

# Evaluation of the resolution to the water crisis

[Environment](#), [Water](#)



## Why We Should Drink Our Pee

**When looking at solutions to our ongoing water crisis, which solution is smarter to invest in? Desalination or Toilet to Tap?**

In recent years, it has become increasingly clear that the earth needs more fresh drinking water. Droughts have destroyed areas that were once lush, the “Use it or Lose” it bill and others like this have made wasting water a luxury, and water subsidies have become ridiculously high. Because humans have over allocated so much of our freshwater and used a large portion of the necessary resource, we now have to find new ways to get water, other than depleting our aquifers. However, most methods of obtaining more water are incredibly high in cost. Two methods that have been gaining traction are desalination, the process of essentially boiling down salt water, and “toilet to tap”, taking sewage water and cleaning it to the point it is healthy to consume. Both of these solutions are remarkably expensive and incredibly extensive. In the grand scheme of water and where we can find it, there are numerous factors that should go into consideration when picking a solution. Cost, efficiency, and final product are just three components that play major roles in planning where and how to find more water. Toilet to Tap and desalination both have their own advantages and their own faults when related back to these components but, when it tied back to what is going to be better for the earth in the long run, we should invest and move forward with Toilet to Tap due to the major increase in pros when compared to desalination.

Before the US knew how little of the precious resource we really had, we overallocated water by creating the Colorado River Compact, wasted water

through inefficient forms of irrigation, and overall improper forms of conservation. These early reclamation acts during the expansion of the West wasted large portions of our water. The Colorado River Compact is a deal that was made in 1922 by seven states, governing the allocation of the water evenly between the seven of them. However, one problem with this deal is the fact that at the time it was made, no one was completely sure how much water we actually had. Because all seven states wanted equal amounts of water, everyone jumped the gun and took as much water as they could. The combination of this and thinking they had more water than they really did, put us on the trajectory of the intense drought that we are suffering from now. Yet another irresponsible way that we have handled our water has to do with the laws surrounding farmers. There is water allocated to municipalities, cities and towns, and water allocated to farmers. Because the government cannot legally tell farmers what to grow, where to grow, or when to grow, they also can't legally tell farmers how to use their allocated water (Lustgarten). Because of this and laws such as the Use it or Lose it law, which states that farmers who don't use all of their water, lose the amount that goes to waste, farmers are using much more water than they need. Due to fear of losing their water, farmers use forms of irrigation that not only waste water, but are completely unnecessary (Lustgarten). This then relates directly back to us and our water supply due to that fact that farmers are wasting gallons upon gallons of freshwater in hopes of not losing it later on in time. The Colorado River Compact and the Use it or lose it law are only two example of how gradually, over time, we have wasted water and put ourselves into this emergency state of drought.

The ongoing water crisis that we have recently been faced with is an incredibly severe and a lasting natural disaster, one that could leave harmful impact on the earth for an insurmountable amount of time. In certain areas like Arizona, cotton has been one of the main sources of income for farmers. However, cotton relies on large amounts of water and because of this, has completely destroyed the surrounding land. The yearly income for the production of cotton has plummeted, but farmers still insist on growing it due to the subsidies the government provides (Lustgarten). Reasons like this are largely why this natural crisis is so severe. Because nothing has been done for so long, people have begun to just sit back and hope that the problem will fix itself, major steps have been taken into researching and testing different water projects. We do have options, it's just about finding which one is going to work for us now and in the future.

Because this drought has been going on for upwards of five years now, large steps have been taken to find solutions; including the projects desalination and Toilet to Tap. Both of these options are feasible and both have their own advantages and disadvantages. Desalination is the extensive and expensive process that takes large quantities of saltwater and converts it to safe, consumable drinking water (Gerbis). This way, we can begin to largely rely on the oceans of water we have right at our fingertips. Worldwide, about 300 million people receive some freshwater from more than 17, 000 desalination plants in 150 countries (Bienkowski). Desalination is a process that has become increasingly more popular as we fall deeper into our water crisis. There are surprisingly numerous ways to perform desalination, including something called multi-stage flash distillation. This method uses heat to

evaporate water, leaving the salt behind (Winkler). Another method which recently has gained popularity is reverse osmosis. Reverse osmosis is less energy intensive than flash distillation, thus making it a more efficient process. However, it still does require a great deal of energy to pump the water. Reverse osmosis can be broken down and simplified into four steps. It begins with setting up a reverse osmosis desalination meaning that you have to set up a pump to intake the source of seawater. Then, “ you need to create flow through the membrane. This will cause water to pass through the salted side of the membrane to the unsalted side. Pressure comes from a water column on the salted side of the membrane. This will both remove the natural osmotic pressure and create additional pressure on the water column, which will push the water through the membrane. Generally, to desalinate saltwater, you need to get the pressure up to about 50 to 60 bars” (Winkler). Once this is done, remaining “ feed water is then pumped into a closed container. As the water passes through the membrane, the remaining feed water and salt solution become more concentrated. To reduce the concentration of the remaining dissolved salts, some of the feed water and salt solution is taken out of the container because the dissolved salts in the feed water would continue to increase and thus require more energy to overwhelm the natural osmotic pressure” (Winkler). Lastly, “ once water is flowing through the membrane, and the pressure is equal on both sides, the desalination process begins. After reverse osmosis has occurred, the water level will be higher on the side where salt was added. The difference in water level is caused by the addition of the salt and is called osmotic pressure; generally, the osmotic pressure of seawater is 26 bars.

The quality of water is determined by the pressure, the concentration of salts in the feed water, and the salt permeation constant of the semi-permeable membrane. To improve the quality of the water, you can do a second pass of membrane” (Winkler). While there were only four major steps in that process, it is clear that none of them are easy feats. They require extensive work and because of this, the cost is incredibly high. If citizens were to switch to water from a desalination plant, the average customer’s bill, now \$71 a month, will rise \$5 to \$7 to pay for the process. A thousand gallons of freshwater from a desalination plant costs the average US consumer \$2. 50 to \$5, compared to \$2 for conventional freshwater. Santa Barbara voters alone agreed to spend \$34 million to build a desalination plant (Rogers). So, we have to ask ourselves, do the pros outway the cons? One of the largest desalination plants is currently offline due to construction which means it’s not very accessible, the method is incredibly expensive, and desalination has been described on numerous occasions as an “ energy hog” (Bienkowski). However, the entire process is currently being improved upon and further researched (Rogers). This means that in a few years time we may know more about it and therefore, know if it’s the solution to our water problem.

As previously mentioned, two large solutions have recently come to light; desalination and Toilet to Tap. Toilet to Tap has gained traction in numerous states now and has been widely known for its “ yuck factor,” even though the solution may be a completely fathomable one. The process is understandably extensive, making sure the water is clean for public consumption (Toilet). The entire step by step process is meant to mimic that of what happens naturally underground naturally, cleaning the water through

a number of different steps. However, the natural process takes much longer and is much slower (Lawler). The first operating direct potable reuse plant, in Big Spring, receives treated wastewater and uses multiple sophisticated treatment processes before sending it to the existing drinking water plant for yet more treatment (Lawler). Processes include membrane ultrafiltration to remove particles down to extremely small size and amounts, reverse osmosis to remove all molecules larger than the smallest inorganics to a very high degree, and an “advanced oxidation process,” (a combination of UV light and hydrogen peroxide), to oxidize remaining contaminants and inactivate pathogens (Lawler). So, the water is completely safe, why hasn’t everyone jumped at the opportunity? We can chalk this up to what is known as the “yuck factor.” The idea of the yuck factor is straightforward and makes sense; people know that water is completely clean and safe to drink, even safer than most tap water. but have a hard time getting past the fact that they’re technically drinking their own sewage water (Toilet to Tap Water). Research has found that people, even if people know the water is clean, believe the water will either taste bad or get them sick (Fimrite). So, is this a reason not to invest in Toilet to Tap? Certain cities in California have tested selling bottled water and so far, it has worked for them. “

Psychologists have found that when cities reintroduce purified municipal wastewater into natural aquifers, streams, or lakes for later withdrawal, public acceptance of the fact that yes-it-was-once-pee improves. Since 2008, Orange County has recharged a local aquifer with billions of gallons of recycled sewage via the largest potable water reuse facility in the world” (Holthaus). However, if we were to fully invest and expand Toilet to Tap, the

costs would be upwards of a billion dollars. Is it worth it to fund that much in a water project only to not have people buy the product due to fear of health risks? One upside is that instead of directly bottling the water, it can be pumped back into our aquifers which would help replenish our dwindling source of groundwater. Again, like the situation with desalination, it is important to look at all aspects and really decide if certain pros outway the cons.

If all factors have been thoroughly looked over and we were to decide on one solution to start potentially fixing the water issue, are there pros and cons that make the decision clear? Is one better than the other? Let's review some of the advantages and disadvantages of both options. Due to the mass amounts of research that have been done dedicated to bettering desalination, until recently, purifying seawater cost roughly five to 10 times as much as drawing freshwater from more traditional sources (Gerbis). This means that desalination was, and still is, being improved upon. Be that as it may, the cost is still high due to the pumping of the seawater, the technology, as well as the environmental cost (Gerbis). Harmful environmental impacts connected to desalination stem from "...large coastal seawater desalination plants discharg[ing] brine into oceans and estuaries, including all of the proposed plants in California..." (Cooley). Unfortunately, the issues don't stop there. There is also the problem that desalination does not produce a large amount of water for how much it costs. Knowing this; if we look at Toilet to Tap, we see that similar to desalination, this entire process is incredibly expensive. Because both are options that may be the solution to our water crisis, it is essential that we differentiate the two to



help us decide which method to use on a larger scale. There is also the problem of accessibility. As previously mentioned, the current largest desalination plant is under construction and therefore, unavailable until reopened in the start of 2017 (Holthaus). When the desalination plant comes online in 2017, it will produce 50 million gallons per day, enough to offset just 7 percent of the county's water usage. Even when the largest plant does come back on, it won't be able to produce nearly as much needed to sustain larger areas (Holthaus). At this point, it is beginning to look like desalination may not be the best option. One of the main problems with Toilet to Tap is that people think it's gross. If people can work to move past this knowing that they then can have back other luxuries such as a green front lawn and swimming pools, Toilet to Tap doesn't have many faults. This drought is so severe that we don't have the time to wait for a better option, we have to work quickly. Therefore, through research, studies, and testing, it has become abundantly clear that Toilet to Tap is the way to go in this water crisis. It will help us to "put a band-aid" on the problem we're currently facing while also gradually helping us with our water supply in the long run. While desalination has some really smart aspects, it may be better for a smaller scale, this would cost less and help smaller areas. If we were looking for a solution on a large scale level, Toilet to Tap is the way to go.

If we as a country were to fully invest in one solution to help pull us out of this intense drought, research has made it abundantly clear that we should pick Toilet to Tap over desalination. The entire process as a whole is overall incredibly more accessible and, we understand the science behind it much more than we do desalination. While desalination does have certain areas

that may be a smart option for smaller cities, the funding for large scale desalination plants is much too high for the unsatisfactory product. While desalination will continued to be researched and funded, it may not be fully developed for years. Because of the track we are currently on when it comes to our water, we don't have the time to sit around and wait for another option. If we want to start pulling ourselves out of this flood, it is imperative that we first find a solution. Right now, it is clear by all the research that has been done that our solution should be Toilet to Tap. The process makes sense to invest in and the product is cleaner than most of the water that currently comes from our taps. So, if we as a society can get past the " yuck factor," we can start to replenish our water supply and save the earth for ourselves and future generations!