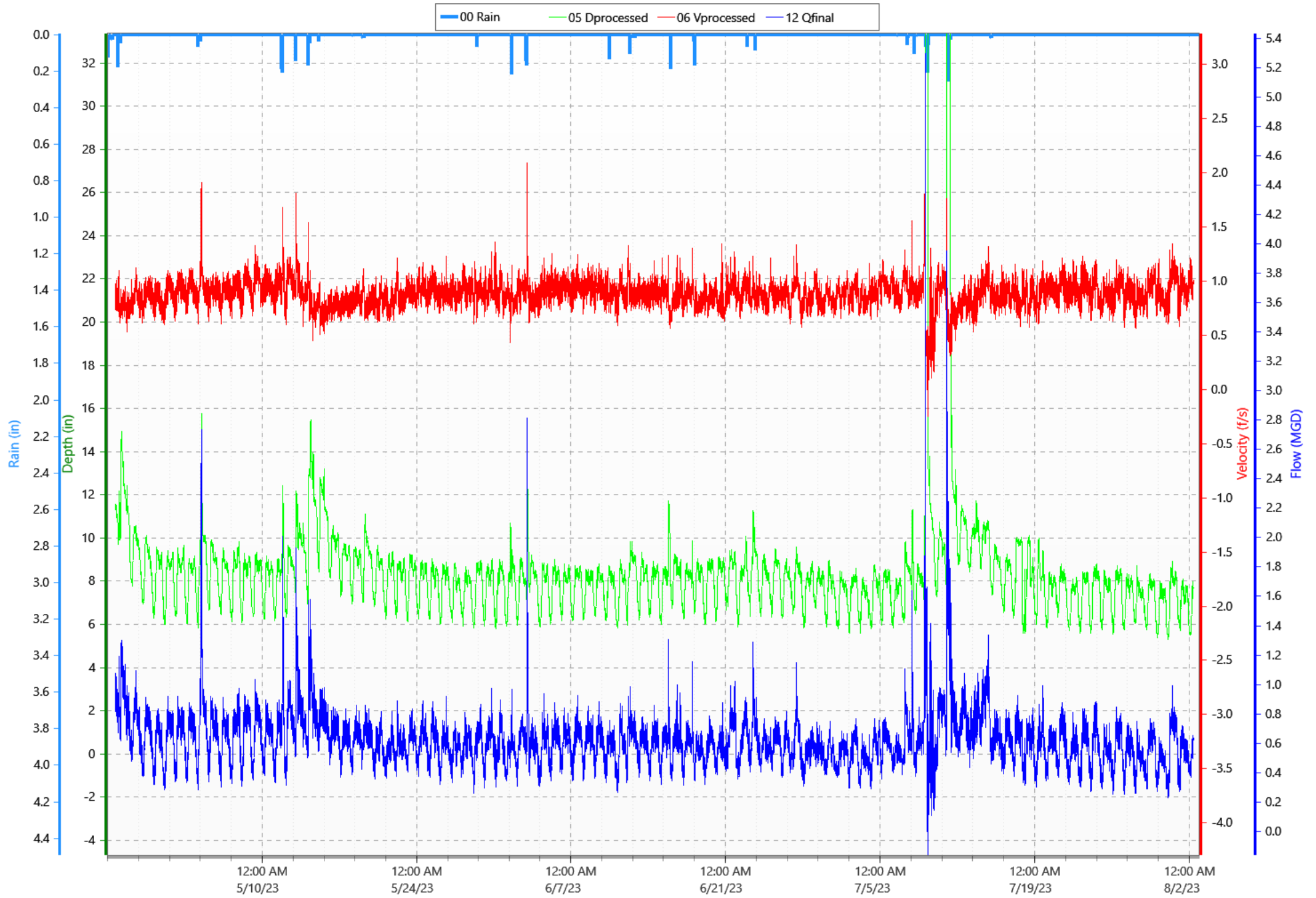
DVQ with Rain - Pipe Dia: 36.88 in.



Print Date: 10/12/2023 12:55:37 PM

BP-19 (4/26/2023 to 8/3/2023)

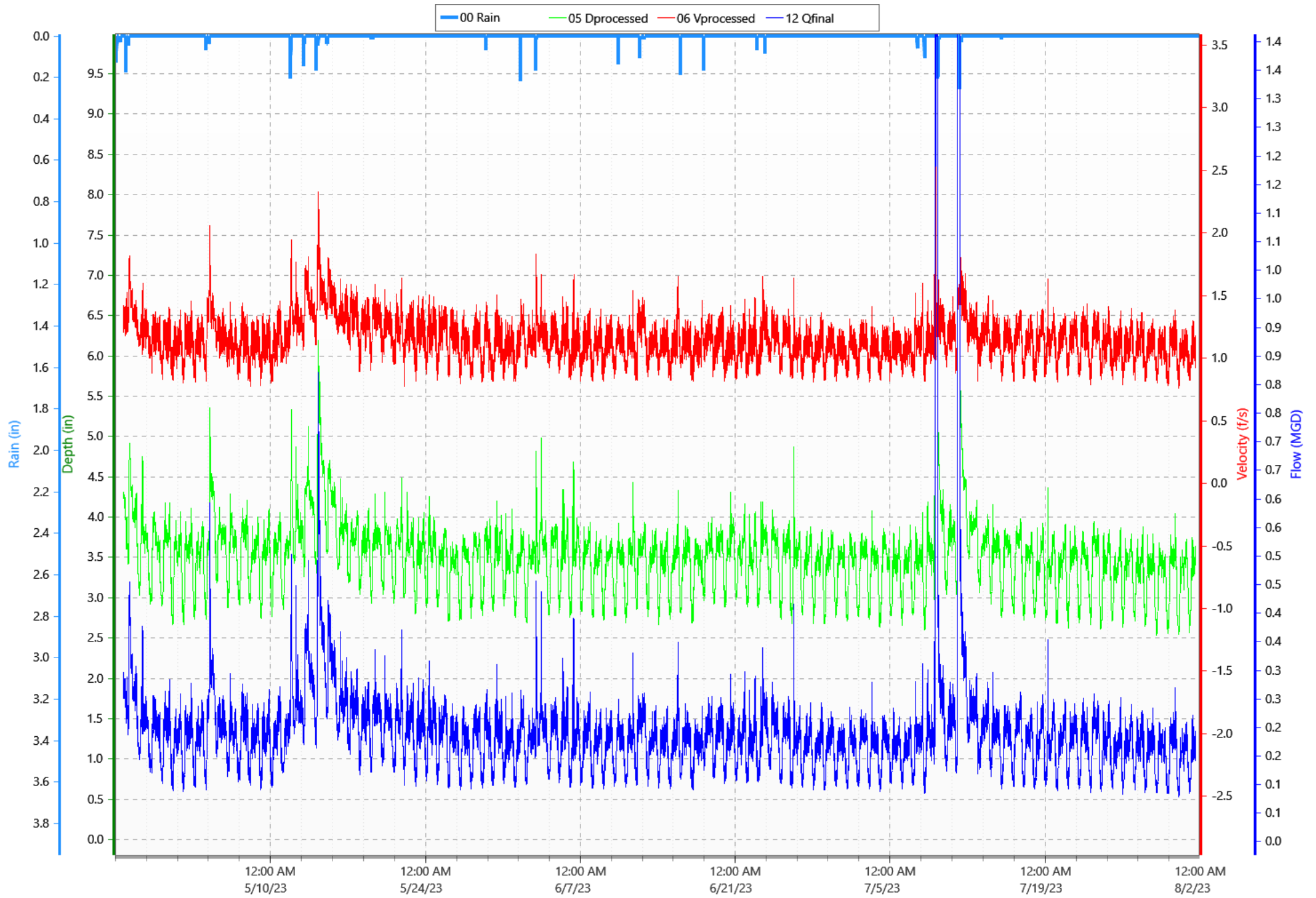
DVQ with Rain - Pipe Dia: 29.50 in.



Print Date: 10/12/2023 10:23:18 AM

BP-20 (4/26/2023 to 8/2/2023)

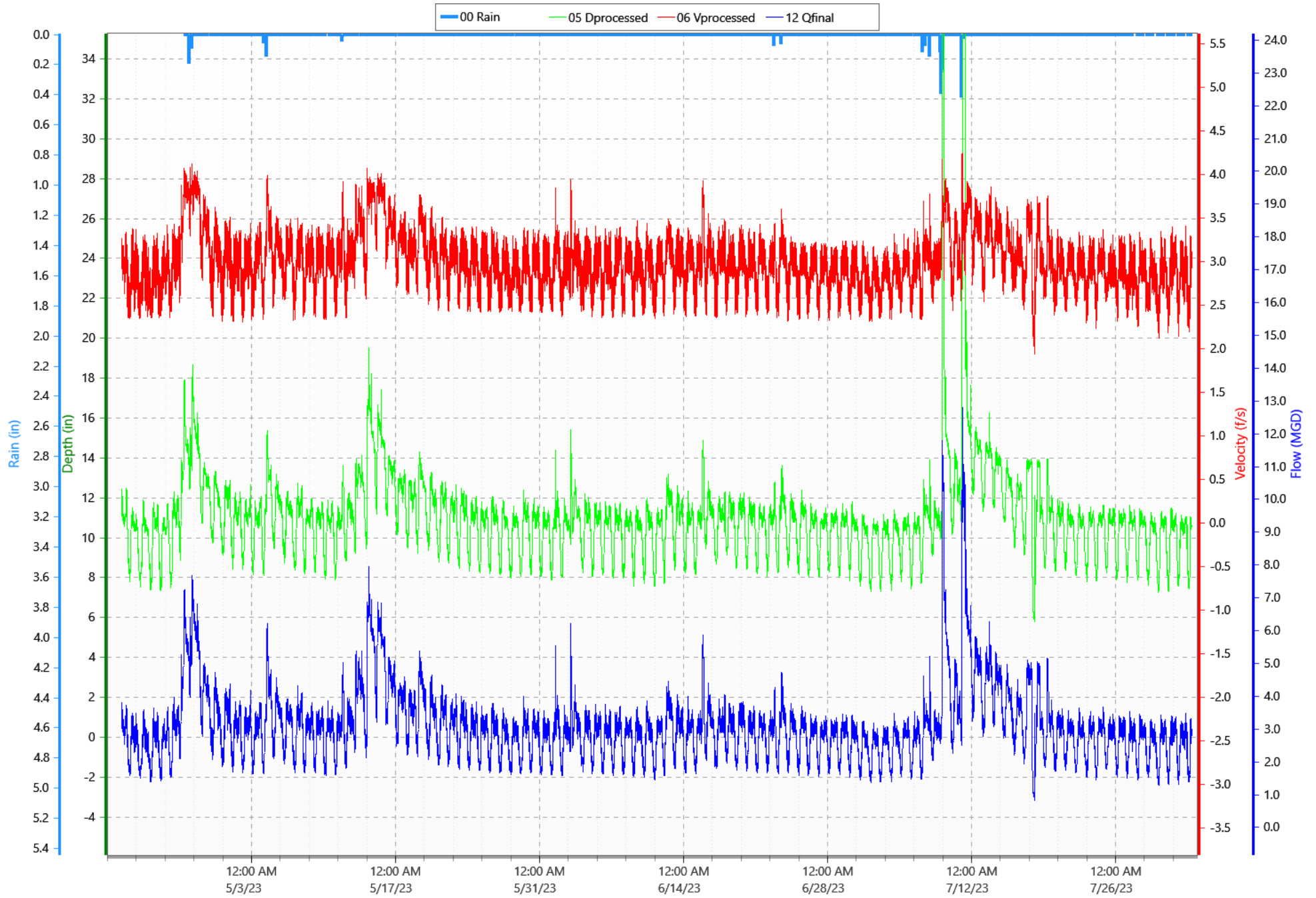
DVQ with Rain - Pipe Dia: 18.50 in.



Print Date: 10/12/2023 10:24:11 AM

BP-21 (4/19/2023 to 8/3/2023)

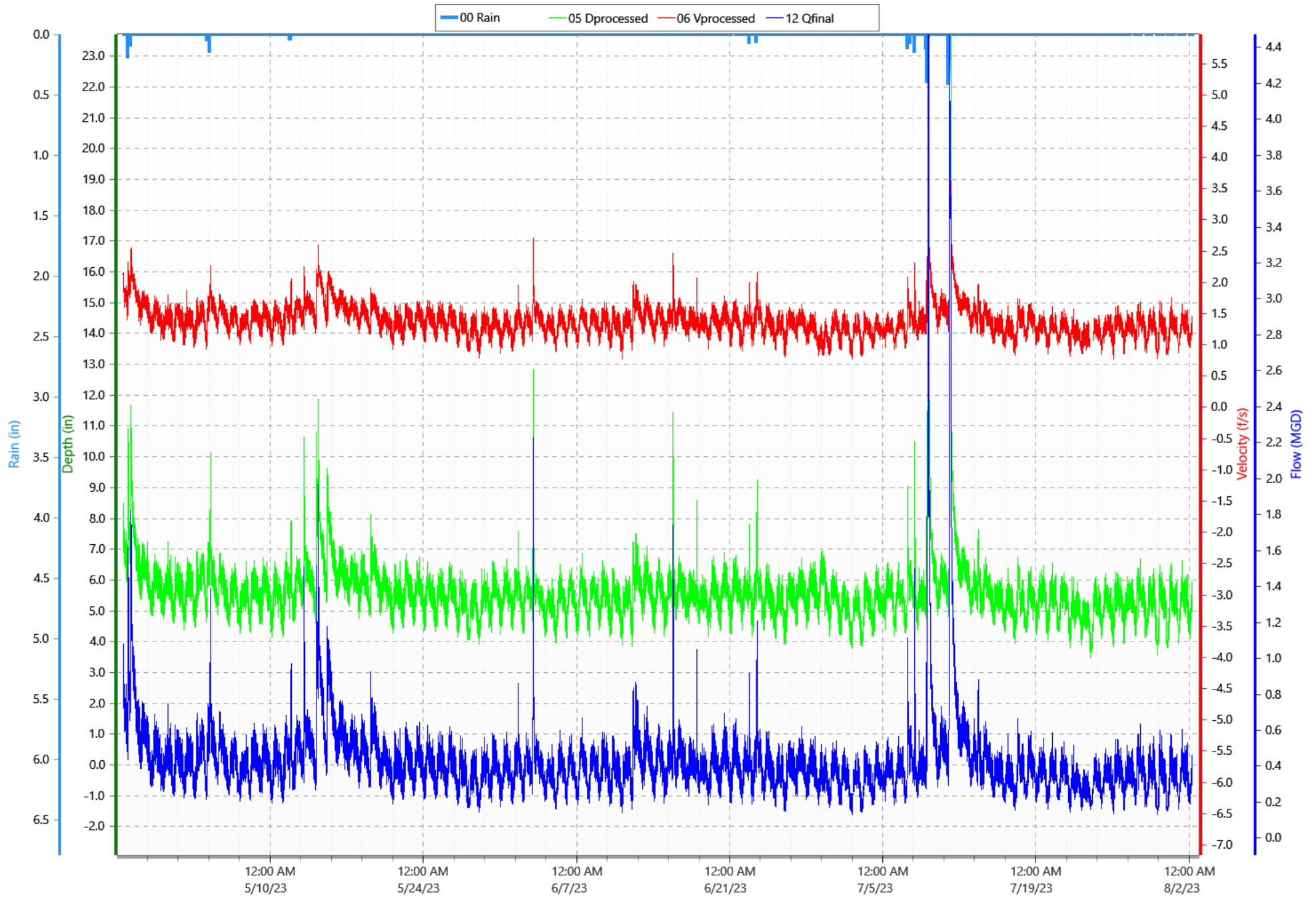
DVQ with Rain - Pipe Dia: 28.75 x 29.75 in.



Print Date: 10/12/2023 10:25:35 AM

BP-22 (4/26/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 16.50 x 17.00 in.



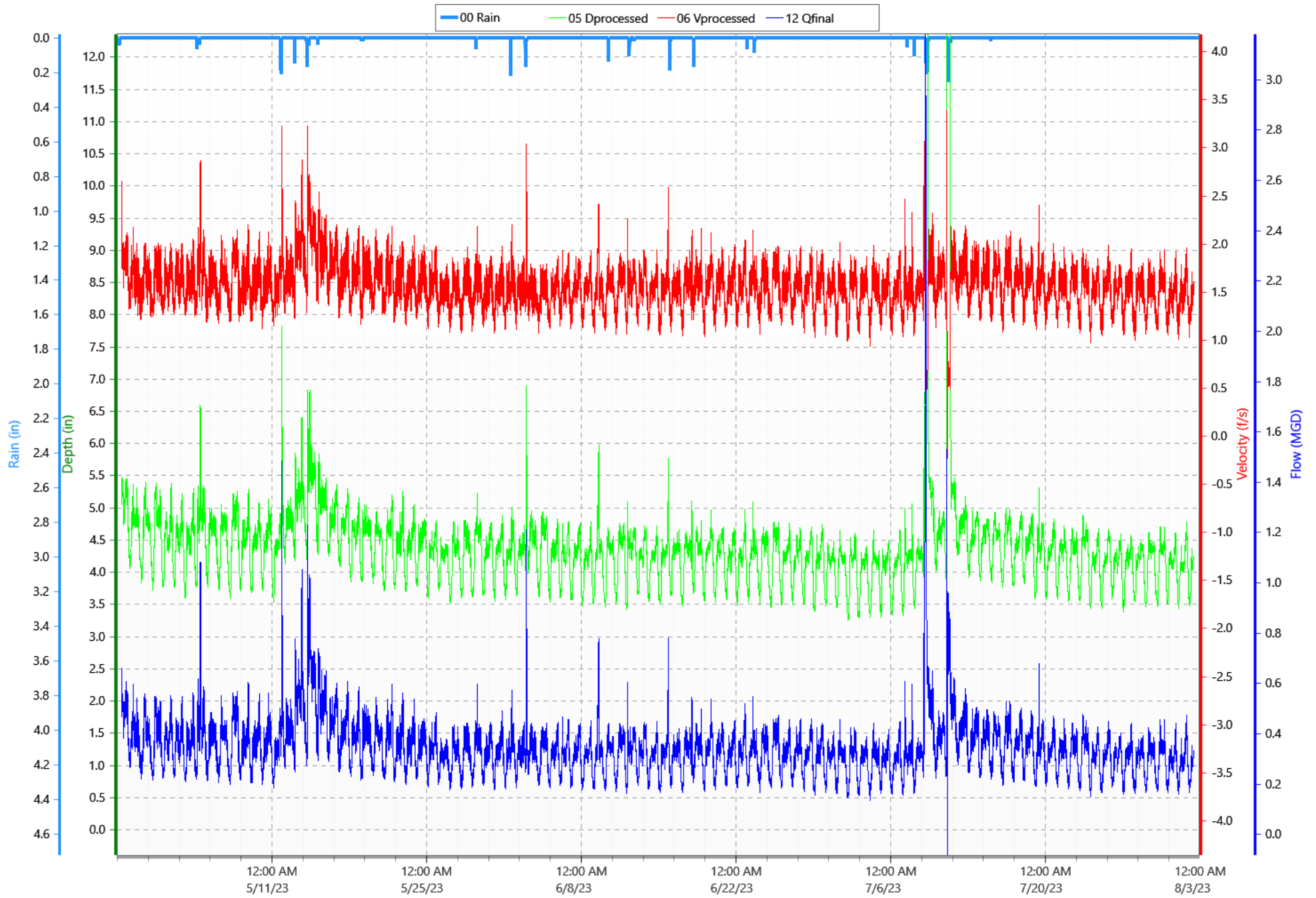
BP-23 (4/26/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 23.50 x 25.00 in.



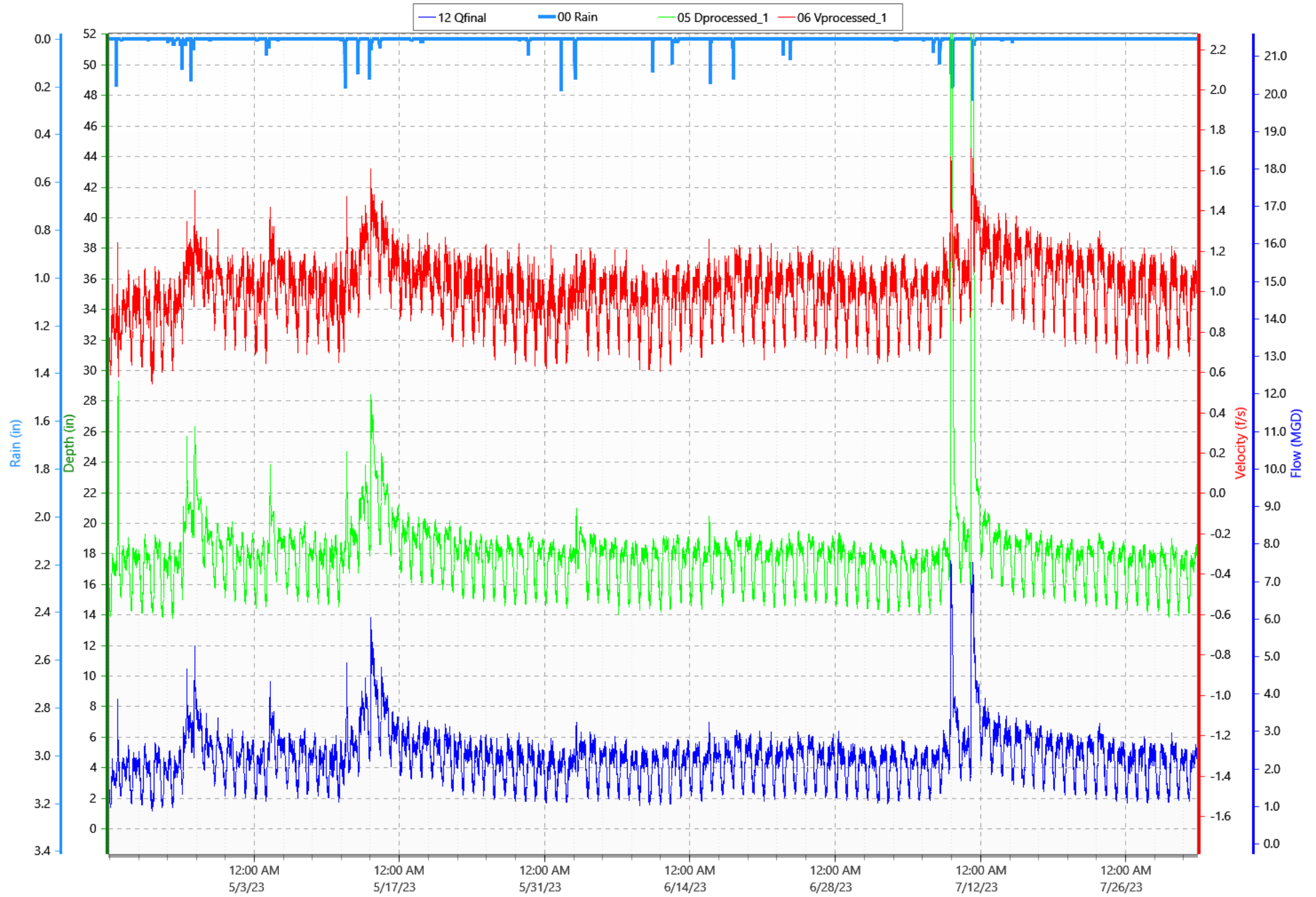
BP-24 (4/27/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 18.50 x 19.00 in.



BP-25 (4/19/2023 to 8/2/2023)

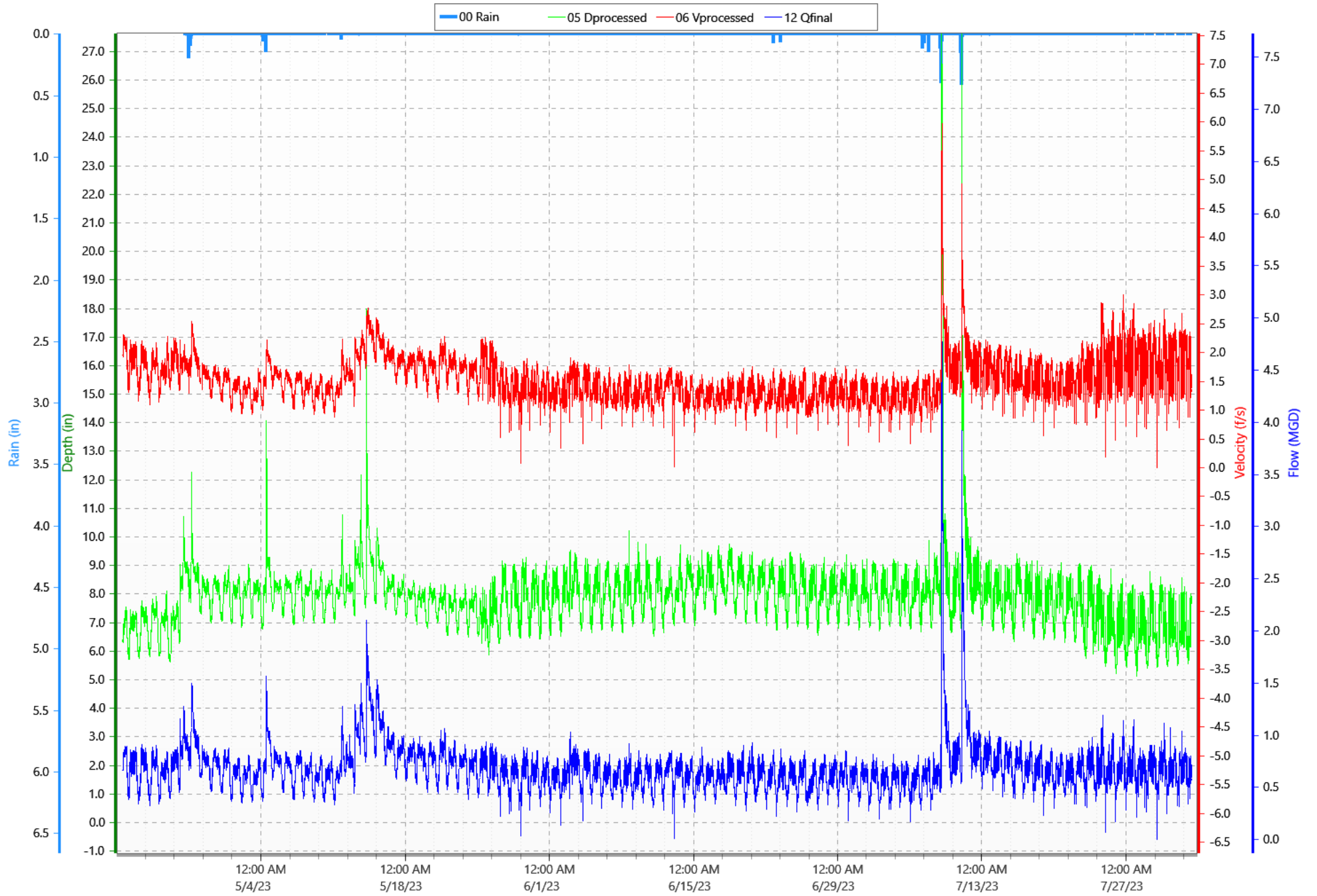
DVQ with Rain - Pipe Dia: 35.75 in.



Print Date: 10/12/2023 10:28:27 AM

BP-26 (4/20/2023 to 8/3/2023)

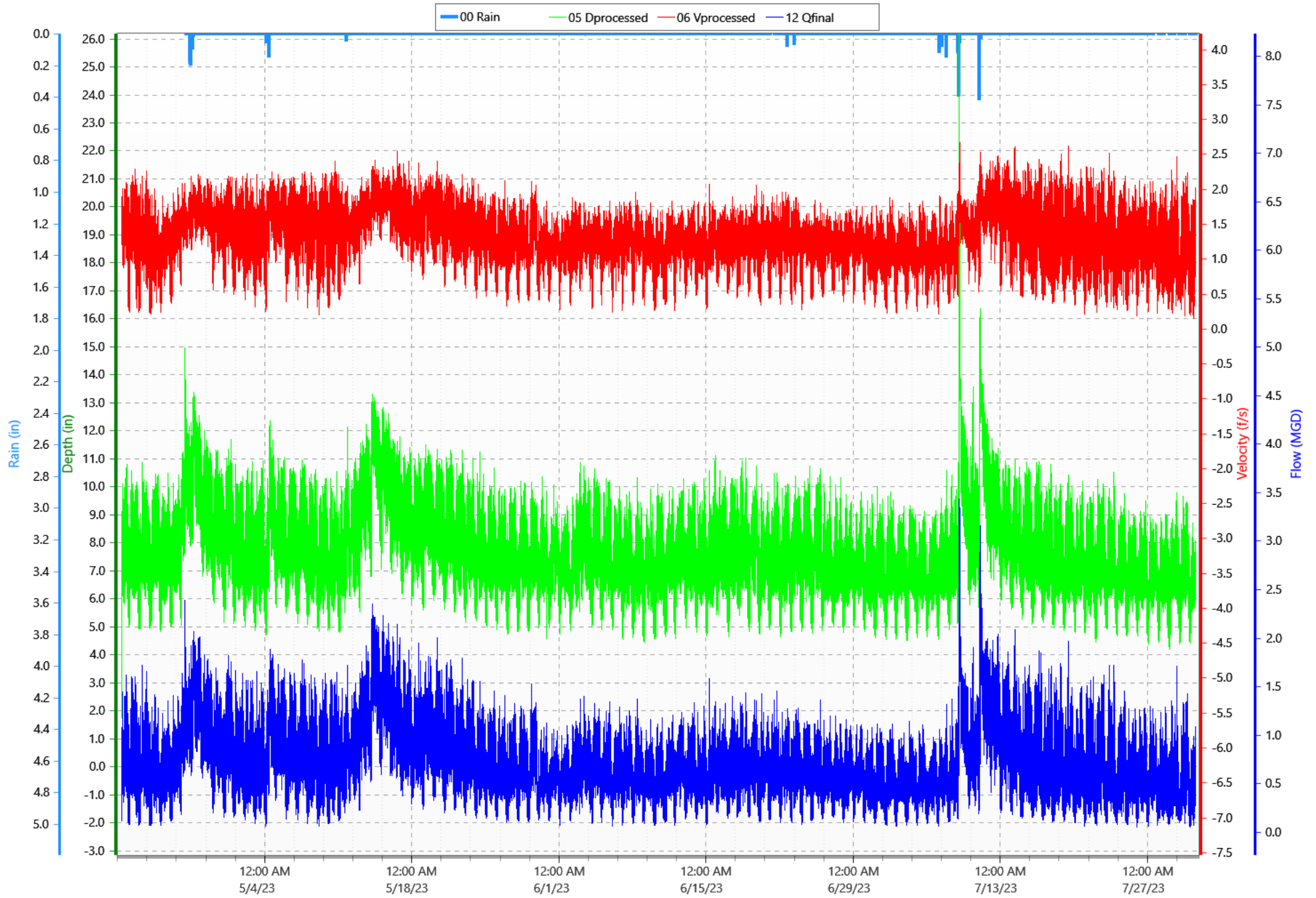
DVQ with Rain - Pipe Dia: 1450 x 15.62 in.



Print Date: 10/12/2023 10:29:19 AM

BP-27 (4/20/2023 to 8/1/2023)

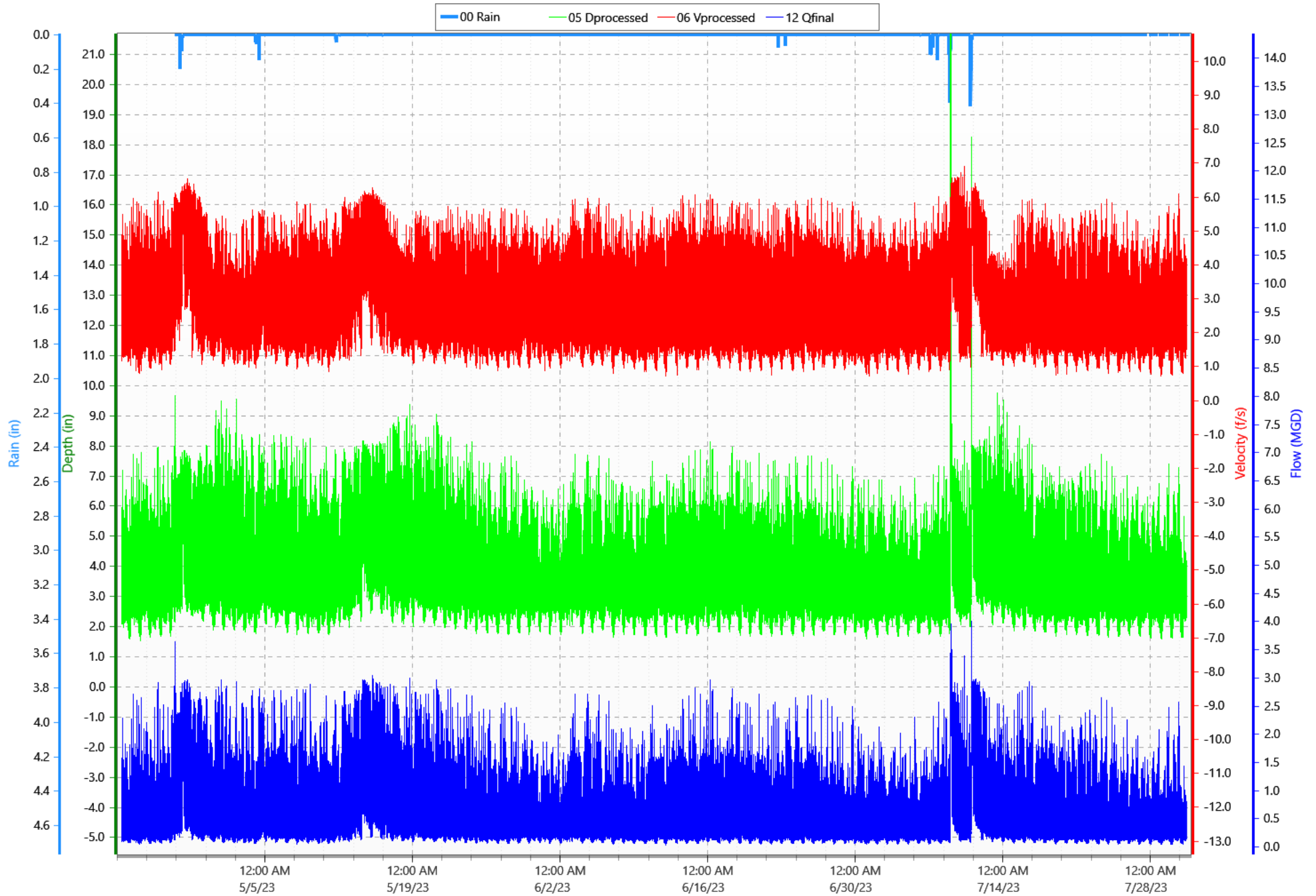
DVQ with Rain - Pipe Dia: 20.25 in.



Print Date: 10/12/2023 10:30:05 AM

BP-27-01 (4/21/2023 to 8/1/2023)

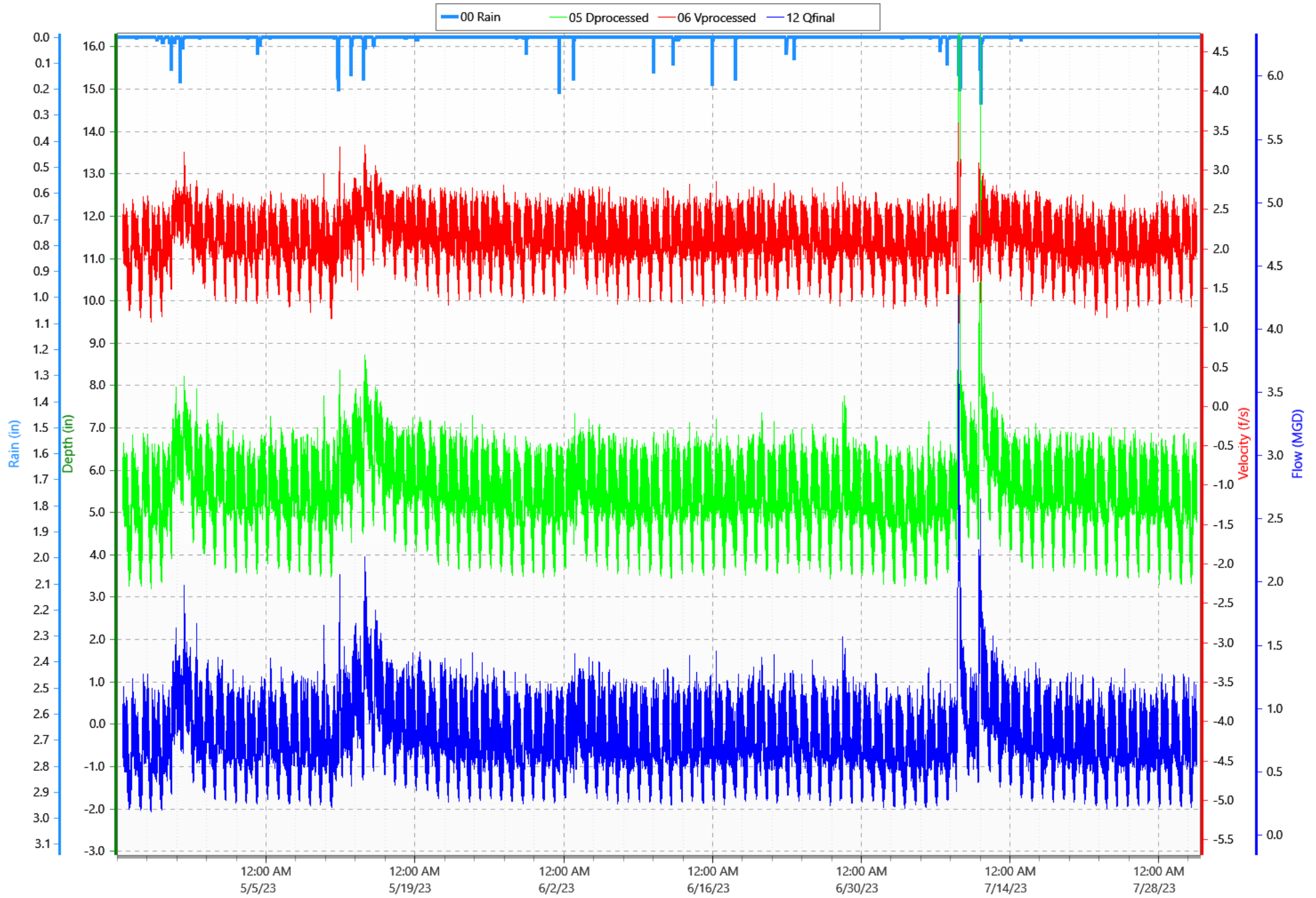
DVQ with Rain - Pipe Dia: 17.10 in.



Print Date: 10/12/2023 10:30:54 AM

BP-28 (4/21/2023 to 8/1/2023)

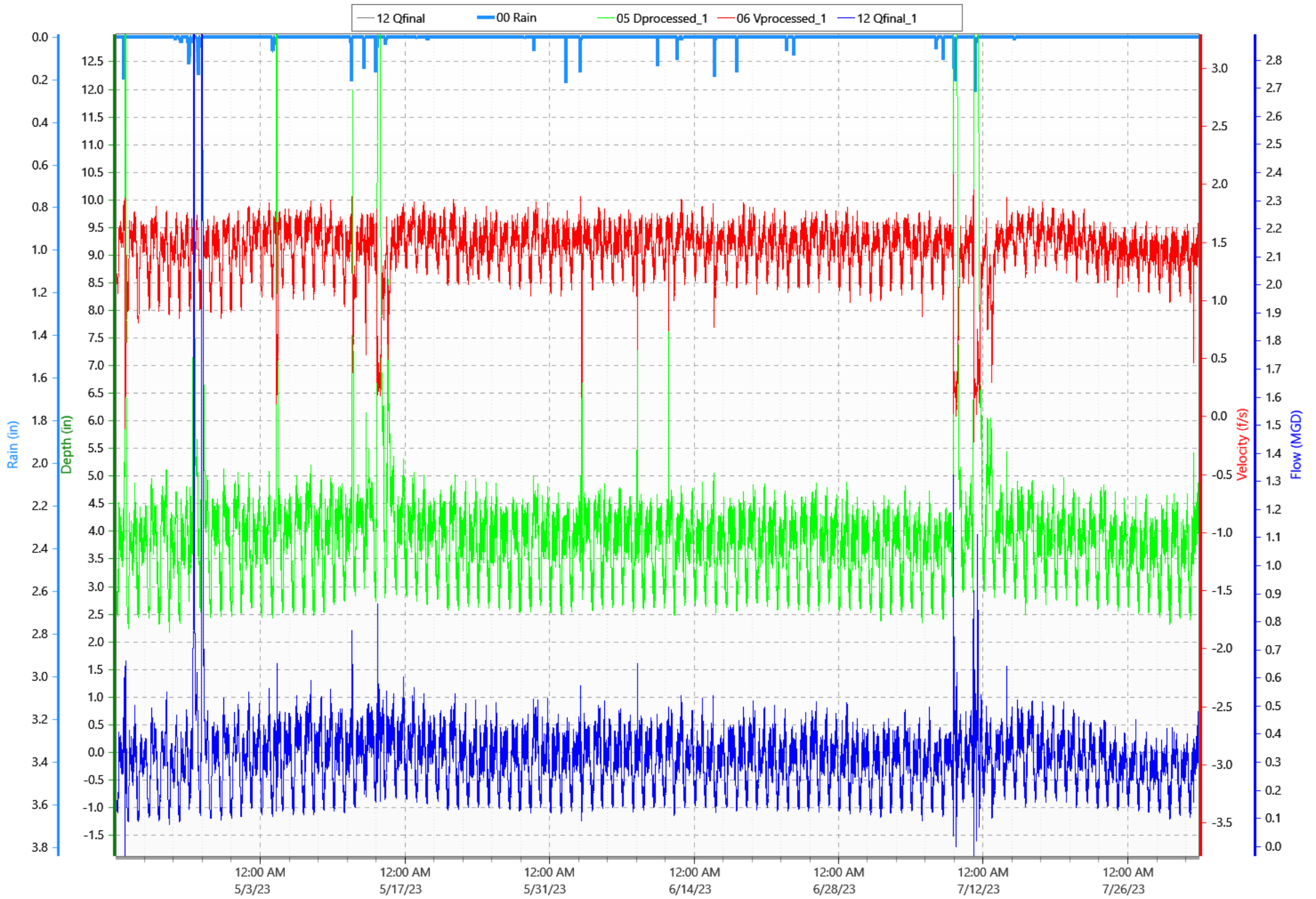
DVQ with Rain - Pipe Dia: 23.70 in.



Print Date: 10/12/2023 10:31:54 AM

BP-30 (4/19/2023 to 8/2/2023)

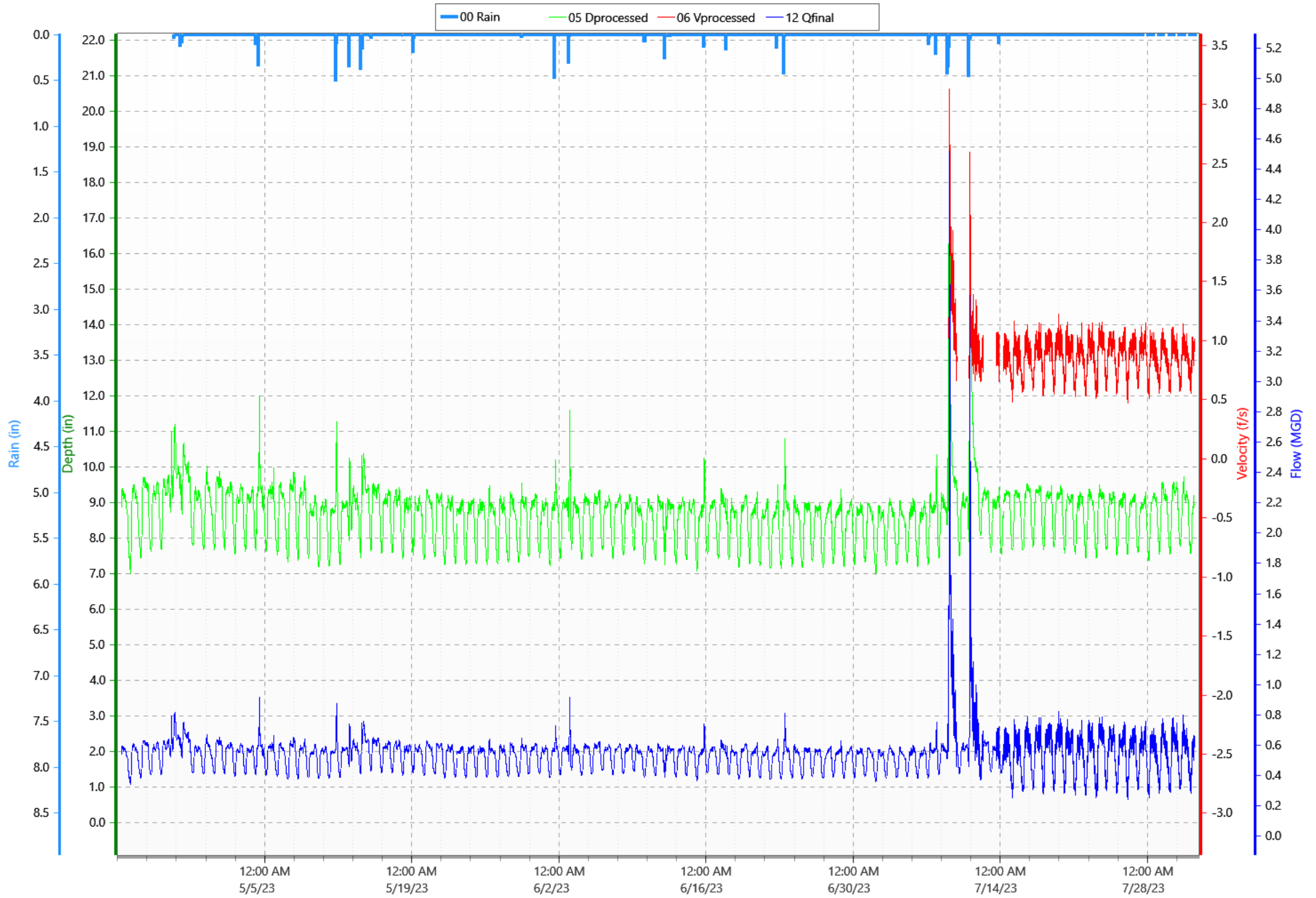
DVQ with Rain - Pipe Dia: 23.20 in.



Print Date: 10/12/2023 10:32:32 AM

IH-12 (4/21/2023 to 8/2/2023)

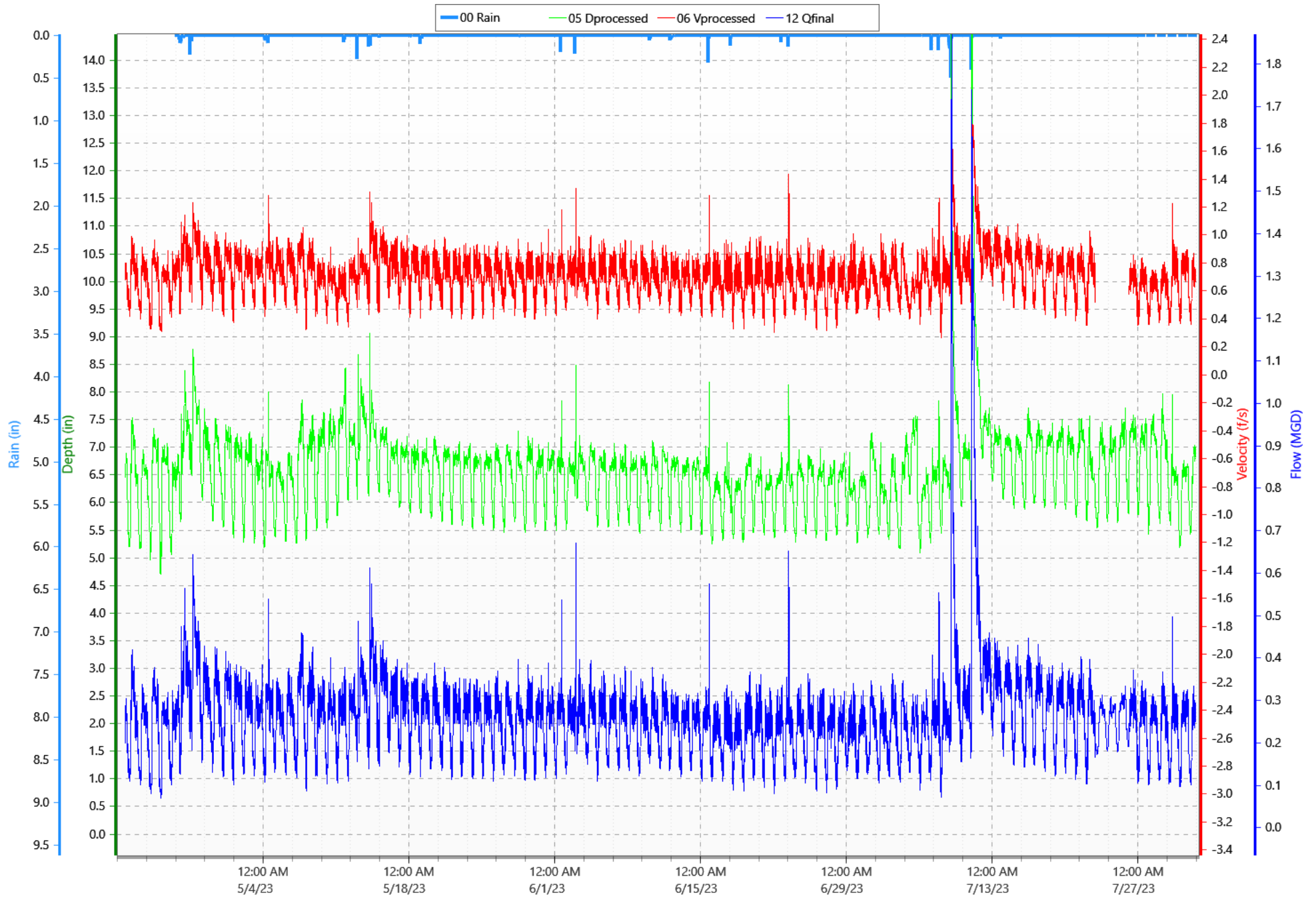
DVQ with Rain - Pipe Dia: 22.20 in.



Print Date: 10/12/2023 10:33:31 AM

IH-13 (4/20/2023 to 8/2/2023)

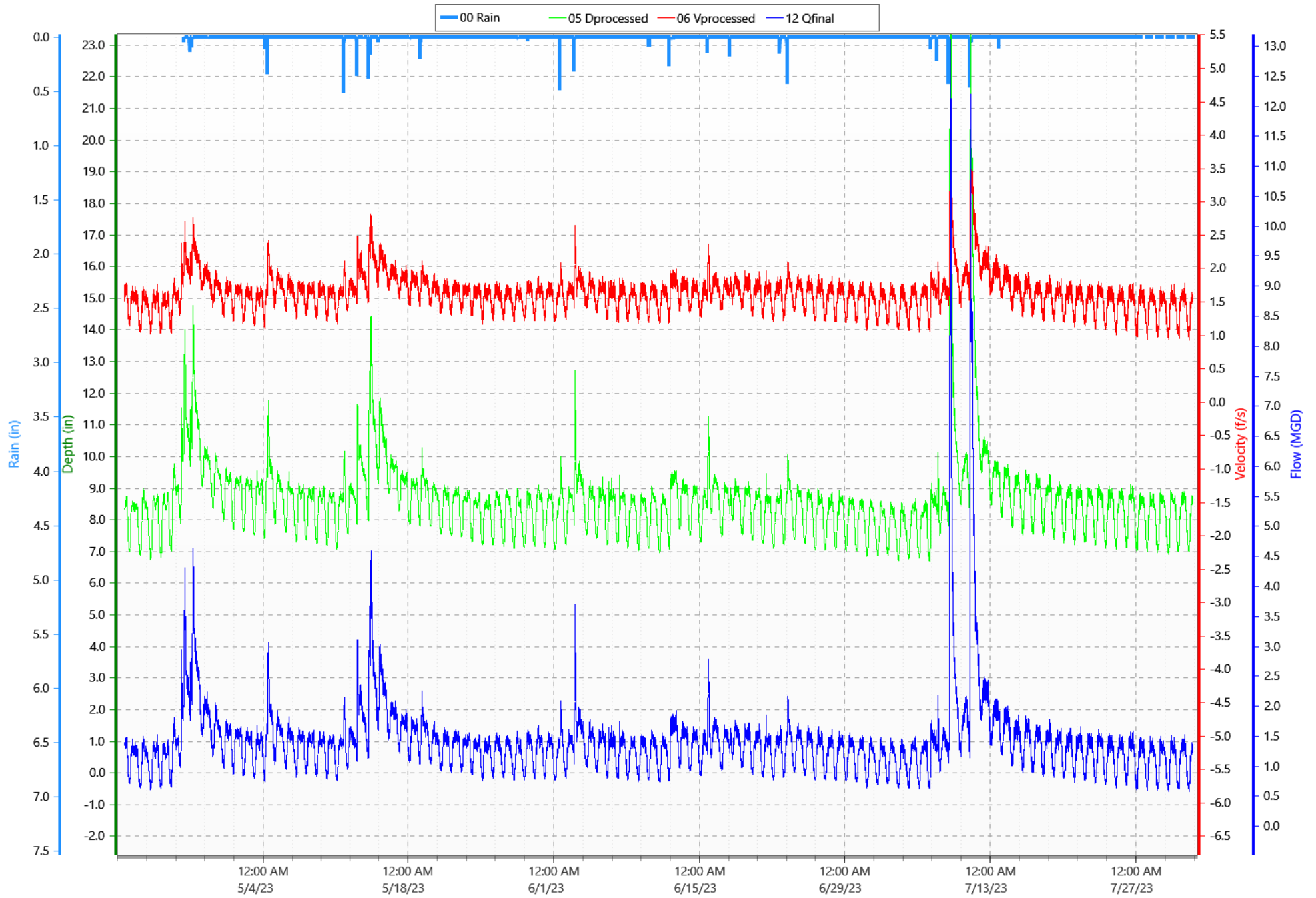
DVQ with Rain - Pipe Dia: 18.00 in.



Print Date: 10/12/2023 10:34:23 AM

IH-14 (4/20/2023 to 8/2/2023)

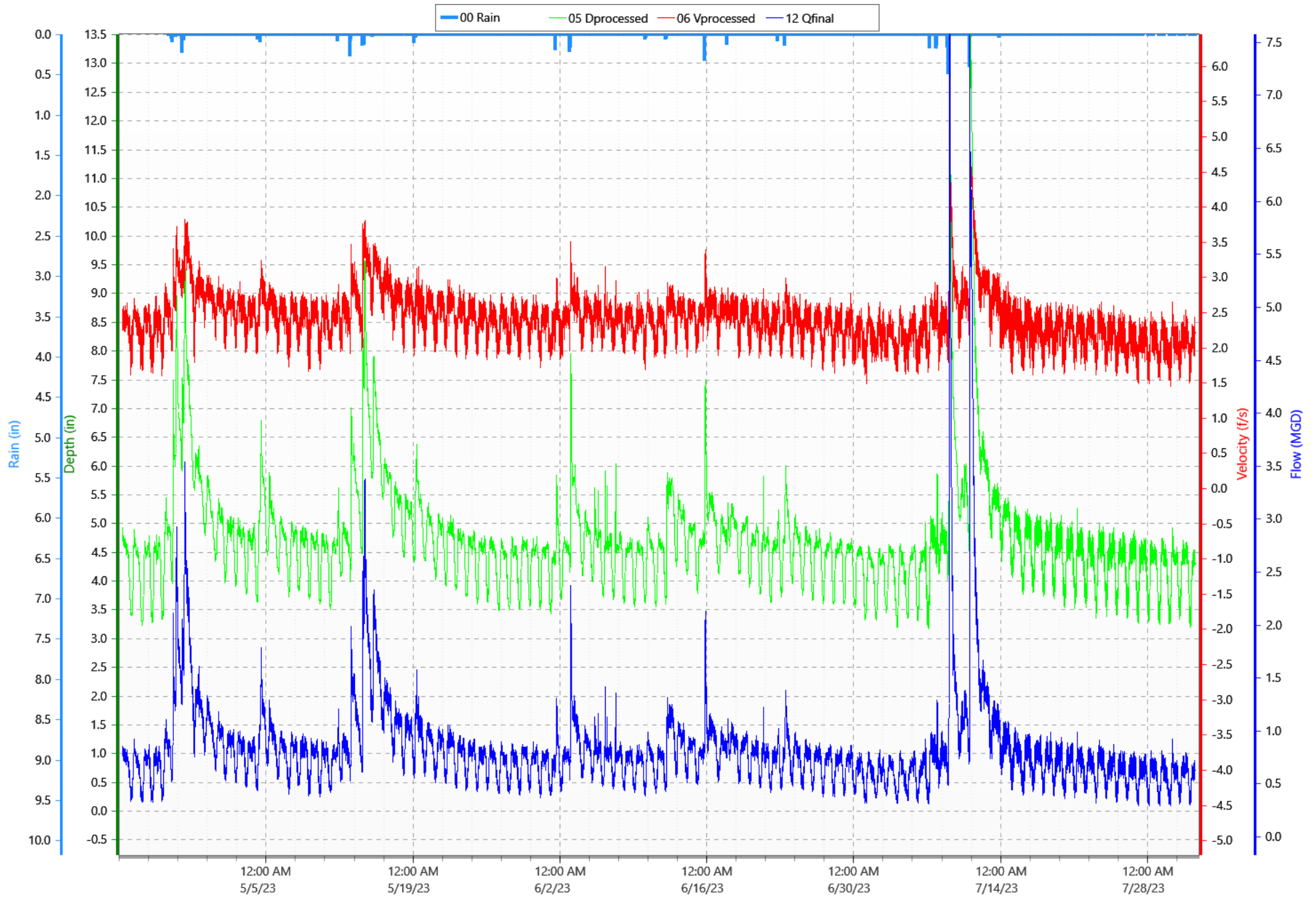
DVQ with Rain - Pipe Dia: 34.00 x 35.00 in.



Print Date: 10/12/2023 10:35:11 AM

IH-15 (4/21/2023 to 8/2/2023)

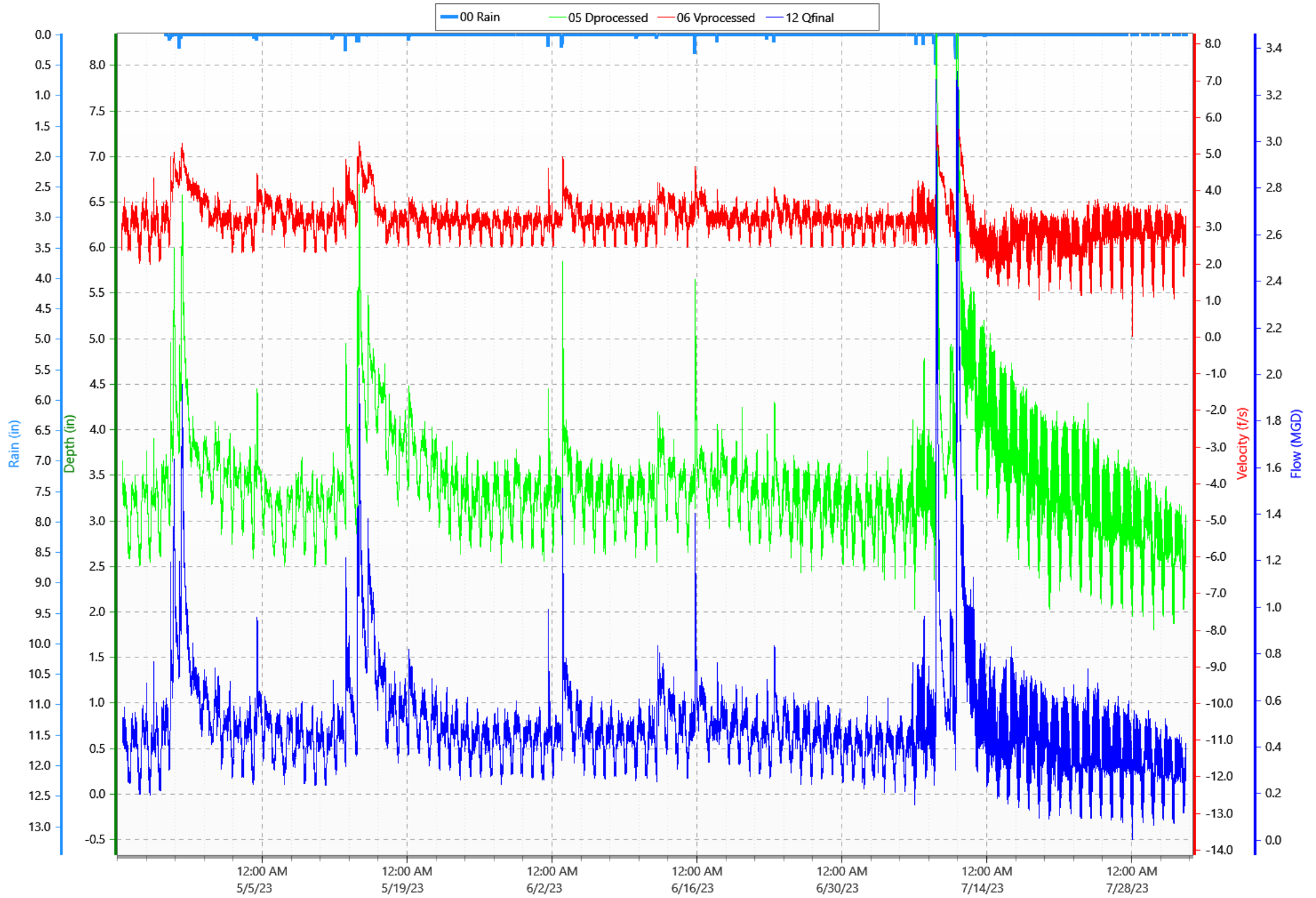
DVQ with Rain - Pipe Dia: 29.00 x 30.25 in.



Print Date: 10/12/2023 10:35:58 AM

IH-16 (4/21/2023 to 8/3/2023)

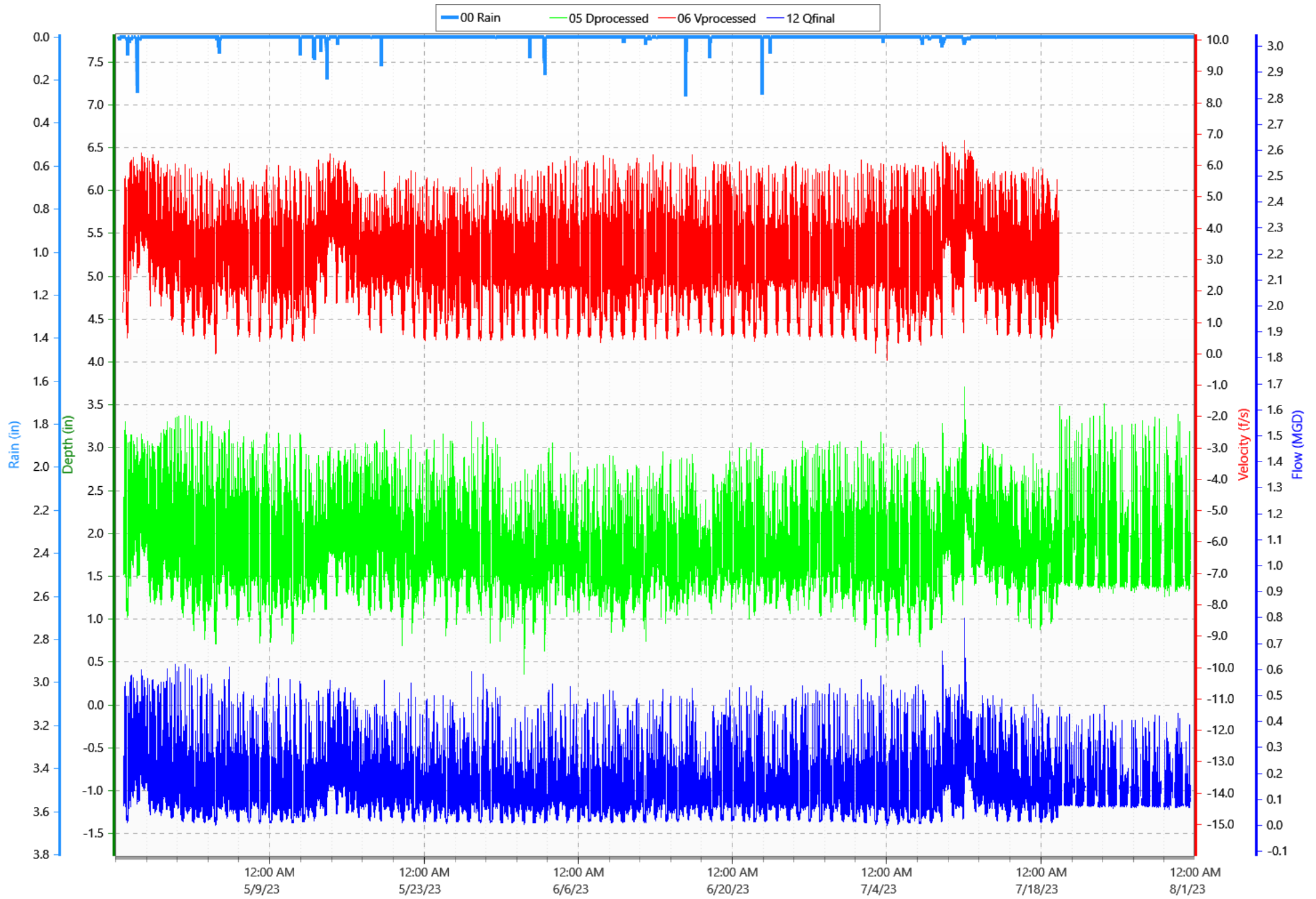
DVQ with Rain - Pipe Dia: 17.44 in.



Print Date: 10/12/2023 12:22:24 PM

LD-01 (4/25/2023 to 8/1/2023)

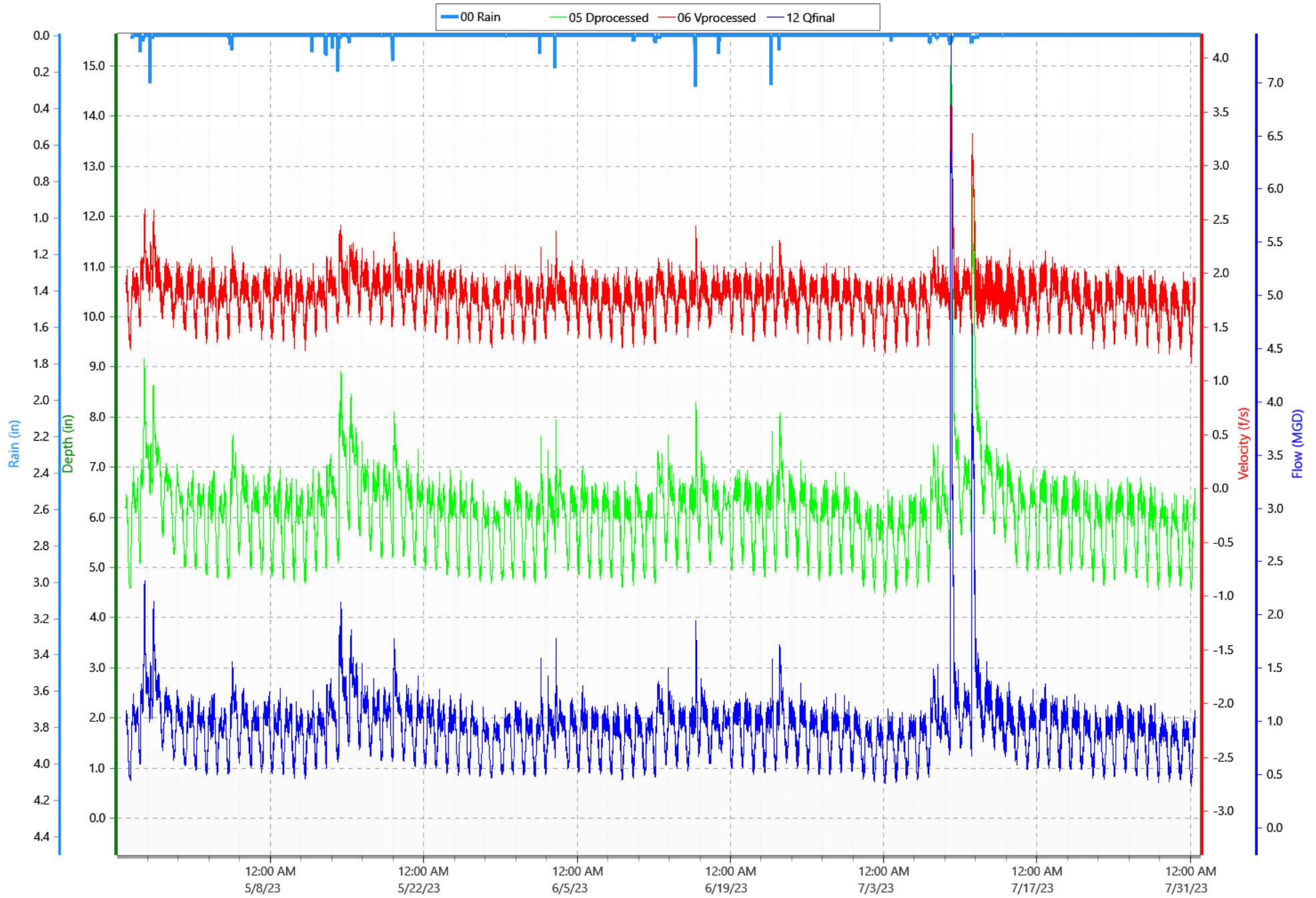
DVQ with Rain - Pipe Dia: 9.75 in.



Print Date: 10/12/2023 10:37:23 AM

LD-02 (4/24/2023 to 8/1/2023)

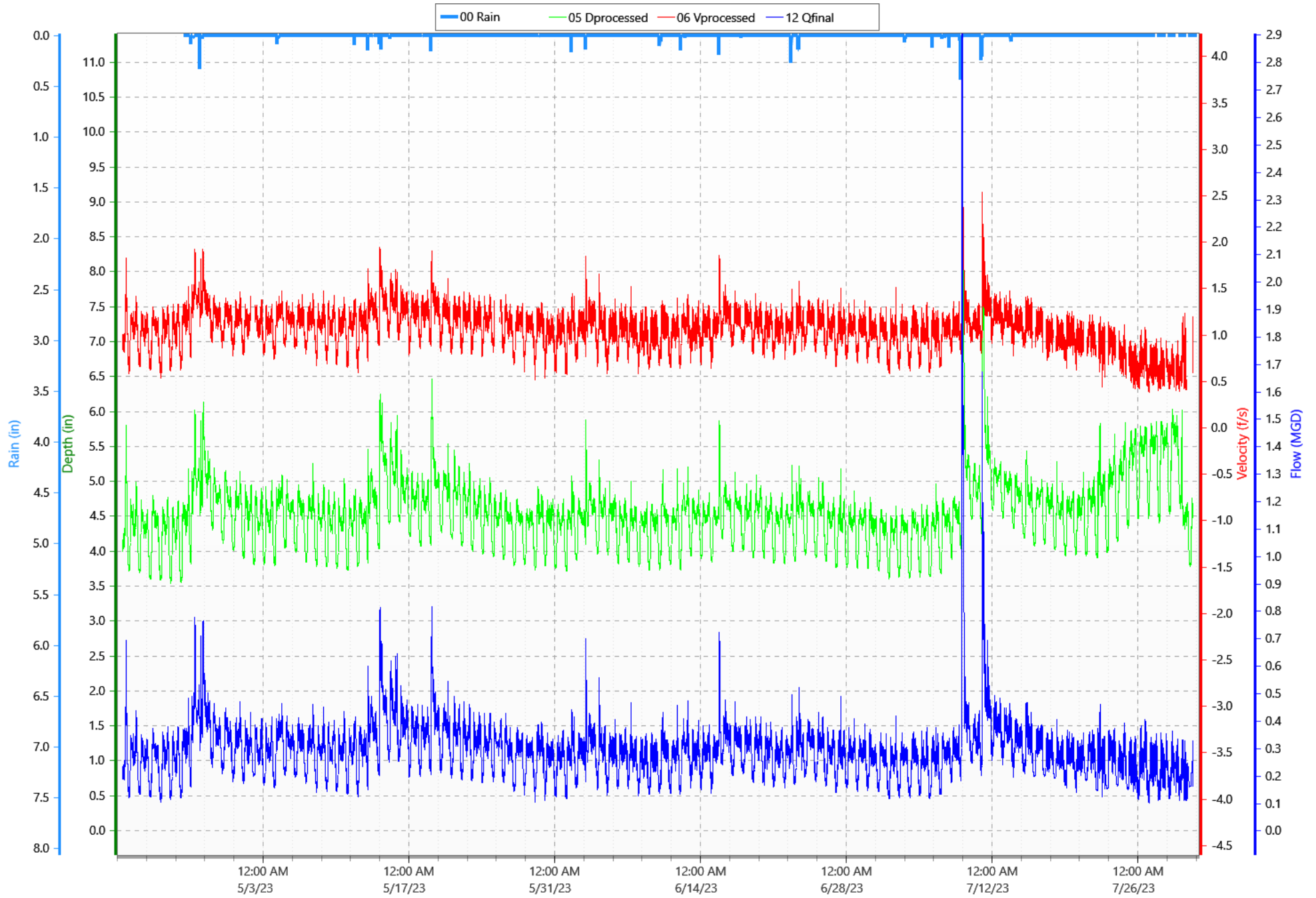
DVQ with Rain - Pipe Dia: 35.50 x 36.00 in.



Print Date: 10/12/2023 10:37:59 AM

LD-03 (4/19/2023 to 8/1/2023)

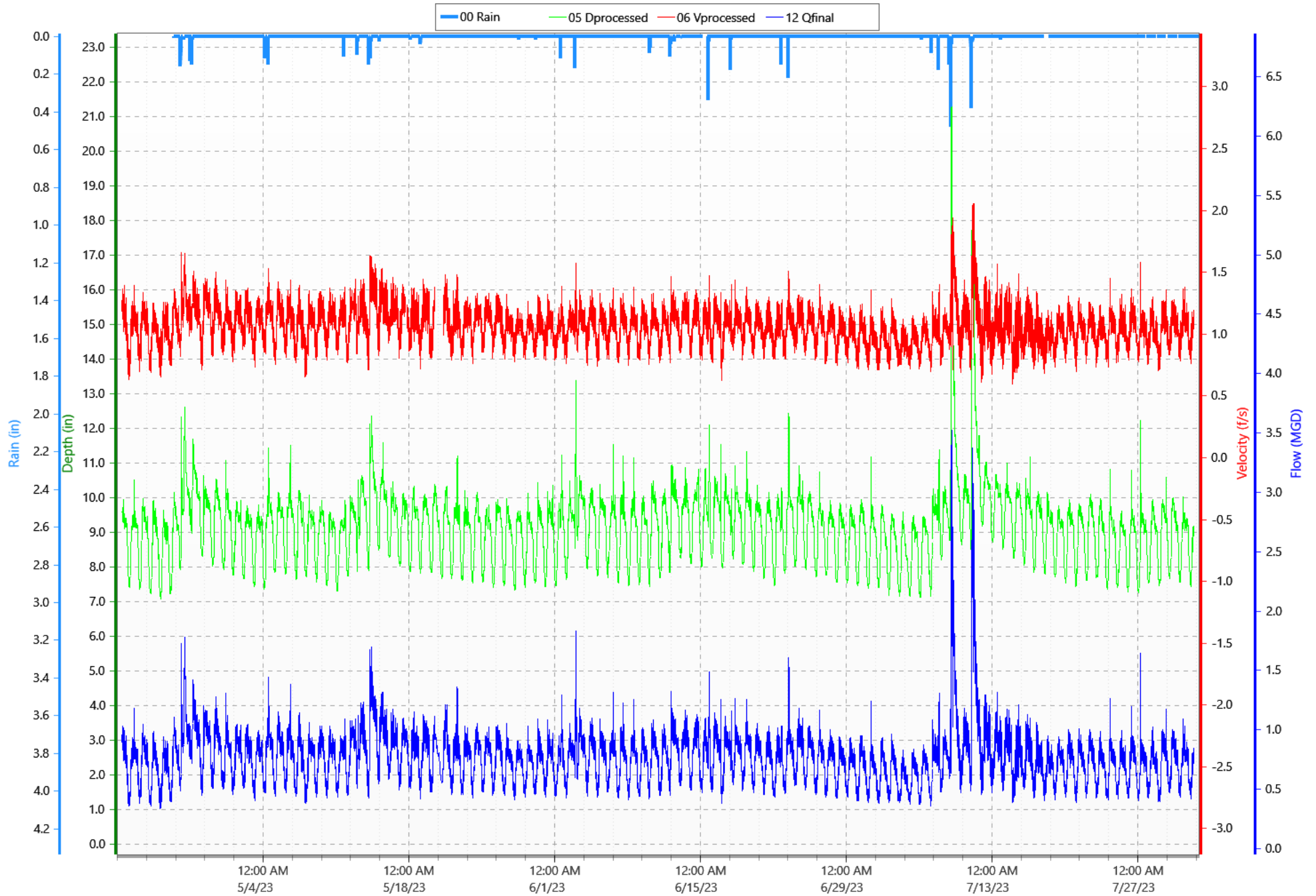
DVQ with Rain - Pipe Dia: 22.00 x 23.50 in.



Print Date: 10/12/2023 10:38:36 AM

ND-08 (4/20/2023 to 8/2/2023)

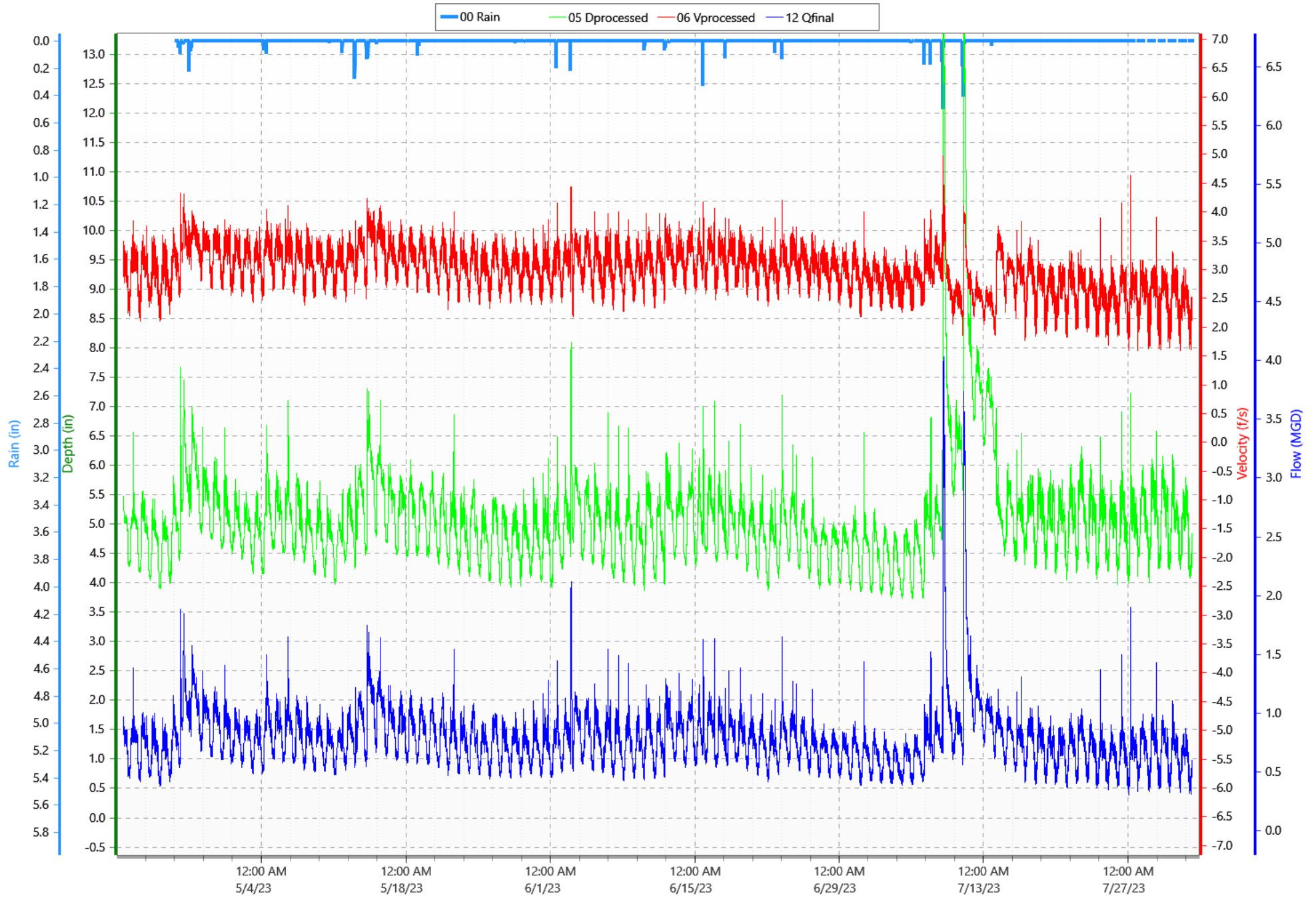
DVQ with Rain - Pipe Dia: 24.00 in.



Print Date: 10/12/2023 10:39:03 AM

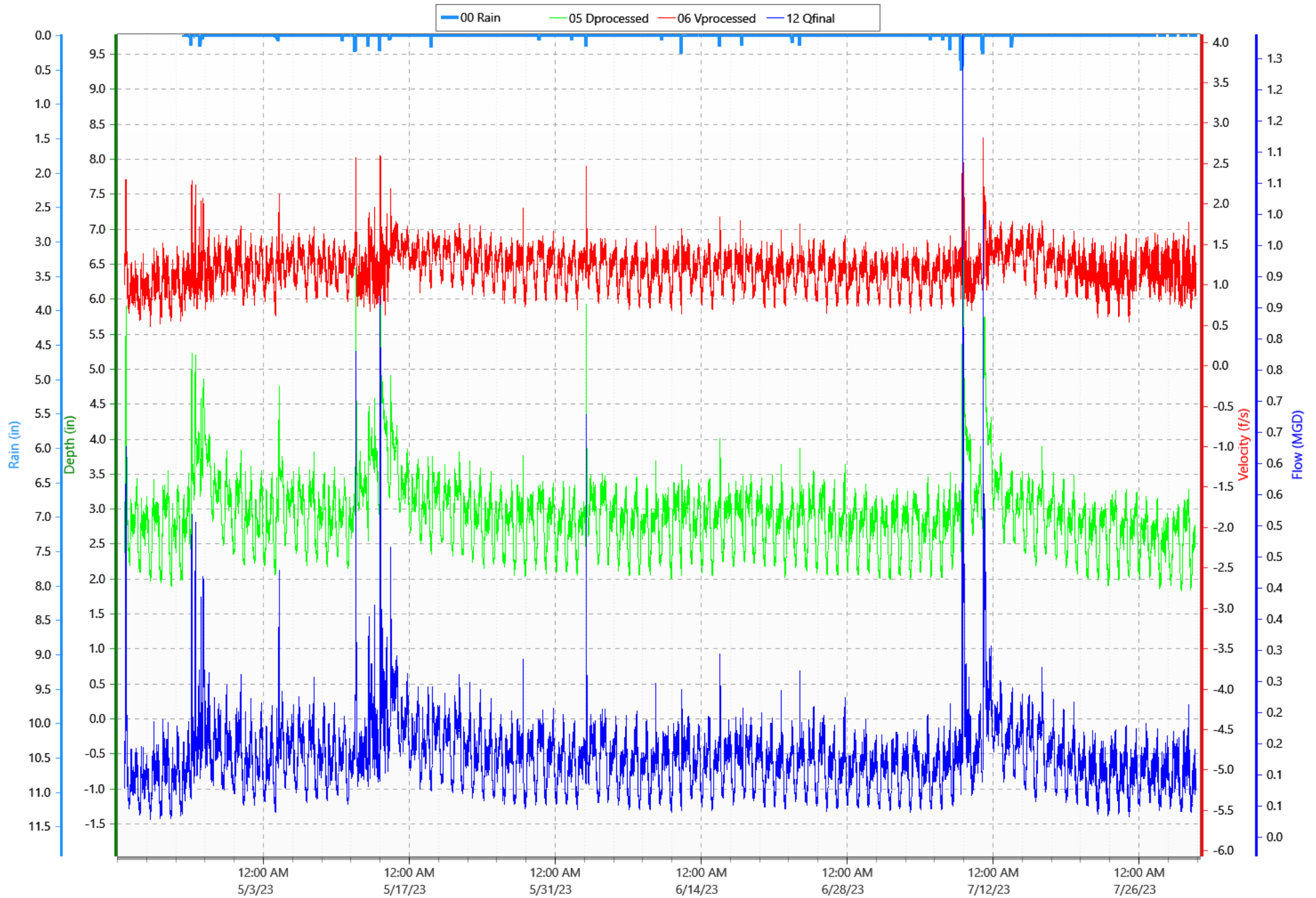
ND-09 (4/20/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 17.00 in.



SV-01 (4/19/2023 to 8/1/2023)

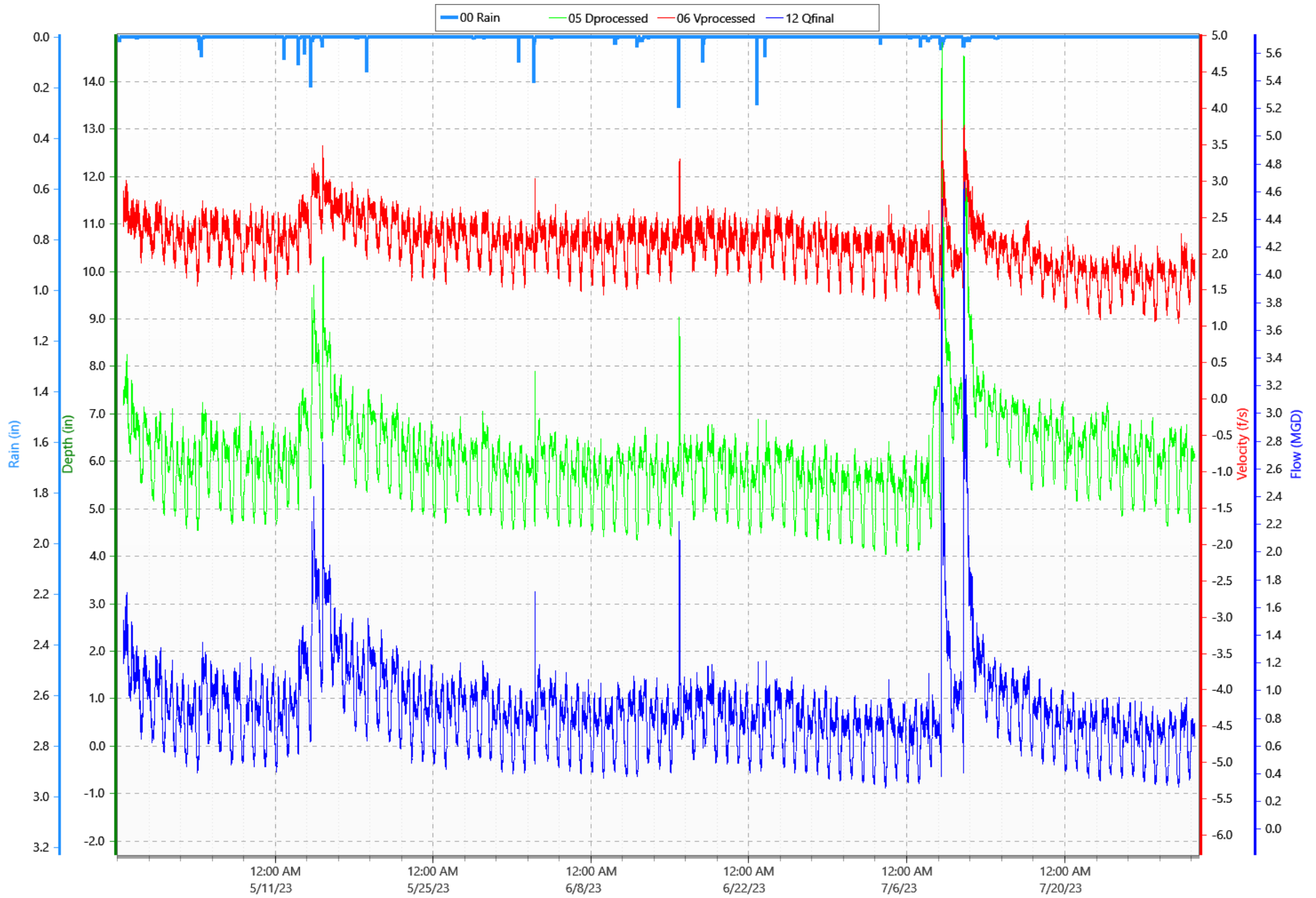
DVQ with Rain - Pipe Dia: 14.00 x 14.50 in.



Print Date: 10/12/2023 12:40:35 PM

WC-30 (4/27/2023 to 8/1/2023)

DVQ with Rain - Pipe Dia: 23.00 in.



Print Date: 10/12/2023 10:39:58 AM

WC-31 (4/21/2023 to 8/1/2023)

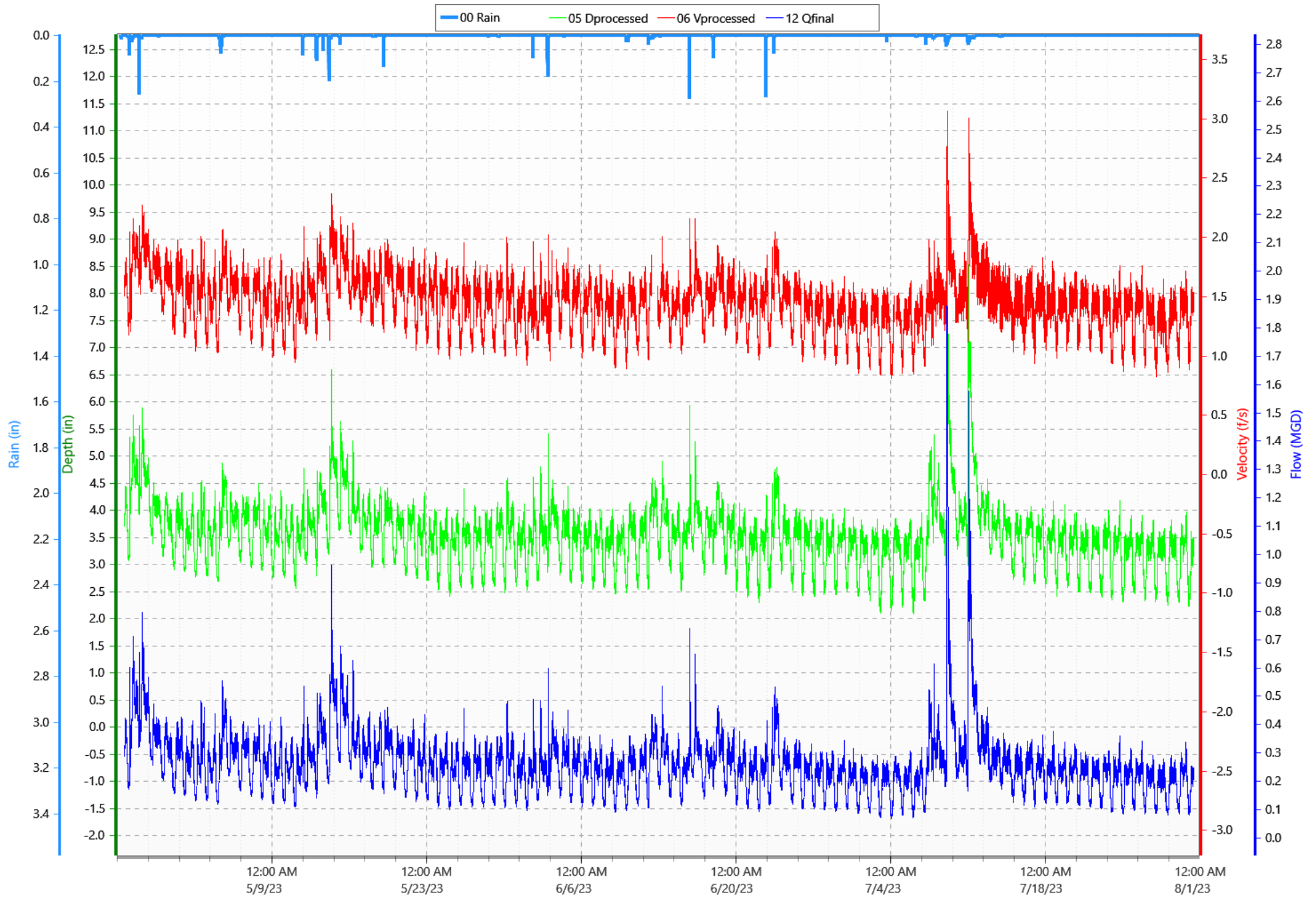
DVQ with Rain - Pipe Dia: 15.00 in.



Print Date: 10/12/2023 10:40:15 AM

WC-32 (4/25/2023 to 8/1/2023)

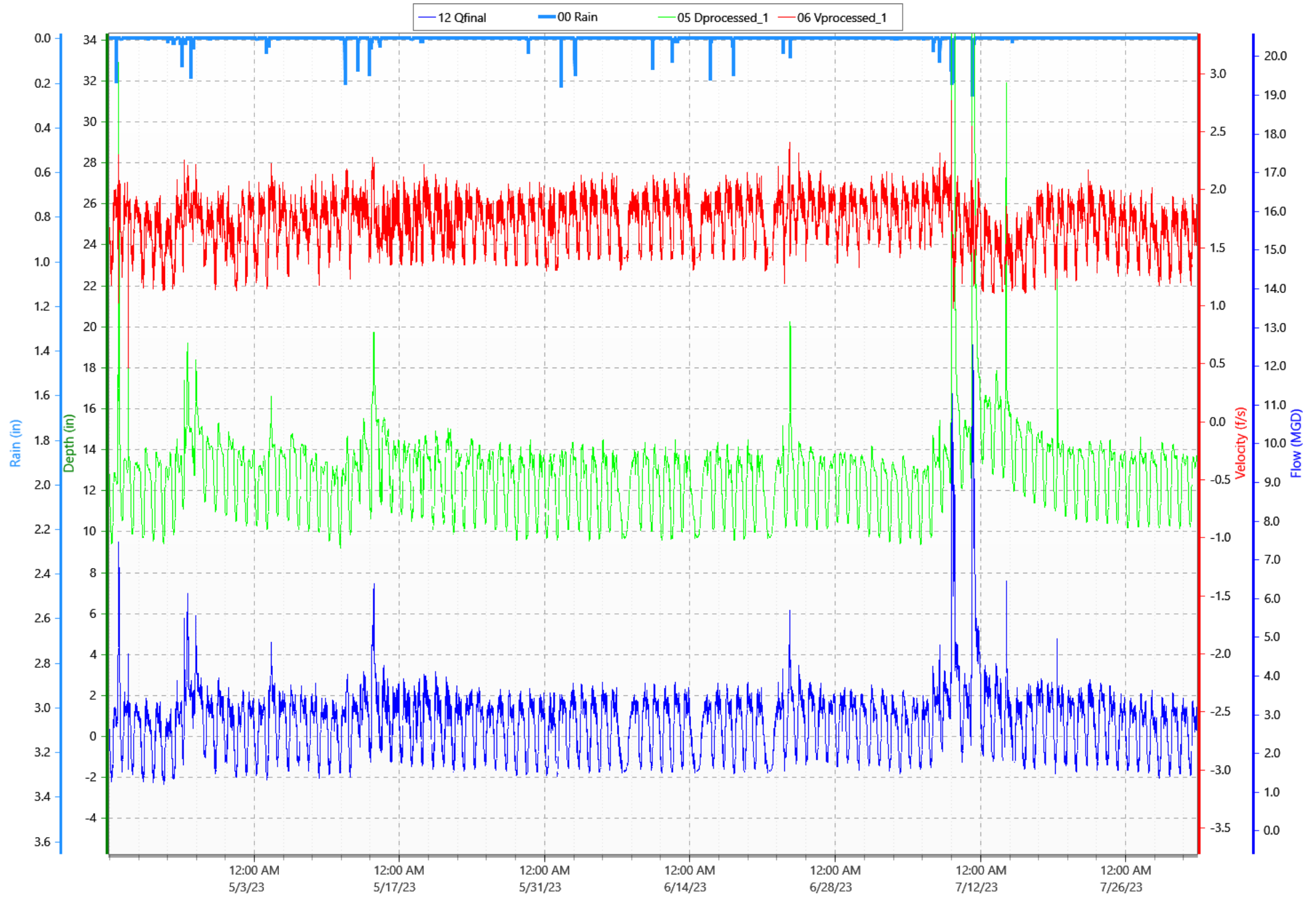
DVQ with Rain - Pipe Dia: 20.50 in.



Print Date: 10/12/2023 10:40:40 AM

WS-01 (4/19/2023 to 8/2/2023)

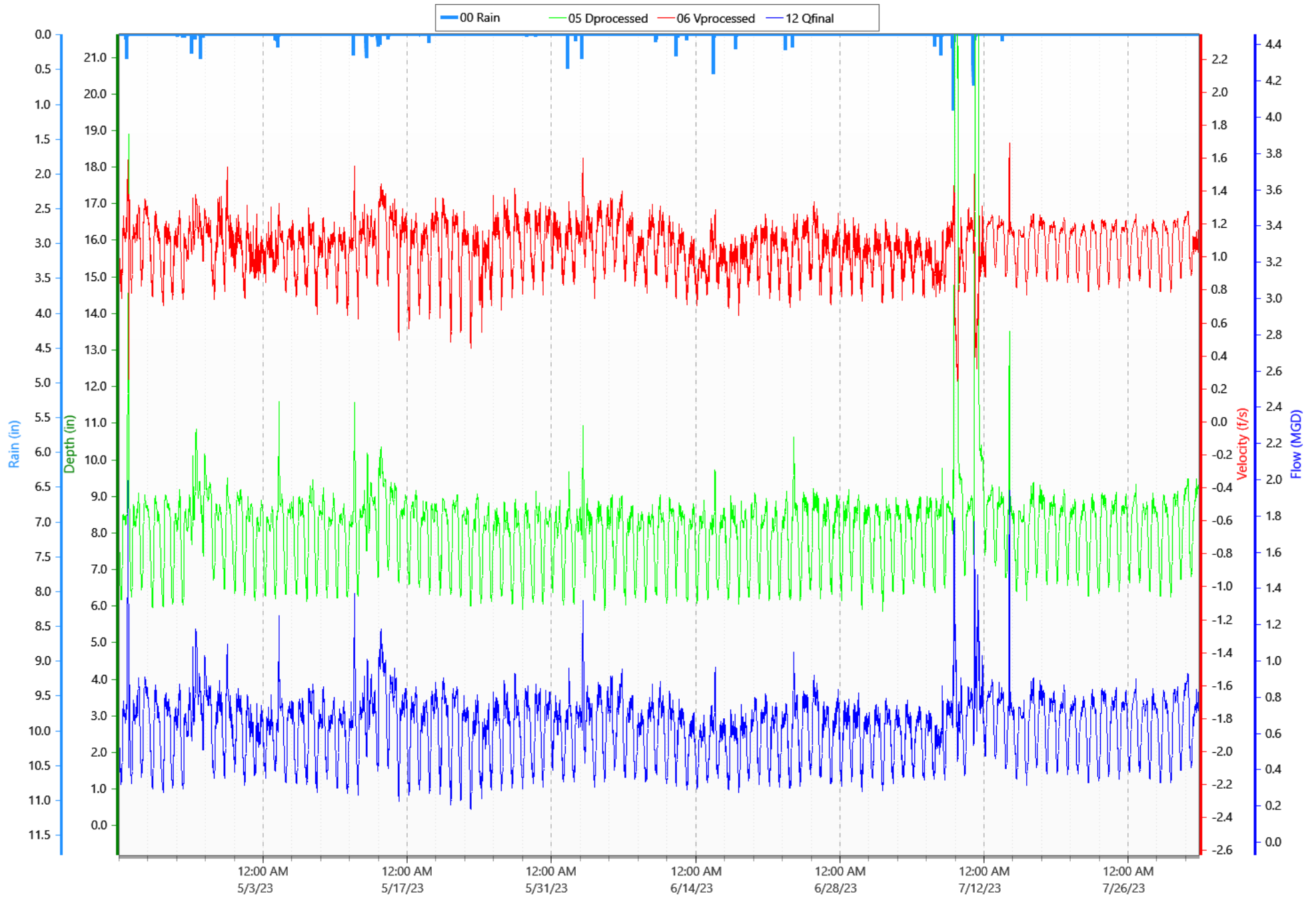
DVQ with Rain - Pipe Dia: 41.66 in.



Print Date: 10/12/2023 10:40:52 AM

WS-10 (4/19/2023 to 8/2/2023)

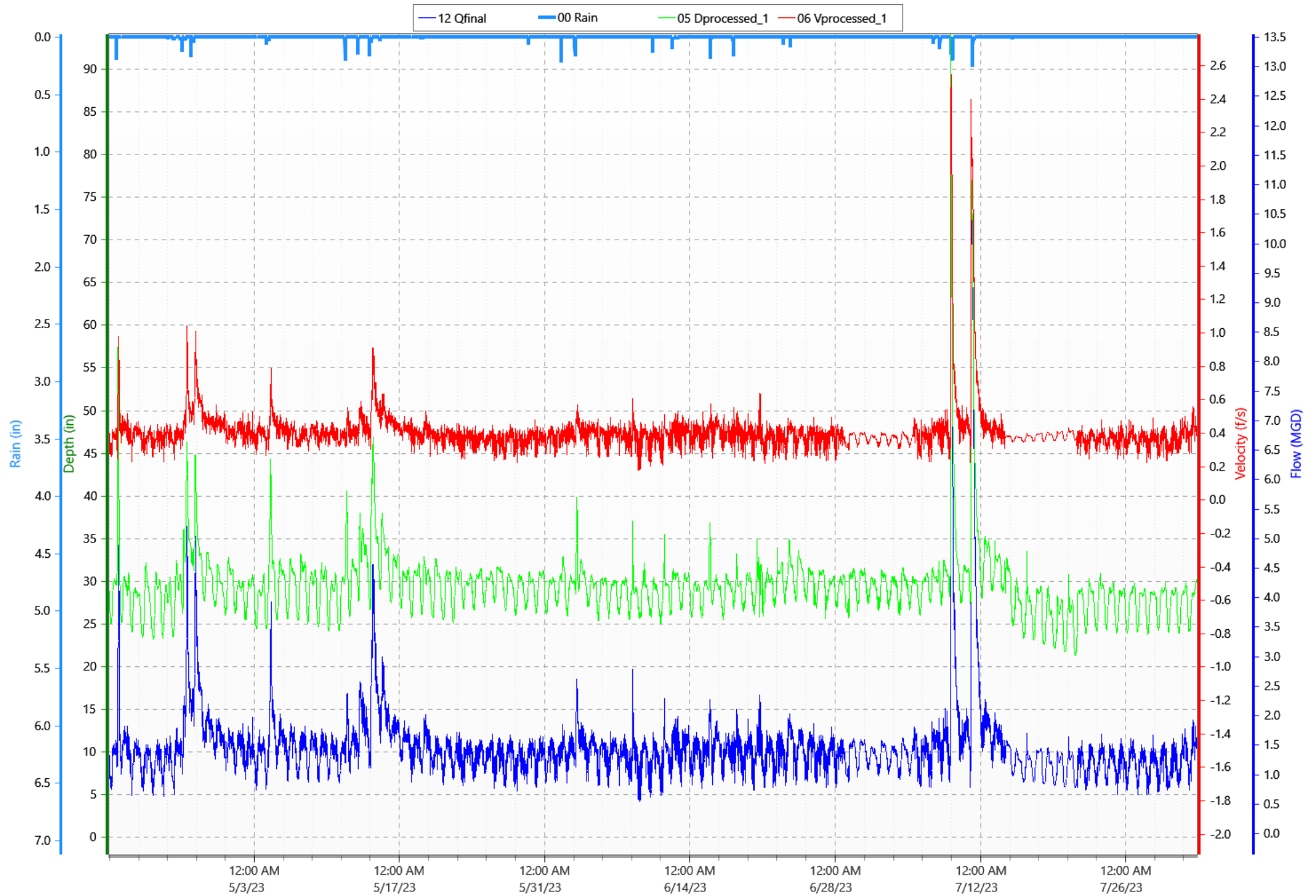
DVQ - Pipe Dia: 23.25 in.



Print Date: 10/12/2023 10:26:03 AM

WS-11 (4/19/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 41.20 in.



Print Date: 10/12/2023 10:41:21 AM