

*Water Efficiency Opportunities
in (and around)
Commercial Buildings*

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What we'll cover

- **Why conserve?**
- **Factors impacting water use**
- **Resource (and dollar) saving opportunities**
- **Toilets and urinals!!!!**

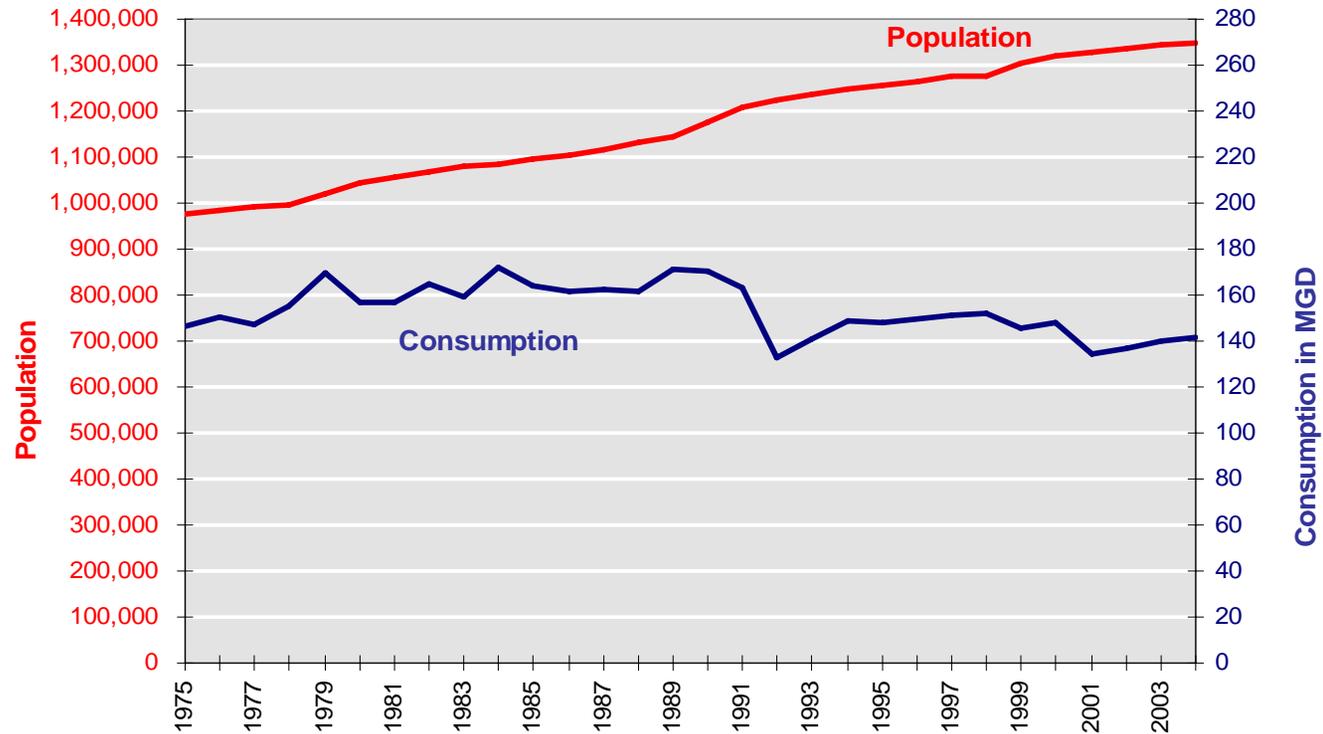
Why Conserve Water?

- **Reduce operating costs**
- **Environmental preservation**
- **Delay/postponement of new supplies**
- **Prepare for drought cycles**
- **And of course...**
 - **Earn up to 5 LEED Credits**
 - 20% water use reduction: 1 point
 - 30% water use reduction: 1 point
 - 50% landscape reduction: 1 point
 - No landscape potable water: 1 point
 - Innovative wastewater treatment: 1 point

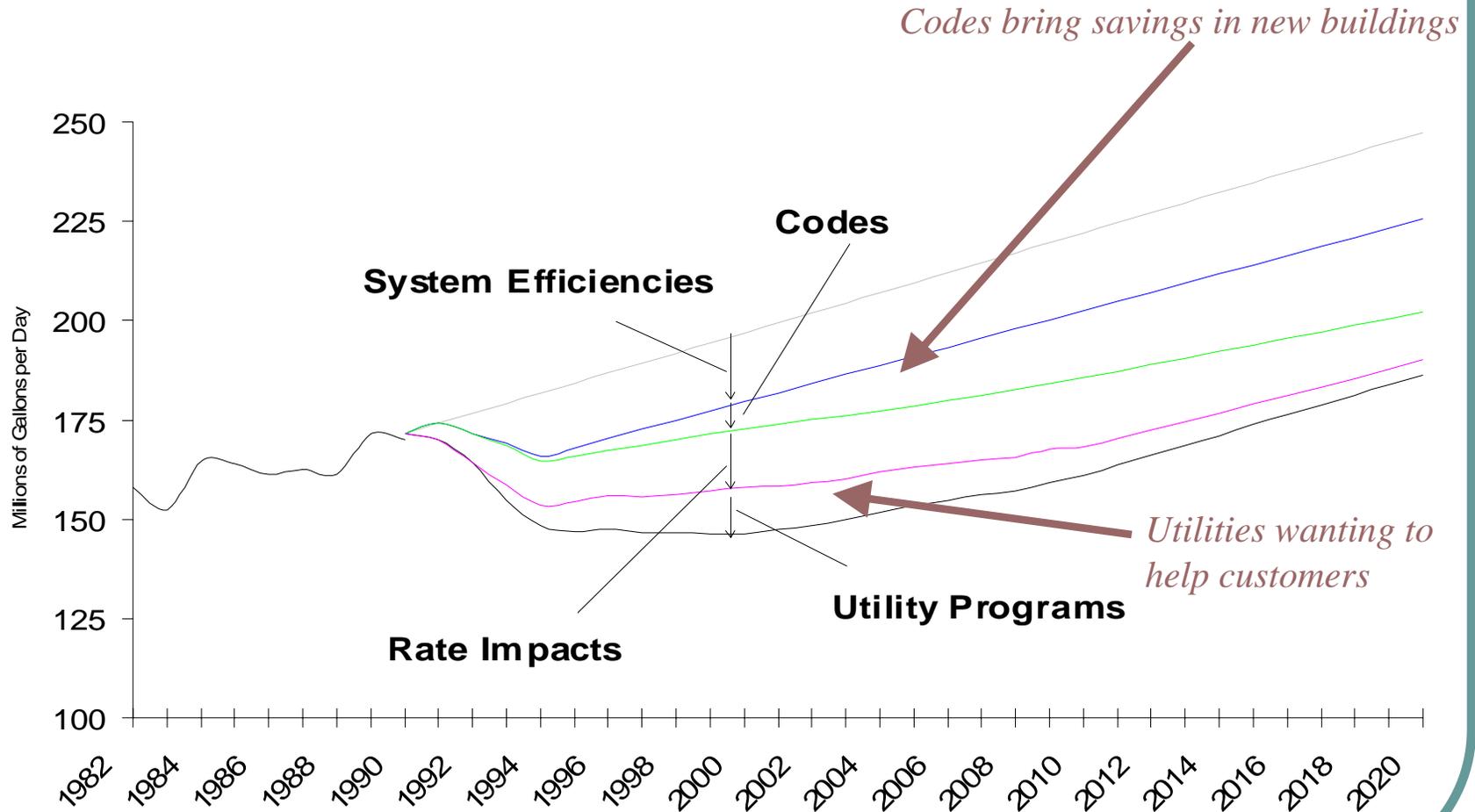


Success of Conservation

**Growth in Population and Water Consumption
Seattle Regional Water System: 1975-2004**



Reduction Breakdowns



Water and Wastewater Rates

- **Water**

- Historically low rates:
 - steadily increasing in recent year
- \$1 to \$4 per CCF (ccf = 748 gallons)
- Summer rates
 - 50%+ seasonal increase

- **Wastewater**

- Significant recent and future costs
- Up to 3x cost of water
- Billed by:
 - Variable: water use volume
 - Flat: flat fee
 - Hybrid: combination of variable and flat

Seattle Commercial Water Rates	2007
Winter (8 months)	\$ 2.29
Summer (4 months)	\$ 3.35
<i>Annual average</i>	\$ 2.64
Wastewater	\$ 7.45
Combined	\$ 10.09

Still...water/wastewater costs are cheap; less than \$0.015 per gallon

LEED and Water...pros and cons

- **Pros**

- A driver for new technologies
- Gives water some attention that it deserves

- **Cons**

- Doesn't encompass all water uses
 - Indoor: only toilets, urinals, aerators, showerheads
- Doesn't factor in customer satisfaction or performance
 - Potentially unhappy customers and maintenance staff
- Life cycle costs not necessarily minimized
- Bad experiences may do more harm than good

- **Soooo...think beyond LEED, especially indoors**

Moving on to opportunities...



Before we talk conservation...

Metering fees

- **Minimize meter size for new construction**
 - Goes up significantly for 3"+
 - 2" installation & connection: ~ \$10,000
 - 3" installation & connection: ~ \$30,000
- **Downsize existing meters**
 - If smaller meter can supply adequate volume
 - Be aware that oversized meters can run slow
- **Install irrigation-only or deduct meters**

Meter Size	Monthly Charge	Max Flow (gpm)
3/4"	\$7.45	30
1"	\$8.30	50
1 1/2"	\$13.50	100
2"	\$20.70	160
3"	\$43.90	450
4"	\$73.10	1000
6"	\$119.80	2000



These fees all vary widely by water provider

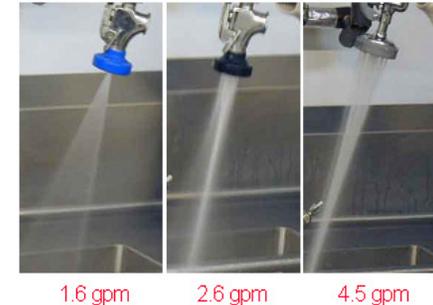
Commercial Water Use Drivers

- **Human occupancy**
- **Age of building**
 - Codes since 1994 have made buildings more water efficient
- **Commercial uses**
 - Largely restroom driven
 - Types of fixtures
 - Tenants (restaurants, health clubs, etc.)
 - Food service?
 - Cooling towers?
 - Irrigation?
 - Vehicle washing?
 - Laundry?
 - Water purification/backflushing
- **Irrigation needs/practices**

* **Fixture specs/ratings are often not accurate**
* **Square footage is generally a bad indicator of consumption**

Kitchen/Laundry Water Uses

- **Dishwashing equipment**
 - Rack washers
 - Pre-rinse sprayers
- **Misc. uses**
 - Water-cooled refrigerator/freezer condensers
 - Disposals
 - Ice machines
 - Dipper wells
 - Steamers
 - Drain water tempering
- **Laundry**
 - WashWise standard machines
 - Commercial: rinse water reuse?



WASHWISE

Irrigation

- **2 possible LEED points**

- 50% reduction from base consumption
- No potable water for irrigation

- **Base irrigation**

- Turf, non-native plants, conventional pipe irrigation

- **50% reduction**

- native plantings, drip/low volume irrigation, captured rain or recycled site water

- **No potable**

- no permanent irrigation, captured rainwater or recycled water



Irrigation Controllers

- **Standard clocks**
 - Typically semi-programmable
 - Pins for on/off hours
 - Manual adjustments
- **Maxicom**
 - Programmable “Cadillac” system
 - Full zone control
 - Weather based scheduling
 - Flow sensor system shutdown



Rain/moisture Sensors

- **Rain sensors**

- Simple technology
 - Will shut off irrigation system if sensor is wet
 - Inexpensive to install
 - Install where rain won't be blocked



- **Moisture sensors**

- Mixed effectiveness
 - Set in soil to assess if adequate moisture
 - Whole system operated by one point or limited data



Other Outdoor Uses

- **Restrooms**

- Toilets usually are not 1.6 gpf
- High uses/fixture



Cisterns/Rain Catchment

- **Toilet flushing**
 - Year-round potential use
- **Irrigation**
 - Huge capacity needed in the Northwest
- **Questionable cost effectiveness**
 - Consider minimizing toilet/irrigation uses first
- **O&M costs should be considered**

Innovative Wastewater Technologies

- **1 LEED point**
 - Generally difficult to obtain
 - Composting toilets
 - “living system” wastewater treatment on site
 - Indoor water measures will reduce your wastewater volumes



LEED Indoor points: Restrooms

- Sinks
- Showers
- Toilets
- Urinals
- **2 Possible LEED points**
 - 20% reduction from 1992 Energy Policy Act
 - 30% reduction from EPA Act



Showerheads/Aerators

- **Aerators**

- Code: 2.5 gpm
 - Code is 0.5 for commercial – rarely followed
- 1.0 gpm offers good flow



- **Showerheads**

- Code: 2.5 gpm
- Many good 1.5 gpm – 2.0 gpm models on market
 - Test for rated flow



Choose pressure compensating products



Autosensor Equipment

Technology has improved significantly over past few years...still very expensive

- **Flushometers**

- Will almost certainly increase water use
 - Multiple flushes with single use: phantom flushing
 - Courtesy flushing
 - Periodic flushing
- Can be calibrated:
 - Time in front
 - Distance
 - Can be retrofit onto many existing flushometers



- **Sinks**

- Tend to minimize faucet run-time



Toilets: Water Consumption

- **Code maximum**
 - Pre-1980: 5 gpf
 - 1980 - ~1994: **3.5 gpf**
 - 1994 to current: **1.6 gpf**
- **LEED: use newer technologies**
 - High Efficiency Toilets (HETs)
 - Dual-flush
 - Many are washdown design
 - Potentially poorer bowl cleaning
 - 1.28 gpf or less (20% less than code)



Toilet Basics

- **Tank toilets**

- Standard
- Pressure assist



- **Flush valve (commercial) toilets**

- 4 bolt wall hung
- Floor mount
- 3 bolt wall hung
 - Current 3.5 gpf exemption for “blowout” fixtures
 - Loophole in the law...Stadiums, prisons, airports, etc.
 - Don't waste water. A good 1.6 gpf blowout fixture exists



Toilet Fixture Use

- **General rule is 5 flushes per person per day**
 - Can vary widely
 - Women use toilets more (some male uses are urinals)
 - Some people have 5 uses/day at work
 - Some people/kids have no uses per day
 - Many people appear to pre-flush
- **Cleaning uses need to be factored in**
 - Can vary from one to three flushes per fixture/day

Toilets: Commercial Flushometers

- **Diaphragm**
 - Used for many decades
 - Easily clogged by debris
 - Newer styles attempt to bypass debris
- **Piston**
 - Less susceptible to debris-related clogging
- *Sensor valves available for both of these*



Some brands of flushometers adjust within a range of volumes

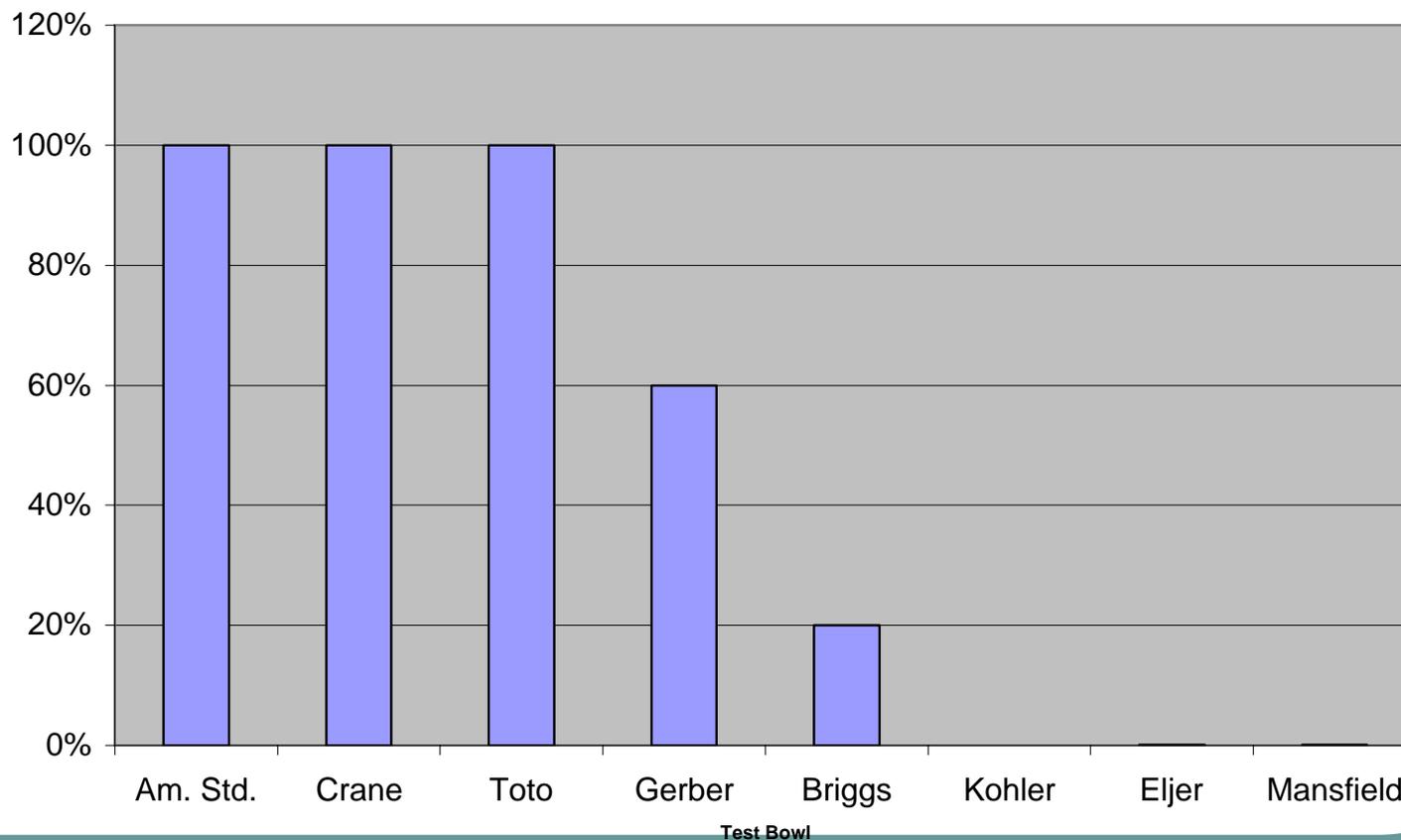
Tank Toilets

- **Choose FlushStar toilets**
 - Performance and Longevity
 - 250 g or more before clogging
 - Less than 2.0 gpf with replacement flappers



Toilet Bowl Performance (4 Bolt Wall Mount)

Percentage of Complete Flushes with 25 ft. Tissue Using
1.15 gpf Gem II Valve at 70-75 psi Static



Toilets: Flushometer Issues

Peak flow ~ 25 gpm

Flush cycle is ~ 5 to 9 seconds

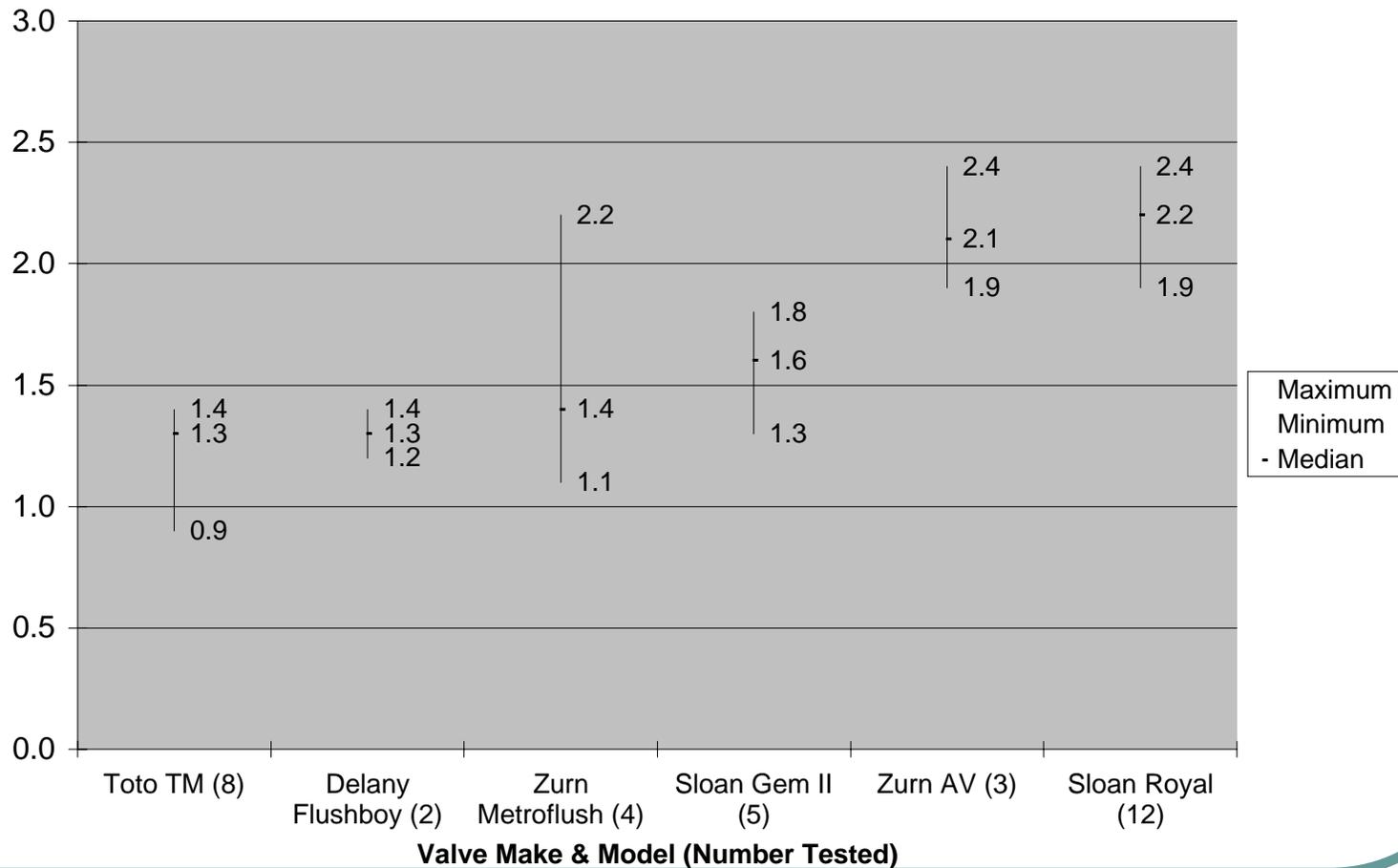
- **Flush volumes are rarely as rated**
 - Typically flush more water...more on this soon.
- **Same model can have wide range of volumes**
- **Internal parts/volumes are interchangeable**
- **Static & running pressure can impact flush and volume**
 - Building pressure below 30 psi is a cause for performance concerns
- **Dual flush handles may not be result in savings**
 - Men have urinals
 - Women often flush toilet paper

“Rated” flush volume listed under valve



Flushometer Testing

**Flush Volumes for Tested Valves
70 psi Static**



Toilet Configuration Recommendations

- **Recommendations for UW**

- 4 bolt wall mount:
 - Sloan Gem II valve/Crane “Placidus” bowl
 - Sloan Gem II valve/Toto CT708 bowl.
 - Third place bowl: American Standard Afwall
 - Toto valve: good performance but adjustments are necessary
- Floor mount toilets
 - Anecdotal data...ask us later

Urinals: Water Consumption

- **Code maximum**
 - Pre-1980: 3.5 was common...no clear code
 - 1980 - ~1994: **1.5 gpf**
 - 1994 to current: **1.0 gpf**
- **LEED: use newer technologies**
 - High Efficiency Urinals (HEUs)
 - Waterless
 - 0.5 gpf or less
 - 1/8 gpf now available



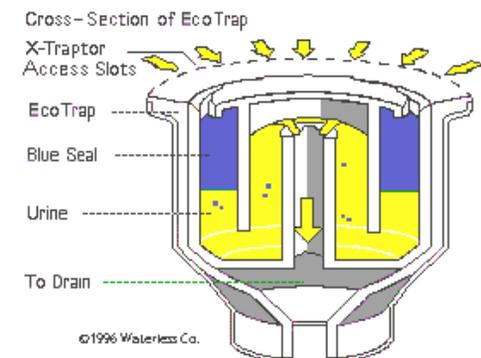
Urinals: Flush methods

- **Flushometer**
- **Autosensor**
- **No flush**



Waterless Urinals

- **Fluid-filled trapway**
 - Allows urinal to flow through
 - Must be refilled or replaced based on uses/time
- **Type of construction**
 - First models were fiberglass or plastic
 - Porcelain models now on market
- **Number of manufacturers making products has increased significantly in recent years**



Waterless Urinal Issues

- **High O & M costs**

- Replacement fluid and cartridges are expensive
- Salts can build-up in drainline
- Cleaning is different: water down drain is undesirable

- **Customer/Custodian/Plumber satisfaction**

- Ventilation/Odors
 - Can be perceived or real issue – reason to complain
- Clogged cartridge can cause slow draining
- Slope of drainline?

- **(if applicable)...retrofits can be difficult**

- Waste outlet is lower than most urinals
 - Large distance between outlet and lip of urinal
 - Can result in urinal lip being high off ground



No Water Urinals



Kohler Steward



Waterless



Falcon/Sloan



Duravit

Other High Efficiency Urinals (HEUs)



Kohler Bardon

0.5 gpf



Zurn

0.125 gpf

Efficiency by Design

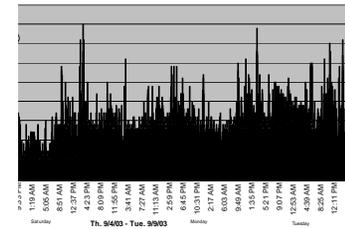


- **Consider longevity/performance of fixtures/equipment**

- Washerless faucets
- FlushStar toilets

- **Water monitoring**

- Building management system real-time link
- Sub-metering major potential uses:
 - irrigation, cooling towers, vehicle washing, water features, tenants



- **Life cycle costing**

- Maintenance costs
- Replacement costs



- **Research the most efficient technologies**

- Food Service
- Laundry
- Other processes
- Cooling towers
 - Conductivity controllers to minimize blowdown



Efficiency by Design

- **Eliminate or minimize fountains/water features**
 - May have backflushed filters for water quality
 - Good candidates for sub-metering makeup water
- **Locate potential water wasters to reduce costs and simplify future maintenance**
 - Hot water
 - Domestic hot water circulation loop? (could waste energy)
 - Locate water heating near point of use
 - Trap primers
 - Used to prevent sewer gases from entering building
 - Should be set for very little water consumption
 - Accessible piping locations



Commissioning for Water Conservation

- **Check all toilets**
 - New construction/shutdowns can cause debris to clog valves
 - Look for leaks and proper flow rate
 - Flush each toilet
- **Check all other equipment for proper flow rate and operation**
 - Trap primers for minimal flow
 - Push button faucets: 10 seconds or less

Resources

- www.savingwater.org Saving Water Partnership(Seattle Public Utilities and Partnering Water Utilities): technical assistance. A report on Water Closet Performance Testing of approximately (50) different tank type toilet models is available here.
- www.resourceventure.org Business and Industry Resource Venture: technical assistance.
- www.waterwiser.org American Water Works Association: online conferences, drip calculator, reference materials.
- www.cuwcc.org California Urban Water Conservation Council: online newsletter “Waterlogue” (listed under “Product News”), plumbing industry links, reference materials, and the Los Angeles Supplementary Purchase Specification. This specification is currently the most stringent toilet testing standard in the nation for tank style toilets. The listing of toilets that have passed the test can be found at this site by clicking “Product News”, then “Technical Information.”
- www.p2pays.org North Carolina Dept. of Environment and Natural Resources: Water Efficiency Manual for Commercial, Industrial, and Institutional Facilities, 1998, available for free download at under “Technical Resources.”
- www.sbcc.wa.gov Washington State Building Code Council: building and plumbing codes online.
- www.eren.doe.gov/femp/techassist/best_practices.html Federal Energy Management Program (FEMP): Best management practices and other useful info.

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