Assessment of Benefits of Flushless Urinals at Kaiser Permanente French Campus Facility in San Francisco

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Background

Worldwide, water demands have tripled in the last half century. Since 1950, the number of large dams (greater than 15 meters high) climbed from 5,000 to 45,000. This represents an average of two large dams per day for 50 years. Until recently, we only paid attention to the benefits of these engineering projects and neglected to notice the damage they have caused. Water tables are falling from over-pumping of groundwater in many places including the United States. Many major rivers, notably the Colorado, now run dry for portions of the year. Large inland lakes are shrinking, most notably Central Asia's Aral Sea and northern Africa's Lake Chad.[1]

There exist many untapped opportunities to increase the efficiency of water use on farms, in factories, and in cities and in homes. Despite their comparatively small use, individuals and businesses can play an important role in conserving water.

"Waste Not, Want Not: The Potential for Urban Water Conservation in California" released by the Pacific Institute in 2003 provides information on the potential for water conservation, questions about industrial production, ecosystem restoration, land use and urban growth. Overall, California's urban water use in 2000 was estimated to be approximately 7 million acre-feet (MAF). This is equivalent to around 185 gallons per capita per day (gpcd) for the nearly 34 million people living in the state. Commercial and industrial uses in 2000 are estimated to have been 1.9 MAF and approximately 700,000 AF respectively, with governmental and institutional uses included in the commercial estimate. No independent estimate of unaccounted-for water (UfW) was done at that time. The California Department of Water Resources estimate for UfW of around 10 percent of all urban use was used as an assumption.

If current water use in California becomes as efficient as readily available technology permits, total urban use will drop from 7 MAF to around 4.7 MAF – a savings of 33%. This will decrease California's urban water use from approximately 185 gpcd to 123 gpcd. California's commercial, institutional, and industrial (CII) sectors use approximately 2.5 MAF of water annually or one third of all urban water use. Previous studies have indicated that the potential for water conservation in this sector is high. The report from Pacific Institute predicts that water use savings between 11 and 17 taf/year can be realized in the hospital segment of the commercial sector.

Water use in all industries can be classified into six broad end uses: sanitation (restroom), cooling, landscaping, process, kitchen, and laundry. Significant end uses include landscaping, restrooms, cooling, and process. The smallest end uses, in terms of total use, are kitchens, laundries and other. It is estimated that of all water used in restrooms the of CII sector, 17 % is used for flushing urinals.[2]

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[1] Postel and Vickers, 2004, Boosting Water Production, State of the World 2004, 46-65

[2] Gleick, P. et al, 2003, Waste Not, Want Not: The Potential for Urban Water Conservation in California, The Pacific Institute

Defining Water Conservation

Currently two broad types of water conservation can be employed: improving water efficiency and substituting reclaimed water. Improving water efficiency involves behavioral and technological improvements. Technological improvements can involve on-site reuse of water or implementing point-of-use reduction technologies such as the subject of this paper, the flushless urinal.

Flushless Urinals

Conventional urinals use at least three liters of water per flush (about a gallon), whereas flushless urinals need neither water nor a flushing system. These new urinals save costs and water, without making concessions on convenience while improving hygiene. Models made of sanitary-ware and fiberglass-reinforced synthetic materials (polyester) are available. A larger order volume now makes the production of ceramic models profitable. Special glazes give sanitary-ware urinals a pore-free surface, while urinals made of synthetic material have a long-lasting gel coating that repels liquids. The urine flows off the smooth surface of the urinal into a siphon that serves to trap the odor - this is the centerpiece of all flushless urinals, and each producer constructs it in a slightly different way.

The siphon contains a liquid sealant that has a specific density that is lighter-than-water. This floats to the top, allowing the urine to flow through it and away, taking any odors with it. The liquid sealant remains in the siphon. Flushless urinals have no joints or cracks in which bacteria can colonize. The special surface repels most liquids and impurities. Cleaning therefore involves less cost and effort than with conventional systems, and strong toilet cleaners are unnecessary.

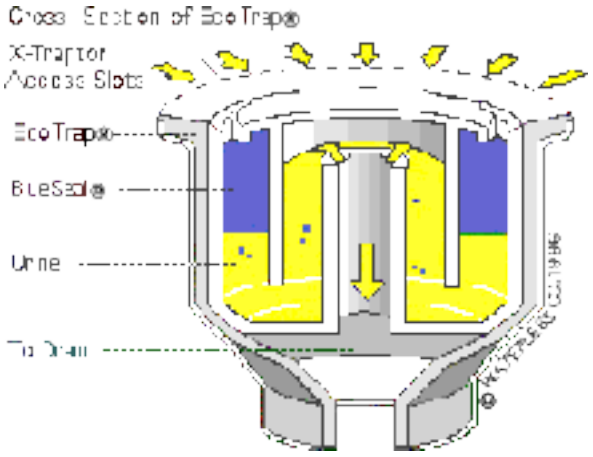
Maintenance work involves replacing the siphon and disinfecting the urinal, and this can easily be carried out by the owner or by a specialist firm in the scope of a service agreement. Maintenance also includes making sure the liquid sealant is kept at appropriate levels. Maintaining the sealant at a sufficient level protects pipes from becoming blocked with deposits because uric scale only forms when urine comes into contact with water.

Flushless urinals are functional, economical, hygienic, virtually odor-free, and non-contact if used and maintained as directed.

Currently there are two manufacturers dominating the flushless urinal market: “Waterless” and “Falcon”. Waterless Company's “Ecotrap” Cartridge is diagrammed below. This cartridge is similar to those of other manufacturers. The major difference is that it is refillable with “BlueSeal” liquid, whereas other manufacturers, such as Falcon, require the replacement of the entire cartridge. Information from the manufacturers indicates that the “BlueSeal” liquid is non toxic and that the cartridges are biodegradable.

An in-depth study at the University of California, Santa Barbara has concluded that maintenance time has been cut in half for flushless urinal models as compared to conventional urinal, freeing maintenance staff for other duties. The UCSB study also showed no significant training costs or difficulties. The entire campus will have exclusively flushless urinals in the near future.

Over the course of several years UCSB has noticed no additional corrosion or other negative in the piping system which is comprised both of cast iron and PVC[3].



The Project

Kaiser Permanente operates a health care facility on 6th and Geary Ave in San Francisco known as the Kaiser French Campus. It is a multistory, three building facility covering about half a city block. The Campus serves as an out-patient facility as well as a medical office building.

This project is an attempt to assess the current water usage of the French Campus that could be prevented by the installation of flushless urinals for men, while taking into consideration as many potential costs as possible.

The current situation at the Kaiser French Campus is that all 28 bathrooms are unisex, containing one toilet each. Based on staff observations the usage breakdown is roughly 50/50 for men and women. Conveniently, they are located either in pairs or within a reasonable distance of each other so a proposal that converts them to 14 men's and 14 women's rooms will not cause any significant problems for employees or visitors.

Each of the 14 men's bathrooms could have a flushless urinal unit installed, and the existing toilet would remain in place. It can be safely assumed that the vast majority of trips to the bathroom are urine only, particularly for men. Nonetheless two estimates are provided, one suggesting that 90% of men's trips to the bathroom are for urination, the second, more conservative estimate suggesting 75%.

Even if the bathrooms were not re-labeled as men or women specific, the same math can be used to gauge the benefits, though the installation costs would double due to the need for 28 units. The benefits would remain the same; therefore it would be a lot more cost effective to convert the bathrooms to sex-specific. Any re-labeling costs for this process have been ignored as negligible.

Explanation of Spreadsheet (attached)

[3] Phone Conversation with Perrin Pellegrin, Sustainability Coordinator, UCSB

Water Costs for Kaiser:
Kaiser staff provided current information on water and sewer rates, as well as a rough estimate of the frequency with which the current toilets are used. Staff estimated that the French Campus experiences 650 flushed toilets daily, or an average of about 23 times a day per toilet. Each toilet is an older model 3.5 gallon-per-flush unit.

Kaiser's 2005 water rate was $1.49 per water-unit (100 cubic feet), an amount scheduled by the city to rise by 15% in both 2006 and 2007. Sewer rates are significantly more expensive, costing Kaiser $5.90 per water-unit. Sewer rates will go up 11% in 2006. This information was obtained from the SFPUC in April 2005.

Ten years hence, Kaiser expects the rates for both sewer and water to double. It is likely that rates will go up even higher, but to maximize erring on the side of caution this report will assume the price doubles in 2017 and remains constant thereafter.

Assuming a very conservative 75% of men's bathroom trips are for urinating, the potential water savings are about 55 gallons daily per converted bathroom. Taking all 14 bathrooms into consideration, along with the increasing price schedules, the potential savings per year start at about $2,150 for a 10 year lifespan. The present value of this most pessimistic of predictions is about $18,000 assuming a normal inflation rate of 3.5%.

A more generous estimate using the higher rate of usage (90% of trips) and a 20 year lifespan gives a present value of future savings of close to $45,000 and in the event the urinals last 30 years, that only increases further.

Cost of units:
The most expensive flushless urinal model on the market appears to be the Sloan WES-1000 which sells for $471.58 each. The higher price reflects this model's ability to handle high amounts of traffic, and intense periods of use, such as what would happen at a sports venue.

The least expensive unit available is the Falcon F-2000 which costs about $230. It is designed for lighter use and would probably be perfect for the Kaiser facility. Nonetheless, both the highest and lowest prices have been placed into the calculations to give as wide a spread as possible.

Government Incentives
There are government programs that will reduce the initial purchase price of flushless urinals. Because of the controversial status of flushless urinals in the city/county of San Francisco, there is currently no formal rebate system for the purchase of flushless urinals. It is likely that this will change very soon, and will probably follow closely the rebate structure of neighboring communities.
Calculations have been based on a lower $150 rebate as well as no rebate at all.

Installation Costs
According to the manufactures, and other reading, installation of flushless models takes a matter of minutes, assuming a “rough-in” is already present. A “rough-in” is basically a hole in the wall through which a pipe is fitted to the existing drainage system, and upon which weight-bearing brackets are installed to hold the urinal (or other fixture) in place.

Unfortunately, in the case of Kaiser, there are no pre-existing rough-ins for urinals. Complicating matters, building a rough-in in an existing facility, is a complicated and time consuming matter involving the removal of a section of wall and existing drain-pipe, installing the new drain, and repairing the wall, fourteen times.

Finding data on rough-in costs is difficult, but Facilitiesnet.com suggests 2 hours as a reasonable time for a from-scratch installation[4]. The current San Francisco plumber's rate is about $90 per hour, but it might be possible to significantly reduce this cost by using Kaiser's on-site maintenance staff, assuming they are available and trained.

If this is determined to be the case, there is no reason to calculate any installation costs because the installation process can be scheduled into the regular work of the maintenance staff as time becomes available.

Cartridge Replacement
The most commonly reported number for the cartridge replacement is every 3 months.

More Externalities – Plumber's Unions.
Despite the apparent ease of adoption at UCSB, there apparently exists antipathy towards flushless urinals from plumbers' unions. California Code plumbing is currently being revised to allow urinals to operate without the use of water.

More Externalities – Hidden Maintenance
If installation is improperly undertaken, the urinal may fail. The two most frequent problems are caused by either an insufficient slope for the drain line, and poor maintenance of the cartridge which keeps it from living up to its promised 7,000 use lifetime. Poor choice of cleaners, such as those of an alkaline nature is known to cause the liquid sealant to break down. Using hard water to clean the urinal may promote calcium build-up that eventually leads to odor problems.

John Watson of Sloan Valve Company suggests - "Non-flushing urinals are a great way to save water, but they may not be ideal for every situation. If you can't ensure a reliable pitch in the drain line and a maintenance staff that is willing to learn new procedures, then you should stick with conventional urinals, particularly the new low-flush models". [5]

Nonetheless, in the 2 years since UCSB has had flushless urinals in place, they have not noticed any negative build up on piping, but it is unknown whether or not problems might occur in 10 or 15 years down the line

Training
Training of maintenance staff is critical to the smooth operation of flushless urinals, and to prevent costly problems in the future. The devices must be cleaned daily with a slightly acidic cleanser, and large volumes of water must never be poured into the urinal. Costs for training have been left out of the final calculations for two reasons. It has been almost unanimously reported that properly installed flushless urinals will save significant amounts of maintenance time, especially costly emergency time which usually pertains to stuck valves and other plumbing elements not present in flushless devices.

The Final Calculations:

[4] http://www.facilitiesnet.com/ms/article.asp?id=1765
[5] http://www.greenclips.com/04issues/253.htm

Overall, the worst case scenario breaks down as follows:

1) Use the most expensive urinal on the markets – the Sloan WES-1000
2) Assume only a 10 year lifespan
3) Assume 2 hours of non-local installation costs at $90/hr
4) Assume zero government rebate
5) Assume only 75% of men's bathroom trips use it
6) Assume the most expensive monthly costs

The result is still a positive present value of about $800. Hardly a sum worth writing home about, but a positive number all the same, which defines it as a good investment. The cost of doing nothing does not even need to be calculated, as it's obvious that it will be decidedly negative.

The most optimistic outlook, assuming essentially the opposite of the above would result in savings in excess of $40,000 in today's money.

Therefore, in pure economic terms there is no question that investing in 14 flushless urinals for the French Campus would be a positive financial decision.