Protein Matrix
industrial grease remediation

Pilot Study Report

Incline Village General Improvement District

Removal of Fat, Oil and Grease Buildup From Lift Station

Executive Summary

From June 19 to September 19 of 2014, Protein Matrix LLC (PM) conducted a pilot study in cooperation with the public works department of Incline Village, NV (Incline Village General Improvement District (IVGID)) in order to test the effectiveness of the Protein Matrix Industrial Grease Remediation (IGR) and its compatibility with wastewater treatment plant (WWTP) processes. The pilot demonstrated the following:

Wastewater treatment plants can reduce cleaning, odor and maintenance due to the accumulation of fat, oil, and grease (FOG) in wet wells/lift stations through the consistent application of Protein Matrix Industrial Grease Remediation.

The accumulated FOG in a lift station can be reacted, passed through to the WWTP, and processed—all without damaging, interrupting, or otherwise obstructing biological treatment methods and processes.

Protein Matrix Industrial Grease Remediation Technology

Protein Matrix Industrial Grease Remediation (IGR) is a plant-based, biodegradable degreaser that emulsifies fat, oil, and grease (FOG) from food and converts it into a benign liquid byproduct that is compatible with sewers and wastewater treatment plant (WWTP) infrastructure and processes. IGR is a patent-pending mixture of ingredients extracted from plant materials and is water-based, non-flammable, and non-volatile. It works by disrupting the intermolecular forces of fat molecules, minimizing the formation of large, solid blocks of fat, and converts FOG to soluble fatty acid salts. With the simple introduction of Protein Matrix IGR, users are no longer committed to expensive pipeline maintenance or an extensive FOG compliance program.

Overview: Incline Village General Improvement District (IVGID) WWTP

Incline Village, NV is a well-known resort town located on the northeastern shore of Lake Tahoe. The IVGID WWTP is of a flow-through design and experiences the seasonal fluctuations in flow rates (ranging from a peak of 1.8 MGD in the summer to a low of about 500 KGD in winter) characteristic of a tourist-driven economy. The plant has a problematic history in terms of fat, oil and grease and has a dedicated FOG compliance division to recommend and enforce use of grease traps and interceptors at restaurants so as to prevent the introduction of FOG into the sewer system. Despite these efforts, prior to the pilot, the plant still experienced significant buildup of FOG in pipes and lift stations and was subject to the high maintenance costs that result from this buildup. For this reason, IVGID was receptive to piloting the Protein Matrix Industrial Grease Remediation product.

Lift Station (Sewer 8) Oil and Grease Maintenance Pilot Study

The lift station chosen for this pilot study, known as sewer 8, processes 50-60% of the plant's total influent water and averages 500 KGD from casinos, restaurants and residential districts. Due to FOG accumulation, a full cleanout is required every 90 days. Each cleanout process requires 192 man-hours, translating to 768 man-hours annually. In this lift station, influent water is delivered via a partial flume into each of two interconnected 12' x 12' square basins (known as the north and south basins). This type of lift station architecture is especially prone to FOG accumulation due to eddys that develop in the corners of the basins. In addition, the problem is exacerbated by the presence of ledges above the basins that trap FOG and debris and make cleanouts difficult.

Sewer 8 is a priority for the plant because the sulfurous odors that emanate from this lift station after 60 days of FOG buildup lead to complaints from the general public. Abatement of this odor was crucial to the pilot study, as the lift station is located in a sensitive location—within 1000 ft. of Lake Tahoe, as well as being situated next to a running path, high-profile homes, recreational facilities, and a popular beach access point.

In the period leading up to the pilot study, extensive FOG had accumulated in both the north and south basins of Sewer 8 (Figures 1A and 1B). On June 2, 2014, the lift station was fully cleaned of FOG and debris (Figures 1C and 1D—note that FOG had already begun to accumulate hours after cleaning, when the picture was taken). After two weeks, FOG had already begun to build up in each basin (1E and 1F). This point marked the start of the pilot study, in which Protein Matrix began feeding IGR into the lift station at a rate of approximately 1 gallon per 100 gallons of flow-through water. The effects were documented through daily WWTP process data and weekly photo and video.

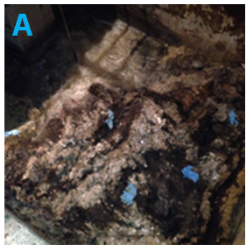
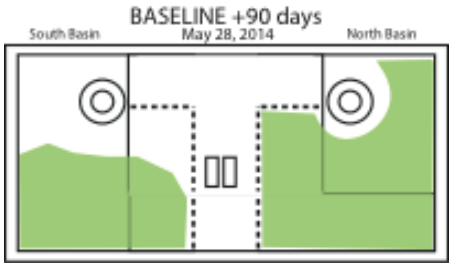
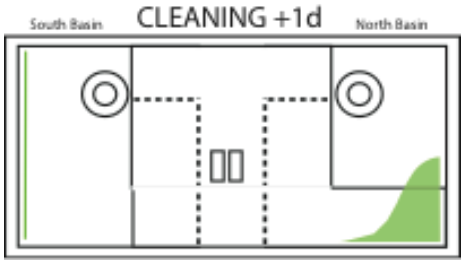
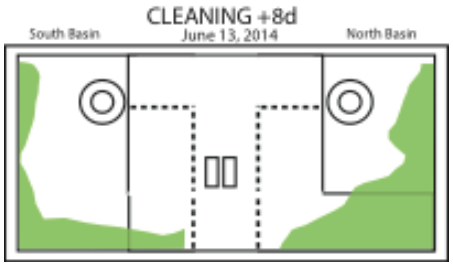
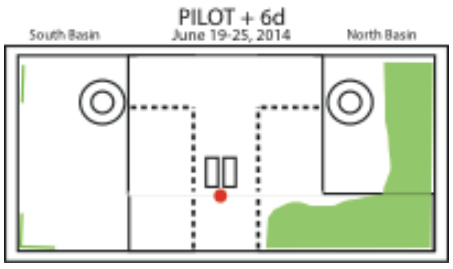
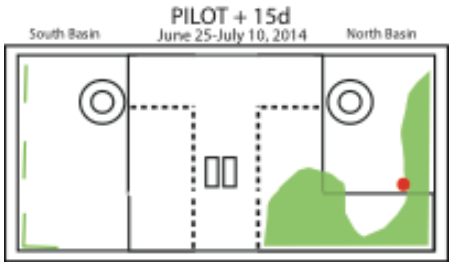
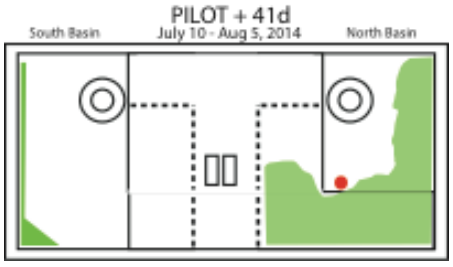
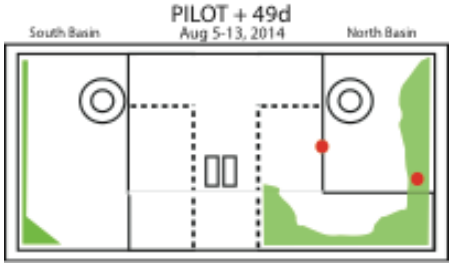
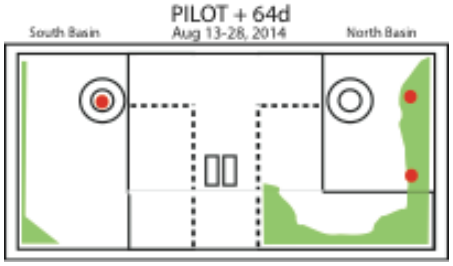
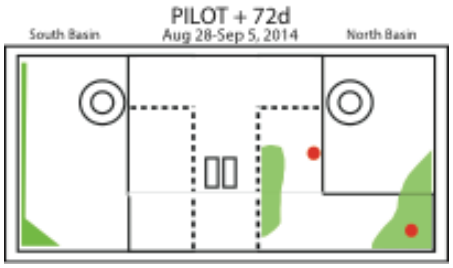
	Before cleaning	After cleaning	Pilot start (14 days after cleaning)	Pilot end (90 days after cleaning)
North Basin				
South basin				

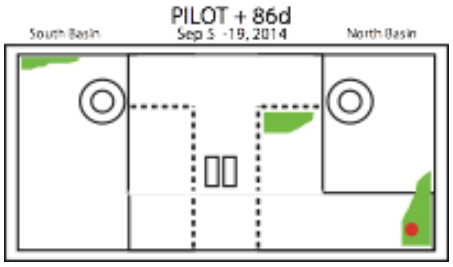
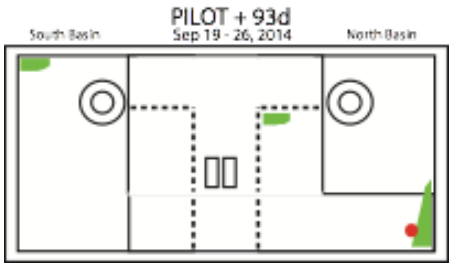
Figure 1. FOG buildup in lift station basins before and after application of PM IGR

Protein Matrix Industrial Grease Remediation was applied via a variety of feed types at differing locations; see Figures 2A-2K. As previously mentioned, and as seen in the figures, FOG had accumulated in the corners of each basin only 8 days post-cleaning. Immediately upon addition of PM IGR, FOG buildup was reduced, but in order to understand and optimize product feed rate and location, these variables were changed at each two-week checkpoint until a definitive pattern emerged. Not all feed rates and locations proved to be desirable, but over the course of the pilot, the optimal feed rate and location was determined. When IGR was applied to the partial flume that carries incoming water to the lift station, IGR was found to react with suspended FOG and inhibit the accumulation of oil and grease in the lift station basins. Once this optimal feed location was discovered, the result was and continues to be the prevention of fat, oil and grease buildup within the lift station (Figures 1G and H).

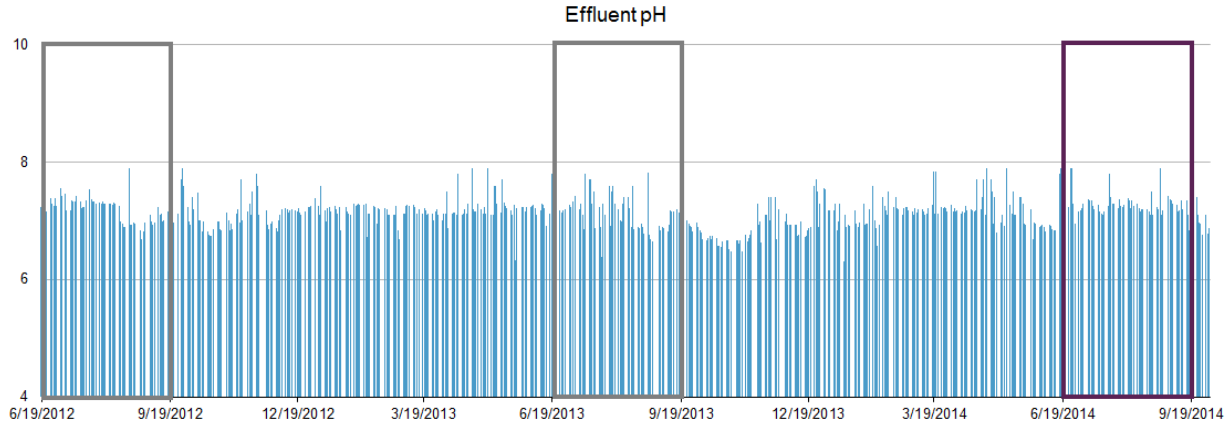
Figure 2A-K. Feed Rates and Locations

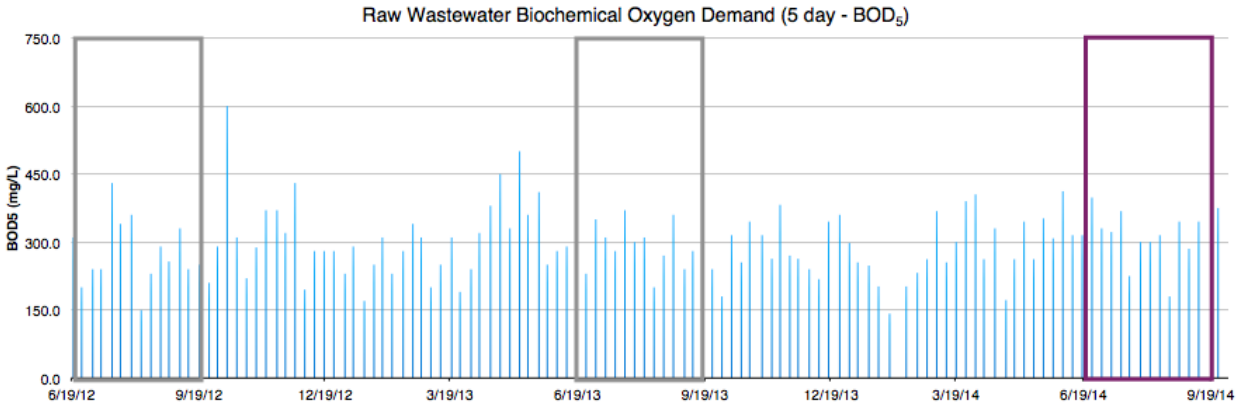
	Period	Number of IGR feed points	IGR Feed Rate (GPD)	
A	Pre-pilot baseline	N/A	N/A	
B	1 day post clean	N/A	N/A	
C	8 days post clean	N/A	N/A	
D	Pilot start (6/19 – 6/25)	1	7.4	

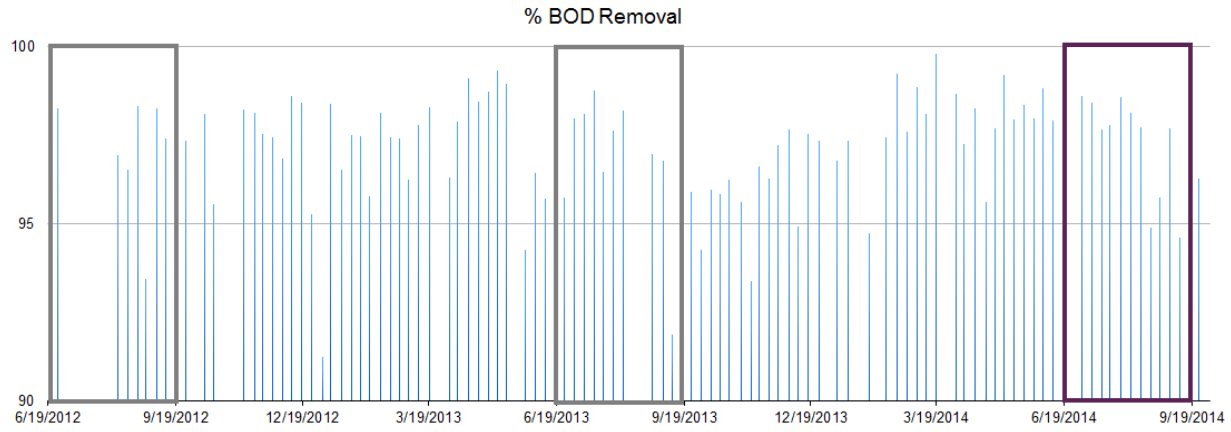
	Period	Number of IGR feed points	IGR Feed Rate (GPD)	
E	6/25 - 7/10	1	4.8	
F	7/10 - 8/5	1	5.6	
G	8/5 - 8/13	2	5.6	
H	8/13 - 8/28	3	6.5	
I	8/28 - 9/5	2	6.5	

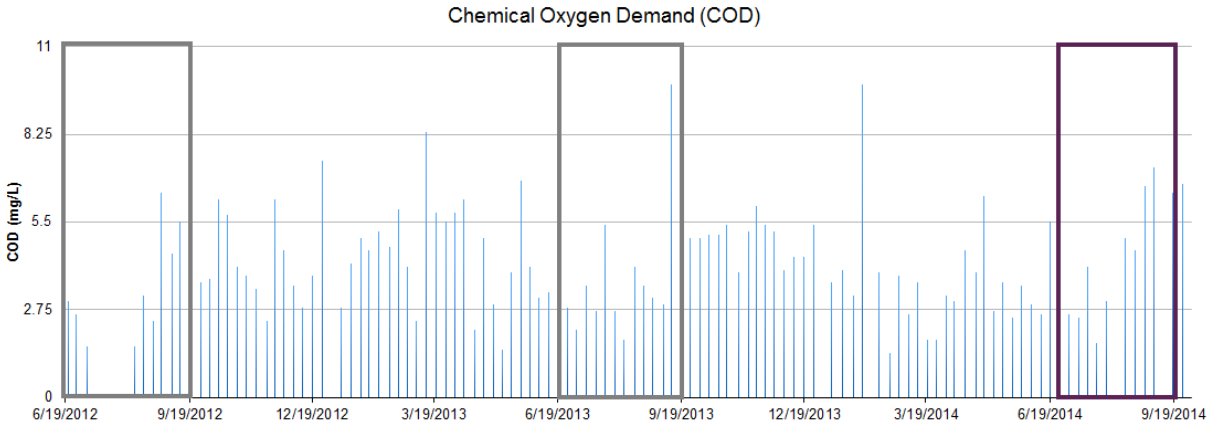
	Period	Number of IGR feed points	IGR Feed Rate (GPD)	
J	9/5 - 9/19	1	5.1	
K	9/19 - 9/26	1	4.5	

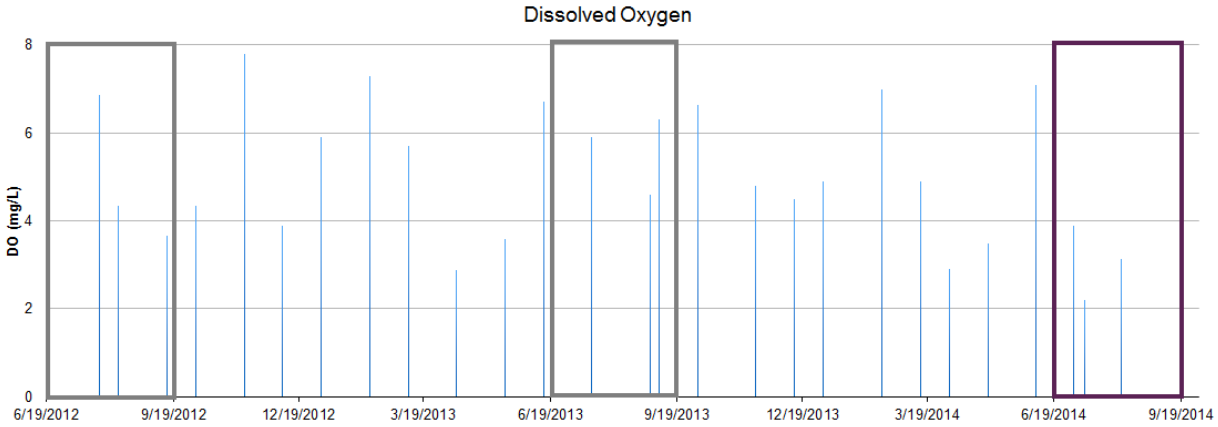
Throughout the course of the study, the IGVID WWTP did not experience any changes in influent or effluent quality, plant processes and dynamics, and biological treatment methods (Figures 3A-K). In each of the figures, data collected during the pilot study is outlined in purple, while the corresponding 3-month periods during each of the prior two years (June-Sept 2012 and 2013) are outlined in gray. For all of the parameters measured, this period is indistinguishable from the previous 3 years or the period leading up to the pilot, indicating that Protein Matrix IGR did not affect these parameters (and the corresponding WWTP processes).

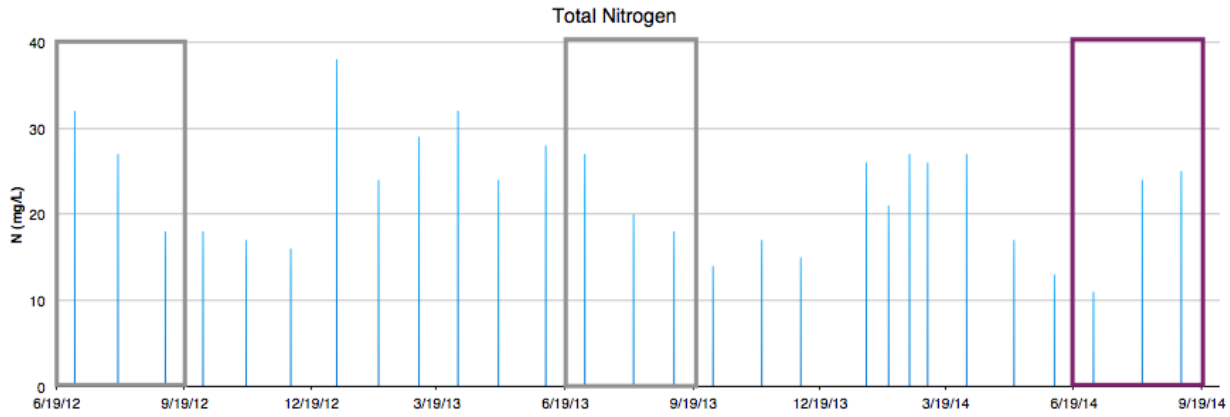


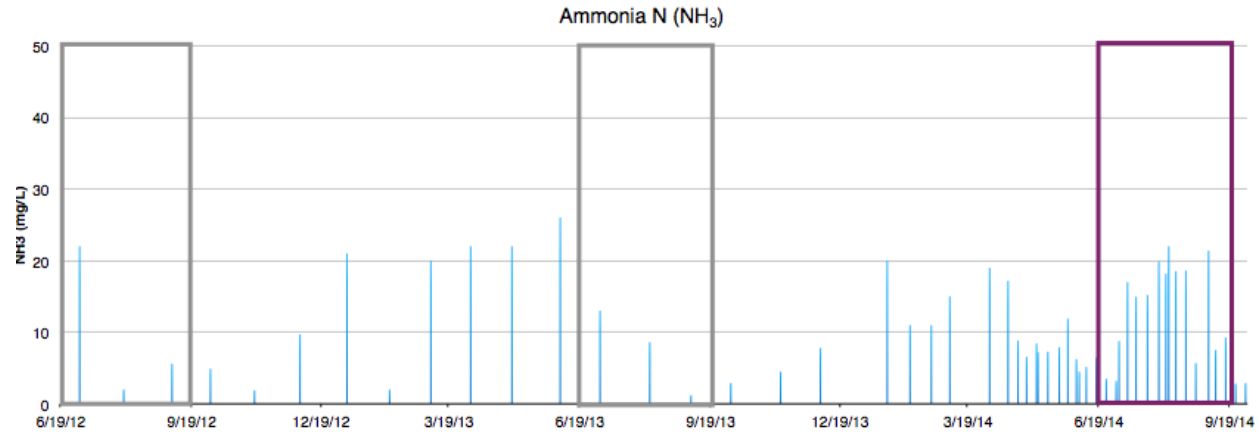


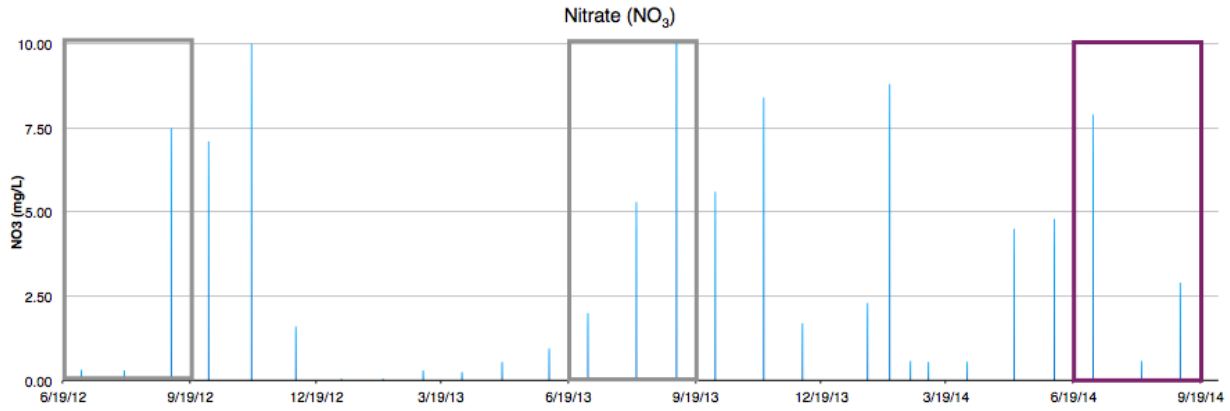

% BOD Removal
100
95
90
6/19/2012
9/19/2012
12/19/2012
3/19/2013
6/19/2013
9/19/2013
12/19/2013
3/19/2014
6/19/2014
9/19/2014


Chemical Oxygen Demand (COD)
COD (mg/L)
11
8.25
5.5
2.75
0
6/19/2012
9/19/2012
12/19/2012
3/19/2013
6/19/2013
9/19/2013
12/19/2013
3/19/2014
6/19/2014
9/19/2014


Dissolved Oxygen
DO (mg/L)
8
6
4
2
0
6/19/2012
9/19/2012
12/19/2012
3/19/2013
6/19/2013
9/19/2013
12/19/2013
3/19/2014
6/19/2014
9/19/2014


Total Nitrogen
N (mg/L)
40
30
20
10
0
6/19/12
9/19/12
12/19/12
3/19/13
6/19/13
9/19/13
12/19/13
3/19/14
6/19/14
9/19/14


Ammonia N (NH_3)
NH3 (mg/L)
50
40
30
20
10
0
6/19/12
9/19/12
12/19/12
3/19/13
6/19/13
9/19/13
12/19/13
3/19/14
6/19/14
9/19/14


Nitrate (NO_3)
NO3 (mg/L)
10.00
7.50
5.00
2.50
0.00
6/19/12
9/19/12
12/19/12
3/19/13
6/19/13
9/19/13
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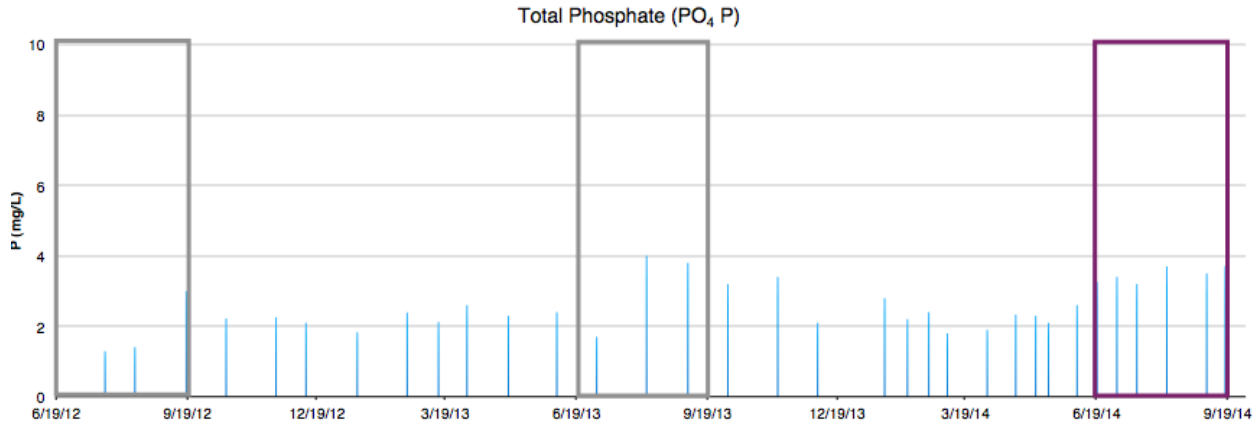
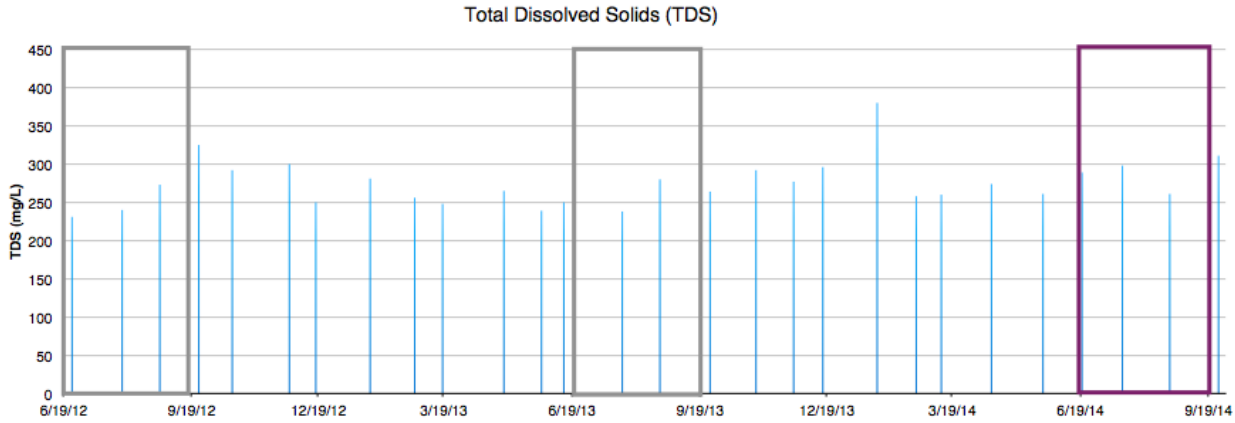
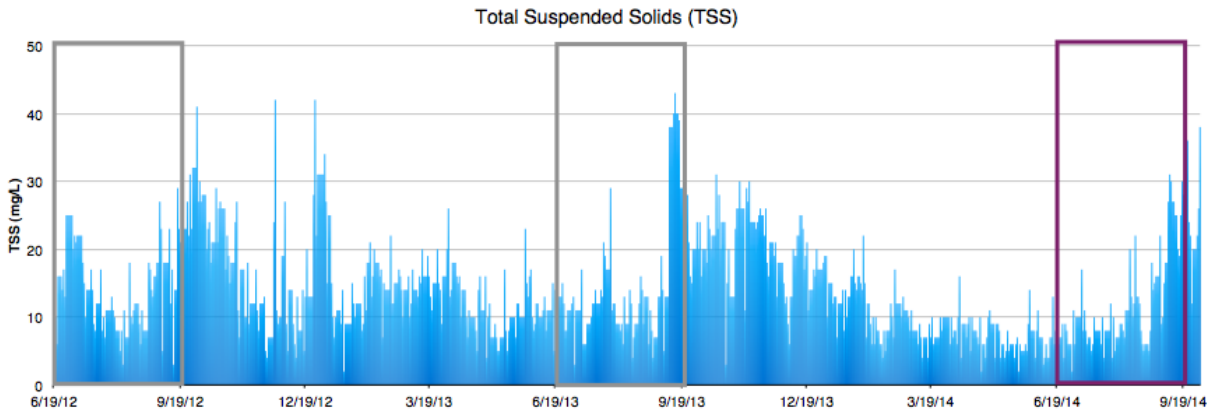
6/19/14
9/19/14







Figures 3A-K. Plant process and effluent quality parameters before and during pilot study

In addition to the clear-cut benefits provided by decreased cleanouts of lift station, the use of Protein Matrix IGR also improved plant efficiency and lowered energy costs. Speaking to the former, IGR lessened the number of delays due to emergency pumping during equipment breakdowns and also allowed plant employees to spend less time tending to clogged pipes and stations. This, in turn, is a decrease in the amount of time that these employees must spend in confined spaces, a situation that can pose a significant danger to worker health. For the latter (lower energy costs), the decreased amount of dissolved oxygen led to DO blowers running less frequently, and the effective increase in pipe diameter due to FOG removal allowed the plant's pumps to operate at increased efficiency. Importantly, PM IGR also significantly reduced the odors emanating from the WWTP, which, prior to the pilot, often led to complaints from the surrounding populace and visitors to local parks and beaches.

Lift Station Pilot Study Recommendations

In order to reduce accumulated fat, oil, and grease, a surface application spray allows IGR to react directly with FOG. Once the accumulated FOG has been removed, IGR can be applied upstream as a continuous drip, which allows for reaction with suspended FOG before entering the station, thereby preventing accumulation. When this plan of action is followed, lift stations require cleaning only due to physical debris and sediment, not as a result of FOG buildup. As such, cleanouts are far less frequent, leading to reduced costs and an improvement in plant efficiency.

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