

# Recreation Management Tech Tips

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Forest Service



## Technology & Development Program

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### MICRO-FLUSH TOILETS

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Ken Earlywine, a former U.S. Department of the Interior (USDI) National Park Service employee developed the original micro-flush toilet design. Ken is now a U.S. Department of Agriculture (USDA) Forest Service employee working on the White River National Forest in Region 2. Ken submitted a proposal to the National Recreation Steering Committee requesting that the USDA Forest Service Technology and Development program transfer the micro-flush toilet design technology to the field. San Dimas Technology and Development Center (SDTDC) received this project through the national steering committee process. This tech tip, written by the SDTDC Sanitary Engineer, is the result of Ken's technology transfer request.

#### Background

Toilet facilities in developed recreation areas employ vault, composting, and conventional flush toilets; however, each of these options has limitations. Vault and composting toilets are vulnerable to users depositing inappropriate materials in them. Vault toilets frequently have unpleasant odors associated with them. Vault waste disposal is a problem in some areas. The waste is concentrated because, unlike flush toilets, no water dilutes the waste. Unfortunately, many small wastewater treatment plants are unable to process undiluted waste. Consequently, the waste either has to be diluted or hauled to a larger wastewater treatment plant that can process undiluted sewage. Composting toilets are expensive, labor intensive, frequently do not work, and potentially endanger employees through pathogen exposure and confined space entry. Conventional flush toilets require a water supply and wastewater disposal often unavailable in remote locations.

Toilet facilities in flood plains need to be portable to prevent water pollution when the water level rises. The portable toilets used as temporary facilities at events are inappropriate for long-term use because they are easy to vandalize, to tip over, and to have inappropriate materials placed in them.

#### Purpose

This tech tip discusses the use of micro-flush toilets as an additional option for the USDA Forest Service. Micro-flush toilets are less likely to have inappropriate materials, such as disposable diapers and trash, placed in them. Flush toilets produce fewer obnoxious odors and are favored by the public. The micro-flush toilets installed at USDI Glen Canyon National Recreation Area (NRA) and Lake Mead NRA have weathered heavy public use with few mechanical problems.

Joe Welch Companies, Inc., constructed the land-based, micro-flush toilets in these two NRAs to a USDI National Park Service design. The two main designs are a floating sanitation facility (FSF) (figure 1) and a land-based movable sanitation facility (LSF) (figure 2). Micro-flush toilets also are suitable for use with fixed-toilet vaults.

#### Floating Sanitation Facilities



Figure 1—Floating sanitation facility.



ARAMARK Corporation Construction Division constructed all the floating sanitation facilities at the NRAs. Although a number of different configurations have been constructed to meet varying design requirements, the FSFs typically have one accessible restroom, one standard restroom, a porta-potty dump station, and two hand-operated boat holding-tank pumpout stations. The FSFs can be attached to existing dock structures or anchored in open water with a unique self-leveling anchorage system that accommodates up to 100 feet of water-level fluctuation with no labor or maintenance required.

The typical floating steel platform is 28 feet by 32 feet and has a 4,000-gallon holding tank. The minimum recommended 20- by 20-foot platform will carry a 1,000-gallon holding tank. The deck is constructed of a long-lasting fiberglass material. Lake water is used for flushing. A double-walled holding tank fixed below the structure's floor stores the effluent. Solar panels supply the power.

The FSFs at Lake Mead NRA are cleaned and checked weekly, and pumped out once or twice a year. The toilets are removed from the lake and stored during the winter.

### Land-Based Movable Sanitation Facilities

Joe Welch Companies, Inc., constructed the LSFs at the same NRAs. The LSFs are movable, solar-powered, self-contained, micro-flush toilets located along the shore of the reservoirs. As the water level fluctuates, the toilets are moved to a new location. The original LSFs were moved with a front-end loader. Empty, they weigh about 4,000 pounds. The newer units have removable wheels and can be towed to another location. The LSFs have a 300-gallon clean-water tank and a 400-gallon waste tank.

Twenty-five solar-powered units are placed along the Boulder Beach District shoreline at Lake Mead. Each LSF has one accessible unisex restroom and one standard unisex restroom. Each restroom has a stainless-steel Microphor micro-flush toilet and a waterless urinal (figure 3). The units at Lake Mead NRA are cleaned and checked daily. They are pumped out every 1 to 2 weeks during the summer and the freshwater reservoir is refilled. They handle approximately 1,000 uses between pumpouts.



Figure 3—Waterless urinal and stainless-steel Microphor micro-flush toilet.



Figure 2—Land-based accessible sanitation facility at Lake Mead.



Figure 4—Water-level change at Lake Mead.

The micro-flush toilets held up well to heavy use, although a few mechanical problems occurred with the systems. The cam operating the toilet flapper needs to be cleaned and adjusted periodically, and the battery needs to be replaced every few years.

Both ARAMARK Construction Division and Joe Welch Companies, Inc., will build custom-designed micro-flush sanitation facilities. The color and siding material, the number of restrooms, and the sizes of holding tanks may be specified.

### **Vault-Toilet Sanitation Facilities**

Micro-flush toilet systems are one option for toilets at campgrounds and other recreational facilities. They may be established permanently with vault holding tanks or septic tanks if water is available from a holding tank, lake, river, or a campground supply. Potable water is not required.

The Microphor stainless-steel toilet, model LF-320, used at Lake Mead NRA is a micro-flush toilet suitable for public facilities. It uses between 1 and 2 quarts of water per flush. This drop-through, nonrecirculating toilet with a flapper maintains a water- and air-tight seal between the bowl and holding tank. The Microphor toilet uses compressed air or electricity and water pressure to assist in emptying the bowl. For price lists and design assistance, contact Microphor, Inc.

### **Pricing (2004)**

#### **Joe Welch Companies, Inc.— Land-based sanitation facility (LSF)**

Double restroom unit, one side Americans with Disabilities Act (ADA)-accessible: \$21,500

Single ADA-accessible restroom: \$16,000

Single non-ADA accessible restroom: \$14,000

ADA-accessible ramp: \$2,850

#### **ARAMARK Construction Division— Floating sanitation facility (FSF)**

Flotation platform, 4,000-gallon double-walled waste tank, double restroom, porta-potty dump station, boat-pumpout system, solar power system, anchor system, motion sensor lighting, and alarms: \$161,500

#### **Microphor, Inc.**

Contact manufacturer for prices.

### **Additional Information**

For further information on micro-flush toilet technology, contact the SDTDC project engineer, Brenda Land, by phone at 909-599-1267, ext. 219, or by e-mail at [bland@fs.fed.us](mailto:bland@fs.fed.us), or the companies listed below.

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