

Technology Brief

EVALUATION OF CRUSHED RECYCLED GLASS AS A FILTRATION MEDIUM IN SLOW RATE FILTRATION

A pilot project was conducted in the City of Roslyn, Washington, to evaluate the feasibility of using crushed, recycled glass as a filtration medium in slow sand filters. Recent updates to the Washington Administrative Code have made filtration mandatory for most water systems using surface water sources. Slow sand filters, which are usually limited to relatively clean water sources, are increasingly being used to treat drinking water in small communities to meet state water quality regulations. This is primarily due to the low costs associated with constructing and maintaining slow sand facilities.

The population of Roslyn is approximately 900, and the source of the City's drinking water is Domarie Creek.

Test Procedure

Pilot columns, constructed of 15-inch diameter SDR 35 PVC sewer pipe, were used to evaluate the effectiveness of slow rate filtration on Domarie Creek surface water. Four different filter media were tested in the columns -- crushed glass, Steilacoom sand, Trinidad Pit sand, and Ellensburg sand. Each column contained 36 inches of filter medium underlain by several layers of support gravels of increasing coarseness with depth.

Filter media washed in a portable electric cement mixer to simulate the process of using a cement

Key Words

Materials: Post-consumer glass sand.

Technologies: Slow sand filtration.

Applications: Surface water filtration in small municipal drinking water treatment facilities.

Market Goals: Create access to state markets.

Abstract: Evaluation of the operational feasibility of using pulverized, recycled glass sand as a filtration medium in slow sand filters.

truck at a full scale facility. Filter media were washed so that less than 0.1% by weight passed a 200 mesh sieve.

Raw water was fed through the filters at a hydraulic loading rate of between 0.060 and 0.071 gpm/ft².

Test Results

The size characteristics of all of the media used in this pilot project fell within the EPA *Guidance Manual* and the *Ten State Standards* recommendations.

Raw and filtered water turbidity samples were collected and measured five days a week over a period of five and a half months, from March to



August. The maximum contaminant level (MCL) given in the State Administrative Code for monthly average turbidity was violated using the glass sand column for one month associated with a storm event, but was otherwise in compliance. Two of the other three columns also violated the monthly MCL for one month. The Ellensburg Sand was the only medium that held the effluent turbidity within the mandated MCL for the duration of the study.

The pressure drop across each filter was also monitored to determine the point at which each reached an unacceptably high (terminal) headloss. The American Water Works *Manual of Design for Slow Sand Filters* indicates that slow sand filtration performance may be regarded as acceptable if filter runs of at least one month can be maintained before headloss makes cleaning necessary. All four media achieved this minimum standard. The Trinidad Sand exhibited the best performance with an average cleaning interval of 6 months. The crushed glass medium required two cleanings over a six month test period. The Ellensburg sand and the Steilacoom Sand each required three cleanings over a thirteen month test period.

In general, all of the filter media appeared to have similar coliform removal efficiencies. The removal of bacteriological contaminants during the pilot study demonstrated that the glass filter media obtained the activity level typically expected with slow rate filtration.

Pilot tests did not indicate that the column containing the recycled glass sand had any affect on concentrations of trihalomethane precursors. Raw water samples were also submitted for

inorganic and volatile organic chemical analyses. The samples were found to be in compliance with all applicable maximum contaminant levels for inorganic and volatile organic compounds. Because coagulants or other conventional methods of pretreatment generally are not used in conjunction with slow sand filtration, slow sand facilities are usually limited to treating source waters that are already in compliance with these MCLs.

The results of this project suggest that slow rate filtration, with either sand or glass, may be an effective treatment process for the City of Roslyn raw water source with the addition of a roughing filter or other method of pretreatment and/or the capability to divert raw water during high turbidity events.

It should be noted that crushed glass typically has a lower density than sand and that as a filter bed, it may fluidize at lower backflow rates than conventional media. Therefore, caution should be used during backfilling or backflushing for harrowing in order to avoid fluidizing the bed and disrupting the structure of the filter beds and support gravels.

Caution must also be used when applying the conclusions of this project to other water systems. The effectiveness of a filter medium and slow sand filtration treatment of drinking water are site specific, and each water system must be evaluated on a case-by-case basis.

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For More Information

For a copy of the full protocol, *Evaluation of Crushed Recycled Glass as a Filtration Medium in Slow Rate Sand Filtration* (No. GL-95-4) use the CWC Publication Order Form. For more information call CWC at (206) 443-7746, email info@cw.org, or visit the CWC Internet Website at www.cw.org.

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