

Grey Water Toilet System

Background

The ECE 379: *Make Sustainability* course has provided an excellent opportunity for UW-Madison students from different concentrations to collaborate on a project and promote the importance of sustainability. Our group focused on the issue of water use. Some of the biggest uses of water in the household are toilet flushing and showering. We decided to develop a system to harvest this relatively clean shower water and reuse it to flush toilets.

Motivation

On average, one person uses over **2,300 gallons** of clean drinking water to flush their toilet each year. This projection is based on a 1.6 gallon/flush toilet, and the individual flushing their toilet approximately four times a day. By reducing water consumption, we would save money and reduce the load on water treatment plants. This system would also help areas of the country that experience large shortages of water by allocating water to more essential uses.

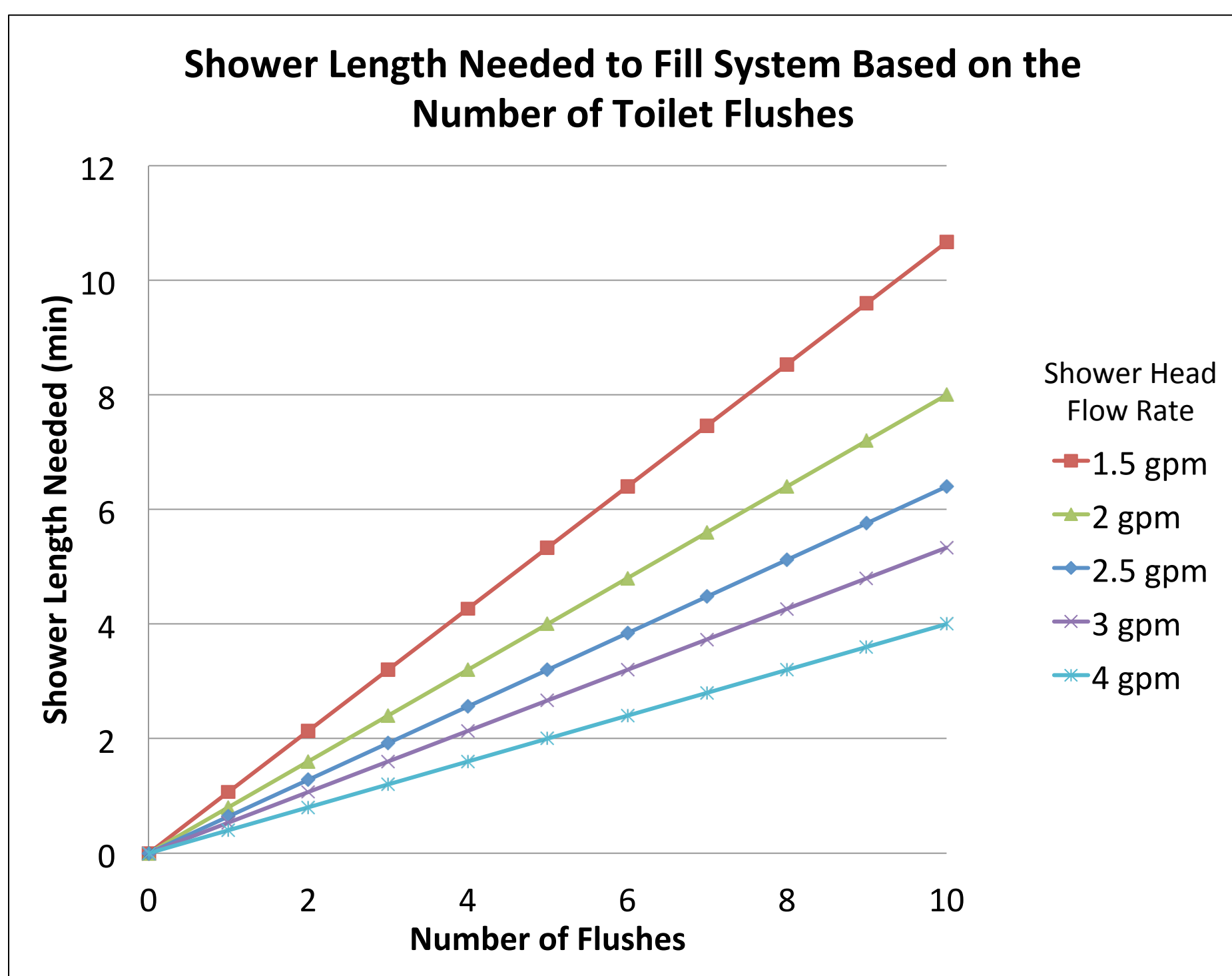
Cost

In order to incorporate this system into a household, one can expect to pay at least \$75/hour for plumbing labor. In Wisconsin, the average price to install a water treatment and purification system is \$738 according to home advisor.

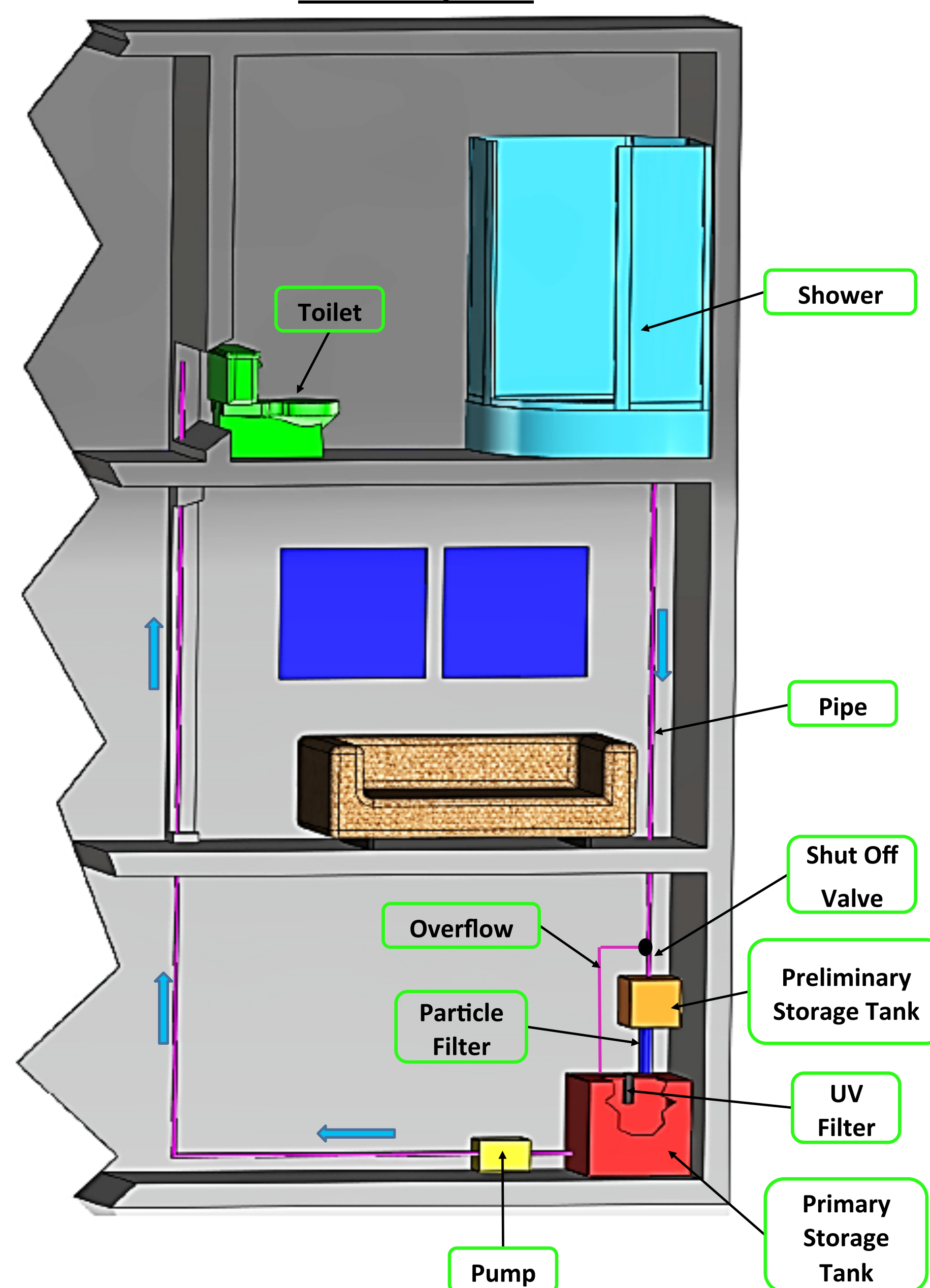
Costs Savings in Madison, WI

- Water= \$2.81 per 1,000 gallons used
- Sewer= \$2.33 per 1,000 gallons used
- 6.4 gal/person-day x (5.14 \$/1,000 gallons) = 0.033 \$/person-day saved
- Consider an average household of three people,
.033 \$/person-day x 365 day/year x 3 people/household =

\$36.14/year-household saved
7,000 Gallons of water saved



Overall System

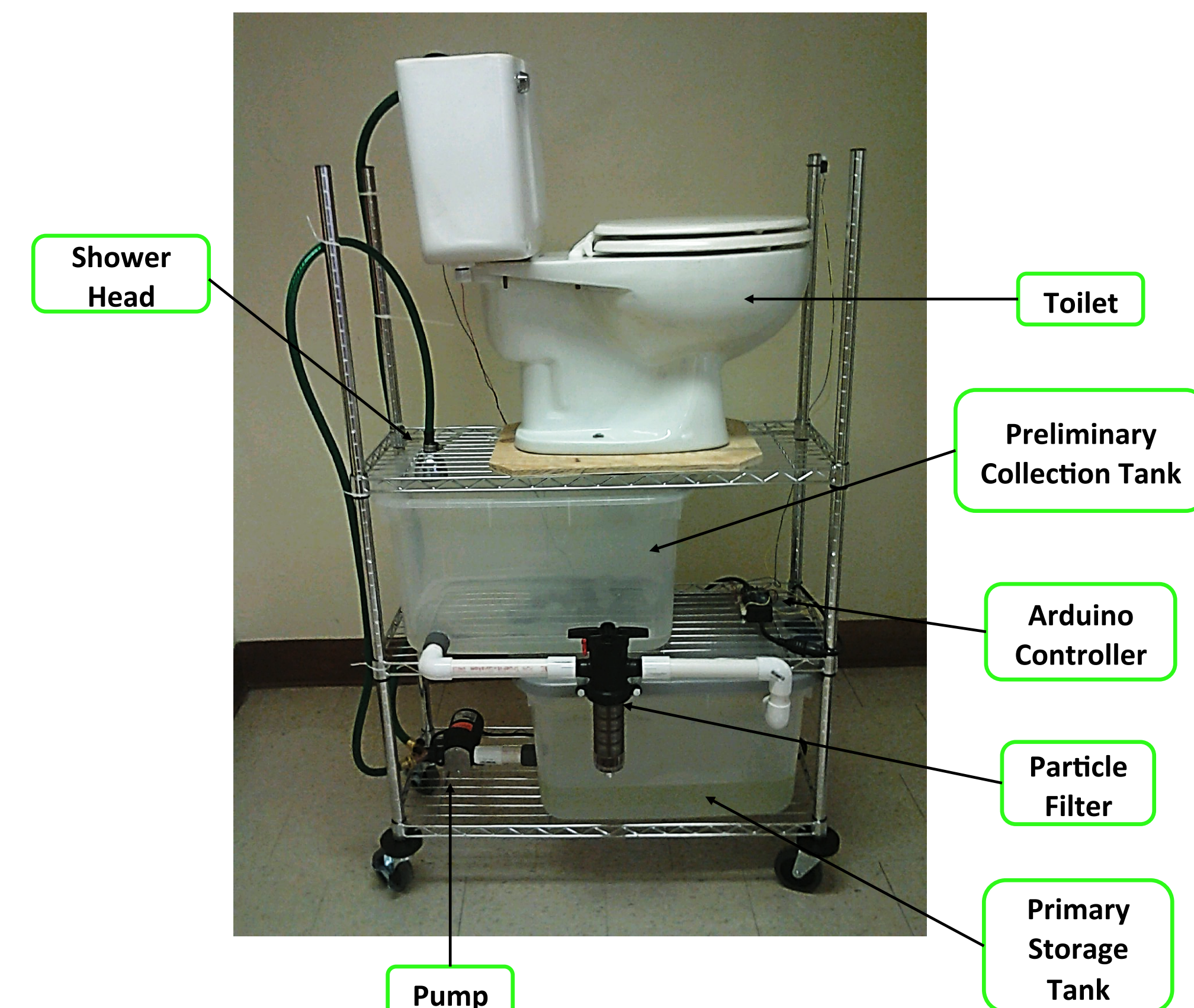


How The System Works

Used shower water drains through the piping system into the Preliminary Storage Tank. There it is stored while the Filter removes hair, sand, dirt, and other particles that could potentially damage the system. Once the shower water has passed through the Filter it enters the Primary Storage Tank where it is kept until needed. While the water is in the tank, the water is cycled through a UV Filter to inhibit bacterial growth. Once the toilet has been flushed, a pump engages moving the water from the Primary Storage Tank to the Toilet. If the Primary Storage Tank is full, a valve above the Preliminary Storage Tank will close diverting the water from the recycling system to the sewer system.

Our Prototype

- 1) Water is pumped through a hose (simulating a shower) into the collection tank
- 2) The water then goes through the filter into the storage tank
- 3) Pump fills the toilet tank with water from the storage tank
- 4) Float sensor in the toilet tanks is triggered and stops the filling
- 5) Toilet is flushed
- 6) Seven seconds after the toilet is flushed the pump begins to refill the toilet tank



Future Work

There is some work that could still be done to improve our prototype. The most helpful change that could be made is the addition of a UV light purification filter. This would prevent bacteria and algae from growing in the holding bin if the water were to be stagnant for an extended period of time. We could also develop the system to warn the user when the storage tank is low or the filter needs to be cleaned. Further development of the prototype would be directed to improve its large-scale applicability in a single home, hotel, or apartment complex environment.

Acknowledgments

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- The **Office of Sustainability** for providing the funding to construct our prototype.
- The **Physics Garage** for providing the makerspace and tools needed to develop our project.
- The **ECE 379 instructors** for creating a positive hands-on learning environment and encouraged us along the way.

This semester has been a great experience and we couldn't have done it without you!