



# GreensandPlus™

**Physical Form**

Black, nodular granules, shipped in a dry form

**Apparent Density**

85 pounds per cubic foot net

**Shipping Weight**

89 pounds per cubic foot gross

**Specific Gravity**

Approximately 2.4

**Porosity**

Approximately 0.45

**Screen grading (dry)**

18 X 60 mesh

**Effective size**

0.30 to 0.35 mm

**Bed Type**

Dual media: Anthrafilt (15-36 in.) and GreensandPlus (15-24 in.)

**Capacity**

700-1200 grains of oxidized iron and manganese/sq.ft. of bed area based on potassium permanganate demand and operation to iron break through.

**Backwash**

Sufficient rate using treated water to produce 40% bed expansion.

**Air/Water Scour**

Optional using 0.8-2.0 cfm/sq. ft. with a simultaneous treated water backwash at 4.0-4.5 gpm/sq. ft.

**Raw Water Rinse**

At normal service flow rate for 3-5 minutes or until effluent is acceptable.

**Uniformity coefficient**

Less than 1.60

**pH range**

6.2 to 8.5 (see General Notes)

**Maximum temperature**

No limit

**Backwash rate**

Minimum 12 gpm/sq.ft. at 55°F

**Service flow rate**

2 - 5 gpm/sq.ft.

**Minimum bed depth**

24 inches (15-18" of each media or dual media beds)

**Flow Rate**

Recommended flow rates with CR operation are 2-5 gpm/sq. ft. Extremely high concentrations of iron and manganese usually require lower flow rates for equivalent run lengths. Higher flow rates can be considered with very low concentrations of iron and manganese. For optimum design parameters, pilot plant testing is recommended. The run length between backwashes can be estimated as follows:

What is the run length for a water containing 1.7 mg/L iron and 0.3 mg/L manganese at a 4 gpm/sq. ft. operating rate?

$$\text{KMnO}_4 \text{ demand} = (1 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn})$$

$$= (1 \times 1.7) + (2 \times 0.3)$$

$$= (2.3 \text{ mg/L or } 2.3/17.1 = 0.13 \text{ grains/gal. gpg})$$

$$\text{At } 1,000 \text{ grains/sq. ft. loading } \div 0.13 \text{ gpg} = 7,692 \text{ gal./sq.ft.}$$

$$\text{At } 4 \text{ gpm/sq. ft. service rate } 7,692/4 = 1,923 \text{ min.}$$

The backwash frequency is approximately every 30-36 hours of actual operation.

The Intermittent regeneration (IR) operation is available for certain applications. Contact your Inversand representative for additional information.

## pH

Raw waters having natural pH of 6.2 or above can be filtered through GreensandPlus without pH correction. Raw waters with a pH lower than 6.2 should be pH-corrected to 6.5-6.8 before filtration. Additional alkali should be added following the filters if a pH higher than 6.5-6.8 is desired in the treated water. This prevents the possible adverse reaction and formation of a colloidal precipitate that sometimes occurs with iron and alkali at a pH above 6.8.

## Removing Fines and Initial Conditioning

Prior to placing the Anthraflit in the filter or placing the filter into service, GreensandPlus should be thoroughly backwashed and the top layer of fine material removed by undercutting in accordance with AWWA B 100, paragraph 4.5.2. This is especially important if Anthraflit is placed on top of the GreensandPlus bed. Each cubic foot of GreensandPlus shipped contains sufficient material to compensate for the removal of this final material.

GreensandPlus is NOT shipped in a regenerated form; therefore it is necessary, prior to use, to regenerate it with a solution of potassium permanganate contacting the bed for a minimum of 4 hours. A regeneration level of 4 ounces of  $KMnO_4$  or chlorine per cubic foot of GreensandPlus is recommended. Before placing into service, the filter must be rinsed of all remaining traces of potassium permanganate.

## Radium and Arsenic Removal Using GreensandPlus

The GreensandPlus CR process has been found to be successful in removing radium and arsenic from well water. This occurs via adsorption onto the manganese and/or iron precipitates that are formed. For radium removal, soluble manganese must be present in or added to the raw water for removal to occur. Arsenic removal requires iron to be present in or added to the raw water to accomplish removal. Pilot plant testing is recommended in either case.

## Methods of Operation Continuous Regeneration (CR)

Continuous regeneration (CR) operation is recommended in applications where iron removal is the main objective in well waters with or without the presence of manganese. This method involves the feeding of a predetermined amount of chlorine ( $Cl_2$ ) and /or potassium permanganate ( $KMnO_4$ ), directly to the raw water before the GreensandPlus Filter.

Chlorine should be fed at least 10-20 seconds upstream of the  $KMnO_4$ , or as far upstream as possible to insure adequate contact time.  $KMnO_4$ , if required, should be fed to produce a "just pink" color in the filter inlet. This slight excess of  $KMnO_4$  or a  $Cl_2$  residual carried through the filter will maintain GreensandPlus in a continuously regenerated condition.

The dosage of  $Cl_2$  and  $KMnO_4$  may be estimated as follows:

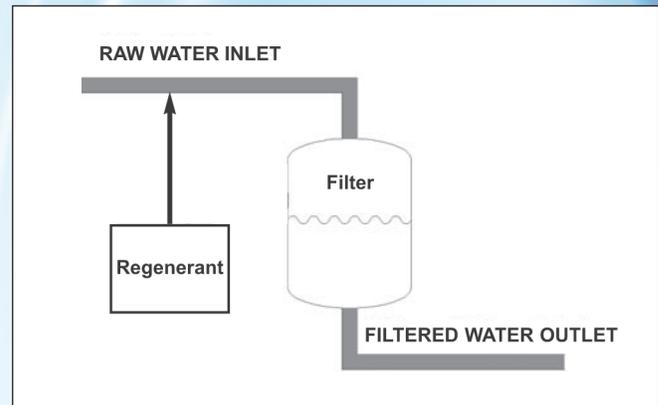
$$\text{mg/L } Cl_2 = \text{mg/L Fe}$$

$$\text{mg/L } KMnO_4 = (0.2 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn})$$

Without  $Cl_2$  the  $KMnO_4$  demand may be estimated by:

$$\text{mg/L } KMnO_4 = (1 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn})$$

## GreensandPlus: Continuous Regeneration (CR)



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