AH, TK, SK, JK, IH

Discover Engineering

Professor Grey

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LA Waterworks Improvement Paper

Dihydrogen monoxide (water) is essential for the survival of humankind, unfortunately only .3% of the freshwater on earth is available for human use, making it especially important to improve treatment techniques for the little freshwater we have to sustain our ever expanding civilization. “The Egyptians reportedly used the chemical alum as early as 1500 B.C. to cause suspended particles to settle out of water” (The History of Drinking Water Treatment pg. 1).

Since then and even earlier humanity has created numerous ways to expedite the sustainability that water provides. The Los Angeles County is and has been the fastest growing county in the US. With 10 million people in 2013, it would be the eighth most populous state, and 88th most populous country in the world (LA Daily News). Such an enormous population only uses four water treatment plant to clean the sewage created by ten million people. One plant, Hyperion is responsible for the majority of Los Angeles sewage. It has not only processes sewage from six different counties, but also is responsible for a 95% reduction in the amount of wastewater solids going into Santa Monica Bay. In short, Hyperion is an engineering marvel, that took many years to design and build to accommodate to the laws of California. Even so, much of the waste water from the plant is pumped into the ocean, effectively being thrown away.

This is the preposition of Group 5 (enginerds), an additional filtration system that starts at the storm drains, converting graywater from heavy rainfalls, households, and businesses into clean, fresh water that would be pumped back to the citizens of Los Angeles for watering lawns, and any other purposes they would see fit. In order to better understand how this plan will work, one must be acquainted with the unique situation the LA County has presented itself concerning water treatment and conservation.

Palm trees are completely foreign and unsustainable in both a Southern California environment, and especially the one created in L.A. They drain the area of its already inconsistent water supply and offer nothing in return. Yet, they have been alive and are alive for one reason. It is the same reason many people mow and water their lawns, landscape and hardscape their properties. There is a tacit agreement between these people to increase and maintain a high property value in/of their area, by whatever standards have been arbitrarily set by society to signify a position of wealth, power, and status.

However, there is a price to pay for such measures: money of course, and in L.A.'s case, water. L.A. is part of a mediterranean climate that regularly receives very few days of rain throughout the year. Most of the water that makes its way into the city comes all the way from the Sierra Nevadas and the Colorado River. In recent years, warmer temperatures have both caused less snowpack in these areas, and contributed to an unusually persistent high pressure zone four miles off the coast that is pushing potential rainclouds further north. The combination of all these factors, as well as the continued surviving and thriving of our palm trees and green grass in the foreseeable future, spells drought, which suddenly or not so suddenly means trouble in paradise.

It is not only the choice of homeowners in LA County to forgo the use of refined greywater and other unpurified sources for use in their homes and lawns, but also that of the numerous businesses that range from corporations based in downtown to the taco place two blocks from your house. The use of personal rerouting water systems in homes all over the county has increased drastically since the drought that hit especially hard in 2014 (NPR, Ben Berman 2015). This process is resourceful to say the least, but only selective homes are affected by this personal water system. The use of an additional filtration system starting from the storm drains and funded by the investments of wealthy businesses and the LA government would benefit all citizens with only a marginal increase in water bill payments. Alongside this, contracting of smaller businesses to help install new pipes to adjoin with the regular piping system will reduce costs in this grand endeavor.

Our design starts at the end of the line. We are proposing putting water treatment plants at the end of each of LA's larger storm drains, to get the most amount of water available. Our process begins with inflow coming from the bottom of the drain, with a metal grate blocking larger debris. The water coming into the inflow then leads into a giant storage tank. When the tank is full, the grate closes and forces water to continue to flow down the storm drain to the ocean. With this, there is no way for the system to get overloaded. The water in the tanks is then piped through one of two gravity filters. Two filters are used so that one can be cleaned while the other one is in use. This process has already eliminated any particles larger than a grain of sand, so the only filtering now required is needed to kill bacteria. This water is now put through pumps, as

a way to create an area of high pressure. This pressurized water is then run through an array of reverse osmosis filters. These filters contain a semi-permeable tube, which only water molecules are able to pass through. This filtering is so fine that even bacteria is filtered out of the water.

The only downside of this process is not all the water is able to be processed. About 60% of the water must be pumped back to an outflow before the inflow grate. This water is either processed again, or sent out to the ocean. The clean water is now stored in a water tower directly next to the plant, ready to flow to households and businesses of LA. This water is actually clean enough for drinking, so it is able to be put back into the normal water system for lawn use, showers, sinks, and even drinking water.

This system is very effective, with only two actual cleansing processes implemented to make the system much cheaper and cost effective compared to others. The Carlsbad Desalination Plant uses reverse osmosis to remove salt and other impurities from water coming from energy plants and purifies it for use in San Diego. This project cost one billion dollars to produce and the four plants that will reroute the water to the city will cost one billion dollars each to initially manufacture. Additional costs include the primary filters, the piping throughout the facilities in Malibu, Venice, Redondo and Long Beach.

As well as performing its task under budget, the water treatment plants have to be implemented smoothly without major reorganization of city infrastructure or lowering private property values. This can be accomplished by adding the plant on to storm drains that already exist, such as the ones that go out along Venice beach. Those by the Venice Boardwalk in particular are prime locations because that isn't really a residential area, populated mostly by small businesses, storefronts, and street stands, and the small water towers would not cause a disturbance. Local artists could be commissioned to spray paint the water towers like so many of the walls off the street and near the skate park. This would both make the towers aesthetically pleasing/welcome in the area, and help support community art. As well as making some small effort in undoing our environmental mistakes, the plant will fit into a piece of our city, another environment that is more temporary, but also more immediate to some of us. The success of any such project is in the fact that people consciously realize the difference it makes for them on a macro and a micro scale; both in their personal puzzle and in the puzzle that they are a piece of. People tend to like things a certain way and an engineer's job is to use that way to design a better one. Perhaps we are like the palm trees: draining every last drop from an ever-gracious host to thrive as we always have; never stopping to realize we've been dying our whole lives.

Bibliography

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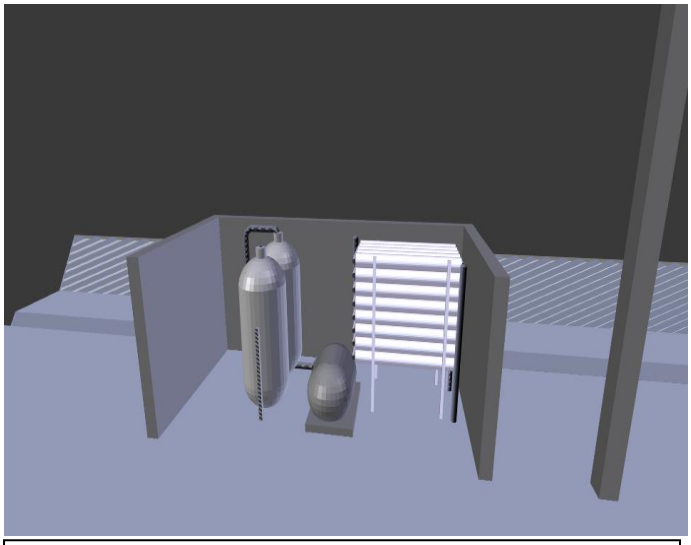
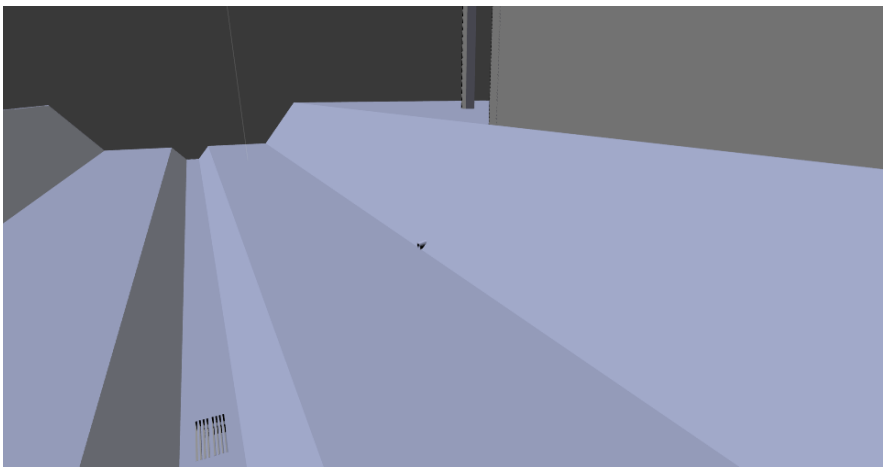
Lasewers.org,. 'LA Sewers'. N.p., 2015. Web. 10 July 2015.

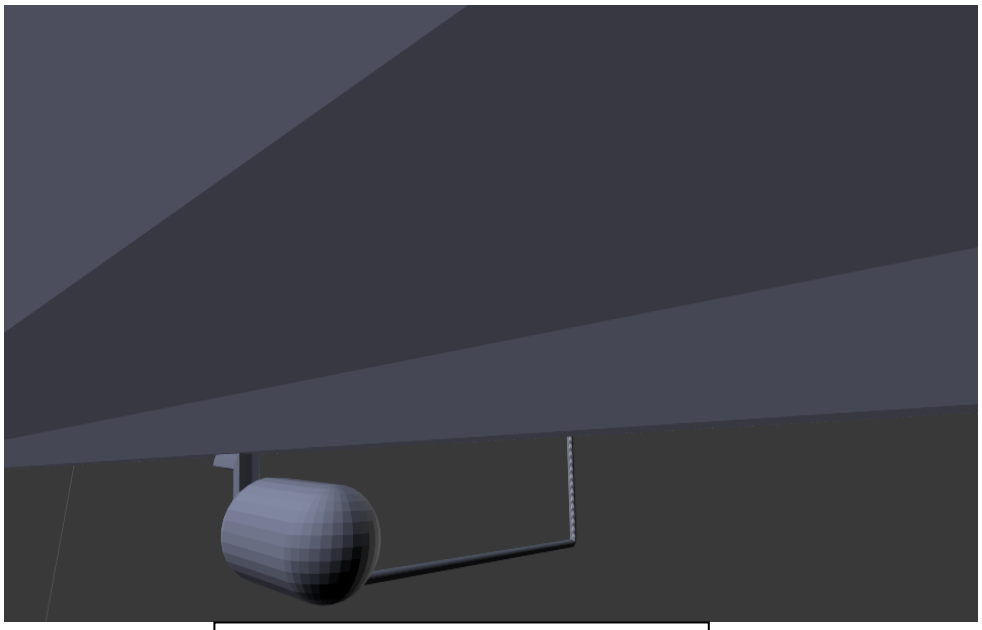
Pictures of the 3D Model



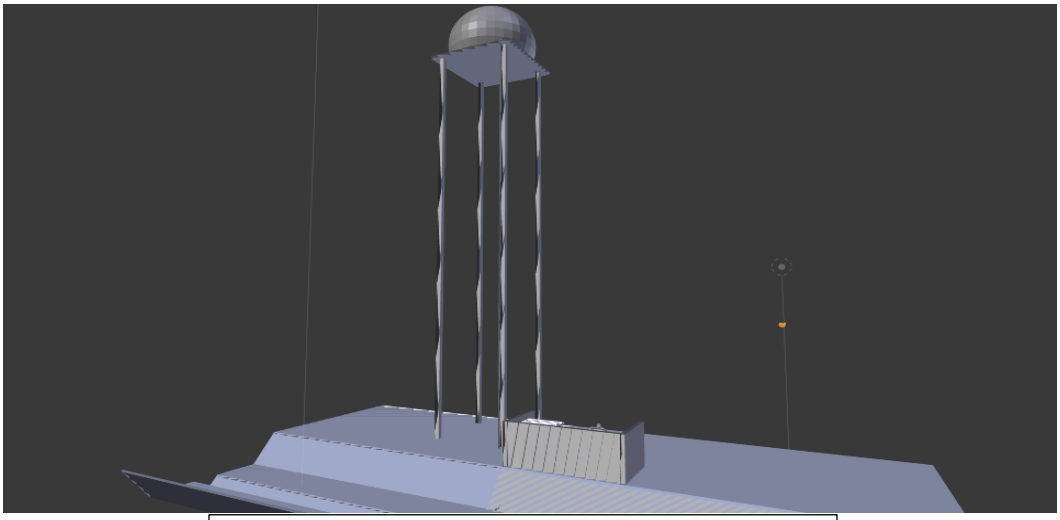
The reverse Osmosis tubes are in white with storage tanks that hold all the grime collected in the outer pipes.



The troughs that lead from the storm drain into the pipe that leads to the first collective water tank.



This is the tank that holds water after going through the storm drain



The water tower that holds water after going through the reverse osmosis chamber.