

Next Filtration Technologies, Inc.

next-Sand

Abstract

- Media filtration is a common technique for the clarification of industrial and municipally supplied water.
- Media filtration is simple, moderately effective and relatively cheap.
- Carefully constructed layers of different media such as anthracite, sand, garnet and gravel (multimedia) provide filtration values of 12 to 20 micron at nominal flows of 3 to 10 gpm/ft² of filter surface area.

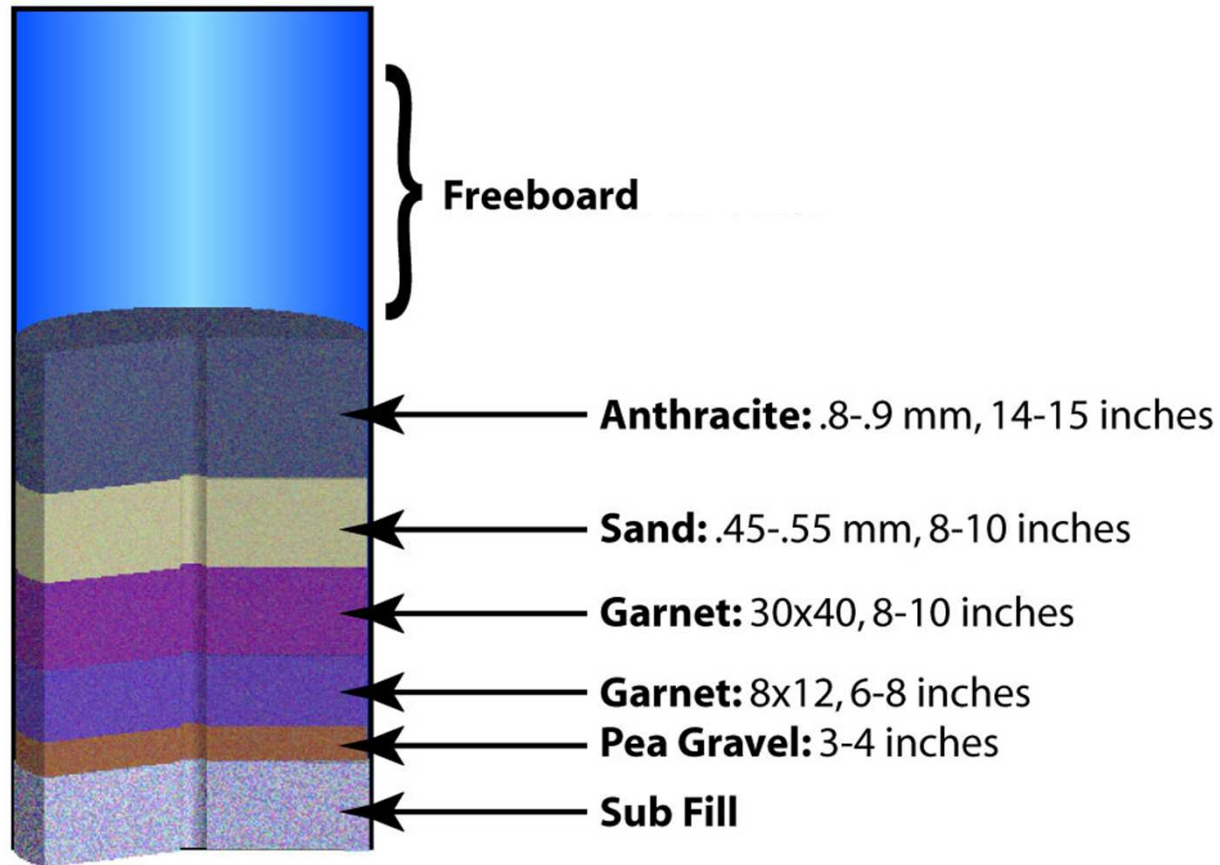
next-Sand

- A unique processed high-purity mineral offers a number of compelling benefits as a replacement for multi-media.
 - Improved filtration efficiency
 - Higher loading capacities
 - Lower pressure drop
 - Higher flow rate per unit of surface area
 - Lower maintenance
 - Reduced water and power consumption.

Overview

- Multi-media filtration design
- Multi-media filtration performance
- Introduction to next-Sand
- next-Sand properties
- next-Sand design and performance
- Pilot studies and installations
- next-Sand advantages

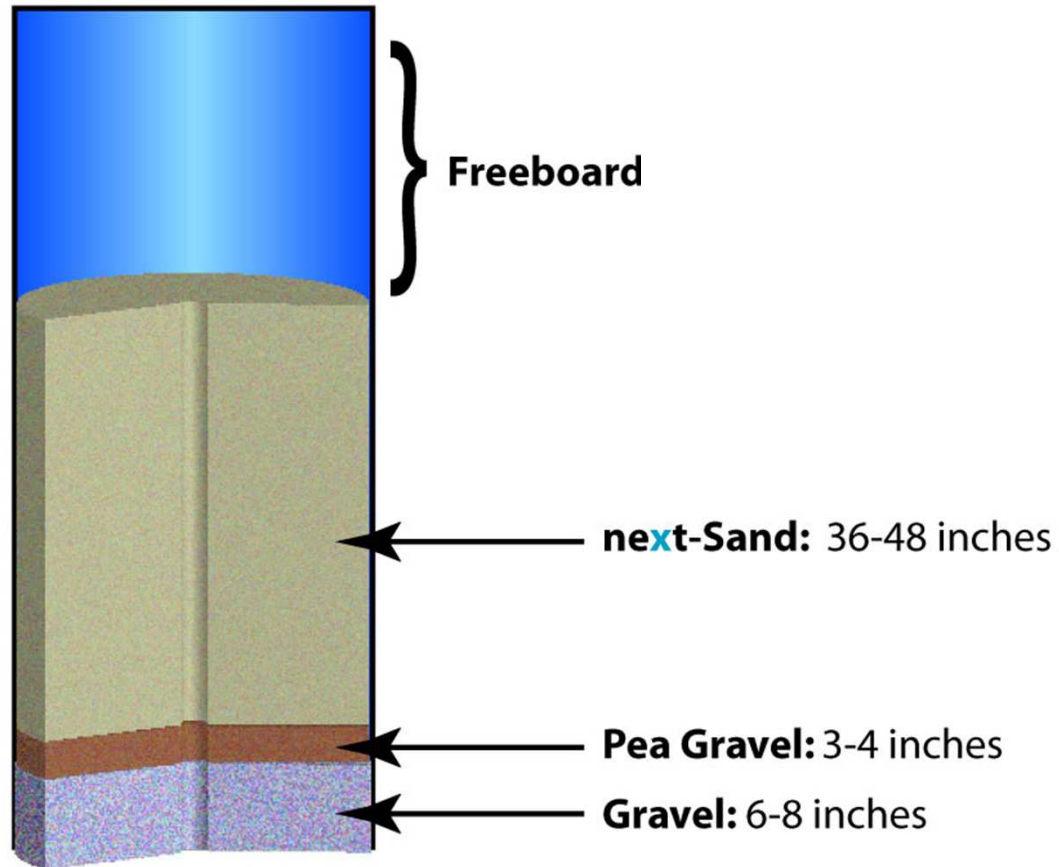
MultiMedia Filter Construction



Multi-media Filter Characteristics

- Flow rates: 3 to 10 gpm/ft²
- Filtration: 12 to 20 micron
- Backwash Rate: 15 to 17 gpm/ft²
- Surface Area: 0.002 m²/gm
- Average Density: 95 lbs/ft³
- Typical bed depth: 36 to 48 inches

next-Sand Filter Construction



next-Sand Properties

- Density: 55 lbs/ft³
- Media size: 14 x 40 mesh
- Surface Area: 25 m²/gm
- Uniformity Coefficient: 1.7
- Surface Charge: net negative
- Bed Void Volume: 55 to 58%

next-Sand Properties

- High purity, processed mined mineral
- High hardness-minimal attrition
- Lower shipping weight vs. multimedia
- High surface area
- Hydrophilic surface
- NSF 61 listed

next-Sand Performance

- Flow rates to 20 gpm/ft²
- 5 micron filtration (nominal)
- Twice the loading capacity of multimedia.
- Lower Delta P than multimedia
- B/W flows of 15 to 17 gpm/ft²
- Bed depth equal to fine sand and anthracite

Case Study-1

Reverse Osmosis pretreatment for a bottled water plant

Background

Bottled water plant using multimedia pretreatment for their RO system. Client sought improved filter performance for higher efficiency and reduced waste.

Equipment

Multimedia: 48”dia. Tank, 36” bed of #16 garnet, #50 garnet, 20x40 mesh sand and anthracite.

next-Sand: 48”dia tank, 36” bed of 14x40 mesh next-Sand

Case Study-1

Reverse Osmosis pretreatment for a bottled water plant

Test Description

The following tests, TSS (Total Suspended Solids, Turbidity and SDI (Silt Density Index) were performed over a 5 month period by the plant operators and a consulting Chemical Engineer.

Test Results

| | Feed | MultiMedia | next-Sand |
|-------------------|--------|------------|-----------|
| TSS | 31mg/l | 23 mg/l | <5mg/l |
| SDI ₁₅ | .40 | .38 | .18 |

Case Study-1

Reverse Osmosis pretreatment for a bottled water plant

Conclusion

Next-Sand out-performed multi-media in every respect. An added benefit was the water savings afforded by next-Sand's reduced backwash frequency of 1/2 that of multi-media.

The high quality next-Sand filtrate allowed the Reverse Osmosis system to operate at higher capacity and higher efficiency.

Case Study-2

Reverse Osmosis pretreatment for boiler feed water.

Background

An electric power plant was designed and constructed with a multi-media filtration system as pretreatment for a Reverse Osmosis system. The design specification called for filtrate of the multimedia system (sand and anthracite) to produce 1500 gpm of water with an SDI of <2 . The multi-media system was never able to meet this specification forcing the plant engineer to find an alternative.

Case Study-2

Reverse Osmosis pretreatment for boiler feed water.

Test Description

After a successful pilot test, the existing vessels were reloaded with next-Sand in early 2002. The system has consistently operated at design capacity while exceeding the water quality spec for over 3 years.

Performance data

| | | |
|-----------------------|---------------------------|--------------|
| System Flow | 1500 gpm (750 gpm/vessel) | |
| Surface Loading | ~14 gpm/ft ² | |
| next-Sand Performance | Feed SDI | Filtrate SDI |
| Initial | 7 | <1 |
| 24 month average | 7 | <1 |

Case Study-2

Reverse Osmosis pretreatment for boiler feed water.

Conclusion

next-Sand allowed the utility to operate their high volume RO on a poor quality water supply that was otherwise unusable based on conventional filtration methods.

next-Sand continues to perform well, under challenging conditions, without maintenance after more than 3 years.

Case Study-3

Filtration performance: SDI & Turbidity reduction, filtration efficiency.

Background

Surface water, (river water with silt and clay particles following a rain event in San Antonio, Texas) was tested to compare the relative efficiency and effectiveness of next-Sand.

Equipment

Multimedia: 36" bed of #16 garnet, #50 garnet, 20x30 mesh sand and anthracite, operated at 12 gpm/ft².

next-Sand: 36" bed of 14x40 mesh next-Sand operated at 12 gpm/ft².

Case Study-3

Filtration performance: SDI & Turbidity reduction, filtration efficiency.

Test Description

The tests were conducted over a 6 day period.
Samples were taken daily.

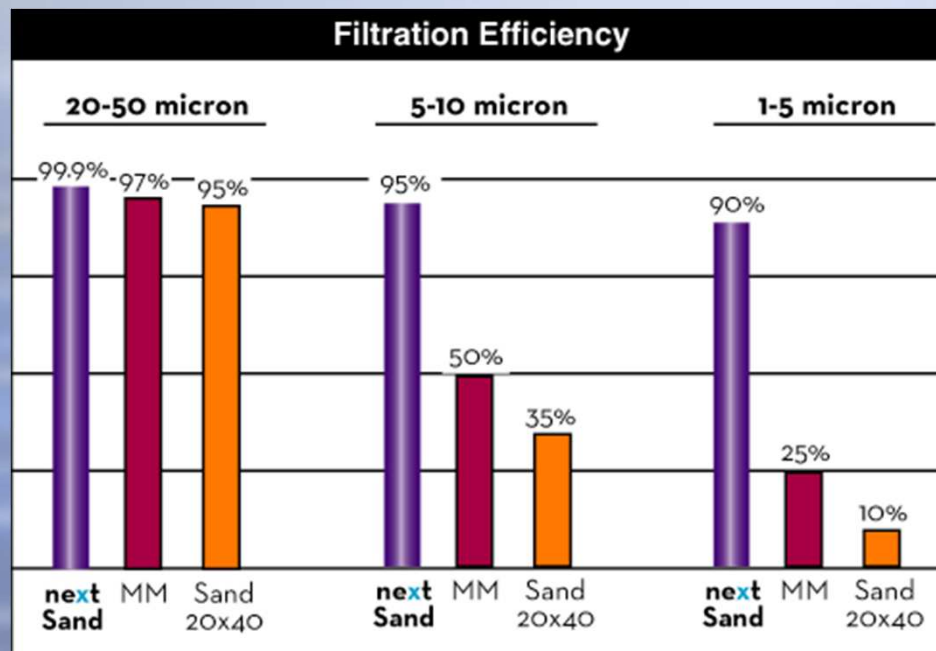
Test Results

| | Feed | MultiMedia | Feed | next-Sand |
|-------------------|------|------------|------|-----------|
| Turbidity | 237 | 171 | 252 | 90 |
| SDI ₁₀ | 8.1 | 6.1 | 8.9 | 4.1 |

Case Study-3

Filtration performance: SDI & Turbidity reduction, filtration efficiency.

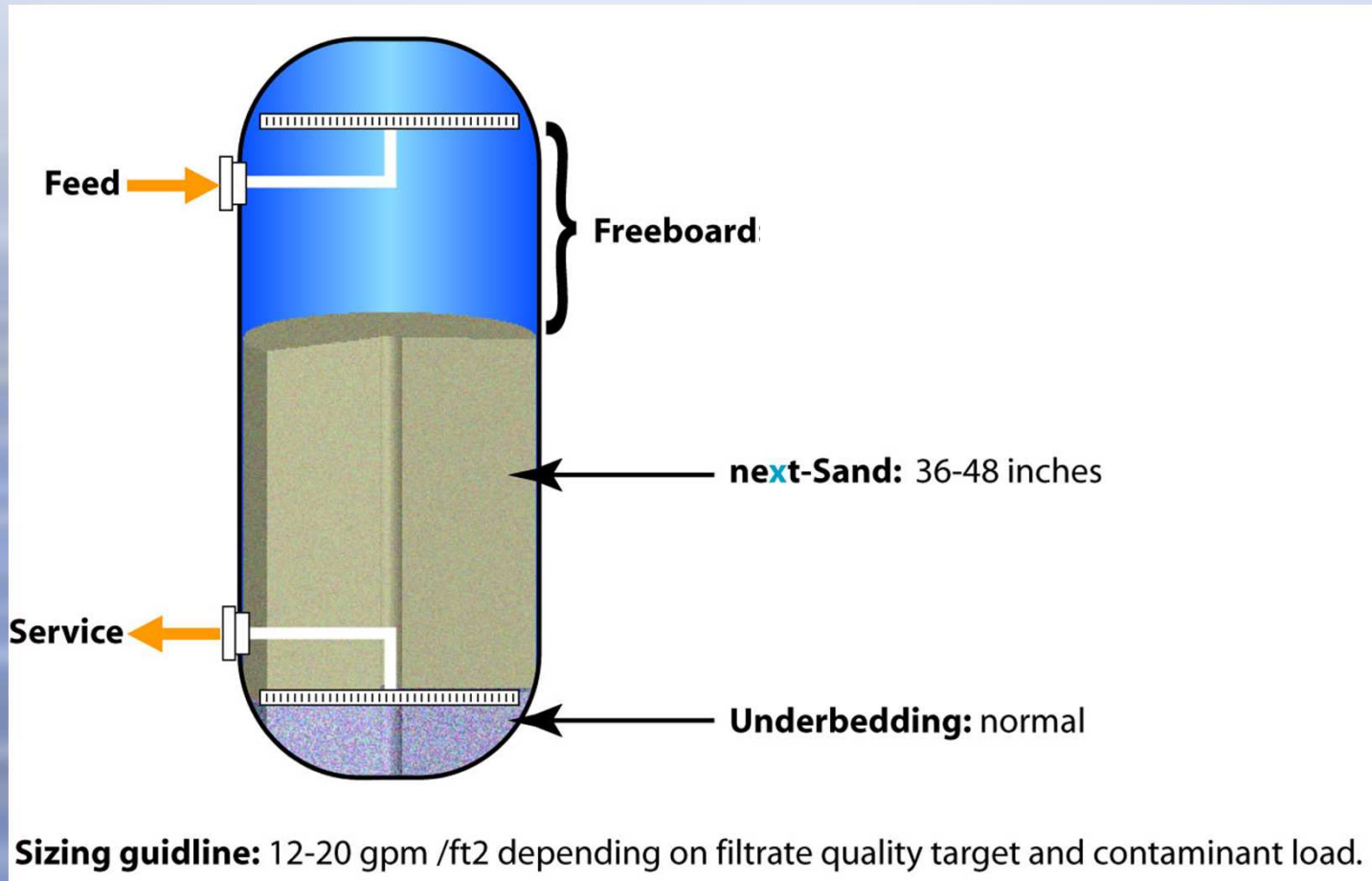
Test Results



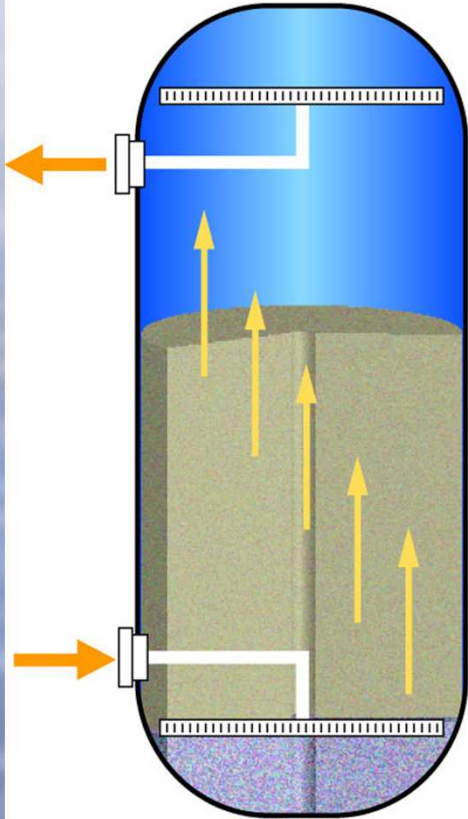
Conclusion

The particle analysis shows that next-Sand performs as well as or better than most 5 micron cartridge filters. next-Sand operated at 1/2 the backwash frequency indicating twice the solids loading capacity of multi-media.

next-Sand System Design

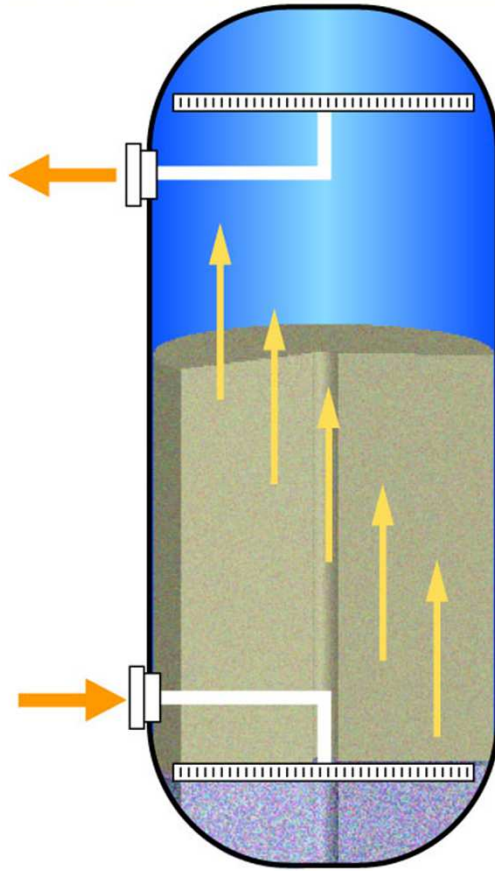


next-Sand Loading and Start-up



1. Load and level underbedding.
2. Backwash 20 to 30 minutes to clean and level.
3. Load **next-Sand**
4. Backwash 20-30 minutes.
5. Settle for 15 minutes.
6. Backwash again 15 to 20 minutes.
7. Ready for service.

next-Sand Backwash



Backwash at 15 to 17 gpm/ft² for 10 to 15 minutes.

Optional Air Scour
Use 2-3 scfm/ft² air@ 90psi with 3-5 gpm/ft² water backwash (@77°F)

next-Sand Advantage

- Higher filtration efficiency
- Lower pressure drop
- Higher performance and higher flows
- Higher dirt loading
- Less maintenance
- Simplified inventory

next-Sand Benefits

- **Less frequent backwash saves time, water, power and reduces waste volume.**
- **Light weight means lower freight costs**
- **Higher filtration efficiency means lower turbidity**
- **NSF 61 listed**

next-Sand

Cost comparison vs. multi-media.

- Half the weight = half the freight
- Twice the loading = half the water usage/waste
- Twice the flow = half the size.

Cost Comparison

500 gpm RO pretreatment.

Multi-media System

- **Surface Area:** 100 ft² (online)
- **Filter vessels req'd:** (3) 96" diameter
- **Media volume:** Approx 527 ft³ weighing approx. 50,000 lbs.
- **Backwash req.:** 850 gpm (6" pipe)
- **Backwash freq.:** Once per day
- **Backwash volume:** 51,000 gallons

Cost Comparison

500 gpm RO pretreatment.

next-Sand System

- Surface Area: 50 ft² (online)
- Filter vessels req'd: (3) 66" diameter
- Media volume: Approx 249 ft³ weighing approx. 13,725 lbs.
- Backwash req.: 400 gpm (4" pipe)
- Backwash freq.: Once per day
- Backwash volume: 24,000 gallons

Cost Comparison

500 gpm RO pretreatment.

next-Sand System Savings

- Footprint savings: 60%
- Capital Savings: \$22,500 (*tanks and piping*)
- Freight Savings: \$1,825 (@ \$5.00/cwt)
- Water Savings: \$29,565/yr (@\$3.00/1000gal)
- Media Savings: \$2904 *on reduced volume*
- Capital and freight savings = \$97.69/ft³
- Water savings: \$59.13/gpm installed capacity/yr.