



Evaluation of Ceraflow-70 as a Filtration Media for High Rate Surface Water Filtration

Project Description

The existing water filtration facility in Clinton MA is a high rate, direct filtration process that has been on-line since 2006. The water filtration plant draws its raw water from the Wachusett Reservoir. Chemical feed systems are provided for chemically assisted filtration, pre-oxidation (potassium permanganate), coagulation, pH and alkalinity adjustment (sodium bicarbonate and sodium hydroxide), and disinfection (sodium hypochlorite).

There are six pressure filters, each 102 inches in diameter and each filter has a maximum flow capacity of 560 gpm and hydraulic loading of 9.87 gpm/square foot. The filter beds are comprised of 24 inch deep beds of granular ceramic media. Standard operation has 5 of the 6 tanks on-line, with one in standby, giving a normal service flow capacity of 2,800 gpm, and a peak capacity of 3,360 gpm.

Pilot testing was conducted to evaluate the performance of Ceraflow-70 filter media, as a direct replacement for the existing fine grain ceramic originally installed. Some of the existing ceramic material had been lost through backwashing over more than 10 years of operations. The Ceraflow-70 is a 0.15 – 0.25 mm, textured, spherical ceramic media with a uniformity coefficient < 1.3.

Pilot Test Results

Ceraflow-70 was installed in one of the 102 inch filtration vessels at a 24 inch depth on the existing garnet under bedding. The plant had existing on-line turbidimeters on the

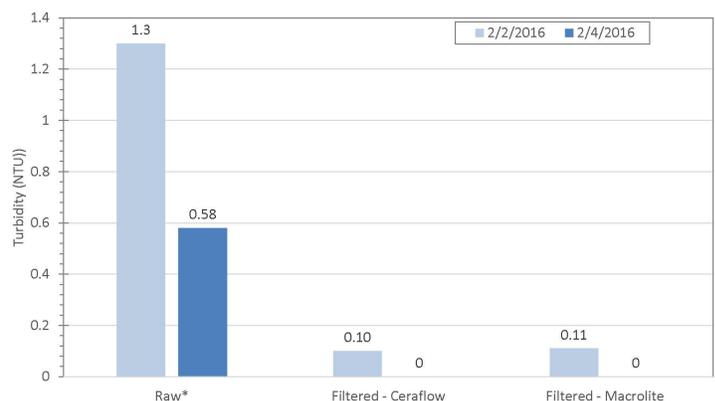
effluent of each filter vessel. Plant operations installed on-line particle counters (HACH 2200 PCX), one on the Ceraflow-70 vessel and one on an adjacent tank with the existing ceramic filter media. These on-line measurements were required to both evaluate the filter performance overall but also to facilitate State Approval.

Turbidity

Typical raw water influent turbidities during the pilot test ranged between 0.28 NTU to 0.44 NTU. The requirements of the Enhanced Surface Water Treatment Rule required the turbidity to be equal to or less than 0.3 NTU in combined filter effluent at 95%.

The Ceraflow-70 effluent turbidity ranged from 0.025 NTU to 0.030 NTU. As seen in Figure # 1 the Ceraflow-70 media achieved turbidity consistent with the existing filter media and was consistently below the 0.3 NTU requirements.

Figure 1. Lab Test Data - Turbidity



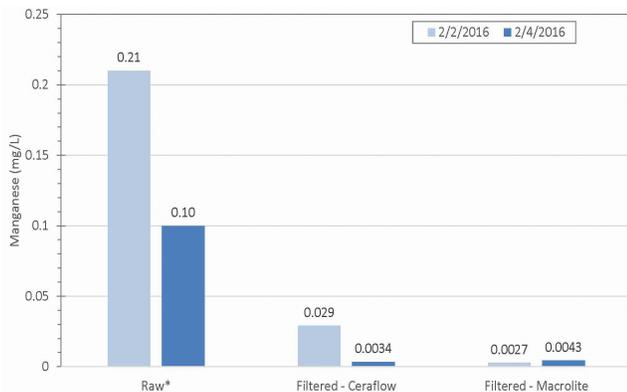
*Raw water is pre-treated at the North Dike Pump Station using Potassium Permanganate. Raw water sample taken at the Water Treatment Facility is this pre-treated water.

Manganese

Typical raw water influent manganese during the pilot test ranged between 0.1 mg/l to 0.2 mg/l. The plant targets a final manganese effluent value of less than 0.05 mg/l to meet State aesthetic water quality requirements.

As seen in Figure # 2 Ceraflow effluent manganese values were consistently below the 0.05 mg/l level and were consistent with the output quality of the existing media.

Figure 2. Lab Test Data - Manganese



*Raw water is pre-treated at the North Dike Pump Station using Potassium Permanganate. Raw water sample taken at the Water Treatment Facility is this pre-treated water.

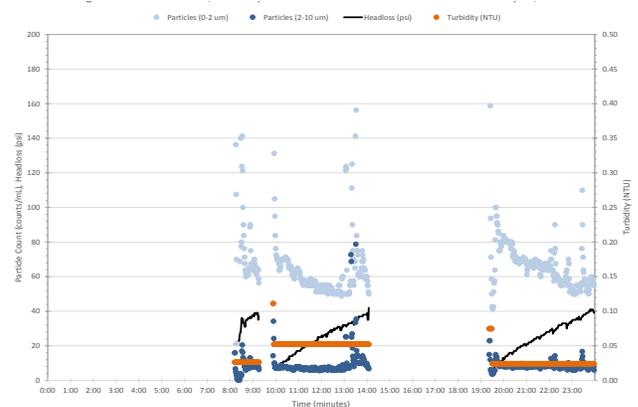
Particle Counts

Particle count and head loss data was recorded at one-minute increments. The particle counters were set up to count particles in the 0 - 2 microns (μm) range and 2 - 10 μm range. These ranges were selected based upon the typical size of Giardia cysts and Cryptosporidium, which are typically larger than 2 microns. An example of the particle removal values in Figure # 3 is from

the last day of the pilot test. The actual numeric counts while informative were used strictly to compare the performance of the Ceraflow-70 to the existing media.

Raw influent particle counts were not measured. The Ceraflow-70, 2-10 microns sized particles in the effluent typically ranged between 2-20 particles per 100/ml with rarely occurring spikes up to 100 particles per 100/ml.

Figure 3. Lab Test Data – Particle Counts



Conclusions:

Filter Media Performance:

The Ceraflow-70 media performed comparably to the originally installed ceramic media and demonstrated the ability to meet the SWTR (LT2ESWTR) at very high filter loading rates.

All particle counts, turbidities and head-loss values were consistent with the original filter media and effluent quality met or exceeded State requirements.