MacArthur Lake Stormwater Capture Project

Draft Environmental Impact Report

Appendix E | Water Mass Balance

Prepared for

City of Los Angeles

environment LA SANITATION CITY OF LOS ANGELES zero waste • zero wasted water

Prepared by

CDM Smith

State Clearinghouse No. 2022040153 | **May 2024**

Appendix E

Water Mass Balance

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CITY OF LOS ANGELES, SANITATION & ENVIRONMENT (LASAN)

MacArthur Lake Stormwater Capture Project

TOS SN-53: Program Management Services, Task Directive No. 59

Date: April 25, 2024

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Reviewed By: Inge Wiersema, PE, ENV SP, and Merrill Taylor, PE

Subject: Flow and Pollutant Removal Mass Balance Estimates

1.0 INTRODUCTION

1.1 Background

The City of Los Angeles, Sanitation & Environment (LASAN) is currently leading the MacArthur Lake Stormwater Capture project (Project) in partnership with the City of Los Angeles (City) Department of Recreation and Parks (RAP) and the City of Los Angeles Bureau of Engineering (BOE). The project site is in downtown Los Angeles and falls within Ballona Creek watershed. This means that all flows tributary to the Project site will ultimately reach the Ballona Creek wetlands if not diverted and treated prior.

The Ballona Creek's Watershed Management Plan identified pollutants of concern are metals, toxins, and bacteria. Zinc has been identified as the limiting pollutant, which means that when zinc removal is managed to the target removal level, all other pollutants of concern will also be managed to levels below the allowable loadings.

Stormwater discharges within the Ballona Creek Watershed are governed by the National Pollutant Discharge Elimination System (NPDES) Permit No. R4-2021-0105. In the WMP, LASAN and the other Ballona Creek Watershed Management Group members identified regional projects to cumulatively meet pollutant reduction targets. The pollutant reduction accomplished by the Project will benefit Ballona Creek, but there are no specific regulatory targets defined in the Total Maximum Daily Load (TMDL) that the city is required to meet for pollutant reduction at the project location. However, the Project is targeting removing 100 percent of trash from the diverted flows and 80 percent of zinc by weight from the Project's diverted flows. The pollutant removal achieved by this Project will contribute to meeting the Ballona Creek TMDL.

1.2 Purpose

The primary purpose of the Project is to help accomplish regulatory NPDES compliance for the Ballona Creek watershed. Additional project objectives include offsetting potable water use for lake level maintenance with captured stormwater and providing community benefits such as enhancement of the park through a nature-based solution, educational opportunities for the community, and improving the overall recreational value of the park.

The purpose of this memorandum is to describe the functionality of the Project's stormwater treatment system, including the estimated volumes of stormwater that would be diverted and the approximate pollutant removal percentages to help meet the water quality goals for the Ballona Creek TMDL requirements.

1.3 MacArthur Lake Stormwater Capture Project Overview

LASAN is implementing a regional multi-benefit stormwater project in MacArthur Park as part of the region's efforts under Los Angeles County's Safe Clean Water Program (SCWP). The project is aligned with several SCWP goals, including pollutant reduction to help meet NPDES permit requirements described above, increasing water supply via reuse, creating community benefits such as education and a cascading water feature.

The proposed project diverts and treats portions of wet weather stormwater and urban runoff flows (aka dry weather flows) from the existing storm drain system and discharges flows into MacArthur Lake for storage. Excess flows from storms return to the storm drain system. In-lake storage decreases the use of potable water needed to maintain the lake water level.

When lake levels are at a maximum water level, a small portion of the water stored in the lake is discharged to the sanitary sewer system by lowering the lake level by up to 8 inches. Lowering the lake allows additional space for new dry and wet weather flows to enter. The lake water that is released to the sanitary sewer mixes with the sewer flows, which are treated at the downstream Hyperion Water Reclamation Plant. Flows that are advanced treated can be reused, providing water supply benefits. It should be noted that during, and up to 48-hours following a precipitation event, lake water is not permitted to be released to sanitary sewer system due to capacity issues in the sanitary sewer during wet weather. Following storms, and when lake level is above minimum levels, diversions of lake water to the sanitary sewer will occur regularly to create storage space for additional stormwater and urban runoff flows.

The Project's storm drain diversion system and treatment units are depicted in Figure 1 below. The purpose and functionality of the numbers shown in Figure 1 are described in more detail below.

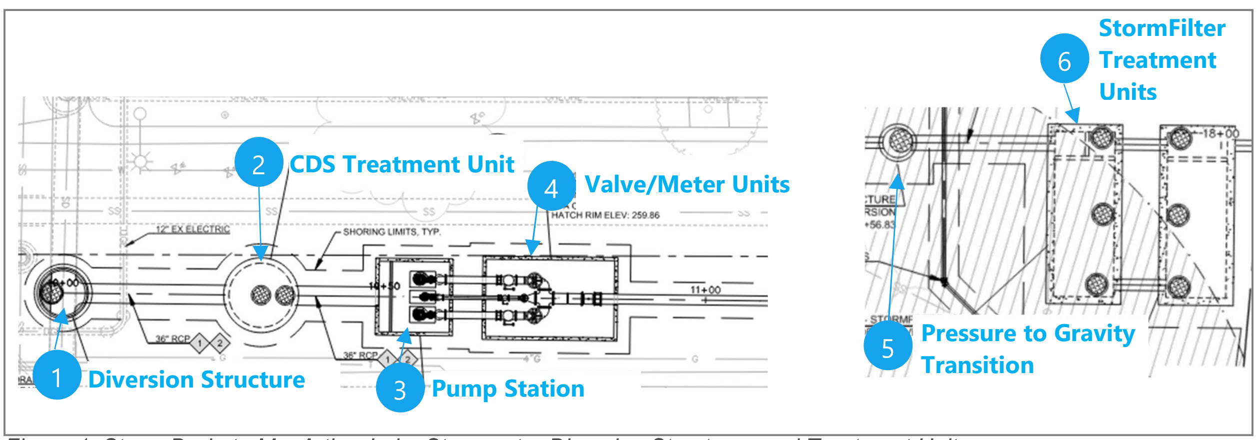

Figure 1. Storm Drain to MacArthur Lake Stormwater Diversion Structures and Treatment Units

The stormwater diversion structure (No. 1 in Figure 1) is designed to divert up to approximately 12.7 cubic feet per second (cfs) of stormwater flow from an existing 45-inch diameter storm drain line to a new 36-inch diameter pipeline on S Lake Street. Diverted flows pass through a Contech brand Continuous Deflective Separator (CDS®) Stormwater Treatment Device (No. 2) or engineer-approved equal. Then, flows are pressurized by a pump station (No. 3) and measured by a valve/meter vault (No. 4) and discharged into an 18-inch diameter pressurized pipe. Following the CDS® unit, pump station, and valve/meter vault, which are all located below ground in Lake Street, the 18-inch diameter pipeline conveys flows of up to 12.7 cfs to MacArthur Park. The 18-inch diameter pipeline follows Lake Street across 7th street, then turns 90-degrees to end up under the sidewalk on 7th street until it passes through a pressure-to-gravity transition structure (No. 5), from where it is conveyed through a 24-inch diameter gravity pipe that leads to two StormFilter® Treatment units (No. 6). Each StormFilter® Treatment unit can treat up to 2 cfs of flow, for a combined total of 4 cfs of fully treated flow. Flows treated by the StormFilter® units (0.15 to 4 cfs) along with the flow bypassing the filters (the StormFilter® bypass [4 to 8.7 cfs]) which are already treated by the CDS® unit, are discharged to MacArthur Lake via a 24-inch diameter gravity pipeline. When the lake is too full to accept additional flows, flow in the 24-inch diameter StormFilter outlet pipe are routed back to the 54-inch diameter storm drain on Grand View Street.

2.0 STORMWATER FLOWS

2.1 Hydrology

The Project diverts flows from storm drains within a 200-acre tributary area located primarily to the northeast of MacArthur Park. Stormwater and urban runoff flow rates and volumes were modeled using LA County's Watershed Management Modeling System (WMMS) version 1.0 (LACDPW, 2010). The WMMS model utilizes a historical record of 20-year hourly precipitation data from 1999 to 2019. The model predicts hourly storm drain flows and pollutant mass loading based on land use-specific storm water monitoring data from the Southern California Coastal Water Research Project (SCCWRP) (CASQA, 2024). The historical storm drain flows as modeled using WMMS 1.0 are depicted in Figure 2. As shown, there is a high variability in stormwater flows at the Project location, primarily due to occasional rainfall characteristics in Los Angeles County. The average flowrate in the 20-year period of record is 0.24 cfs, while the maximum predicted flow rate is 85 cfs. Flows exceeded 12.7 cfs during 17 days per year (nearly 5% of the days) while large storms resulted in flows exceeding 30 and 50 cfs during 10 and 4 days, respectively.

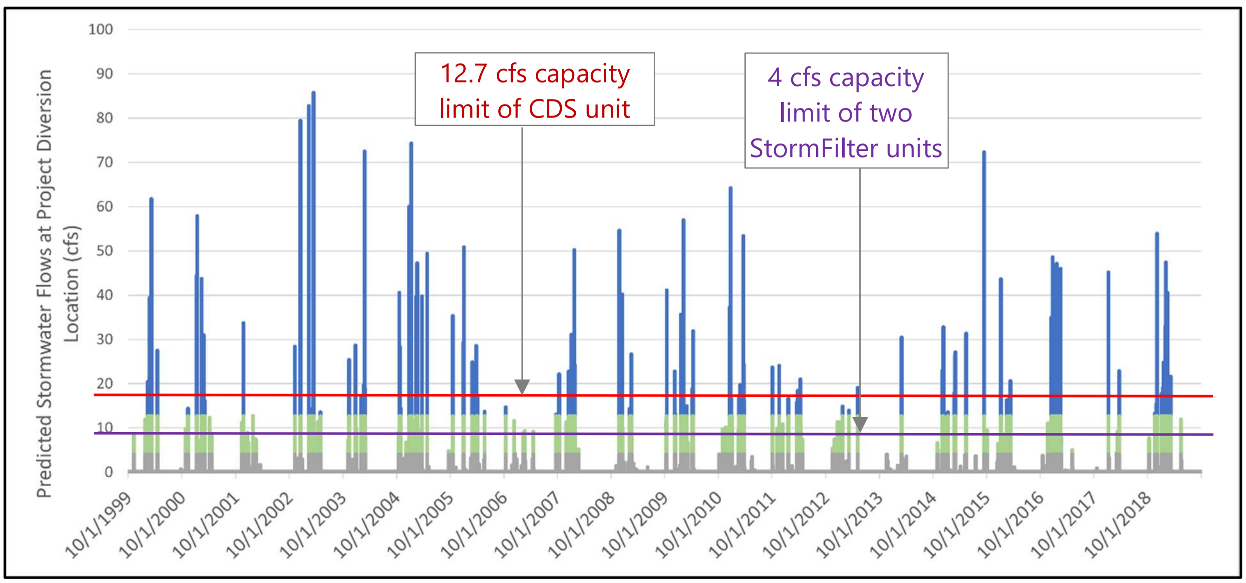

Figure 2. WMMS Model output of 20-year Stormwater Flows Predicted at the Project Diversion Location for the MacArthur Park Project Tributary Area

Flows predicted in the storm drain also include measured dry weather flows from storm drain monitoring conducted by V&A Consulting Engineers, Inc. between November 15, 2023 and December 27, 2023. Average dry weather flow was calculated at 0.149 cfs based on this monitoring. See Attachment A for the V&A Storm Sewer Flow Monitoring report.

2.2 Flow Balance

The schematic presented in Figure 3 below illustrates the average annual flow rate (expressed in cfs) and annual average volume (expressed in acre-feet per year or AFY) predicted to be present at the Project's diversion location in Lake Street based on the 20-year historical data set. As shown, the schematic separates the predicted flow rates and water volumes into the following sequential components:

1. Flows upstream of the Project's diversion structure.
2. Flows in and out of the CDS® unit
3. Flows in and out of the StormFilter® unit
4. Flows in and out of MacArthur Lake

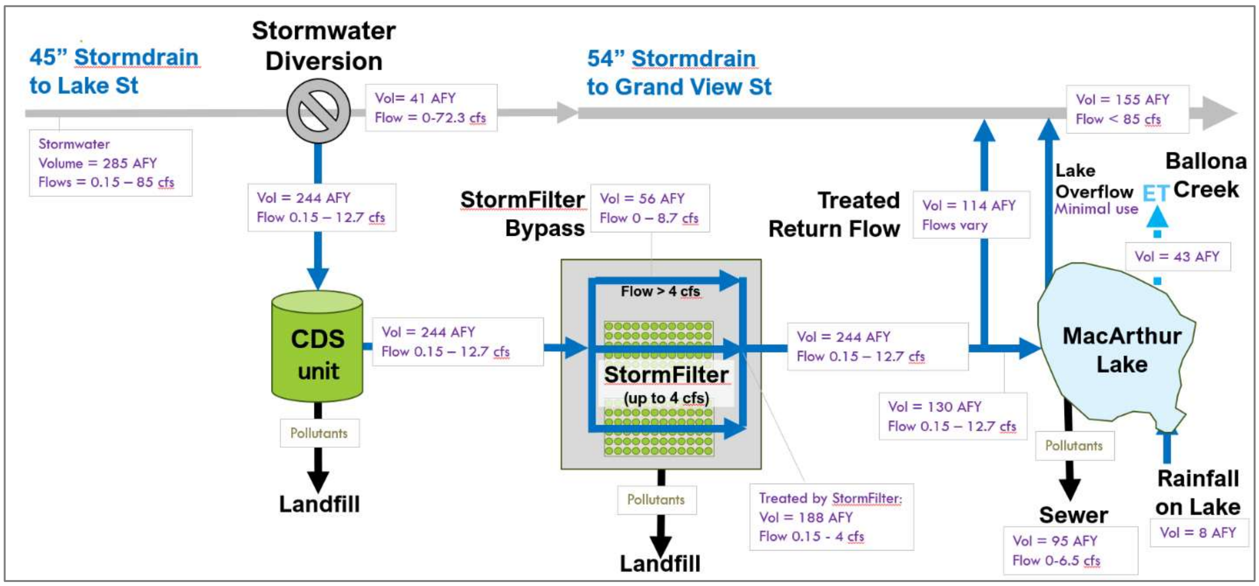

Figure 3. Storm Drain Flows Diagram Showing Annual Average Flows in Acre-Feet per Year (AFY) between 1999 and 2019 and Flow Capacities of each Diversion or Treatment Unit in cubic feet per second (cfs).

The schematic shown in Figure 3 summarizes the average annual flow volumes at the different stages in the project expressed in AFY. For example, it shows how much water is estimated to flow from the storm drain through the diversion structure to treatment units and back to the storm drain or into the lake, and then how much lake water is released to the sanitary sewer system. As shown in the hydrology chart in Figure 2 and in Figure 3, a portion of the flows bypass the project entirely as they exceed diversion capacity. The CDS® unit can only divert up to 12.7 cfs, while medium to large size storm events will result in flows exceeding 12.7 cfs. The hydrologic record used for the WMMS model predicts flows as high as 85 cfs at the Project's diversion location. On average, the hydrologic record has 17 days with stormwater flows exceeding 12.7 cfs per year and thus 348 days per year with flows below 12.7 cfs. The mass balance of annual average stormwater flows in AFY are summarized in Table 1.

Table 1 Average Annual Stormwater Volume Mass Balance (AFY)

Project Stage	Inflows in Acre-Feet per Year (AFY)		Outflows in Acre-Feet per Year (AFY)	
Diversion Structure	From Storm Drain to Diversion	285	Diverted to CDS® unit (0.15-12.7 cfs)	244
			Diversion bypass to Storm Drain (0.15-60 cfs)	41
	Total volume	**285**	**Total volume**	**285**
CDS Unit	Diverted to CDS® unit (0.15-12.7 cfs)	244	To StormFilter® from CDS® (0.15-12.7 cfs)	244
	Total volume	**244**	**Total volume**	**244**
StormFilter	To StormFilter® from CDS (0.15-12.7 cfs)	244	Treated by StormFilter® (0.15-4 cfs)	188
			StormFilter® Internal Bypass (0-8.7 cfs)	56
	Total volume	**244**	**Total volume**	**244**
Lake	From StormFilter® to Lake	130	From Lake to Sewer	95
	Rainfall on Lake Surface	8	Lake Evaporation	43
	Total volume	**138**	**Total volume**	**138**
Stormdrain to Ballona Creek	Diversion Bypass to Storm Drain	41	Stormdrain to Ballona Creek	155
	Treated Return Flow to Storm Drain	114		
	Total volume	**155**	**Total volume**	**155**

As shown in Figure 3 and listed in Table 1, it is estimated that 244 AFY of the 285 AFY of stormwater flow that reaches this project site can be diverted, while 41 AFY would bypass the diversion and the first treatment step of the project. Subsequently, 188 AFY of the 244 AFY that reaches the StormFilter will be treated by the cartridge units that have a combined treatment capacity of 4 cfs, while 56 AFY will internally bypass the cartridges when flows exceed 4 cfs. It is estimated that the Lake will receive 130 AFY of flows that are either treated by the StormFilter® unit or bypass the StormFilter® (already treated by the CDS® unit), as well as 8 AFY of annual rainfall on the lake surface, resulting in a total average lake inflow of 138 AFY.

If the lake is too full to accept more flows from the StormFilter® (treated) or via the StormFilter® bypass, a valve will close to stop directing flow to the lake and redirect the flows through a new 24-inch diameter pipe that travels east on 7th Street and then follows South Grand View Street where it connects to the existing 54-inch diameter storm drain. On average, it is estimated that 114 AFY of treated return flows are re-directed to the storm drain on South Grand View Street.

There is also an existing lake spillover system that surrounds the lake that maintains the water level in the lake at a desired maximum setpoint. Once the lake level exceeds this setpoint (e.g. during an intense precipitation even when the lake was already close to the maximum level), lake water will overflow into this spillover system via weirs and then be routed to an existing 24-inch diameter stormdrain that empties to a 30" stormdrain and ultimately reaches the same 54-inch diameter stormdrain that accepts the project's treated return flows.

It is estimated that on average 43 AFY will be lost to evaporation, using seasonal average evaporation rates for Los Angeles from the National Oceanic and Atmospheric Association. Actual evaporation losses will vary annually depending on temperature variations. The remaining 95 AFY (138 AFY inflow – 43 AFY of evaporation) of flow that reaches the lake is discharged to the sewer ahead of storms to make room for wet weather flows. The maximum discharge rate from the lake to the sewer is 6.5 cfs (approximately 2900 gallons per minute), according to LASAN sewer operations staff recommendations during the Project's preliminary design phase. This flow rate allows the lake to drain 8 inches in approximately 10 hours.

It should be noted that the Project's Lake level operations will ultimately impact how much water will be released to the sewer versus spilling over in the storm drain surrounding the lake to protect the sidewalk from flooding. If the lake levels and upcoming storm events are monitored closely and lower lake levels would be acceptable, it is estimated that up to about 200 AFY could be released to the sanitary sewer. Once lake water is released to the sewer, it will flow to the Hyperion Water Reclamation Plant (WRP) where it can ultimately be recycled, especially after the commissioning of Operation Next (currently in the planning stages) to purify water for potable reuse.

Based on the average annual flow balance using 20-year historical data from 1999 to 2019, approximately 285 AFY of stormwater is estimated to reach the Project's diversion structure location. More than 86 percent (244 AFY) of the flows will be diverted and treated with the CDS® unit, and 66 percent of the flows (188 AFY) will also be treated by the StormFilter® units prior to discharge into the lake or returning to the storm drain when the lake hits capacity. Treated return flows will go to the storm drain for conveyance to Ballona Creek while lake water drawdown releases to the sanitary sewer will be recycled at Hyperion WRP.

3.0 POLLUTANT REMOVAL

Pollutant removal is achieved in three ways by the project, namely 1) CDS® unit treatment, 2) StormFilter® unit treatment, and 3) treatment by the Hyperion WRP of lake water (including stormwater that reached the Lake) that is released to the sanitary sewer. With zinc being the limiting pollutant in the watershed, pollutant removal is focused on this water quality constituent, along with sediment and trash.

The CDS® unit is expected to remove 100 percent of trash from incoming storm drain flows.

3.1 CDS Unit

CDS® units are underground systems that use centripetal forces to separate debris from water. An example of a CDS® unit is shown below in Figure 4. The Contech website describes CDS® functionality as follows:

"*The CDS® unit uses patented continuous deflective separation technology. The CDS® system screens, separates, and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables, and neutrally buoyant material without blinding.*" *(Contech, 2024a).*

According to Contech's CDS® Guide: Operation, Design, Performance and Maintenance, CDS® systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (µm). For some regulatory environments, CDS® systems can also be designed to achieve an 80 percent annual solids load reduction based on an average particle size (d50) of 75 microns (µm) or 50 microns (µm). (Contech, 2024a)

Zinc sources in the watershed are assumed to be predominantly associated with sediment. Both metals and phosphorus are modeled as a function of sediment transport in WMMS Model (LACFCD, 2020). A 2007 report by the Los Angeles Regional Water Quality Control Board (RWQCB) reported measured zinc concentrations in the water column (dissolved Zinc) compared to sediment pore water concentrations (Zinc associated with sediment) in the Los Angeles/Long Beach Harbor and San Pedro Bay. The dissolved

Zinc concentrations ranged from 0.75 to 7.64 ug/L, whereas Zinc concentrations associated with sediment ranged from 4.31 to 34.7 ug/L (LA RWQCB, 2007).

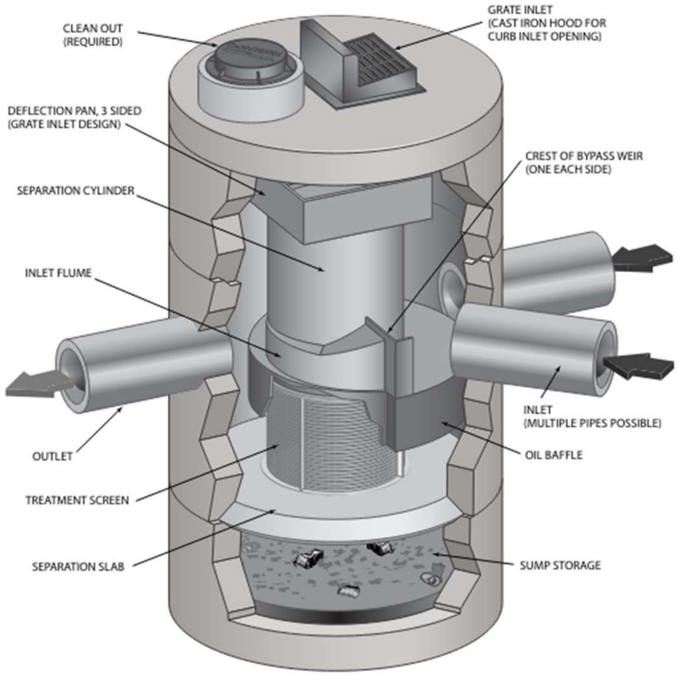

Figure 4. Contech CDS unit rendering illustrating typical components.

Averaging these ranges, and assuming these concentrations are representative of the Los Angeles area, it was approximated that roughly 80 percent of zinc is associated with sediment, while only 20 percent is a dissolved stage. The CDS® unit is designed to exceed 80 percent sediment removal on average but is not effective in removing dissolved zinc. The CDS's sediment removal rate is therefore assumed to be 80 percent. Consequently, it was assumed that the CDS® unit will remove 80 percent of Zinc associated with sediment, but not remove any of the dissolved zinc. This results in a net zinc removal rate of 64 percent (80% * 80% for sediment-bound Zinc + 0%*20% for dissolved Zinc).

3.2 StormFilter® Unit

The secondary treatment system selected for the Project is called a StormFilter® unit. These stormwater treatment units are also manufactured by Contech. They are concrete vault-style treatment structures containing media-filled cartridges that trap particulates and adsorb pollutants from stormwater runoff. An example of a StormFilter® unit is shown below in Figure 5. The Contech website describes StormFilter® functionality as follows:

"During a storm, runoff passes through the filtration media and starts filling the cartridge center tube. The air inside the hood is purged through a one-way check valve as the water rises. When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to exit the cartridge. A siphon is established within each cartridge that draws water uniformly across the full height of the media bed ensuring even distribution of pollutants and prolonged media longevity. After the storm, the water level in the structure starts falling. A hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators at the bottom of the hood. Air then rushes through the regulators, breaking

the siphon and creating air bubbles that agitate the surface of the filter media, causing accumulated sediment to settle on the treatment bay floor. This unique surface-cleaning mechanism prevents surface blinding and further extends cartridge life." (Contech, 2024a)

Media cartridges will be replaced when needed based on decreasing flow rates and clogging (assumed once every 1-2 years). Spent media will require proper disposal offsite.

StormFilter® units were assumed to remove 75 percent of zinc and 80% of sediment. The amount of Zinc removal is based on a Contech study of metals removal through the StormFilter® (see Attachment B). The MetalsRx® media used in the Contech study is no longer available, but PhosphoSorb® has similar characteristics to the MetalsRx® and was selected for the project. Contech studies using PhosphoSorb® media, the same media proposed for use as part of the MacArthur Lake Stormwater Capture Project, have shown more than 80 percent TSS removal in Washington state field tests (WSDE, 2017). For conservative planning purposes, 80 percent sediment removal was used for the project StormFilter® sediment removal rate. When the lake has storage capacity, all flows that exit the StormFilter® unit will continue to MacArthur Lake. Based on the flow balance calculations, it is estimated that more than half of all flows from the StormFilter® unit by volume continue to the lake where additional removal can occur via sedimentation or release to the sanitary sewer for treatment.

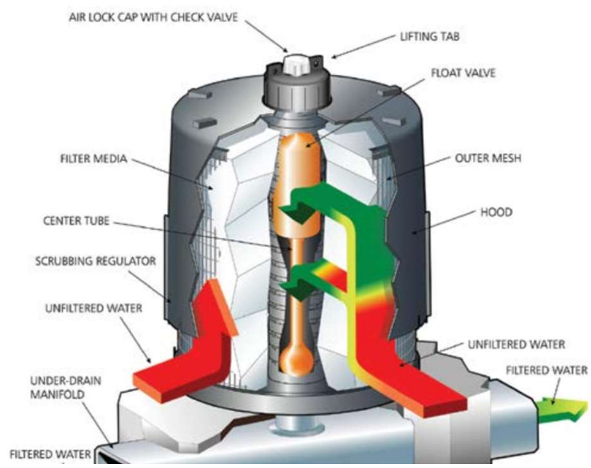

Figure 5. Contech StormFilter® unit rendering illustrating a single vault structure similar to one of the two used by the Project (left). A single StormFilter® cartridge rendering depicting water flow into filter, through media, and down/out of cartridge into a manifold cast into vault floor.

3.3 Lake Sedimentation and Sewer Discharge

As shown in Figure 3 above, approximately 95 AFY of lake flows, on average, are released to the sanitary sewer system and treated for reuse at the Hyperion WRP. Water diverted to the sanitary sewer system is assumed to achieve 100 percent zinc removal, along with removal of other pollutants, as it will not reach the Ballona Creek watershed.

4.0 FLOW AND POLLUTANT REMOVAL SUMMARY

Combining the flow information in Section 2 with the pollutant removal assumptions and performance information for the treatment units and lake to sewer discharge in Section 3, a mass balance calculation of zinc and sediment removal was prepared by the Project's Design Team (Carollo Engineers, Inc.) and reviewed by the civil design lead Craftwater Engineering.

The WMMS 1.0 model predicts storm drain flows and estimates pollutant mass within those flows for sediment, total Nitrogen, total Phosphorus, copper, lead, zinc, and Fecal Coliform. The Project team developed an hourly timestep mass balance calculation using the 20-year hydrologic record presented in Figure 3. Hence, for each hour during the 20-year period model simulation, the model estimates the pounds of zinc and tons of sediment in storm water. Zinc removal by CDS® was calculated as 64 percent of the total zinc load for flows less than 12.7 cfs (see Section 3.1 for CDS® zinc removal calculation). Flow bypassing the diversion was not considered in the pollutant removal calculation, consistent with the SCWP methodologies.

For the StormFilter® unit, zinc removal was calculated as 75 percent of the zinc load entering the StormFilter®, and sediment removal was calculated at 80 percent. For flows above 4 cfs that bypass cartridges within the StormFilter®, zinc removal was prorated based on the flow rate, calculated as follows:

$$\frac{4\ cfs}{Total\ Flow\ to\ StormFilter\ in\ cfs} * 75\% * Zinc\ load\ to\ StormFilter\ in\ pounds$$

The annual average zinc removal over the full 20-year period was calculated by summing the hourly zinc removals and dividing by 20 years for both treatment units. The results of this as a mass balance are presented in Figure 6 and Table 2 below. As shown, the Project is estimated to remove 96 percent of sediment and 93 percent of zinc, which meets the intent of the Project presented to the SCWP.

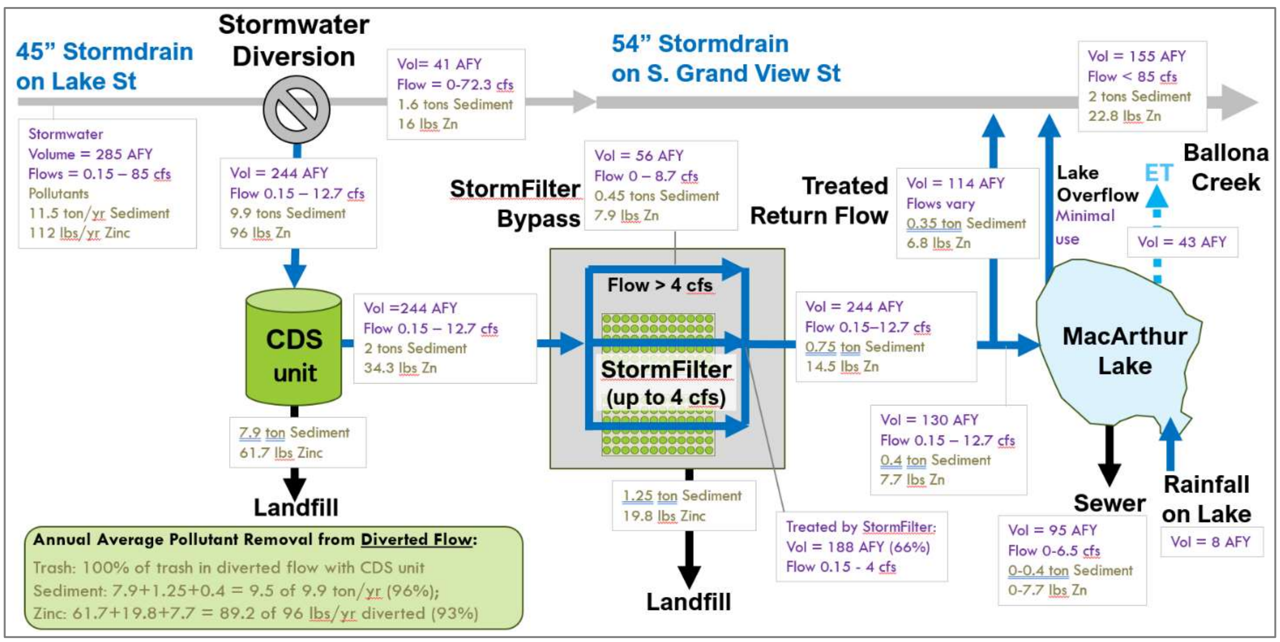

Figure 6. Flow and Pollutant Removal Summary for the Project

As shown in Figure 6 and listed in Table 2, the WMMS model estimates that approximately 11.5 tons of sediment (ton/yr) and 112 pounds of Zinc per year (lbs Zn/yr) will reach the Project's diversion structure location.

Based on a flow diversion of 244 AFY, it is estimated that about 96 lbs Zn/yr will be diverted to the CDS® unit. Approximately 61.7 lbs Zn/yr associated with sediment will be trapped by the CDS® unit and disposed of at a landfill or similar after periodic cleaning by a vactor truck. From the 34.3 lbs Zn/yr that enters the StormFilter® unit, approximately 26.4 lbs Zn/yr will be treated with the cartridges based on 188/244 AFY (77%) of the flow being treated. Using an absorption effectiveness of 75% as described above, it is estimated that about 19.8 lbs Zn/yr will be absorbed by the cartridges. These will periodically be replaced, with the captured sediment/pollutants hauled off site to a landfill. The remaining 14.5 lbs Zn/yr (6.6 lbs/yr of Zinc not absorbed by cartridges+ 7.9 lbs Zn/yr from the StormFilter® Overflow) will continue on either to the lake or, if the lake is full, to the 24-inch diameter treatment return flow leading to the storm drain in South Grand View Street.

Table 2 Zinc Removal Mass Balance in Average Pounds per Year

Project Stage	Inflows in Pounds per Year		Outflows in Pounds per Year	
Diversion Structure	From Storm Drain to Diversion	112	Diverted to CDS® unit	96
			Diversion bypass to Storm Drain	16
	Total weight	**112**	**Total weight**	**112**
CDS Unit	Diverted to CDS unit (0-12.7 cfs)	96	To StormFilter from CDS®	34.3
			Removed by CDS® unit	61.7
	Total weight	**96**	**Total weight**	**96**
StormFilter	To StormFilter® cartridges	26.4	From StormFilter® to Lake	7.7
	To StormFilter® Overflow	7.9	From StormFilter® to Treated Return	6.8
			Removed by StormFilter®	19.8
	Total weight	**34.3**	**Total weight**	**34.3**
Lake	From StormFilter® to Lake	7.7	From Lake to Sewer	7.7
	Total weight	**7.7**	**Total weight**	**7.7**
Storm Drain to Ballona Creek	Diversion bypass to Storm Drain	16	Storm Drain to Ballona Creek	22.8
	Treated Return flow to Storm Drain	6.8		
	Total weight	**22.8**	**Total weight**	**22.8**

As shown in Figure 6, it is estimated that 7.7 lbs Zn per year of this 14.5 lbs Zn/yr will reach the Lake, while 6.8 lbs Zn/yr will be returned to the storm drain via the 24-inch return pipeline.

Based on the flow/mass balance shown in Figure 6, on average 7.7 lbs Zn/yr is estimated to reach the lake. It is unknown how much zinc will remain in the lake (likely attaching to lake sediment and settling out) and how much will be released to the sewer. However, all pollutants that end up in the Lake and/or will be rerouted to Hyperion WRP via periodic releases to the sewer will not be reaching the Ballona Creek wetlands are therefore considered removed for SCWP compliance.

Hence, the average annual combined removal rate for zinc is about 93 percent using the Safe Clean Water methodology of dividing the weight of pollutant removed (89 lbs Zn/yr) by the weight of pollutant diverted into the project (96 lbs Zn/yr). Sediment removal is higher, due to CDS® and StormFilter® high removal performance for sediment and is estimated at 96 percent.

It should be noted that actual flow rates, flow volumes, pollutant loads, and pollutant removal rates may vary substantially when combining the large number of variables such as, but not limited to, precipitation patterns, storm durations, storm frequencies, land use activities within the tributary watershed contributing to variability in pollutant loads, system operations of the Project's diversion pump stations and lake level management, as well as the cleaning frequency and maintenance of the CDS unit and StormFilter® units. The flows and pollutant loads presented herein are intended to help size the Project components (pipelines, pump, and selection of treatment unit sizes) only. This memorandum is not intended for water quality compliance.

5.0 REFERENCES

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10. WSDE (Washington State Department of Ecology). 2017. *General Use Level Designations for Basic (TSS) and Phosphorus Treatment for Contech Engineered Solutions Stormwater Management StormFilter® with Phosphosorb® media.*

ATTACHMENT A

V&A STORM SEWER FLOW MONITORING REPORT

Monitoring Site: Site 1

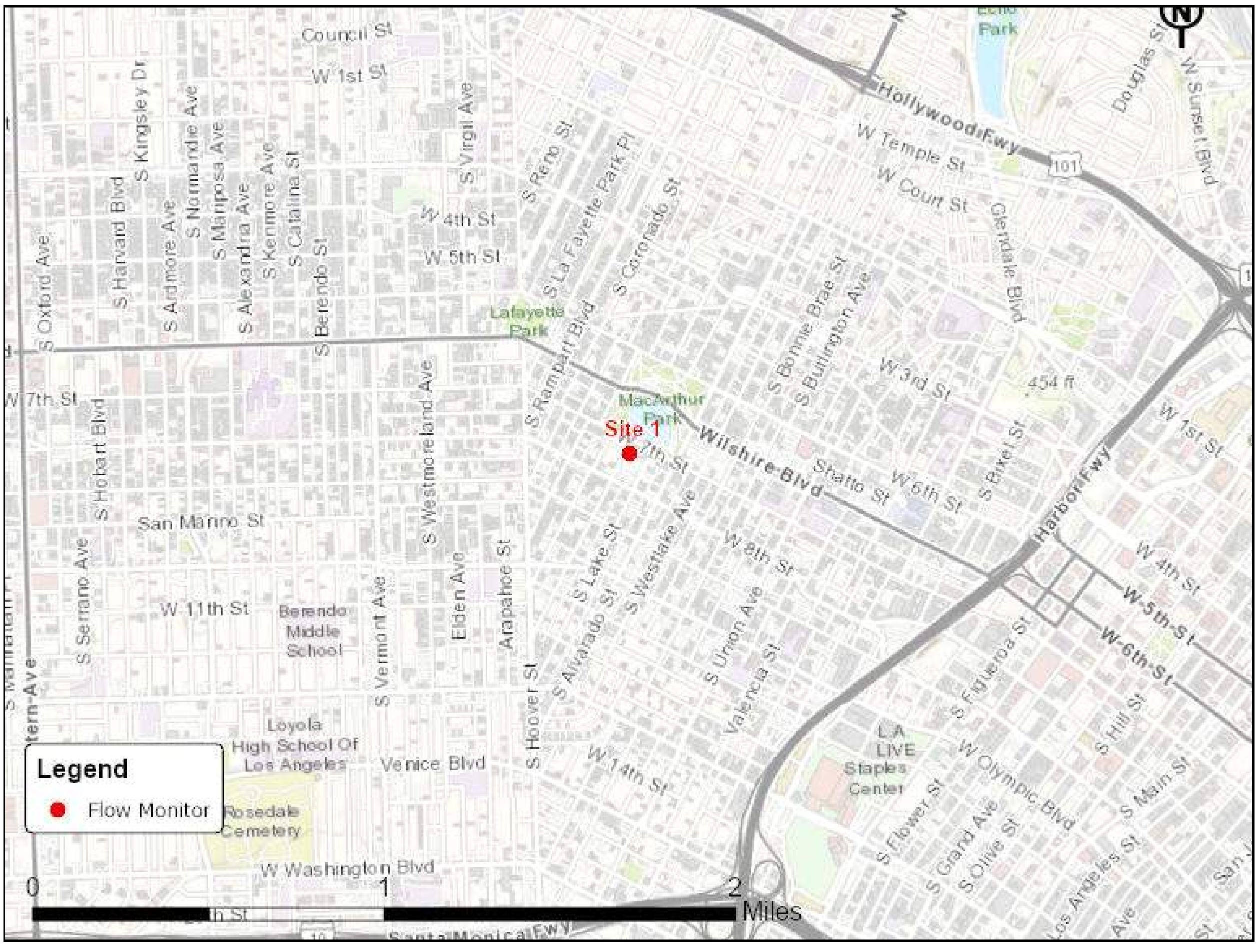
Carollo | LASAN, California

Sanitary Sewer Flow Monitoring

November 15, 2023 - December 27, 2023

Location: 7112 S Grand View Street

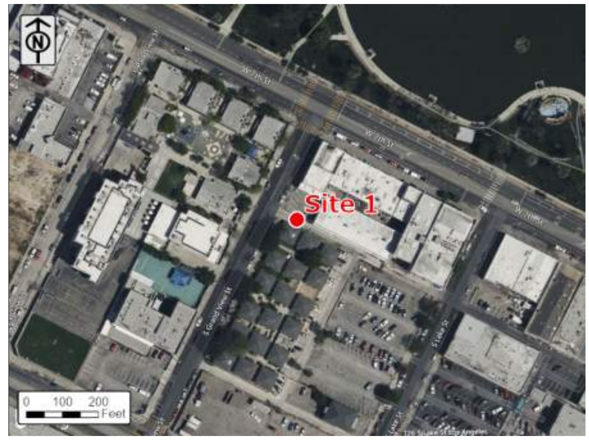
Data Summary Report



Vicinity Map: Site 1

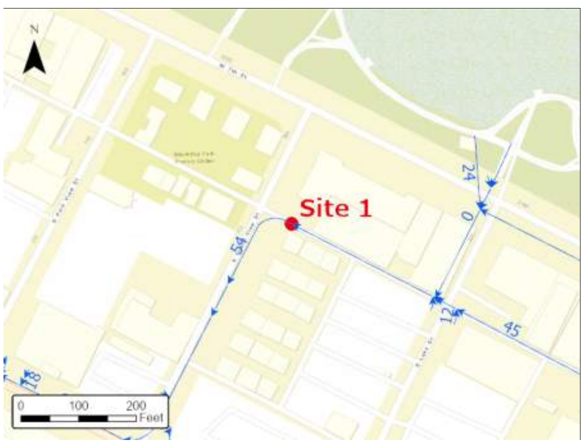
SITE 1

Site Information MH ID: 94662

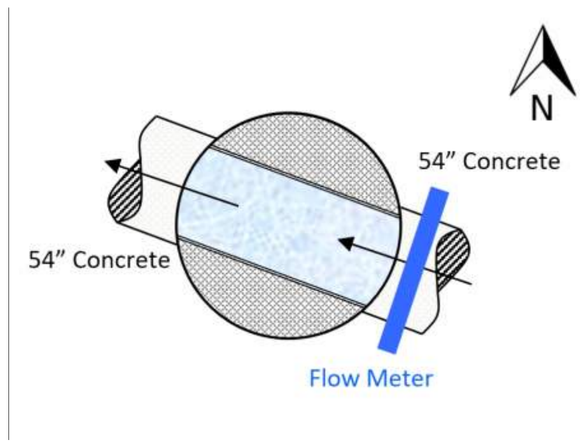


Satellite Map

Location:	7112 S Grand View Street
Coordinates:	118.2792° W, 34.0569° N
Rim Elevation:	262 feet
Expected Pipe Diameter:	54 inches
Measured Pipe Diameter	54 inches
ADWF:	0.149 cfs
Peak Measured Flow:	52.288 cfs
Sediment:	None



Sanitary Map



Flow Sketch

Street View


Plan View

SITE 1

Additional Site Photos

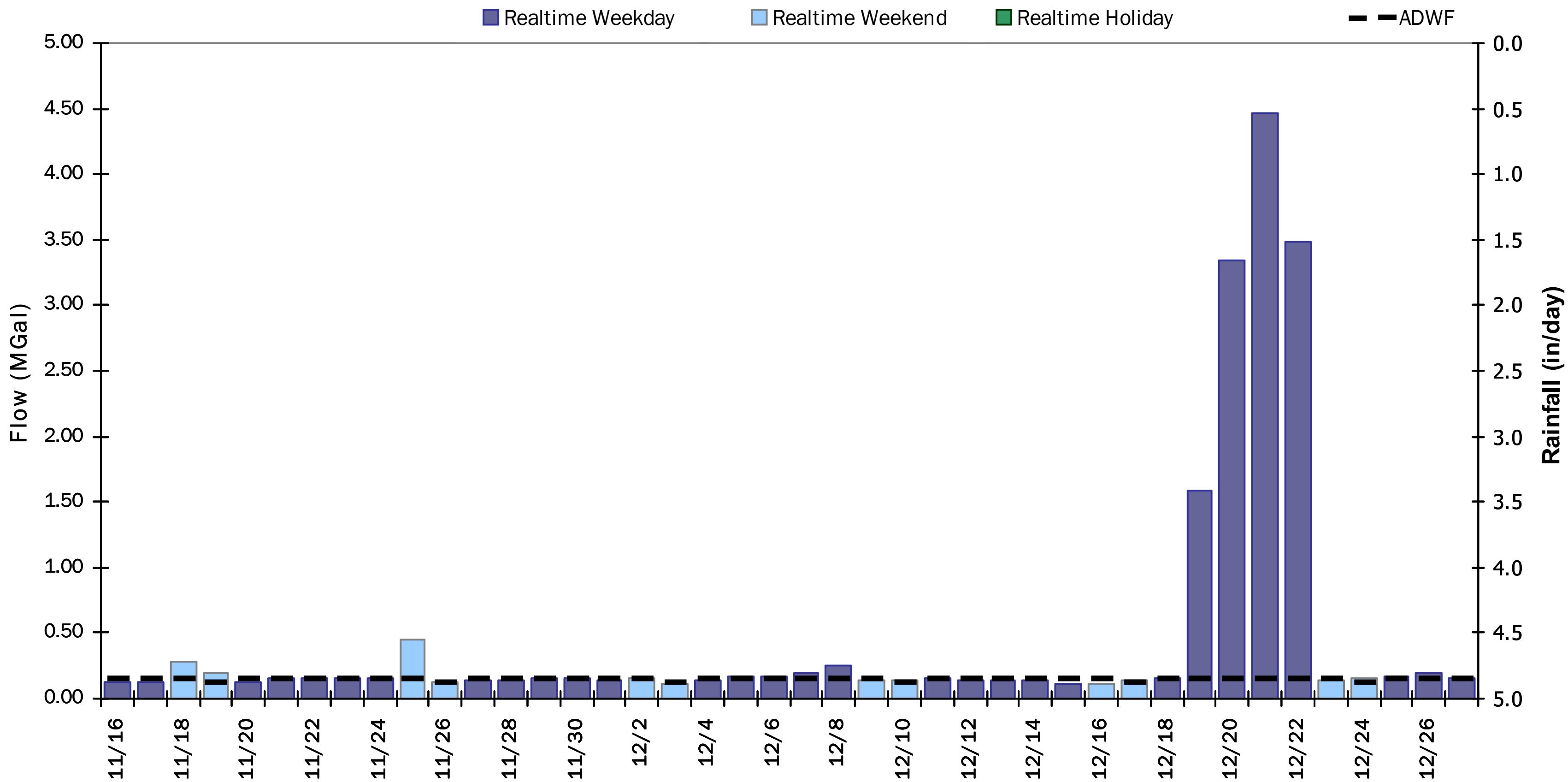
Northwest Effluent Pipe

Monitored Southeast Inlet Pipe

SITE 1

Period Flow Summary: Daily Flow Totals

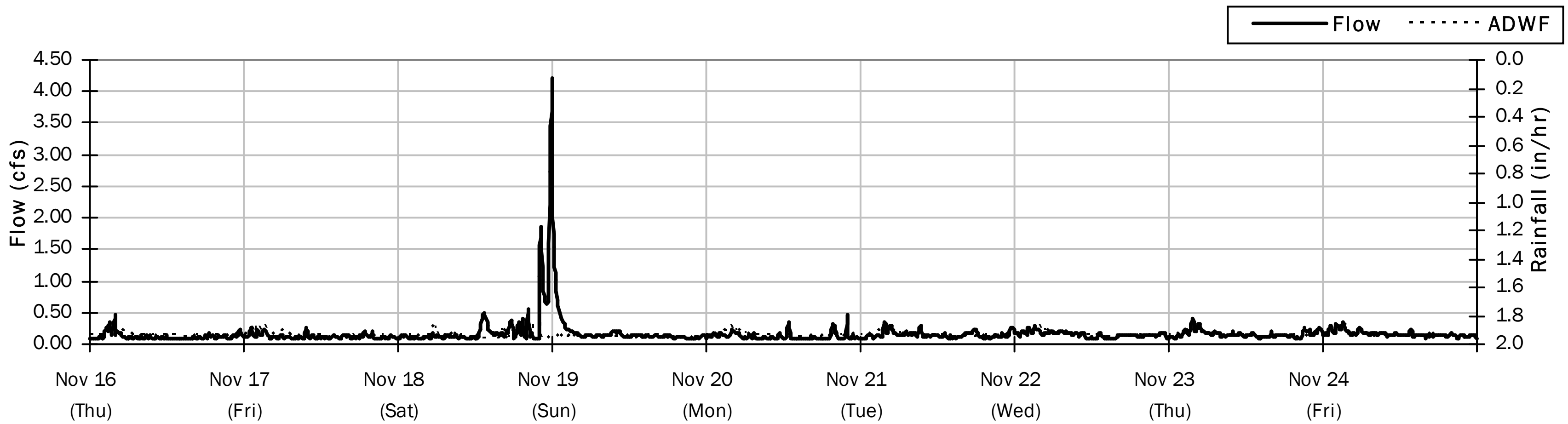
Avg Daily Flow: 0.454 MGal   Peak Daily Flow: 4.471 MGal   Min Daily Flow: 0.116 MGal

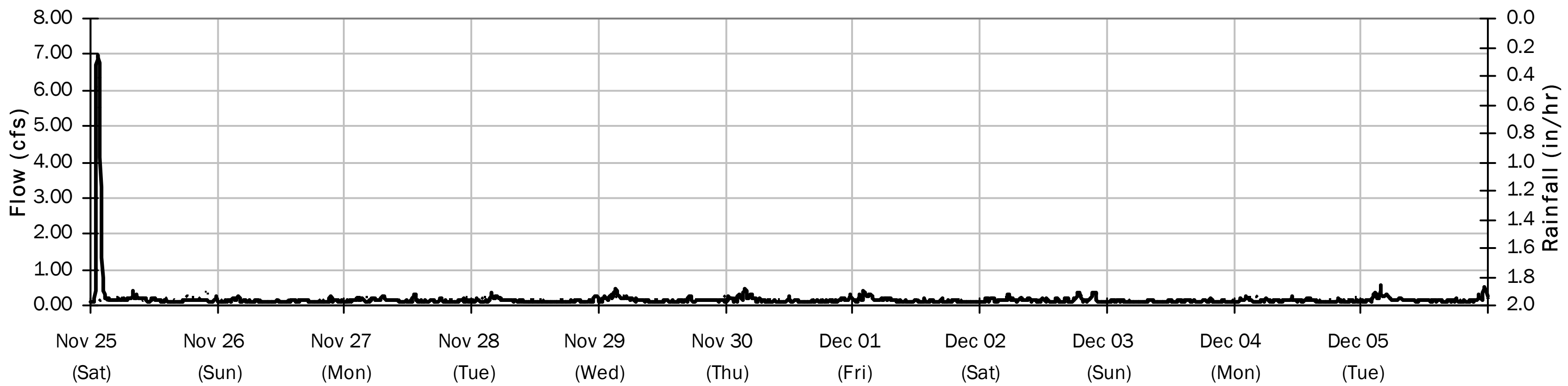


SITE 1

Flow Summary: 11/15/2023 to 12/5/2023

Period Avg Flow: 0.168 mgd Period Peak Flow: 6.982 mgd Period Min Flow: 0.078 mgd

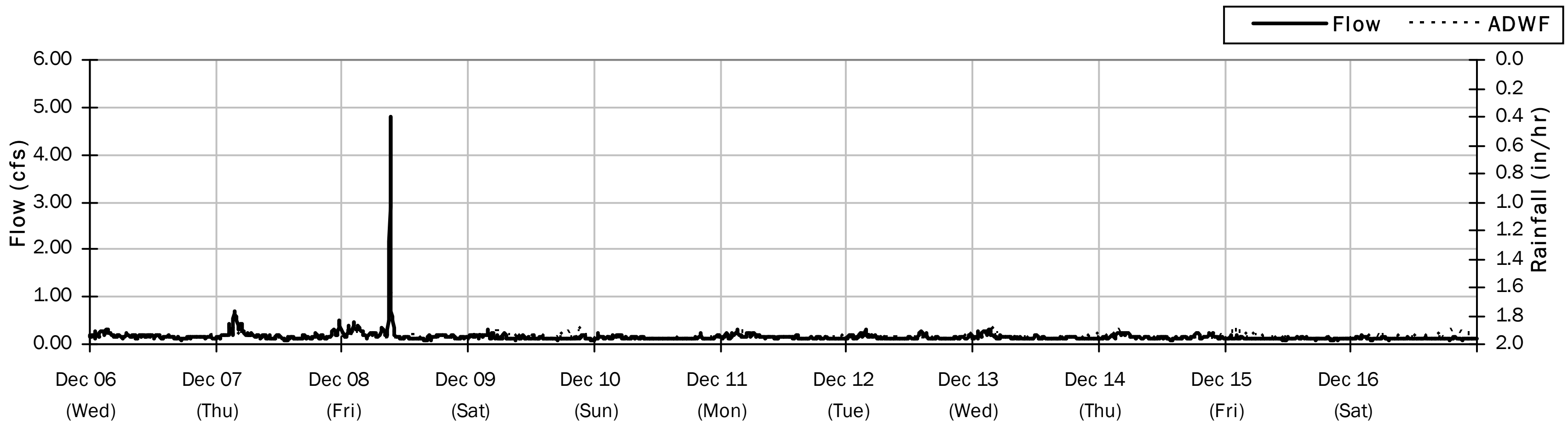


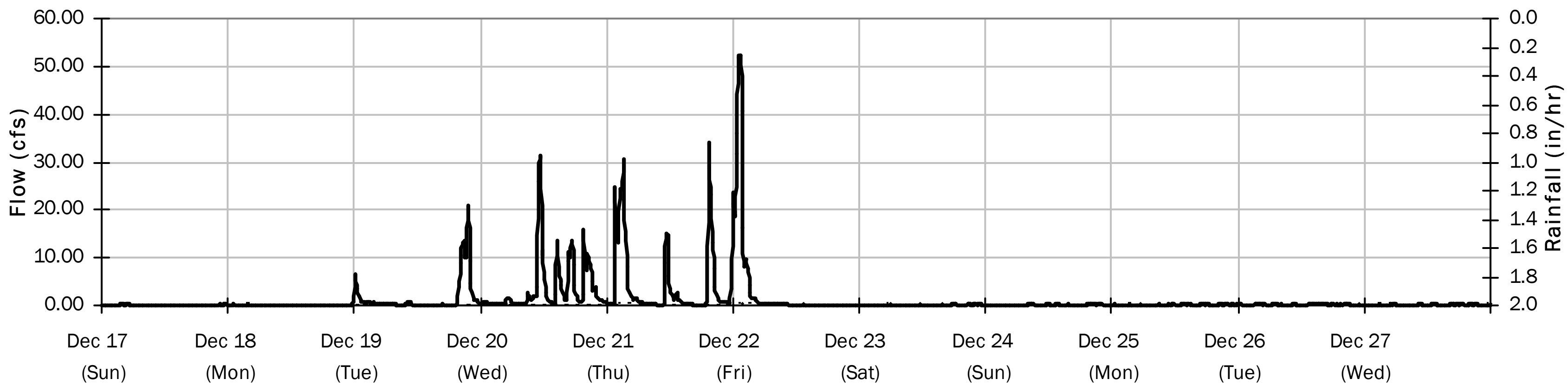


SITE 1

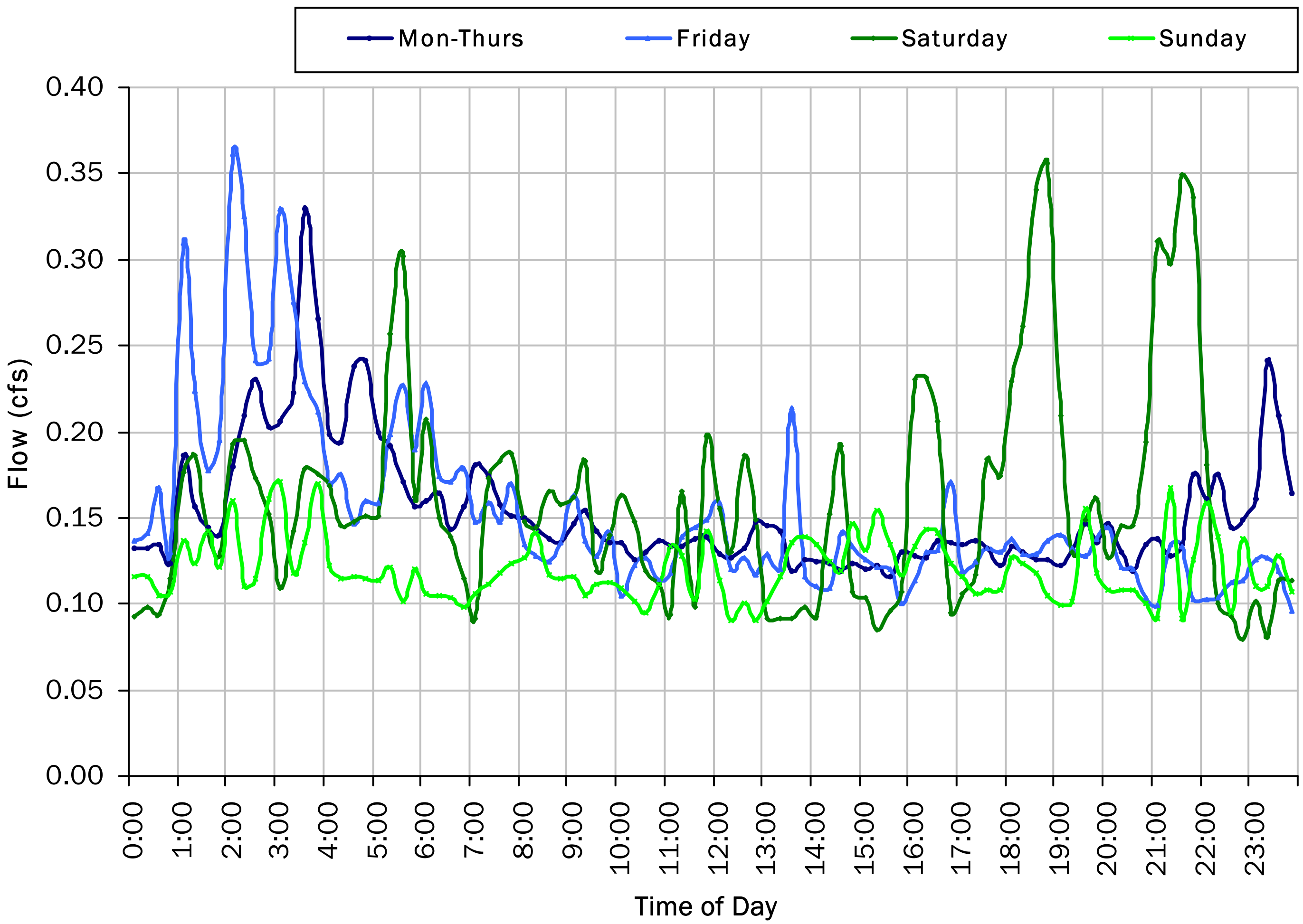
Flow Summary: 12/6/2023 to 12/27/2023

Period Avg Flow: 0.713 mgd Period Peak Flow: 52.288 mgd Period Min Flow: 0.088 mgd

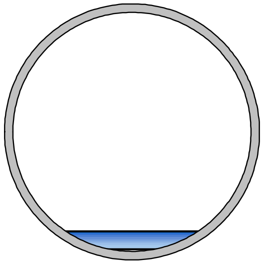




SITE 1
Average Dry Weather Flow Hydrographs

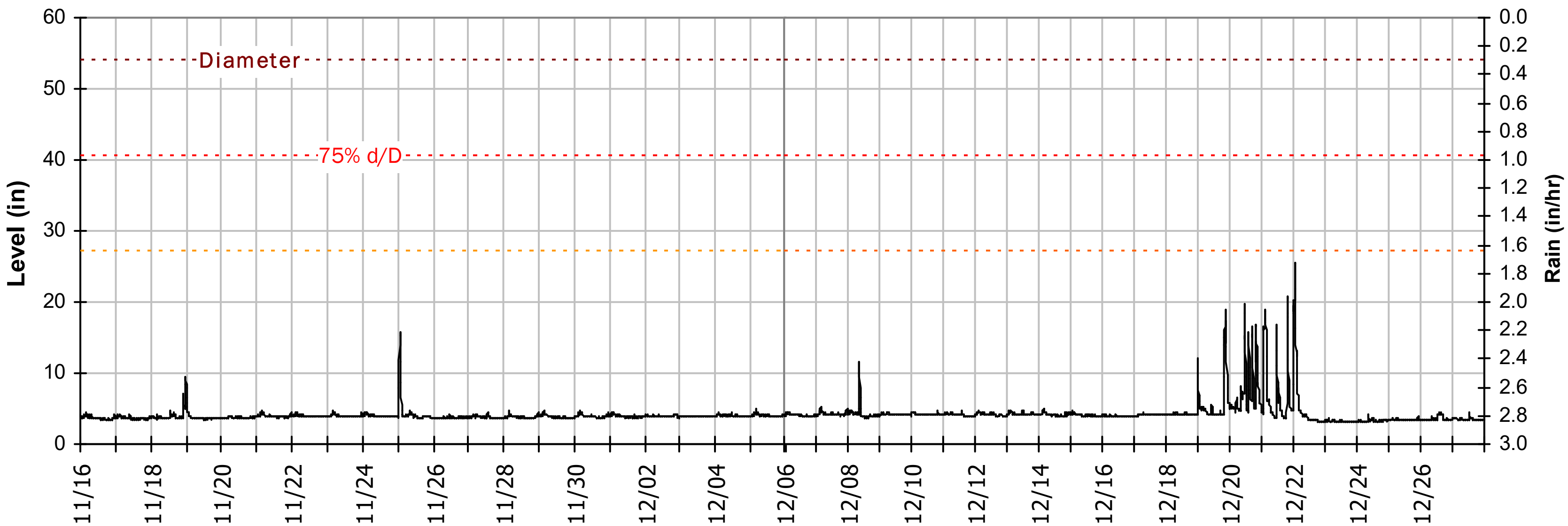


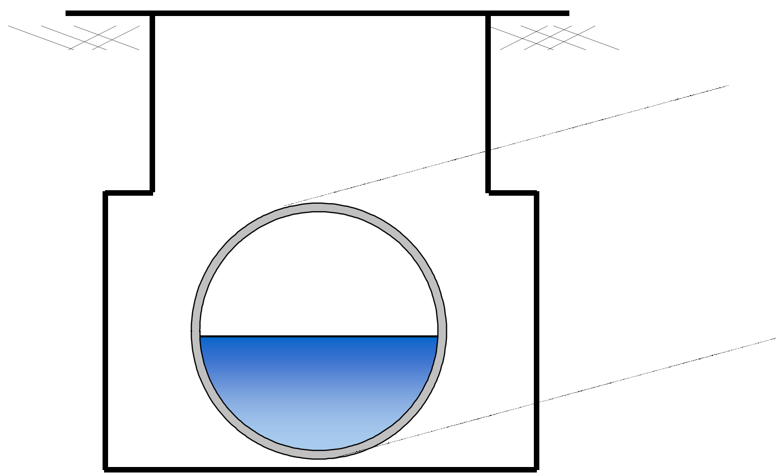
ADWF:
0.149 *cfs*



SITE 1
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

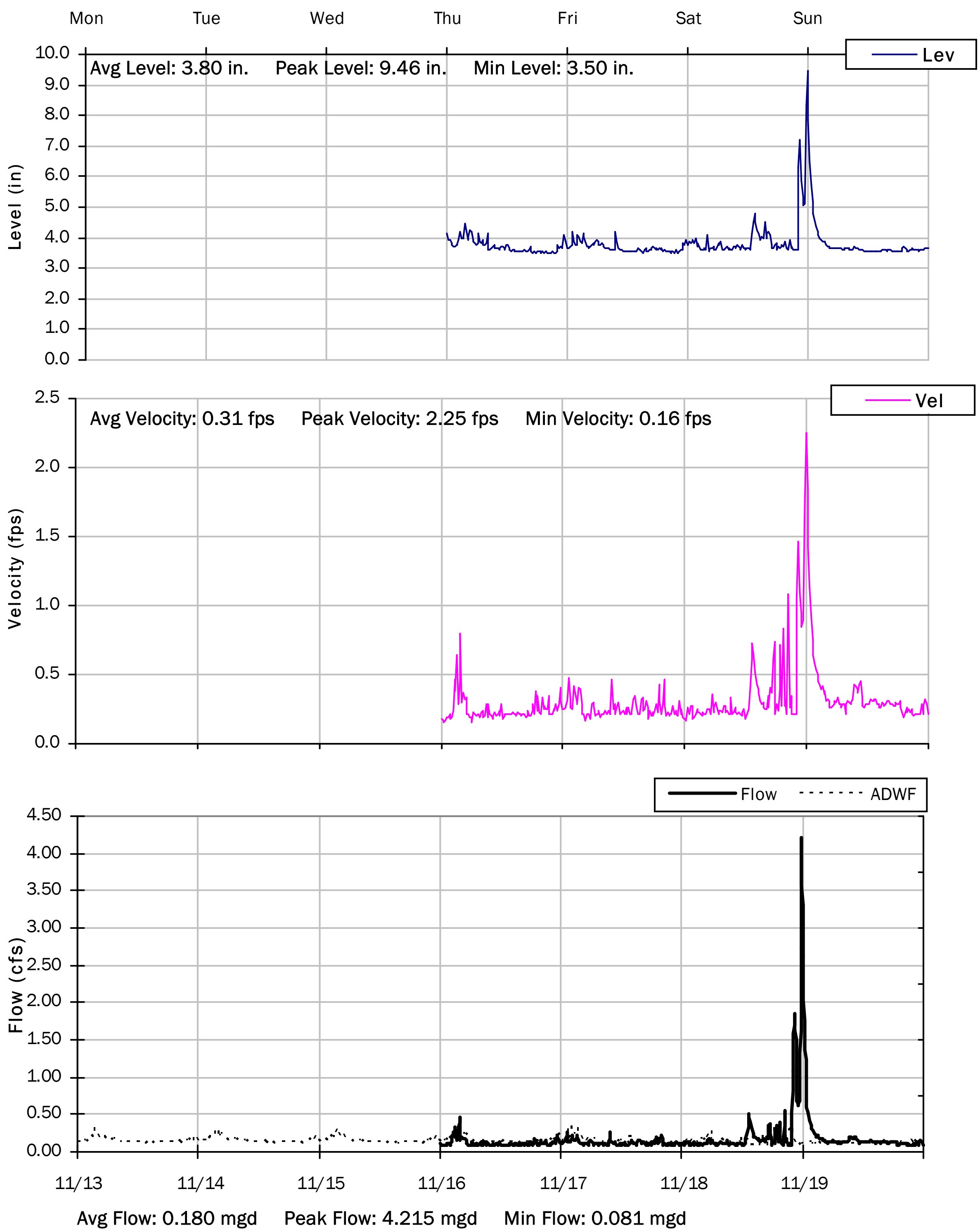




Pipe Diameter:	54	*inches*
Peak Measured Level:	25.6	*inches*
Peak d/D Ratio:	0.47	

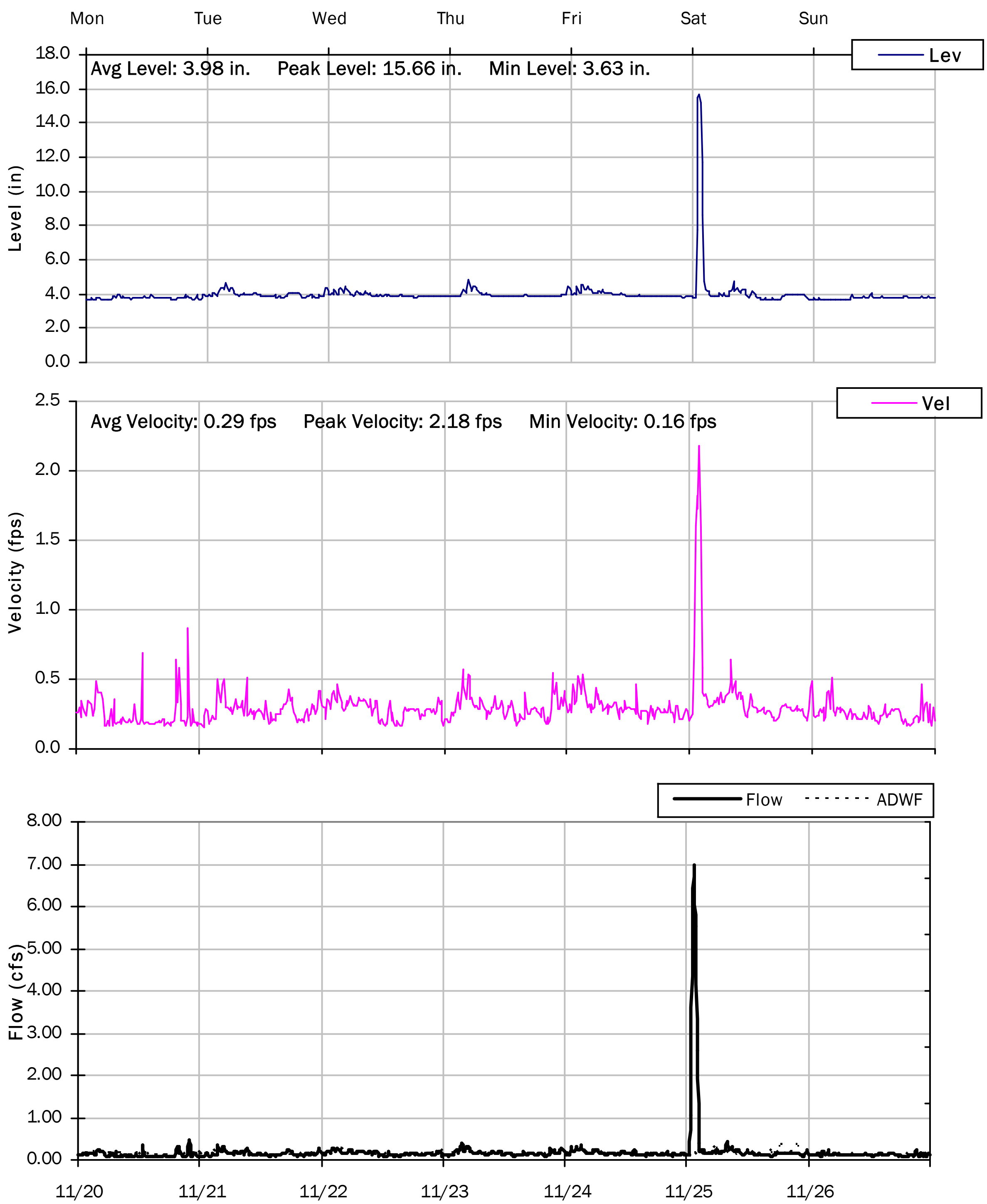
SITE 1

Weekly Level, Velocity and Flow Hydrographs
11/13/2023 to 11/20/2023



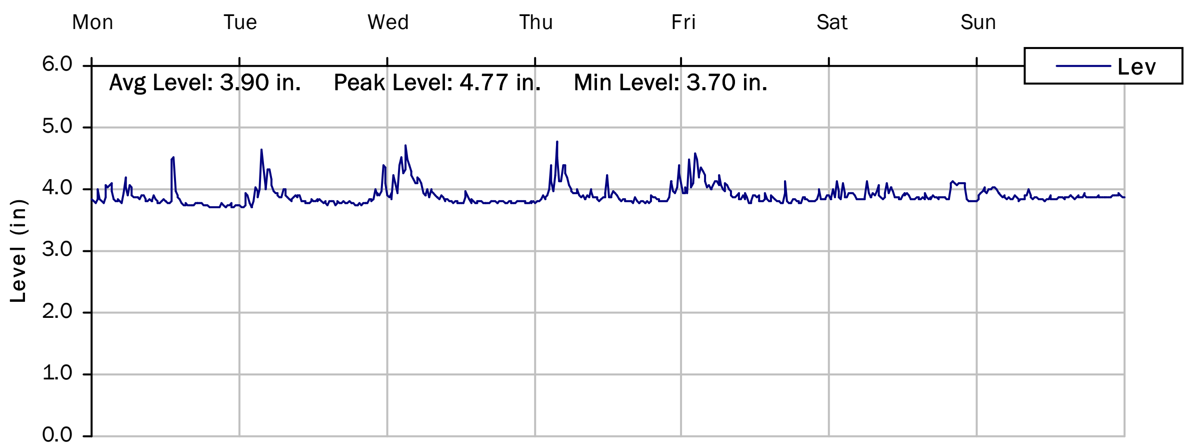
SITE 1

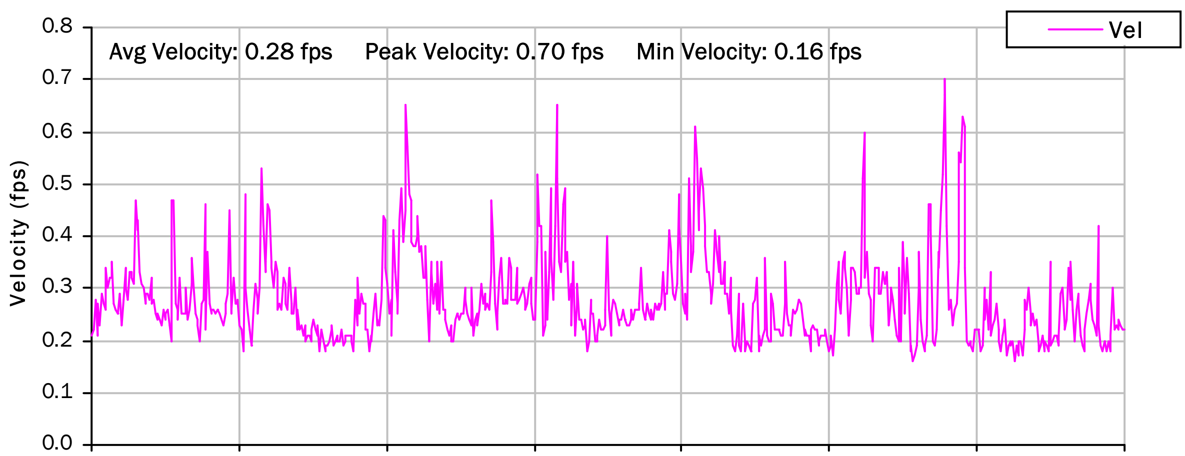
Weekly Level, Velocity and Flow Hydrographs
11/20/2023 to 11/27/2023

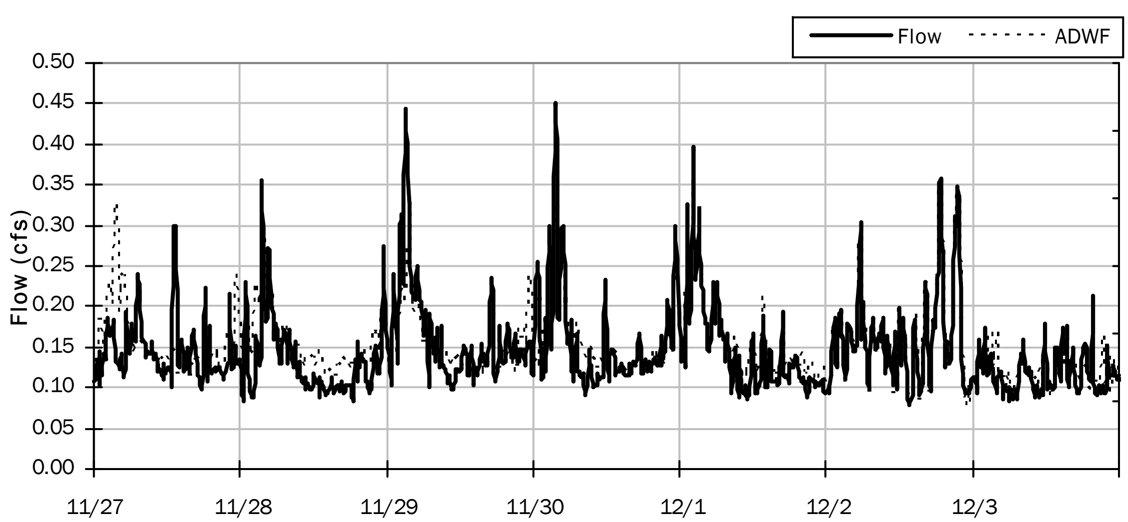


Avg Flow: 0.188 mgd Peak Flow: 6.982 mgd Min Flow: 0.082 mgd

SITE 1
Weekly Level, Velocity and Flow Hydrographs
11/27/2023 to 12/4/2023

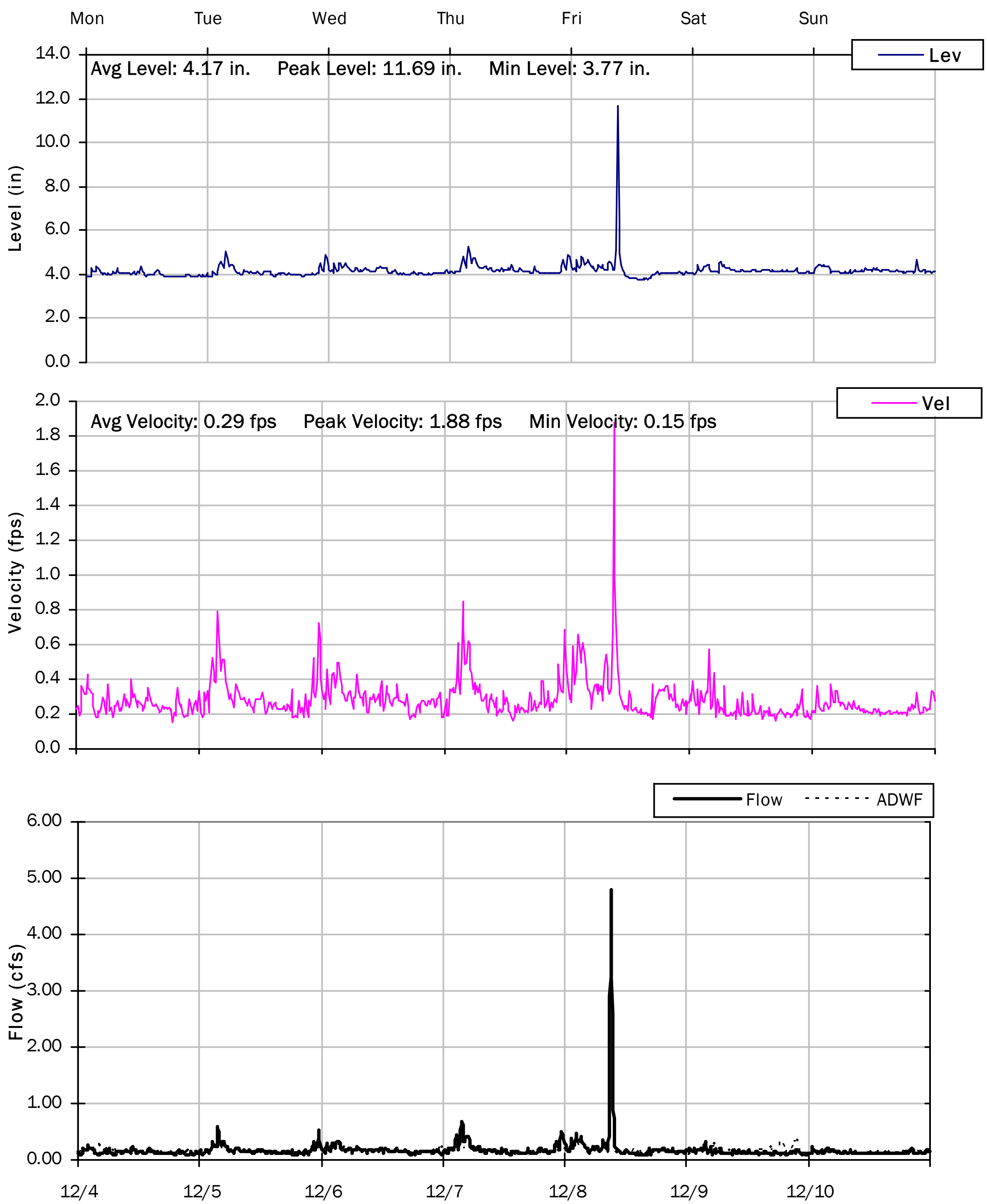






Avg Flow: 0.145 mgd Peak Flow: 0.449 mgd Min Flow: 0.079 mgd

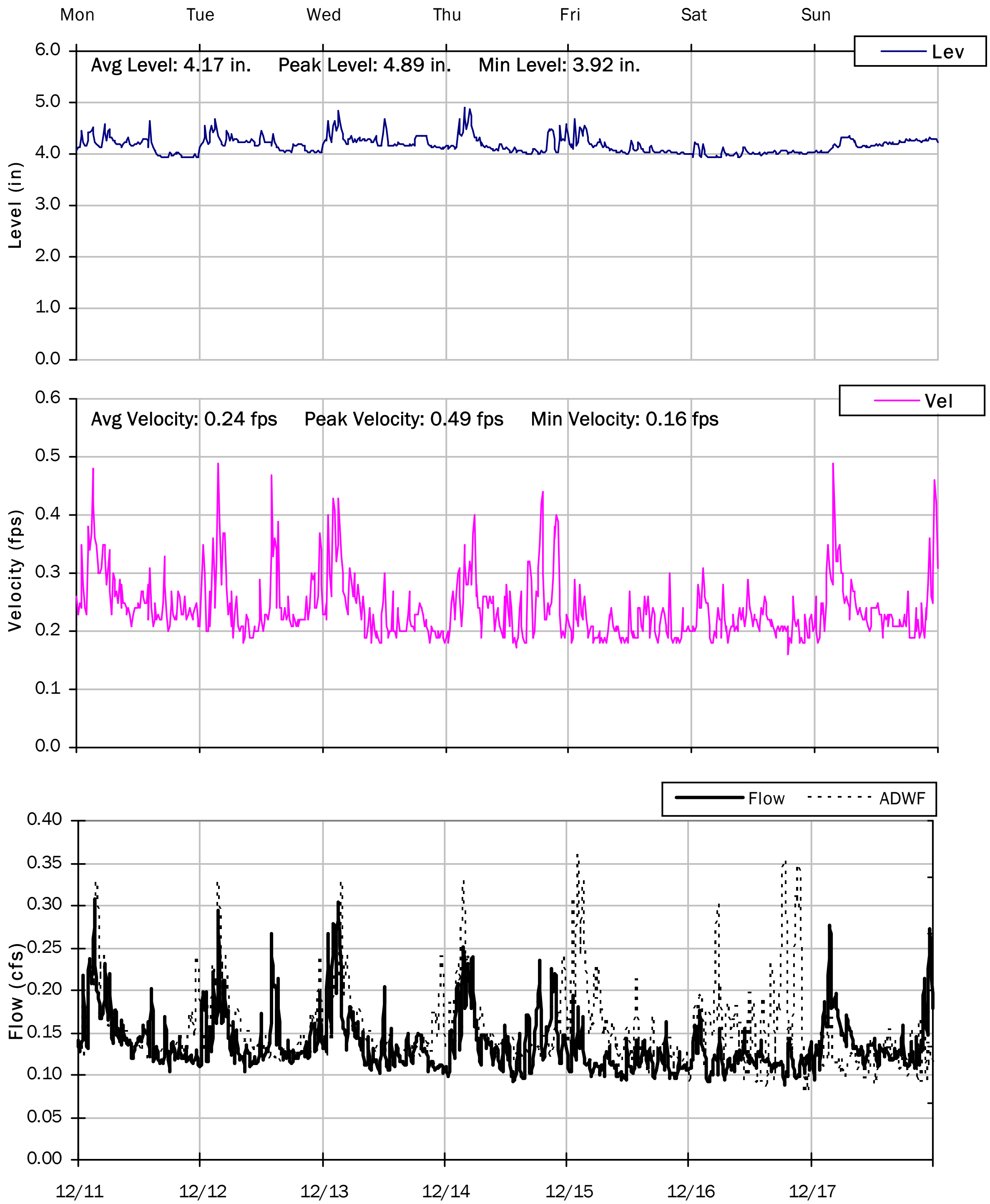
SITE 1
Weekly Level, Velocity and Flow Hydrographs
12/4/2023 to 12/11/2023



Avg Flow: 0.170 mgd   Peak Flow: 4.782 mgd   Min Flow: 0.078 mgd

SITE 1

Weekly Level, Velocity and Flow Hydrographs
12/11/2023 to 12/18/2023

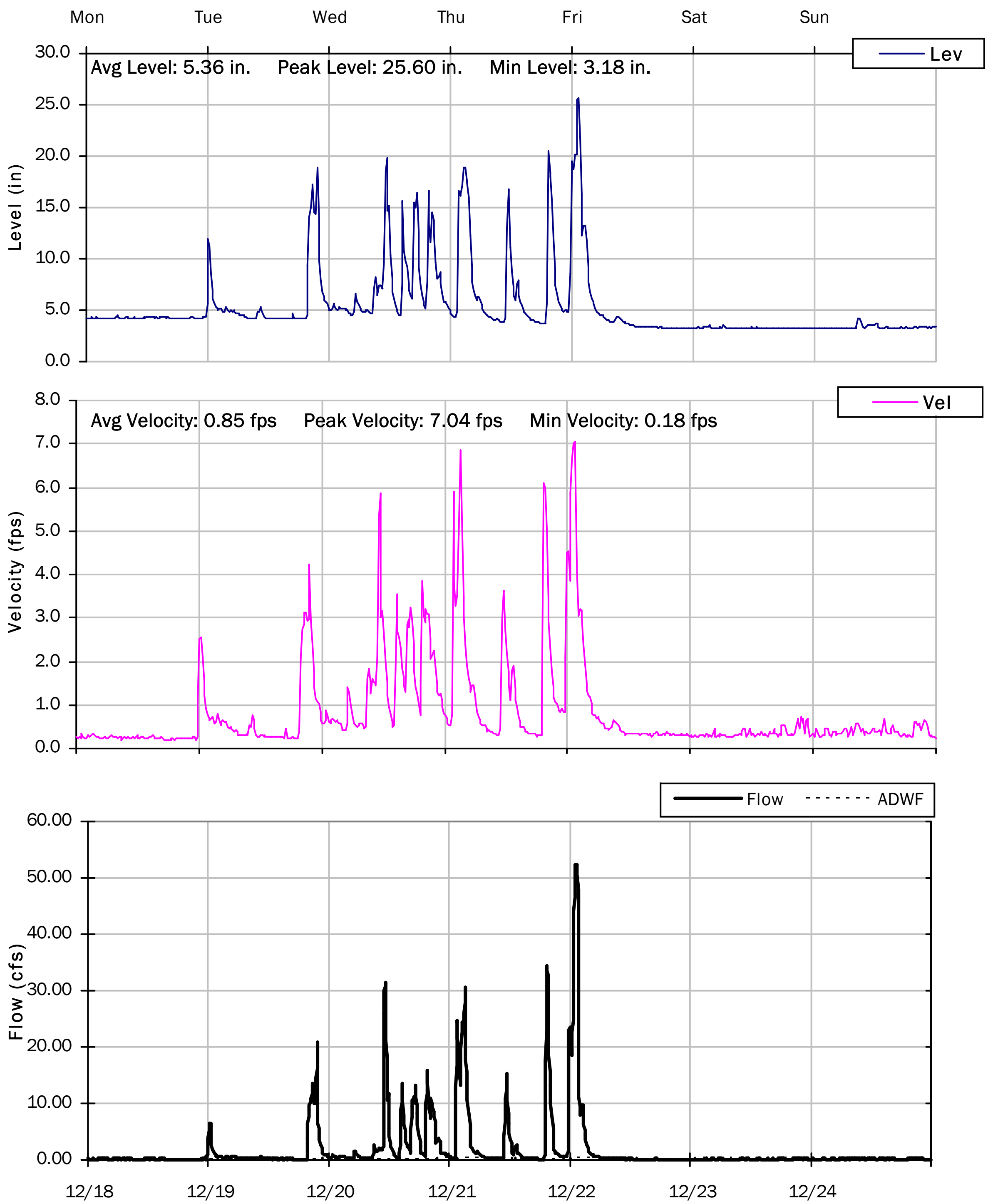


Avg Flow: 0.137 mgd Peak Flow: 0.308 mgd Min Flow: 0.088 mgd

SITE 1

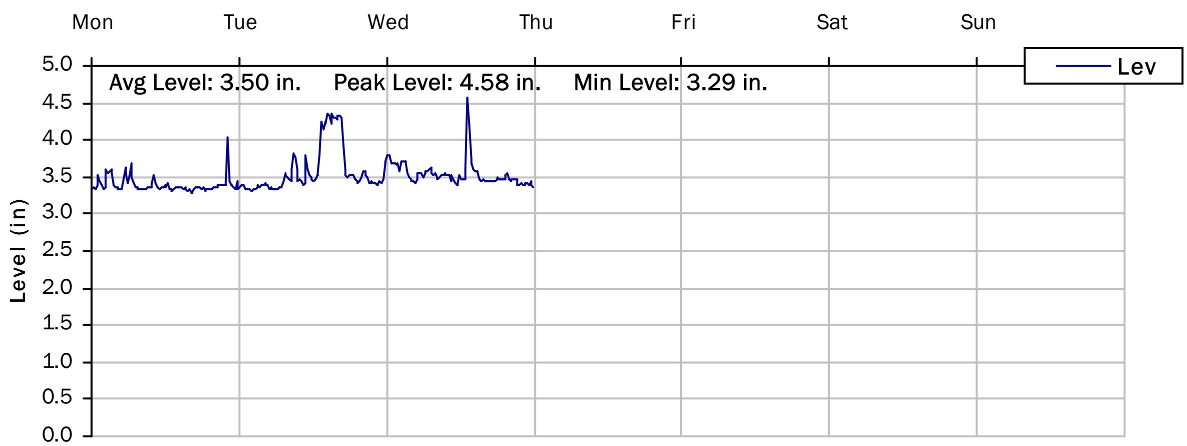
Weekly Level, Velocity and Flow Hydrographs

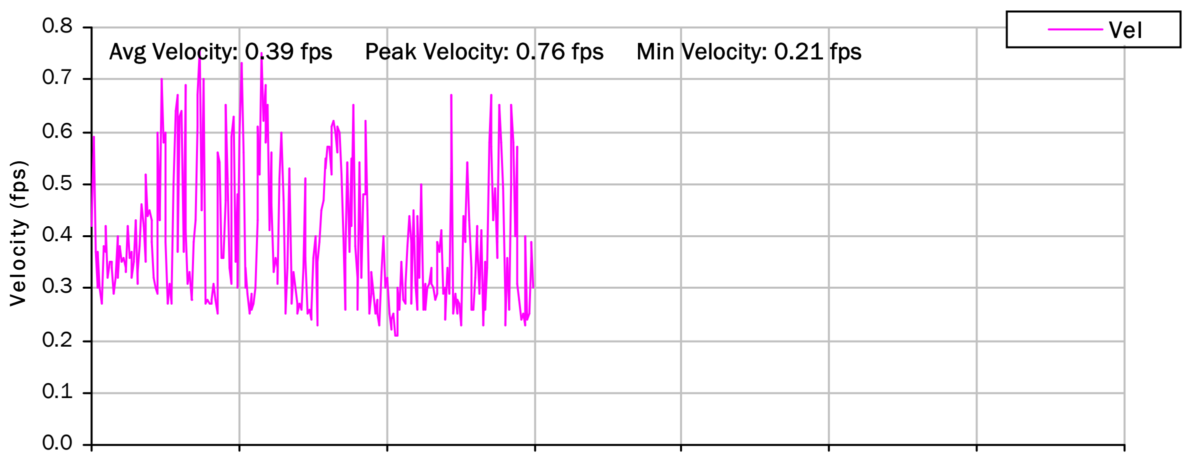
12/18/2023 to 12/25/2023

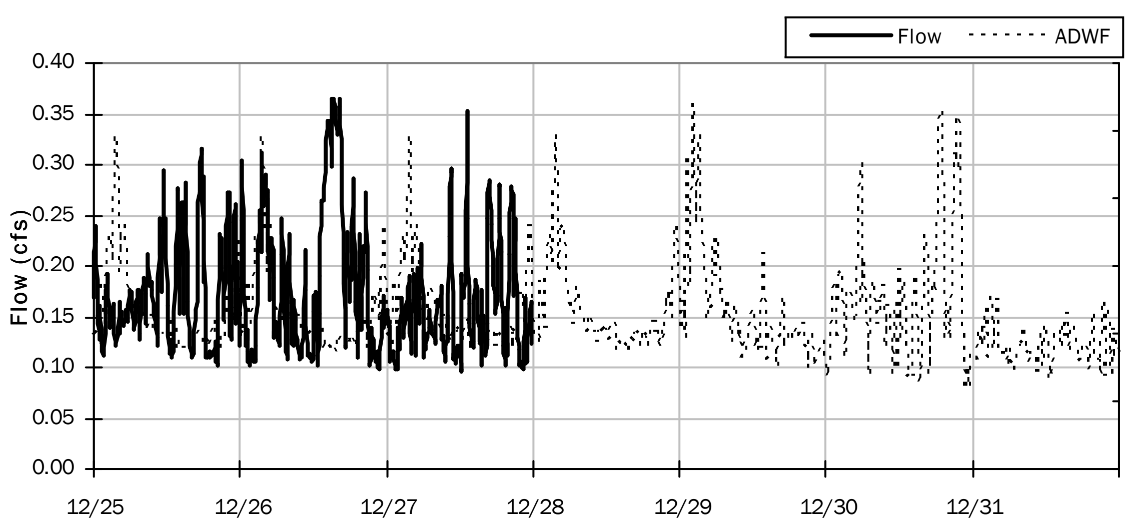


Avg Flow: 1.907 mgd   Peak Flow: 52.288 mgd   Min Flow: 0.096 mgd

SITE 1
Weekly Level, Velocity and Flow Hydrographs
12/25/2023 to 1/1/2024







Avg Flow: 0.173 mgd Peak Flow: 0.365 mgd Min Flow: 0.098 mgd

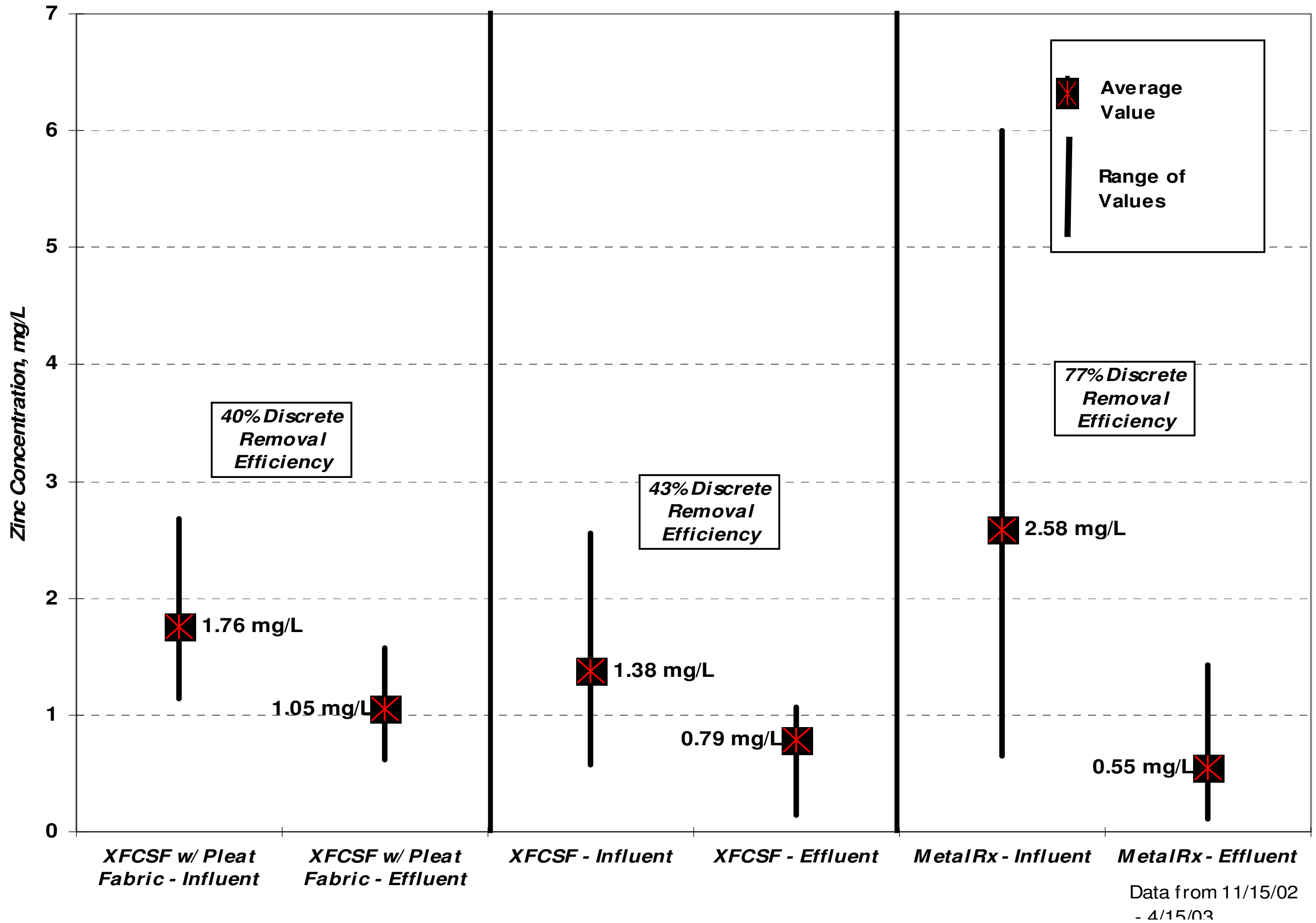
ATTACHMENT B

CONTECH STORMFITLER METALS REMOVAL STUDY

CONTECH CONSTRUCTION PRODUCTS INC.

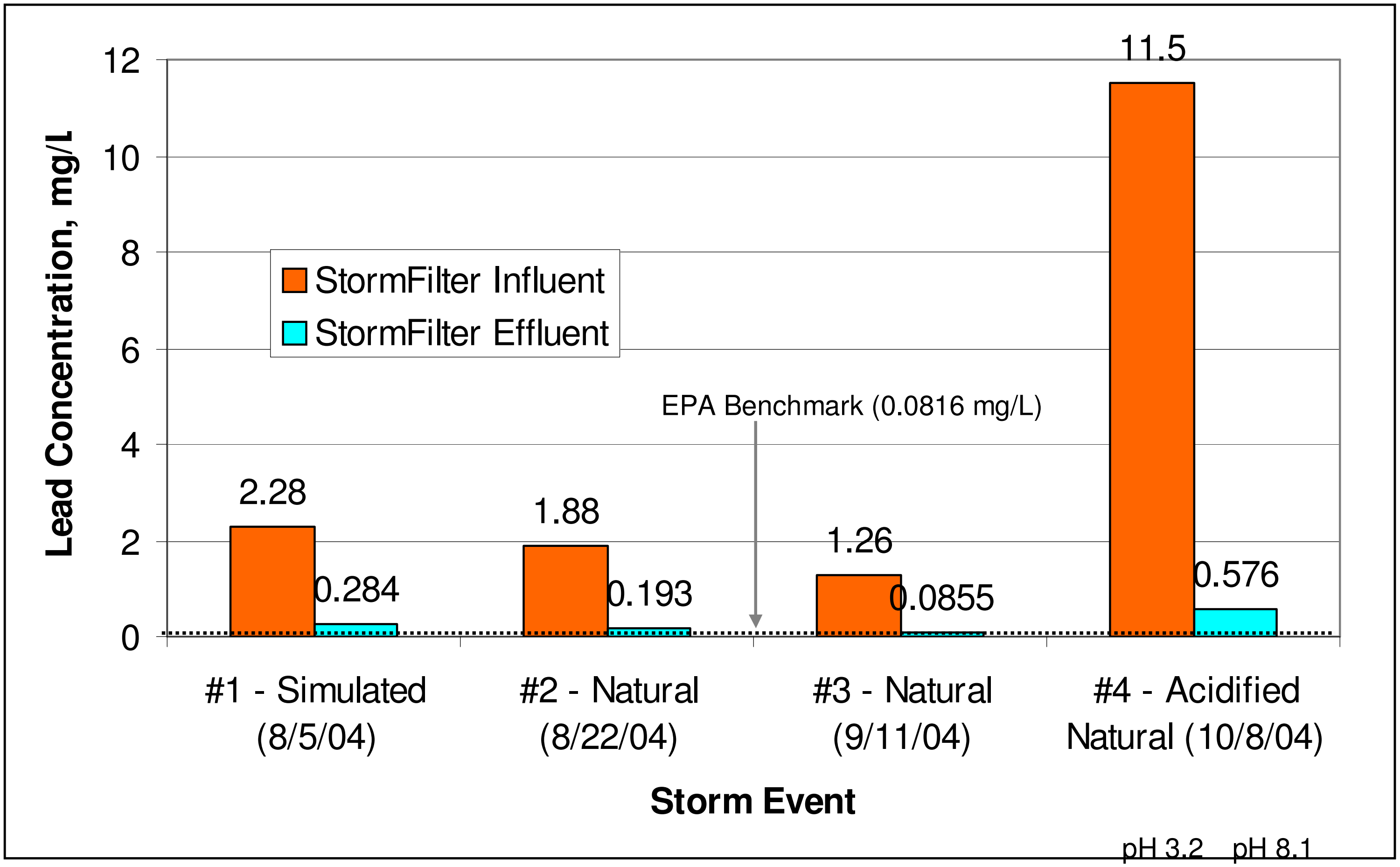
Knowledge. Solutions. Service.

StormFilter Performance - Zinc



Knowledge. Solutions. Service.

Two-Stage StormFilter Performance – Lead



CONTECH CONSTRUCTION PRODUCTS INC.

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Charleston Boatyard, Charleston, OR

Outfall	Event	pH	TSS (mg/l)	Copper (mg/l)	Lead (mg/l)	Zinc (mg/l)	Chrom. (mg/l)
B	Before AVG	7.6	355*	0.8*	0.03	1.22*	0.03
	Before MAX	9.4*	1,800*	3.2*	0.15	4.77*	0.15
	After	7.1	14	0.1	<0.004	0.27	0.01
	Reduction		96%	88%	>87%	78%	67%
D	Before AVG	8.1	324*	1.9*	0.07	0.82*	0.13
	Before MAX	8.9	878*	5.4*	0.17	1.95*	0.45
	After	7.3	27	0.3*	0.01	0.24	<0.005
	Reduction		92%	84%	86%	71%	>96%
Water Quality Goal		5.5-9	130	0.1	0.4	0.6	NA

*Value exceeds benchmark value.

StormFilter Performance - Boatyard

Outfall	Event	pH	TSS (mg/l)	Copper (mg/l)	Lead (mg/l)	Zinc (mg/l)	Chrom. (mg/l)
B	Before AVG Before MAX After **Reduction**	7.6 9.4* 7.1	355* 1,800* 14 96%	0.8* 3.2* 0.1 88%	0.03 0.15 <0.004 >87%	1.22* 4.77* 0.27 78%	0.03 0.15 0.01 67%
D	Before AVG Before MAX After **Reduction**	8.1 8.9 7.3	324* 878* 27 92%	1.9* 5.4* 0.3* 84%	0.07 0.17 0.01 86%	0.82* 1.95* 0.24 71%	0.13 0.45 <0.005 >96%
Water Quality Goal		5.5-9	130	0.1	0.4	0.6	NA

*Value exceeds benchmark value.