

Project Name	Sand Lake Iron Enhanced Sand Filter	Date	12/4/2018
To / Contact info	Jim Shaver, District Administrator		
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From / Contact info	Carl Almer & Mike Majeski		
Regarding	2018 IESF Performance Summary		

Background

The following memo summarizes the results of the Sand Lake Iron Enhanced Sand Filter (IESF) for the 2018 monitoring season. The information provided in this memo is intended to provide a general indication of system performance during the second year of operation and provides a basis for easement compensation to the underlying landowners of the Sand Lake IESF.

Results

Monitoring of the Sand Lake IESF began on April 27, 2018 with the installation of Isco automatic water quality samplers at two locations. One Isco was installed in the agri-drain overflow structure adjacent to the IESF filter and one Isco was installed in the outlet manhole of the IESF filter. These locations were selected to determine pre- and post-IESF total phosphorus, dissolved phosphorus, and suspended sediment concentrations and total flows through the system. Surface water runoff discharged through the IESF filter throughout the monitoring season (April 27 to Oct 29) with the exception of a few weeks in August and September when ditch stage was below the elevation of the sand filter inlet (Figure 1).

Table 1 summarizes the performance of the IESF based on FLUX analysis of water quality samples and calculated flow rates. Table 2 includes a summary of watershed loading and phosphorus removal by the IESF filter.

Table 1. Sand Lake IESF 2018 Total Phosphorus Performance Summary

Total IESF Discharge (CF)	TP Load to IESF (Lbs)	TP Load out of IESF (Lbs)	Total TP Removed (Lbs)	% TP Removal	Flow Weighted Mean TP of Discharge Flow (ppb)
2,571,264	32.6	7.3	25.3	78	46

Table 2. Annual Watershed Load

Total Watershed Discharge (CF)	Watershed TP Load (Lbs)	Total IESF TP Removed (Lbs)	% TP Removal
3,374,784	43.4	25.3	58

Discussion

Year 2 operation of the Sand Lake IESF performed as expected throughout most of the monitoring season, except for the month of October when high stage in the ditch resulted in water backing up in the subsurface drain tile system of the filter. Reduced outlet flows were observed during this timeframe, which can be attributed to debris/ rock buildup in the trail culvert downstream of the IESF facility. Although some of the sediment was removed in the fall of 2018, it is recommended all sediment build-up in the culvert be cleared out before the spring of 2019 to increase potential flow through the IESF filter drain tile system. Based on the FLUX analysis of the water quality discharged from the IESF filter, the average concentration of total phosphorus from the IESF was 46 parts per billion (ppb). This value is below the in-lake concentration goal for Sand Lake set by the Sand Lake Diagnostic Study. For comparison, the average concentration of total phosphorus from the IESF in 2017 was 37 ppb.

Table 3 summarizes annual load and water quality analysis from 2017 and 2018. Total discharge to the IESF filter was nearly double compared to 2017 and the watershed average TP concentration was significantly less in 2018 compared to 2017. These conditions influenced the amount of TP removed by the IESF.

Table 3. Annual Load Comparison

Year	Total Watershed Discharge (CF)	Total IESF Discharge (CF)	Watershed Average TP Concentration (mg/L)	Watershed TP Load (Lbs)	Total IESF TP Removed (Lbs)	% TP Removal (Filter)	% TP Removal (Watershed)
2017	3,769,371	1,241,862	0.515	107.7	36.3	92	34
2018	3,374,784	2,571,264	0.274	43.4	25.3	78	58

In 2018, approximately 25 percent of the total watershed TP load (10.8 lbs) bypassed the IESF due to high flow rates in the ditch that exceeded the flow capacity of the IESF system. If flow rates in the ditch upstream of the IESF could be attenuated such that peak flows are reduced from 5 cfs to 1 cfs, a significant increase in the overall treatment of the watershed load would be realized within the IESF. Attenuation of peak flows has been on the District's radar and renewed landowner outreach efforts are recommended to pursue control structures at the two immediate upstream road crossings (197th St. N and Ostrum Ave. N).

Based on our understanding of the easement agreement with the landowner, the 2018 annual payment should be \$30/Lb TP (25.31 Lbs) or \$759.30.

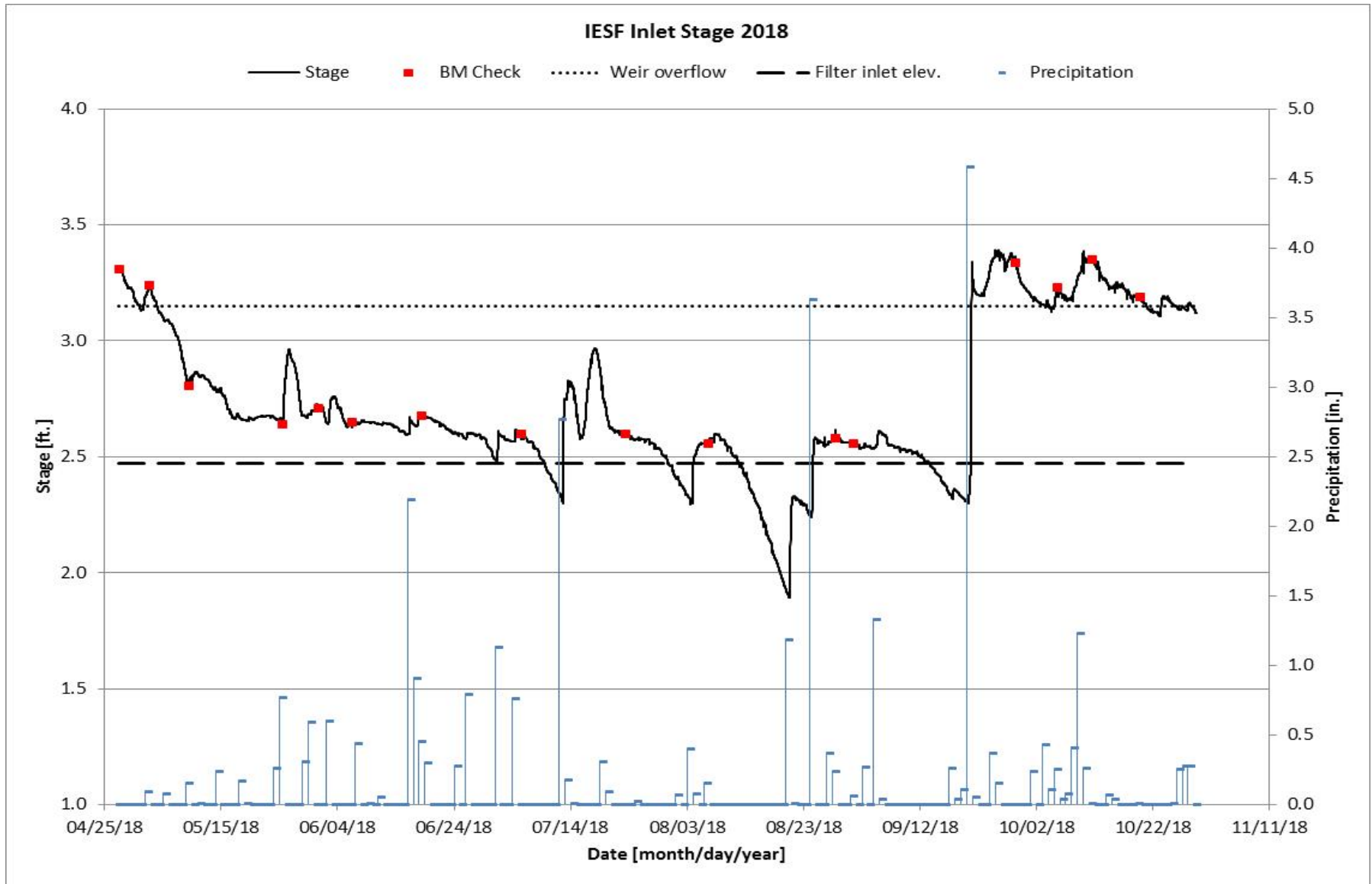


Figure 1. IESF Inlet Stage