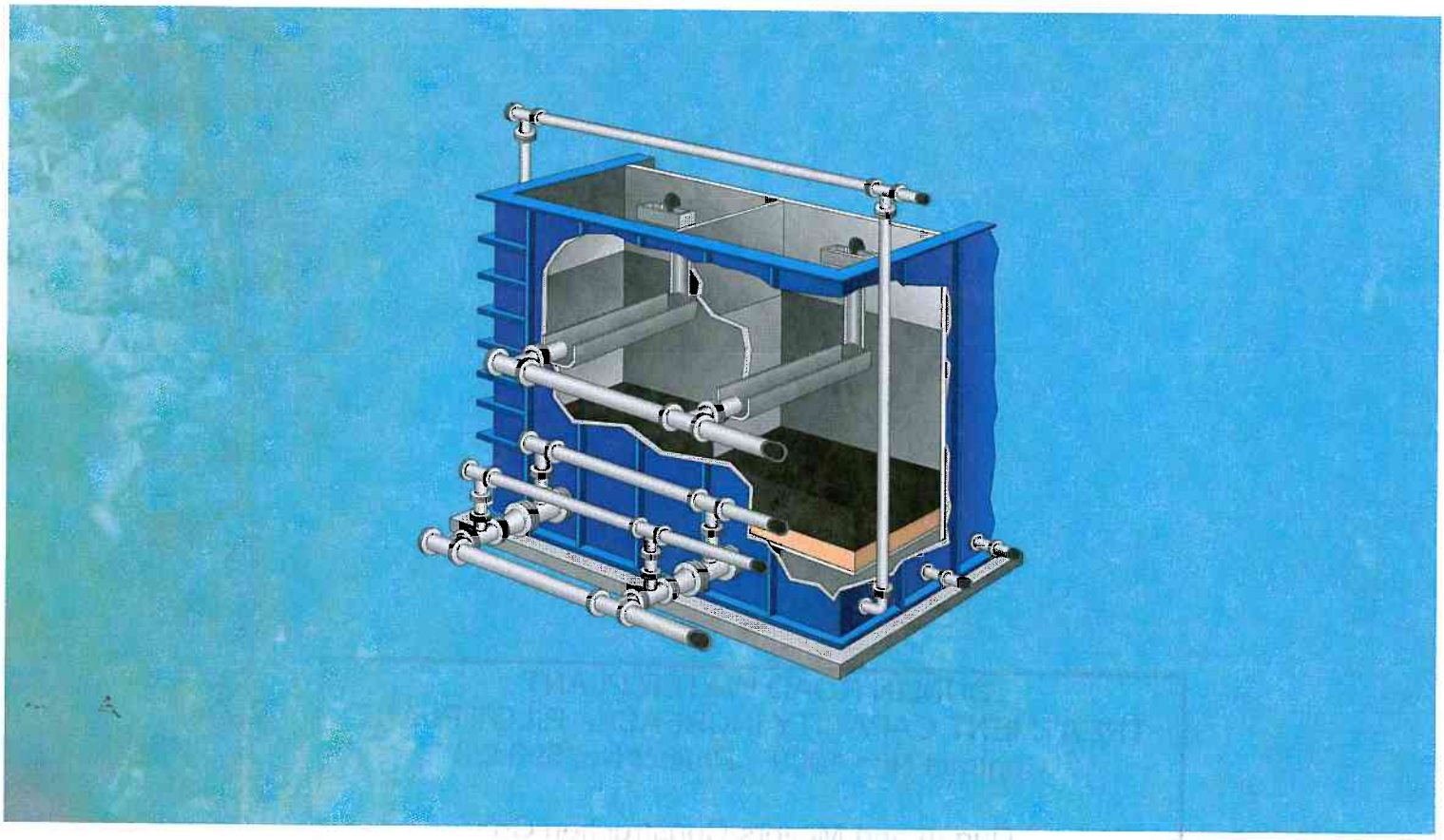
INFILCO DEGREMONT INC.



Package Gravity Filters Train 1

Dublin, OH Pilot Performance Test Report



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1. INTRODUCTION

Infilco Degremont, Inc. (IDI) conducted a packaged gravity filter pilot performance test at the Dublin, OH Water Treatment Plant following a contract by Dugan and Meyers Construction Co for AECOM. The filters were used after a dual stage clarification and softening system. The pilot performance test was conducted over a period of 4 days.

1.1 OBJECTIVES OF THE STUDY

The main objective of the pilot performance test was to verify that the filters were able perform according to the requirements identified by Dugan and Meyers, and AECOM. The final acceptance of the filters were contingent upon a successful performance test. Requirements for the filters' performance were not stated, but were assumed to have the filters produce acceptable effluent quality for the systems downstream. The filters were fed at 80 gpm.

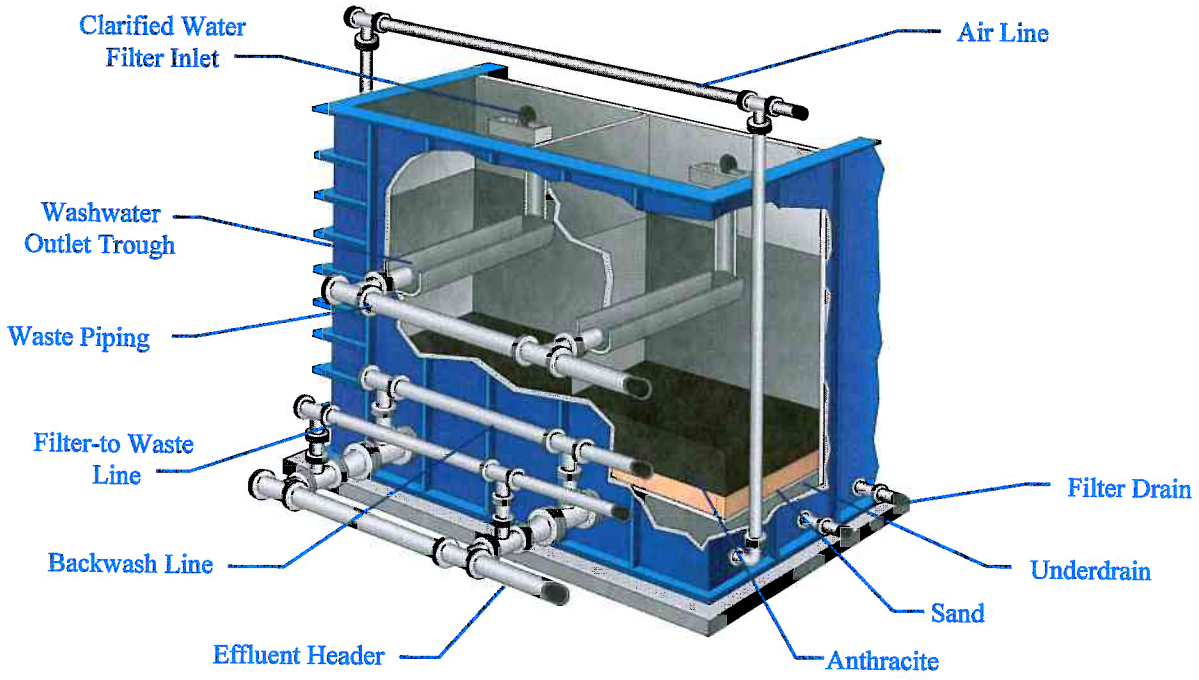
1.2 IDENTIFICATION OF PARTICIPANTS

Pilot performance test of the filter process required the collaborative efforts of several parties, as described below:

- Contractor: Dugan and Meyers Construction Co. in conjunction with Infilco Degremont, Inc. were responsible for every aspect of the performance test.
- Consulting Engineer: AECOM for overseeing the pilot testing, sample collection, and lab sample analysis.
- DAF Manufacturer: Infilco Degremont Inc. was responsible in conjunction with Dugan and Meyers for every aspect of the performance test
- Client: Dublin Road Water Treatment Plant, OH for providing, power, water, and the site location for the pilot study.

2. PGF PROCESS DESCRIPTION

In the filtration system, the residual suspended solids are removed. The clarified water from the preceding clarifier system is divided over two filter bays, where the residual suspended solids are retained. The media in the gravity filter is supported by a false floor with nozzles and consist of an anthracite layer located on top of a sand layer.



To remove the retained solids, backwashing of the filter bays is carried out on a regular basis. The backwash cycle includes a surface wash and water rinse step. The filtered water is held in an equalization tank and then fed to reverse osmosis systems. The gravity filters shall be completely independent of each other allowing for one filter to backwash while the other remains in service.

3. DESCRIPTION OF PILOT EQUIPMENT

FIGURE 3.1 – PGF Pilot

3.1 FILTER DESCRIPTION

The filter's influent water was fed by the effluent of the recarbinization tank. The flow was controlled by a modulating effluent valve which was set to flow at 80 gpm (roughly 2.67 gpm/sqft). Influent water to the filters was close to 110 gpm. The excess influent water was drained through the backwash trough which acted as an overflow. Only one filter cell was in service at a time, while the other one would be in standby.

Number of filters	1
Number of Filter Cells per Filter	2
Filter Cell Dimensions	5' X 6'
Filter Cell Area	30.0 sqft
Unit Filter width	6.0 ft
Unit Filter length	10.0 ft
Unit Filter height	10.0 ft
Backwash Rate	25.0 gpm/sqft
Surfacewash Rate	30.0 gpm
Media submergence	4.67 ft

3.2 MEDIA CONFIGURATION:

Filter beds consist of two layers of filter media and are similar in each cell. The first layer consists of silica sand and is 12 inches high. The second layer of sand consists of anthracite coal and is 14 inches high.

3.3 BACKWASHING SEQUENCE:

The backwashing sequence was trigged in 4 ways when the filter was run in the auto mode. They were triggered by the operator or by exceeding a set turbidity, differential pressure, or run time. The filters ran under this backwashing sequence:

Steps	Time for each step	Setpoints
1. Drain Step	5 minutes	1.5 ft
2. Surface Wash Step	2 min	30 gpm
3. Surface Wash/Backwash Step	3 min	30 gpm
4. Backwash Step	8 min	25 gpm/sqft max
5. Filter to Waste Step	15 min	0.8 NTU

4. PILOT STUDY PROTOCOL

4.1. PILOT PLANT OBJECTIVES

The pilot test protocol developed for this study was based upon a joint workplan created by Infilco, Dugan and Meyers, and AECOM. The protocol provided directives for performance evaluation of the Accelator®. A summary of the treatment goals is shown below.

- Evaluate the performance of each filter for a 4 day period.
- Evaluate the performance of each filter in terms of filter run times and filtered effluent quality to determine the acceptance of each filter.

4.2 PILOT SETUP

Each filter was setup onsite at the Dublin Road Water Treatment Plant in Columbus, OH. Influent water was gravity fed from the recarbonization tank. Filtered effluent was sent to a equalization tank, which was then pumped to RO systems. The spent backwash water was sent to a spent wash water holding tank. The complete pilot setup can be seen in Figure 4.1.

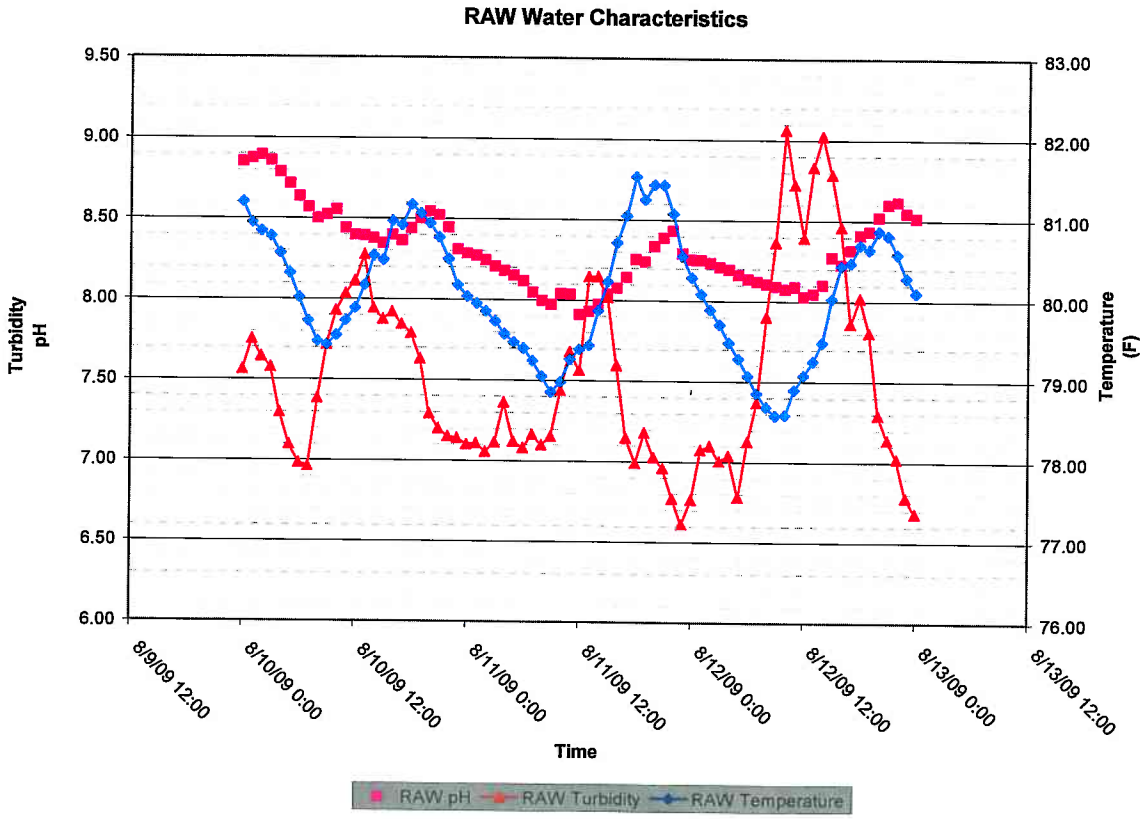
Figure 4.1 View of Influent line to Filters

4.3. FREQUENCY OF SAMPLING

The targeted parameters to assess the filters performance were turbidity, particle count, and filter run time. An IDI field service engineer had taken readings from online turibidimeters, particle counters, and differential pressure gauges throughout the course of the pilot report. The online turbidimeter was used to determine that steady-state had been reached when a consistent effluent quality was attained following the start-up of the test run. A data logger located on the control panel recorded all these readings as well as filter run times.

4.4. RAW WATER QUALITY

Over the length of the test, raw water turbidities ranged from 7 to 20 NTU. The raw water averaged a total hardness of 250 mg/L, a calcium hardness of 150 mg/L, and a total alkalinity of 145 mg/L. The graph below indicates the raw turbidity and ph levels during the course of the pilot performance test.



5. FILTER PROCESS VERIFICATION

As part of the pilot plant objectives during the performance test, optimization of all process variables must be performed in order to find the optimum conditions. In order to evaluate different process variables throughout the study two different response surface optimization experiments were performed. The following process variables for the filters were optimized.

- Backwashing sequence
- Optimization of processes upstream of filters

6. PERFORMANCE TEST RESULTS

The following figures detail the results of the performance test.

- Figure 6.1: Filter 1A's performance from 8/21/2009 to 8/25/2009
- Figure 6.2: Filter 1B's performance from 8/26/2009 to 9/2/2009

Figure 6.1:
Filter 1A Performance 8/21/2009 to 8/25/2009

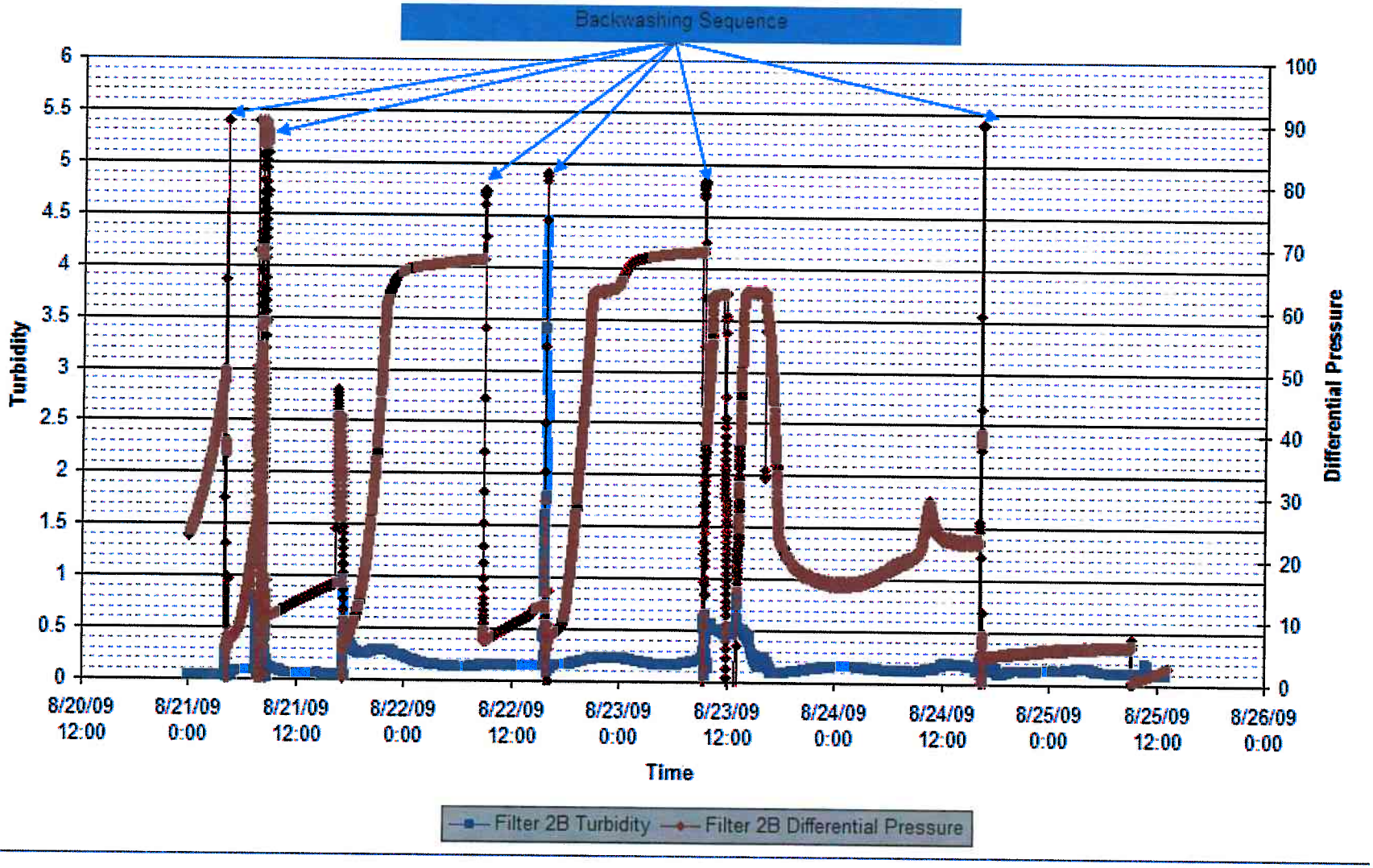
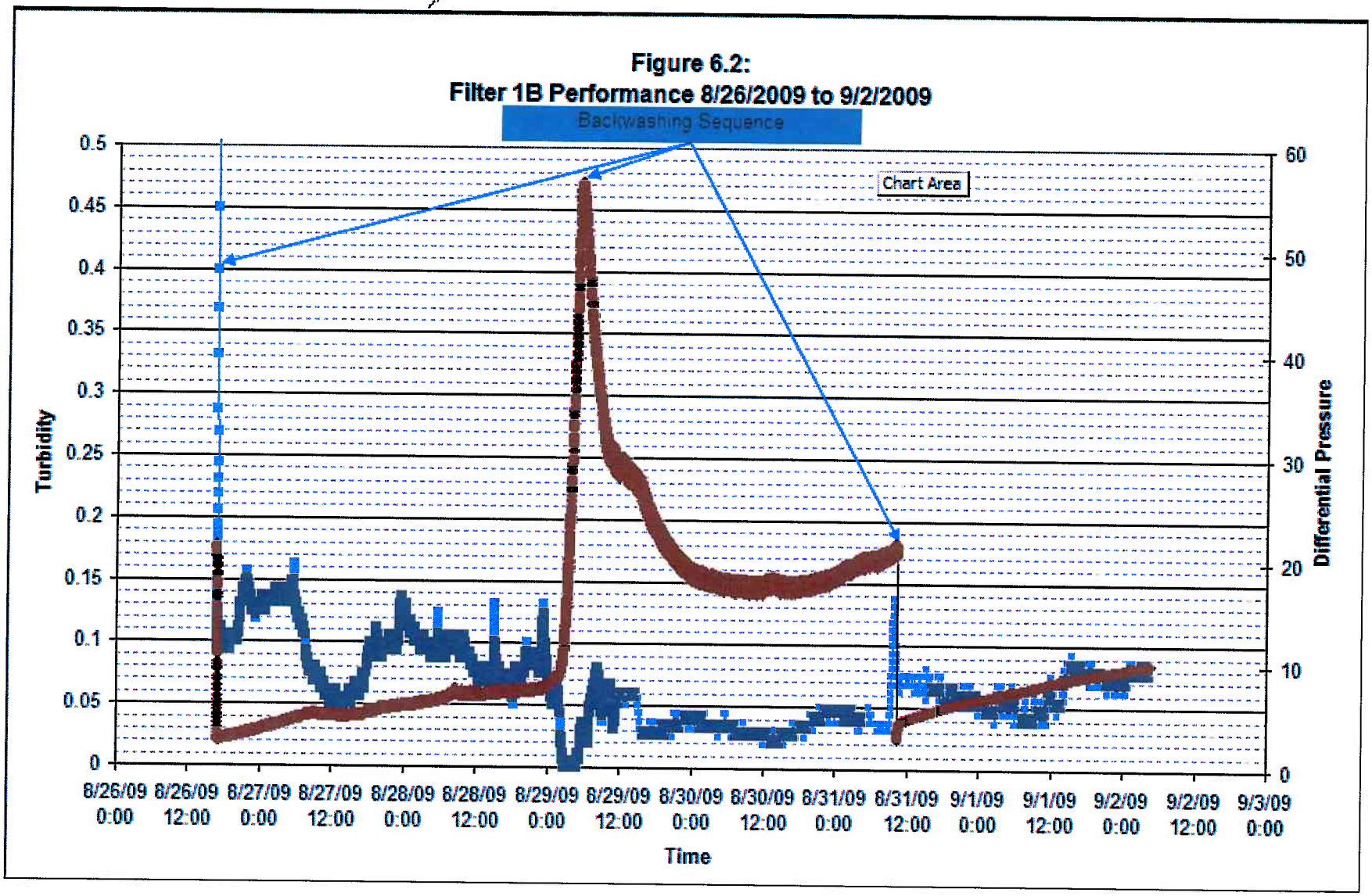


Figure 6.2:
Filter 1B Performance 8/26/2009 to 9/2/2009



7. CONCLUSIONS

The results of the performance test verified that the filters are capable of effective treatment on a continuous basis. The process train, high-rate dissolved air flotation followed by softening and media filters, is a viable solution for the new water treatment facility. Specific conclusions are as follows:

- Other conclusions may be drawn from other lab analysis not performed by IDI. Further investigation of determining the optimal coagulant dosages may be warranted during the course of the pilot study