# The Implementation of Project: Drop a Brick in Davis, CA

Joseph Glossop
Daniel Jara
Courtney Kohler

## Abstract

The focus of our project is to implement a water savings device to be used in high flow toilets that minimizes the amount of water used per flush in the city of Davis. The idea behind this is to provide a cheap alternative that helps reduce the amount of water used per flush without actually replacing the toilet itself. This can be especially helpful in terms of low income households where toilet replacement or rebates are not necessarily a feasible strategy. Traditionally people have used bricks inside the tank of the toilet to minimize the amount of water used per flush, but with this project the idea is to renovate this concept by using something that is safer for toilets and can be delivered cost effectively through the mail. The challenges to this project are actually determining the number of high flow toilets that are still in use in Davis and assessing the long term cost benefits of implementing a water savings device over actually replacing the toilet. The methods used to identify the impact of such a project are a cost benefit analysis in terms of the price to install either a brick or new toilet versus the amount of money and water saved for either alternative. The results of the project are indeed profound, especially when projected to the statewide level and quantifying the amount of water that could be saved without actually replacing high flow toilets. Ultimately, implementation of project drop a brick can be an attractive alternative to those looking to save water without having the means to replace an old toilet. While this project indeed has a convincing set of water savings data, there are a few limitations to the effectiveness of using the brick as a water savings alternative. First, does the flushing efficiency of the brick method compare to that of a new low flow toilet and second, how exactly would this be measured given different diets and the need to flush either more or less often. In conclusion, project Drop-a-Brick has some limitations but the preliminary

results show that it is indeed a cost effective way to save water without having to actually replace a toilet that still functions.

**Introduction**

Water is a scarce resource in general, but the magnitude of its scarcity is exemplified during times of drought. A state of emergency was declared for California in January of 2015 amid reports of dramatically low levels of snowpack (Governor, 2015). In March, Governor Jerry Brown issued an executive order with many different strategies for managing our limited supply of water. A key part of the call to action was a request for all Californians to conserve water by reducing their water usage by 20% (Governor, 2015). In this dramatic statewide setting, our research firm is proposing a way for the City of Davis, California to be at the forefront of water conservation. We want to explore the use of a toilet displacement device in order to offset the waste of water from the flushing of old, inefficient toilets in Davis, California. This is a potential way of reducing water use from toilets without having to completely replace the fixture.

**Objective**

The main objective of this project is to analyze the potential water conservation impacts of instituting Project: Drop-a-Brick in Davis, California. The innovators behind Project Drop-A-Brick have revamped this original method, and added a clever spin on the seemingly simple technology. These bricks are made of natural rubber, ecologically designed, and are 90% lighter than a natural brick (‘What is..’, 2014).The brick can reduce water consumption by half a gallon a flush on average, and this number could save 6 billion gallons of water in 90 days if everyone in California used one (‘What is..”, 2014). Our project will evaluate the potential water reductions in implementing this device in all of the inefficient toilets in Davis, California. The project will consist of data collection, data analysis, and the preparation of a final report summarizing our findings.

The main results of this research should show a difference in both the water savings aspect and cost effectiveness of using a water displacement device in a high flow toilet compared to a newly installed low-flow toilet. The main output of the project is going to be a table of comparison representing water savings and cost analysis between the two scenarios. Also, there should be a comparison of the effectiveness of the displacement device to actually replacing the toilet. This information will be displayed in a table.

**Hypothesis**

Can water-displacing devices placed inside high-flow toilets be a feasible water saving and cost effective alternative to outright replacing those toilets with more modern low-flow ones?

**Data Sources**

American Community Survey 2007-2012, U.S. Census Bureau

City of Davis

Project Drop-A-Brick

**Methods and Assumption**

Methods

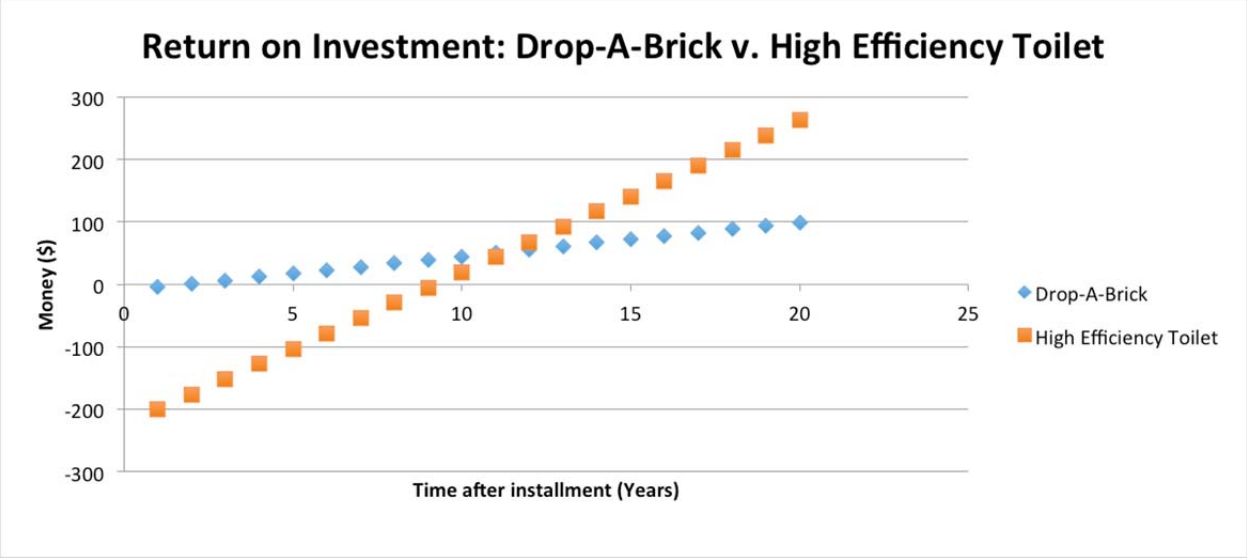
- Cost-Benefit Analysis
- Water Use Calculations with and without the brick and with high efficiency toilet (HET)

Assumptions

- 5 flushes per day per person (Roughly based off of Exercise 2).
- 15 flushes per unit per day
- $125 for toilet installation/removal
- $100 for toilet cost
- All units built prior to 1979 have toilets that use 3.5 gallons per flush.
- Each unit is 3 bedroom 2 bath unit with 3 people

**Calculation/Results**

- Gal/yr = Gpf*[Flushes/day/unit]*365 (days/yr)
- AF/yr = Gal/yr*(1 Af / 325851 gal)
- Water Saved = (no brick)-(w/brick) or (no brick)-(new toilet)
- Money Saved = Scenario(Gal. of water used)*$0.002/gal]
- Money Saved per Unit per year = Money Saved/# of units
- Time to Pay-off = Total Cost/Money Saved per Unit/year



| Units: 12701 | Gpf | Flushes/unit | Gallons/Year | AF/Year | Water Saved (AF/Year) |
|---|---|---|---|---|---|
| Unmodified Toilet | 3.5 | 15 | 243382913 | 747 | 0 |
| Toilet with Brick | 3 | 15 | 208613925 | 640 | 107 |
| High Eff. Toilet | 1.27 | 15 | 88313228 | 271 | 476 |

Gpf- Gallons per flush

AF- Acre-feet

| Units: 12701 | Money Saved- Everyone | Money Saved per Unit | Total Cost | Time to pay-off (years) |
|---|---|---|---|---|
| Unmodified Toilet | $- | $- | $- | 0 |
| Toilet with Brick | $69,537.98 | $5.48 | $10.00 | 1.8 |
| High Eff. Toilet | $310,139.37 | $24.42 | $225.00 | 9.2 |

**Conclusions**

For this project our hypothesis was: can water-displacing devices placed inside high-flow toilets be a feasible water saving and cost effective alternative to outright replacing those toilets with more modern low-flow ones? In our project we analyzed what the impacts in water and financial savings would be from implementing project Drop-A-Brick. As such it was clear that huge water savings could be gained from this one time simple installation *(107 AF/yr)*. Furthermore, it would take under two years for the brick to pay itself off. Additional analysis was done on the impacts of instead installing a HET. From this analysis there were much greater water and financial savings per year, *476 AF and $24.42* respectively. As such it would take *9.2 years* for the toilet to pay itself off and would in the long run lead to much greater savings of water and money. According to the USGS the state of California uses approximately 42 MAF per year. So if every California city took this simple action the state could see drastic decreases in water use.

Government agencies and nonprofits are groups that would benefit from our research because we are evaluating the potential results of implementing an indoor water reduction mechanism. We posit that our research will demonstrate that instituting Project: Drop-a-Brick citywide will lead to notable declines in the overall indoor water demand. Also, this could be a very effective public outreach mechanism that could be used to start dialogues about water conservation when they are distributed. Finally, with an estimated cost of $10 per brick, this could be a low cost method of reducing water demand. Davis, California could even be an example of instituting this project for other towns in the state. This report will be provided to the Davis City Council for their review.

**Recommendation/Limitations**

One of the primary difficulties of this project, and perhaps the one that will require the most effort, is identifying the total amount of high-flow toilets that still operate within the city of Davis. Also, since the project is comparing the results of implementing the displacement device to actually replacing the toilet, assessing the labor costs associated with replacement can be a challenge. One limitation of the project is assessing the flushing efficiency of toilets that have a displacement device installed as opposed to a new low-flow one. This is something that can be approximated, but hard to measure without actually conducting flushing trials on low-flow and modified high-flow toilets.

## References

"Governor Brown Issues Executive Order to Redouble State Drought Actions." Governor Brown Issues Executive Order to Redouble State Drought Actions. March 25, 2015. Accessed April 16, 2015. http://ca.gov/Drought/topstory/top-story-6.html.

"What Is Drop-A-Brick - Project: Drop-A-Brick." Project DropABrick. January 1, 2014. Accessed April 15, 2015. http://www.projectdropabrick.org/what-is-drop-a-brick/.

"City of Davis 2010 Urban Water Management Plan." *City of Davis*. Brown and Caldwell, 1 July 2011. Web. 1 June 2015.

"Glacier Bay 2-piece High Efficiency Dual Flush Complete Elongated Toilet in White-N2316 - The Home Depot." *The Home Depot*. Web. 1 June 2015.