Erreca and Westley SRRA Waterless Urinals

Case Study

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Water and Wastewater Branch
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Caltrans

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Executive Summary

Erreca and Westley rest areas are located along one of the highest used sections of Interstate 5. Water resources are fairly limited at both rest areas and Caltrans district staff has installed a variety of technologies to help reduce water usage. One of the most effective measures they have installed to date has been waterless urinals. Since their introduction, they have helped save approximately 2.7 million gallons of water at the Erreca Rest Area from 2009 and 1.5 million gallons of water at Westley Rest Area from 2012.

District and contract maintenance employees have generally found the waterless urinals to be very serviceable and easy to maintain. However, several issues and concerns were identified during a site visit which should be addressed in future installations in order to improve performance and maintenance of the technology. Most notably, the maintenance staff needs to be provided with the proper brushes, cleaners, cartridges, sealant and other equipment. The staff was given the proper training and information regarding waterless urinal maintenance.

The effectiveness of different brand urinals was somewhat varying. The Sloan porcelain urinals were found to operate relatively odor free and appeared to be clean and sanitary. The ZeroFlush stainless steel urinals were discolored and appeared to be dirty even after cleaning. They also emitted a considerable amount of odor even when the cartridge was in place due to the poor cartridge mounting interface.

Estimates suggest that there are currently limited financial incentives for implementing waterless urinals at these locations. However, higher financial savings are likely in the future as water prices rise in the coming years.

Overall, the fluid sealed waterless urinal technology seems to be a viable option for water conservation. Certain models operated very effectively and odor free. However, special care and precaution should be exercised when selecting this product.

Erreca SRRA Background

Erreca SRRA is located in Caltrans District 10, on Interstate 5, 0.7 miles north of the Fresno county border. This rest area receives nearly 1.5 million visitors each year and has had problems in the past finding enough available water to keep the rest area operational for the entire year. Water is currently drawn directly from the California Aqueduct under the authority of the San Luis Water District. Supply is limited though, and water allocations typically run out before the end of the year forcing the district to find other sources of water available for purchase. This problem, along with a broader district wide mandate in 2005 to cut water usage by 20%, lead the maintenance staff to explore avenues for reducing water usage.

A key technology that is helping them achieve this goal at Erreca SRRA is waterless urinals. Eight have been installed in total at both the Northbound and Southbound rest areas. The first to be installed in 2009, were 4 Sloan porcelain waterless urinals at the Southbound rest area. A few years later in 2012, 4 Zeroflush stainless steel urinals were installed at the Northbound rest area. In 2012, Sloan waterless urinals were also installed at Westley rest area.

Figure 1: Aerial view of Erreca Rest Area with California aqueduct to the right

Waterless Urinal Overview

Sloan Model: WES-4000

The Sloan waterless urinals at the Southbound Erreca rest area and Westley rest area were bought from Ferguson Enterprises for approximately $289 each. Replacement cartridges are purchased for an average of $38 a piece from various sources. These cartridges are typically replaced every 3 to 4 weeks. Sealant fluid, which may be used to refill cartridges, is also sold separately for $18 a gallon but is not typically provided to the maintenance contractor.

Figure 2: Sloan Waterless Urinal

These waterless urinals remain notably clean in appearance due to their porcelain construction. They also remain relatively odor free during normal operation. Initially, there were fears regarding the porcelain urinals being vandalized. Fortunately, only one of these urinals has had to be replaced due to vandalism in their nearly 10 years of use. One criticism of this fixture is its small diameter outlet hole which leads to a residual buildup inside of the fixture's urine collection chamber underneath the cartridge.

Zeroflush Model: ZF-301

The Zeroflush waterless urinals at the Northbound Erreca rest area were purchased for approximately $750 each from Ferguson Enterprises. Cartridges for this urinal are purchased for approximately $25 each. Cartridges are typically replaced every 3 to 4 weeks in these urinals as well. Cartridges for this fixture are somewhat difficult to secure properly. Frequent cartridge seal failures have lead to a noticeable and significant amount of odor being emitted from the urinals.

Figure 3: Zeroflush Waterless

These fixtures are very durable and vandal resistant due to their stainless steel construction. However, properties

of the stainless steel in addition to pooling along the flat bottom of the fixture, has lead to considerable staining and discoloration which appears to be permanent.

Maintenance

Routine Maintenance

The Erreca rest area is currently maintained by Lincoln Training Center. Their staff has been trained by the Caltrans site supervisor on the proper maintenance of the fixture. The main cartridge replacement procedure is carried out every 3 to 4 weeks as needed. The steps of the procedure are as follows,

1. The staff receives a cartridge replacement kit sold by the manufacturer which includes a cartridge removal tool, a new cartridge, a disposal bag, a new cartridge, a small packet (2-3 oz. for Sloan)(10oz for Zero-Flush) of blue sealant fluid and an instructions manual.

Figure 4: Typical cartridge replacement kit

2. The spent cartridge is removed from the urinal using the metal tool provided in the re-

Figure 5: removal of Spent Cartridge

3. The urine collection chamber is then cleaned with a toilet brush. A slimy sediment buildup is usually found collecting inside of the chamber and must be removed.

Figure 6: Buildup accumulated after two to three weeks of use

Figure 7: Cleaning urine collection Chamber

4. The urinal is then flushed with 5 gallons of hot water.

Figure 8: Flushing the urinal

5. The new cartridge is then inserted into the urinal and blue sealant solution is poured over the top of the cartridge where it seeps in through a hole on the top of the cartridge.

Figure 9: Installed new cartridge

6. The spent cartridge is placed in the supplied plastic bag and then placed in the trash receptacle.

Figure 10: Disposal of spent Cartridge

Suggestions for Improved Maintenance

The above maintenance procedure is for the most part in accordance with the manufacturer's suggestions but could be improved in a few areas. The first notable problem is that the staff does not have access to the proper 1.5 inch diameter bottle brush to clean the fixture correctly. The toilet brush which is supplied to the staff is too large to clean deep inside of the fixture piping. If the correct brush were supplied it would assist in preventing substantial sediment buildup. Currently, Lincoln Training Center is responsible for supplying all necessary cleaning supplies to their staff. In the future, it should be communicated to Lincoln Training Center's management that their staff needs to be supplied with the appropriate bottle brushes or the brushes should be listed as required equipment within the Caltrans vendor approved maintenance contract. Caltrans staff may also want to explore the possibility of providing these supplies if Lincoln Training Center is unable to.

Cleaning solutions were also not readily available to the staff for flushing the urinal in step 4. The urinals were instead flushed with only hot water. This is probably effective at flushing out most sediment but the addition of one of Sloan's approved cleaning solutions would improve performance. (See attachment 3)

The last key deviation from the manufacturer's recommendation is in step 5. Here the manufacturer's replacement instructions call for the cartridge to be preloaded with a quart of water prior to pouring in the sealant fluid. This step ensures that sealant fluid is not lost during the urinal cartridge's first use. It seems that the omission of this quart of preloaded water

is not causing any loss in effectiveness of the sealant fluid system, as there was no noticeable smell. However, if this procedure is added to the maintenance process it may be possible to conserve a noticeable amount of sealant fluid and so extend the life of the cartridges.

Cartridges for both systems are in theory reusable and sealant fluid is available for purchase separately. However, reuse of the cartridges is not supported by either of the waterless urinal manufactures and requires an extensive cleaning procedure which must be devised by the end user at their own risk.

Issues Regarding Waterless Urinal Maintenance

The staff did have a few complaints regarding the maintenance procedure. The first was the terrible odor that the fixtures emit whenever cartridges are removed for servicing and replacement. If the problem is due to urine sedimentation and buildup, it may be possible to remedy the problem by applying citric acid solution just after removing the cartridge. However, if the problem is due to back flow of sewer gases it may be harder to remedy. Sloan recommends wearing a breathing mask while replacing urinal cartridges if a strong odor is present. In the future, these masks should be provided to the maintenance staff by Lincoln Training Center. The second complaint was regarding the ZeroFlush cartridges. They were notably harder to remove and insert and tended to pop out causing odor to leak out from the fixture even during normal operation. Lastly, the cleaning staff would benefit from longer sturdier gloves that are less prone to ripping. Staff reported that the gloves currently supplied ripped very easily and provided inadequate protection due to their lack of wrist and forearm coverage. Lincoln Training center and/or Caltrans should provide staff with sturdier and longer gloves.

Plumbing Problems

The plumbing directly behind these urinals occasionally gets clogged with urine sediment at which point it has to be fixed by Caltrans staff. To clear the clog the section of piping with the sediment is removed and scrubbed. It is then thoroughly rinsed and replaced. It is estimated that this occurs every 3 to 4 years. A couple remedies have been suggested to address this problem. The first modification which has been made on the Southbound side of Erreca SRRA is a switch to PVC piping for all of the comfort station plumbing. The

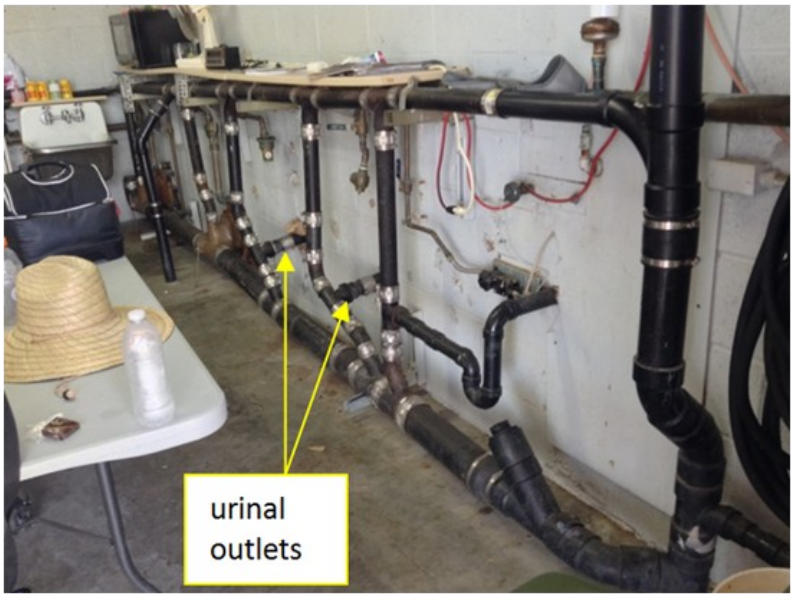


Figure 11: PVC plumbing at South Bound Erreca Rest Area

expectation is that the smoother surface of the PVC will deter buildup. The second idea is to improve the cartridge maintenance routine so that the urinals can be more thoroughly cleaned and flushed.

One recommendation for future rest areas, is to design the plumbing system so that the urinals are the last fixture in the line before it is routed away from the building. This will allow the flow of the other bathroom fixtures to aid in washing away urine sediments from the piping directly behind the urinal. At Erreca rest area this was not a significant problem since the plumbing is configured in exactly this manner. However, at Westley rest area urine sedimentation within the piping is a much more common problem due to the plumbing configuration which isolates the urinal piping from the flow of the other bathroom fixtures.

Additional Maintenance Pictures

Figure 12: Permanent Discoloration of ZeroFlush Urinal

Figure 13: Sediment buildup removed from fixture

Figure 14: Removal of Zero Flush Urinal Cartridge

Performance Comparison

Table 1: Waterless Urinal Performance Comparison

	Sloan	ZeroFlush
Initial cost	$289	$750
Cartridge cost	$38	$25
Maintenance issues	Small outlet drain leads to sediment buildup in urine collection chamber, significant odor when replacing cartridge	Cartridge locking system is difficult and prone to failure, significant odor when replacing cartridge
Vandal resistance	May be broken by vandals in high risk areas	Vandal resistant due to stainless steel construction
Appearance	Easily cleaned to like new condition.	Discoloration and staining cannot be fully removed and causes fixture to appear dirty even after cleaning
Smell	No significant odor during normal use	Significant odors due to frequent cartridge seal failure

Expenses & Savings at Erreca Rest Area

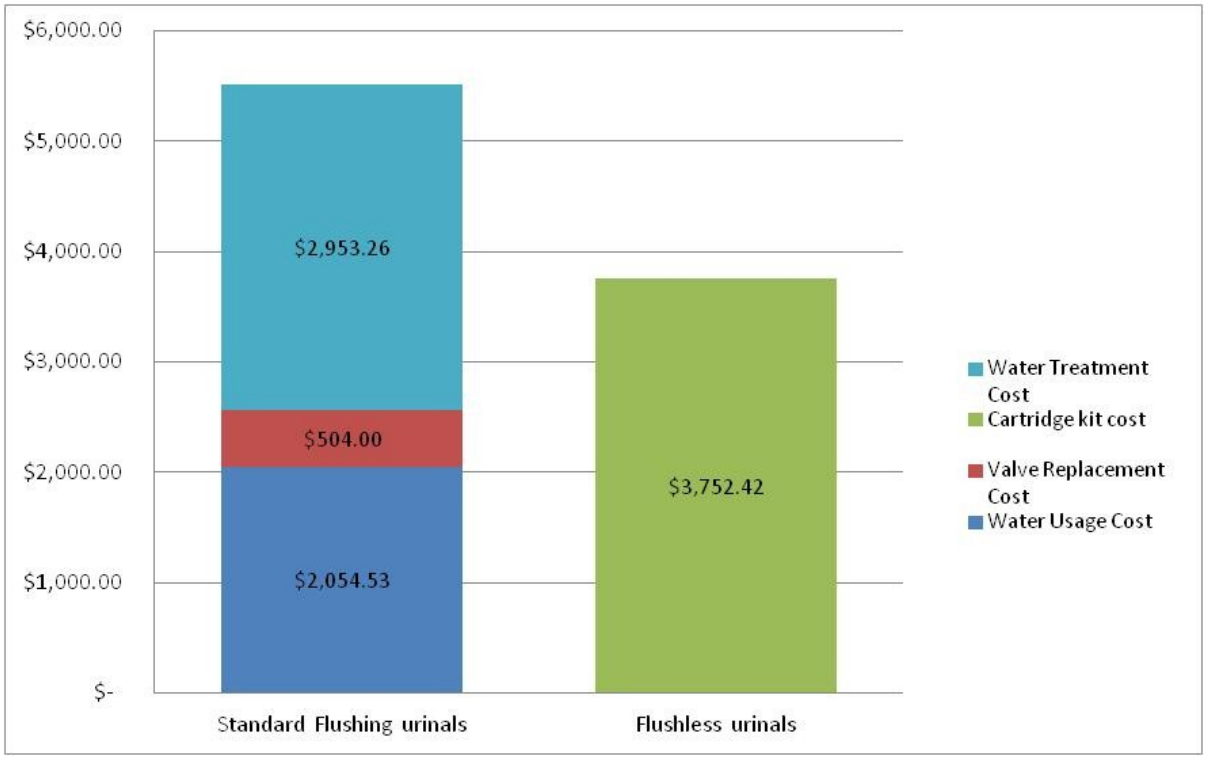
The Erreca Rest Area currently gets its water from the San Luis Water District. Water prices are as high as $879 per acre foot (ac-ft) and are expected to increase steadily in the coming years. The facility on average uses a total of 32 ac-ft (10,427,245 gallons) per year. Of this total, it is unknown how much is used for irrigation and how much is used for comfort station facilities. Staff estimated that after the installation of all eight waterless urinals, water usage dropped by approximately 4 ac-ft per year (1,303,406 gallons/yr). Flow estimates based on off ramp traffic counts suggest that the water savings is closer to 2.34 ac-ft per year (762,492 gallons/yr). This equates to approximately a $2,055.00 savings per year.

The Erreca Rest Area also has an onsite water treatment system which processes all of the incoming water to the rest area. It is likely that water treatment costs have been reduced somewhat proportionally to the amount of potable water which has been saved by the waterless urinals. Accounting for water treatment savings in this manner correlates to a $2,953 savings per year. (See table 2)

Maintenance staff also estimates that in the past when standard flush urinals were in use a flush valve required replacement every 2-3 months at the rest area. This equates approximately to a $504 annual cost that is also no longer incurred.

All cartridges for the waterless urinals are currently purchased under an RQS requisition. 200 cartridges are stored onsite and 4 are dispensed to the maintenance staff at a time when they run out. Cartridges are not carried in stock at most supply houses and must be ordered far in advance to ensure that they arrive when needed. Cartridges are available in stock at Grainger Inc. However, Caltrans staff did not want to order through this company due to multiple past experiences in which procurement receipts were filed inaccurately by Grainger Inc. Cartridge expenses per waterless urinal average $469 per year. For all eight urinals this sums up to approximately $3,752 in cartridge cost per year for the rest area.

Table 2: Total Annual Urinal Expenditure Estimates for Erreca Rest Area



With water savings (-$2,055), water treatment savings (-$2,953), maintenance savings (-$504), and cartridge costs ($3,752) taken into account it appears that using waterless urinals is saving close to $1,700 annually.

Savings could potentially be much higher in built in and permanent trap systems where only fluid must be replaced.

Reduced Potable Water Demands and Wastewater Loads on OWTS

Waterless urinals have greatly reduced potable water demands at Erreca SRRA. This has relieved many of the stresses that the water supply system experienced during peak visitation. More specifically, the Southbound rest area at Erreca SRRA continually had difficulties in the past with adequate water pressure due to inadequate pipe size. Waterless urinals have reduced the load on this pumping system and have for the most part remedied the issue. Waterless urinals have played a key role in increasing the operational reliability of the rest area and has helped keep the rest area free of any water supply related issues.

Another key benefit of waterless urinals in this application is the reduction of wastewater loads. Both Erreca rest area, and the nearby Westley rest area, have onsite wastewater Treatment Systems (OWTS). Because of this, both rest areas are very susceptible to wastewater overloading if peak demands reach levels excessively higher than the designed treatment capacity. Before the installation of waterless urinals, the systems at both of these rest areas routinely operated at and above their capacity during these peak surges of visitor traffic. At Westley rest area specifically, the leach fields which are meant to disperse treated wastewater underground would occasionally be overloaded causing sewage overflow and surface ponding. While using waterless urinals does not reduce amount of minerals and organic content that must be treated, it does reduce the physical volume of liquid that is sent through the treatment system which is critical to preventing overloads. Removing unnecessary urinal flush water from the treatment process reduces wastewater flows to levels that are manageable for the system. Since the introduction of waterless urinals, no sewage overflows have occurred at either of the rest areas. Waterless urinals have made operations at these rest areas environmentally safer.

Conclusion

Waterless urinals have saved approximately 2.7 million gallons of water at the Erreca Rest Area and 1.6 million gallons of water at Westley Rest Area. District and maintenance employees were generally very supportive of the new waterless technologies. Numerous issues and concerns were identified during a site visit which should be addressed with certain procedural and product improvements.

The effectiveness of the installed waterless urinals was somewhat varying. The Sloan urinals seemed to be operating relatively odor free and appeared to be clean and sanitary. The ZeroFlush stainless steel urinals were discolored and appeared to be dirty eve after cleaning. They also emitted a considerable amount of odor even when the cartridge was in place.

During and after installation proper training and information must be provided regarding cleaning procedures and maintenance of the waterless urinals. Proper brushes, cleaners, cartridges, sealant and other equipment must be provided to ensure safe and clean maintenance. Some further investigation is needed in order to address the maintenance concerns regarding odor during cartridge replacement and poor cartridge mounting interface.

Overall the fluid sealed waterless urinal technology seems to be a viable option for water conservation. However, special care and precaution should be exercised when selecting this product.

Individuals Interviewed for Case Study

Caltrans Staff

Kent Kibble (CT Maintenance Manager I) (209) 948-7259

Jack Avalos (CT Landscape Maint. Lead worker) (209) 576-6204

Ken Thomson (Landscape Assoc, CT Range-D) (916) 227-5340

Jon Bevan (CT Maintenance Area Supt.) (209) 948-7530

John Miller (CT Maintenance Area Supt.) (209) 576-6316

Lincoln Training Center Staff

Michael Martin (559-408-8668) South Bound rest area

Linda Ponce (559-474-2207) Northbound rest area

Various onsite cleaning staff at both Northbound and Southbound rest areas

Attachment 1: Types and Manufacturers of Waterless Urinals

There are many other companies that manufacture waterless urinals. Below is a listing of the different types of waterless urinals along with a listing of several companies that manufacture them.

Disposable Cartridge Style Waterless Urinals

These are by far the most widely available and prevalent type of waterless urinal. The urinal works by utilizing a sealant fluid which is lighter than water. This fluid floats on top of water and urine creating a seal which allows urine to flow through while sewer gases remain trapped beneath it.

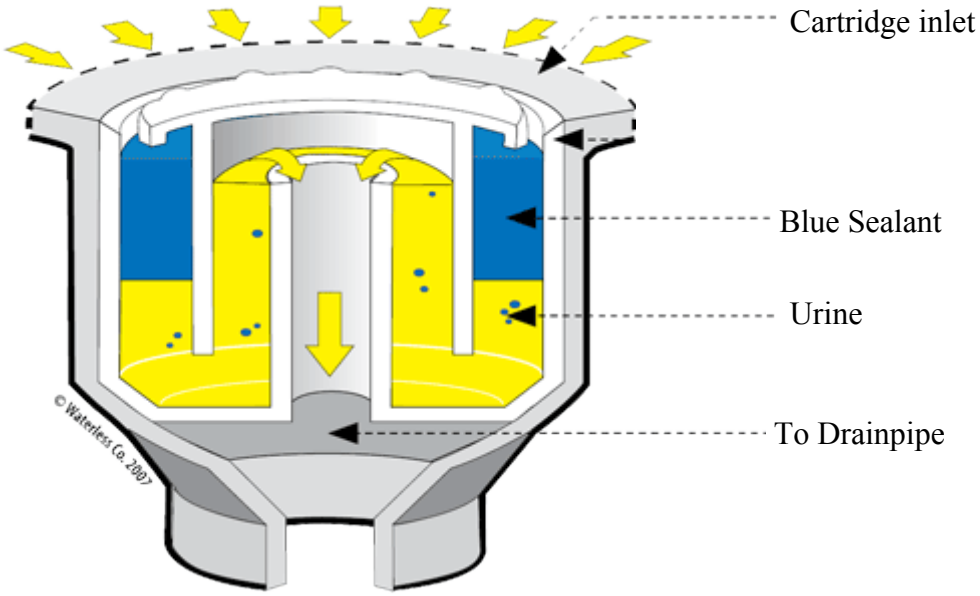


Figure 15: Typical Waterless Urinal Cartridge

Disposable Cartridge Style Waterless Urinals Manufacturers

Sloan

Sloan sells porcelain waterless urinals with a disposable cartridge. The technology that is used has been licensed from Falcon Waterless urinals

Zero Flush

Zeroflush sells porcelain and stainless steel waterless urinals with disposable cartridges.

Waterless Brand

Waterless brand sells urinals with a disposable cartridge system. Cartridges for these fixtures are around $8.00. The outlet drain is 2" in diameter. All fixtures are porcelain.

Falcon

Falcon sells porcelain urinals with disposable cartridges that have blue sealant fluid inside. Falcon urinals use the same style cartridges as Sloan urinals since Sloan has a license to use Falcon's urinal technology in its products.

American Standard

American Standard sells cartridge based waterless urinals. Their technology is licensed from Zeroflush so performance is nearly identical. Cartridges are disposable and sealant fluid is poured into each new cartridge. All fixtures are porcelain.

Time Mist

Time Mist sells cartridge based waterless urinals. Their technology is also licensed from Zeroflush. All fixtures are porcelain.

Uridan

Uridan make ceramic and glass fiber reinforced plastic urinals. Their replaceable cartridge use biodegradable plant-based sealant fluid.

Built in Trap Waterless Urinals

These urinals function on the same principles as the replaceable cartridge urinals. However, the blue sealant fluid is poured into a trap that is built into the urinal. These urinals often have removable traps that look similar to a cartridge but are intended to be cleaned and reused for the life of the fixture.

Built in Trap Waterless Urinals Manufacturers

Kohler

Kohler sells built in trap waterless urinals so there is no cartridge to replace. The urinal is simply flushed out with water and new sealant fluid is poured directly into the urinal where it is caught in the built in trap. All fixtures are porcelain.

Zurn

Zurn sells urinals that have a permanent trap that is removable for cleaning. The system uses blue sealant fluid that is sold separately.

Duckbill Diaphragm Waterless Urinals

These urinals utilize a funnel which is design to open to allow urine flow and curl up afterwards to create a barrier from sewer gas seepage. This technology is somewhat unproven but claims to require less maintenance than cartridge based systems. This technology is predominately used in industrial stainless steel fixtures.

Duckbill Diaphragm Waterless Urinals Manufacturers

Bestcare

Bestcare sells stainless steel fixtures that are painted white. It uses a duck bill diaphragm as a gas barrier.

Acorn

Acorn sells stainless steel urinals with a duckbill diaphragm as a gas barrier.

Ecotech

Ecotech sells urinals that use a duck bill diaphragm as a gas barrier.

Neo-Metro

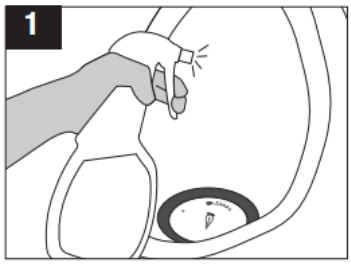
Neo-Metro sells stainless steel urinals that use a duck bill diaphragm as a gas barrier.

Attachment 2: Sloan Maintenance and Cartridge Replacement Instructions

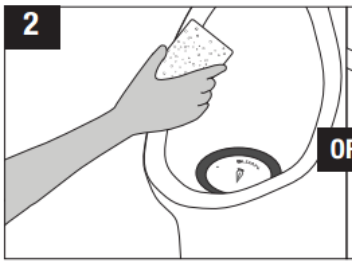
SLOAN®
Water Connects Us™

CLEANING AND CARTRIDGE CHANGING INSTRUCTIONS

URINAL BOWL CLEANING INSTRUCTIONS

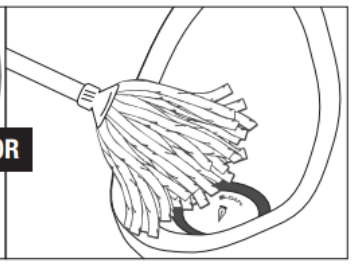


Spray (mist) cleaner on the entire bowl and wipe outside then the inside.



Clean outside and inside of bowl with rag or sponge.

OR



Clean the entire outside and inside of bowl with mop.

WHEN SHOULD A CARTRIDGE BE CHANGED?

Blue sealant appears on top of the cartridge

OR

Fluid flows very slowly into the cartridge

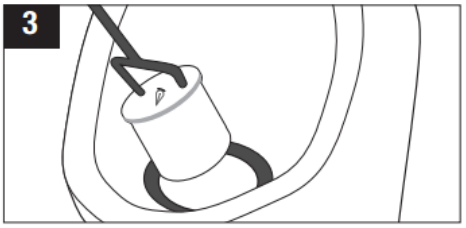
OR

Fluid does not drain into the cartridge

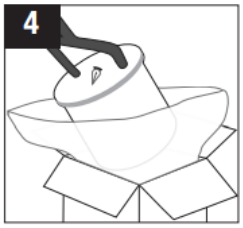
CARTRIDGE CHANGING INSTRUCTIONS

Insert key into cartridge.

Turn key to left to unlock.

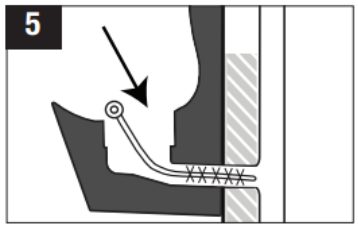


Lift and tilt cartridge to drain all free liquids (water, sealant and urine).

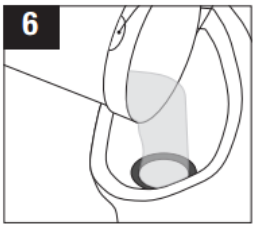


Place cartridge into bag, tie bag to seal and dispose.

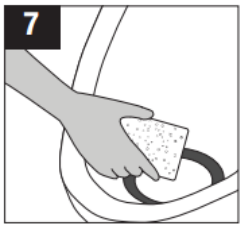
CAUTION After removing cartridge from housing, certain naturally occurring but **potentially hazardous sewer gases may escape through the opening until re-installed properly.** If replacement cartridge will not be re-installed immediately, place a rag or paper towels into opening to block any sewer gases. Remove the paper towels or rag prior to inserting new cartridge. Never smoke, have an open flame, or place your nose or mouth near waterless urinal housings into which a cartridge is not yet properly installed. You also can wear a breathing mask when removing or installing any waterless urinal or cartridge to reduce potential exposure to any such gases.



Scrub the housing and deep inside of the tailpipe with a long 1.5-inch diameter nylon brush.

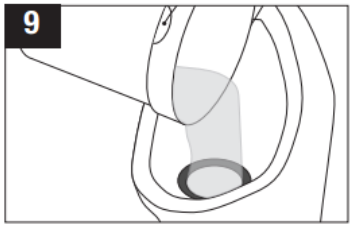


Flush housing with 5 gallons (20 liters) of hot soapy water.



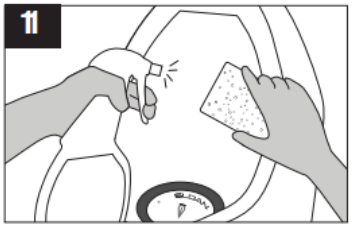
Wipe clean inner stainless steel rim.

Insert new cartridge into housing and turn key to right to lock and click into place.



Slowly fill cartridge with 1 quart (1 liter) or more of clean water until there are no air bubbles.

Add blue sealant (allow time to drain into cartridge).



Spray (mist) cleaner and wipe clean.

Attachment 3: Sloan Recommended Cleaners

North American Cleaner Recommendations *(updated 03/28/09)*

SLOAN Waterfree

Important: Using a spray bottle, apply properly diluted cleaner by spraying/misting onto the surface of the urinal and wiping away with a rag or sponge. Never apply cleaner directly into the cartridge.

Optimal

3M / 19L Non-Acid Bathroom Cleaner - Ready-to-use and concentrate. Product/Bar Code: 34-8506-4579-6

3M / 23L Neutral Quat Disinfectant Cleaner - Concentrate disinfectant. Rinse-free. Product/Bar Code: 34-8506-3356-0

CB Chemie / BIO-CHEM WLU Cleaner - Ready-to-use and concentrate. Specifically formulated for waterfree urinals. Product/Bar Code: N.A.

The Clorox Company / Clorox Anywhere Hard Surface Cleaner - Ready-to-use disinfectant. Product/Bar Code: 4460001683

Fortech / Waterfree Urinal Cleaner - Ready-to-use. Specifically formulated for waterfree urinals. Product/Bar Code: 177-32

Rancho Industrial Supply / Lightning - Concentrate. Neutral disinfectant germicidal cleaner. Product/Bar Code: 6836-206-37265

Rochester Midland Corp / Enviro Care - Concentrate. Product/Bar Code: 120020. GreenSeal certified.

Sloan / Clean Green Waterfree Urinal Cleaner - Concentrate. Product/Bar Code: 6.290.100

Spartan / Waterfree Urinal Cleaner - Organic-acid based cleaner, specically formulated for waterfree urinals. Ready-to-use. Product/Bar Code: 7180 / 53727-14710

TEC-Chem / Non-Acid Bowl Cleaner - Ready-to-use. Product/Bar Code: 0-40064-52662-7

Total Maintenance Solutions (TMS Group/IMSCO) / Cleaner for Waterfree Urinals - Ready-to-use. Product/Bar Code: 60300112

Utility Wonder Products / Cleaner for Waterfree Urinals - Ready-to-use. Product/Bar Code: 25-5010

Recommended

3M / 4L Bathroom Disinfectant Cleaner - Concentrate disinfectant. Product/Bar Code: 34-8508-5194-9

3M / 15L Non-Acid Disinfectant - Concentrate disinfectant. Product/Bar Code: 34-8506-3340-4

3M / 25L HB Quat Disinfectant Cleaner - Concentrate disinfectant. Rinse-free. Product/Bar Code: 34-8506-1260-6

Betco / Sanibet RTU Cleaner - Ready-to-use disinfectant. Product/Bar Code: EPA 6836-290-4170

The Butcher Company / Morning Mist Disinfectant Cleaner Solution #33 - Ready-to-use and concentrate disinfectant. Product/Bar Code: N.A.

Choisy Labs / AMFO - Ready-to-use disinfectant. Product/Bar Code: 3051

Coastwide Labs / Virustat DC - Concentrate disinfectant. Rinse-free. Product/Bar Code: CLO491

Hillyard Industries / Arsenal Non-Acid Restroom Disinfectant/Cleaner #19 - Ready-to-use disinfectant. Product/Bar Code: HIL0081922

Midlab, Inc. / Bright Solutions Hard Surface Sanitizer - Ready-to-use disinfectant. Rinse-free. Product/Bar Code: BSL4300012

Midlab, Inc. / Maxim Table Top Sanitizer - Ready-to-use disinfectant. Product/Bar Code: DS430

Spartan Chemical / hdqC 2 Clean on the Go - Concentrate disinfectant. Product/Bar Code: EPA 1839-169-5741

Waxie / 710 Multi-Purpose Disinfectant Cleaner - Concentrate disinfectant. Product/Bar Code: EPA 37265-CA-01

Waxie / Quat 128 Disinfectant Cleaner - Concentrate. Product/Bar Code: EPA 6836-206-14994

For additional information on commercial cleaners, refer to the manufacturers' web sites.

Non-Commercial Cleaner Recommendations

The commercially available cleaners listed above provide the best results for waterfree urinals but if they are not available to you, the following options can be used.

Vinegar and Hydrogen Peroxide – Mix equal parts (1:1) of white vinegar (5%) and hydrogen peroxide (3% solution). NOTE: if using this formula to clean stainless steel, be certain to thoroughly wipe the surface dry when finished.

Citric Acid – Mix 1 part citric acid to 20 parts water.

Sloan Valve Company • Phone 800-982-5839 • Fax 800-447-8329 • waterconservation@sloanvalve.com • www.sloanwaterfree.com

0816570 Rev. 0h (04/09)

Attachment 4: Online Resources

Manufacturers' Maintenance instructions

Sloan Maintenance and Cartridge Replacement Instructions
http://www.sloanvalve.com/Maintenance_Guides/Urinal_Cleaning_and_Cartridge_Replacement.pdf

Zeroflush Maintenance and Cartridge Replacement Instructions
http://www.zeroflush.com/insert_replacement.pdf

Falcon Maintenance and Cartridge Replacement Instructions
http://falconwaterfree-media.s3.amazonaws.com/1373323243-CARTRDIGE_CLEAN_CHANGE_INSTRUCTIONS_ENGLISH.pdf

Falcon Stainless Steel Urinal Maintenance Instructions
http://falconwaterfree-media.s3.amazonaws.com/1332954389-stain_steel_maint.pdf

Further Reading

Waterless Urinals Report and Evaluation by Industrial Economics, Incorporated
http://www.mass.gov/eea/docs/eea/lbe/lbe-waterless-urinals-rpt.pdf

Technology review of urine diversion components by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
http://www.sswm.info/sites/default/files/reference_attachments/MUENCH%20and%20WINKER%202011%20Technology%20Review%20of%20Urine%20Diversion%20Components.pdf

Attachment 5: Measurements and Calculations

Caltrans Ramp Count Data

06/20/2013 CALTRANS TRAFFIC VOLUMES Page # 2
13:35:32 PRINT FILE FOR RAMP AADT

10-MER-005

P POST P MILE	P S	DESCRIPTION	2003 ADT	2004 ADT	2005 ADT	2006 ADT	2007 ADT	2008 ADT	2009 ADT	2010 ADT	2011 ADT	2012 ADT
000.475		NB OFF TO ERRECA REST AREA					1720		1500			1500
000.854		SB OFF TO ERRECA REST AREA					1800		1550			1350
000.891		NB ON FR ERRECA REST AREA								1460		
027.097		NB OFF TO WESTLEY REST AREA					1400	1375				
027.343		SB OFF TO WESTLEY REST AREA					2250	1815				

Erreca SRRA Urinal Flow Estimates Based on Ramp Count Data

	North Bound	South Bound
Traffic (vehicles/day)	1,720	1,800
visitors (people/day)	2,236	2,340
men (men/day)	1,275	1,334
urinal usage (flushes/day)	1,020	1,067
water usage (gal/day)	1,020	1,067
water usage (gal/yr)	372,160	389,470
water usage (ac-ft/yr)	1.14	1.20

Statistical variables

Average number of people per vehicle	1.3
Average percentage male of C.S. usage	57%
Average urinal usage per male at C.S.	80%
Gallons per flush	1.0

Combined water usage (ac-ft/yr)	**2.34**
Total cost ($/yr)	**2,055**

Visitors/yr	**1,670,240**

Water Savings

Gallons/year	761,629
Gallons since 2009	2,691,668

Erreca Water Usage Record

Month	Year	Usage (gal)	Usage (ac ft)	Closing Allocation Balance (ac ft)	Acre Feet Billed	Acre Feet Balance
March	2013	539,300	1.959	39.345	1	
April	2013	892,000	3.103	36.607	4	
May	2013	872,200	3.035	33.930	3	
June	2013	757,000	2.627	31.607	3	
July	2013	1,239,000	4.305	27.804	4	
August	2013	894,200	3.083	25.060	3	
September	2013	686,400	2.442	22.953	3	
October	2013	824,900	3.082	20.422	3	
November	2013	671,300	2.507	18.361	3	
December	2013	533,900	0.969	16.723	1	
January	2014	633,800	0.000	14.778	1	
February	2014	311,200	0.000	13.823	1	
					30	11.00

Erreca SRRA Cost Estimates

Water	
Urinal usage (ac-ft/yr)	2.34
cost per ac-ft	$ 879.00
Cost per year	**$ 2,054.53**

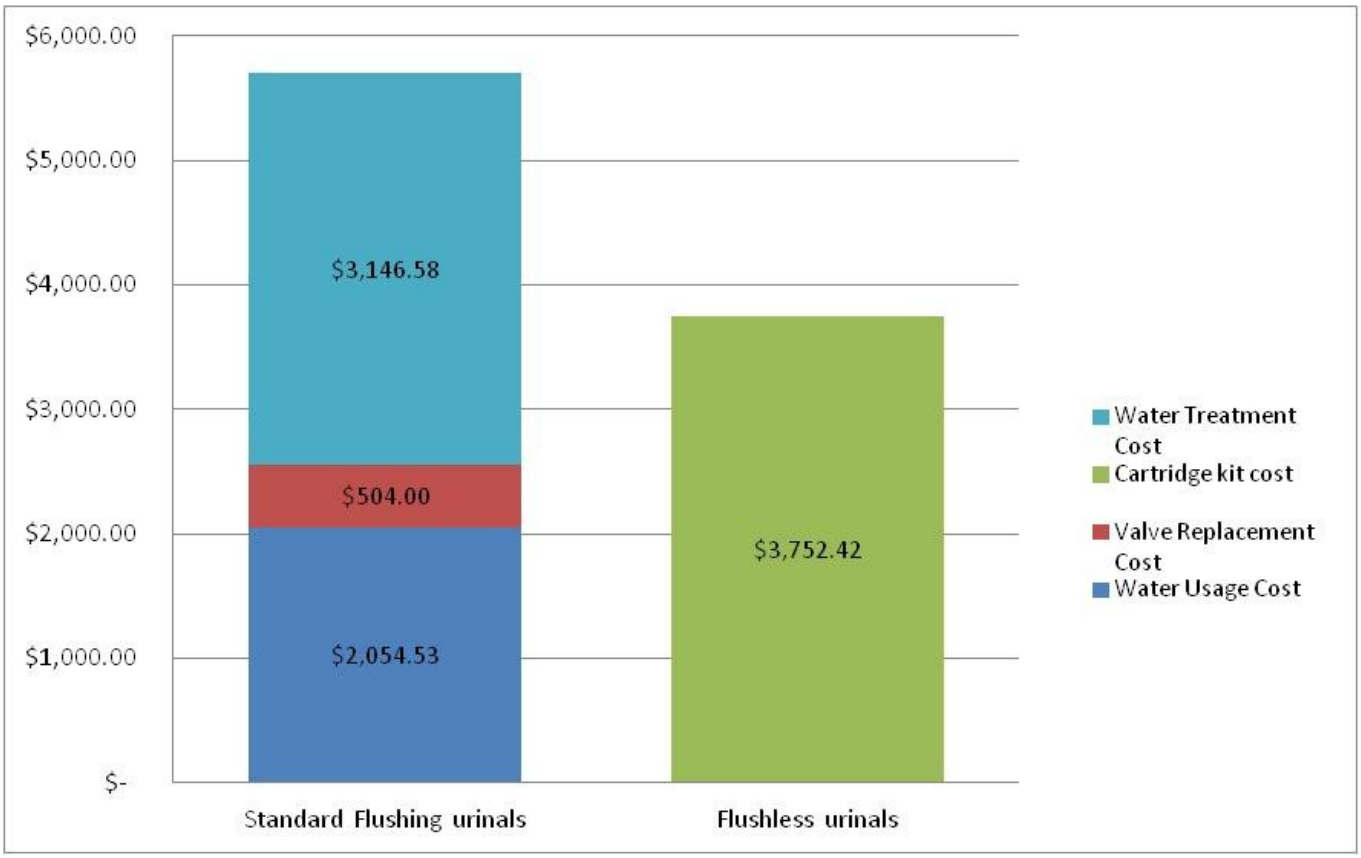
Flush Valves	
replacement frequency (months)	2.5
Valves/yr	4.8
cost per valve	$ 105.00
Cost per year	**$ 504.00**

Cartridge cost	
aproximate cost per cartridge	$ 31.50
cost to replace all cartridges in facility	$ 252.00
frequency of replacement (weeks)	3.5
replacements per yr	15
Cost per year	**$ 3,752.42**

Treatment Cost	
Total Treament Cost/year	$ 40,386.41
Total treated gallons/year	9,775,543
Price/gallon	$ 0.00
gallons used flushing Urinals	761,629
Cost per year	**$ 3,146.58**

Total Annual Urinal Expenditure Estimates for Erreca Rest Area

	Standard Flushing urinals	Flushless urinals
water	$ 2,054.53	
water treatment	$ 3,146.58	
valves	$ 504.00	
cartridges		$ 3,752.42
	$ 5,705.11	$ 3,752.42



Westley SRRA Urinal Flow Estimates Based on Ramp Count Data

	North Bound	South Bound
Traffic (vehicles/day)	1,400	2,250
visitors (people/day)	1,820	2,925
men (men/day)	1,037	1,667
urinal usage (flushes/day)	830	1,334
water usage (gal/day)	830	1,334
water usage (gal/yr)	302,921	486,837
water usage (ac-ft/yr)	0.93	1.49

Combined water usage (ac-ft/yr)	**2.42**
Total cost ($/yr)	**2,130**

Visitors/yr	**1,731,925**

Statistical variables

Average number of people per vehicle	1.3
Average percentage male of C.S. usage	57%
Average urinal usage per male at C.S.	80%
Gallons per flush	1.0

Water Savings

Gallons/year	789,758
Gallons since 2012	1,579,516