



A NEW SUSTAINABLE WASTEWATER MANAGEMENT SYSTEM

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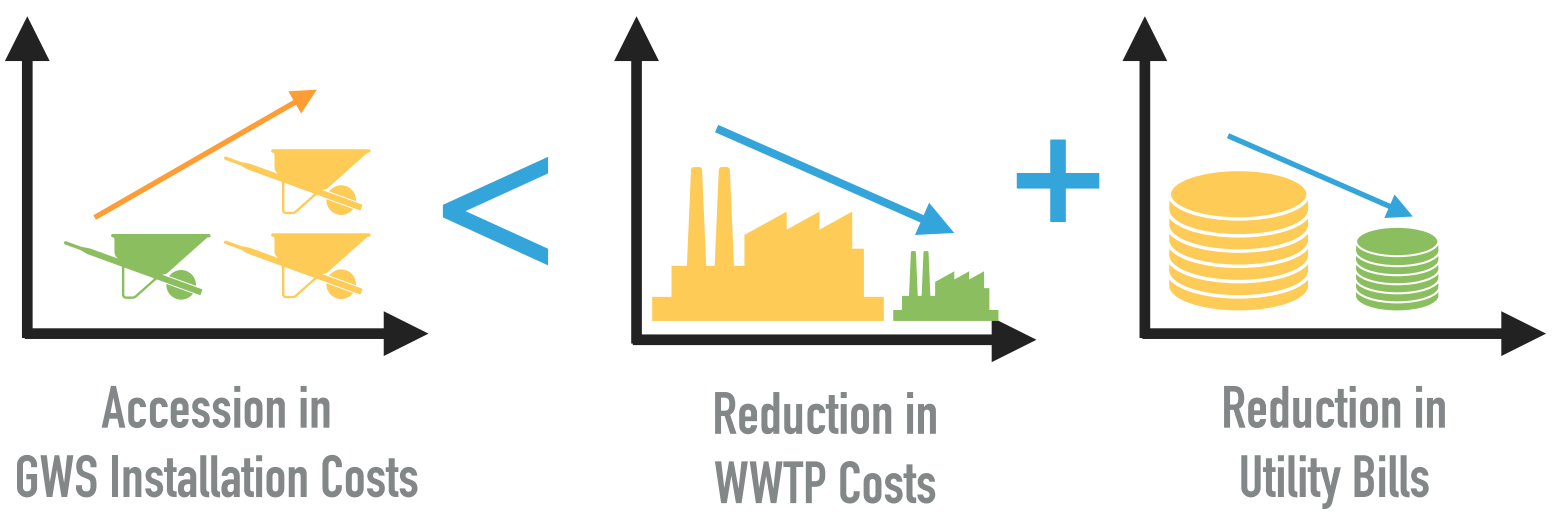
ABSTRACT

Wastage of water is one of the most common environmental issues in the modern era. However, if this level of usage can be controlled, or recirculated properly, the wastage can be lowered down to a very minimum. In the conventional residential plumbing system, blackwater and greywater gets mixed and go through the same sewage pipe. This mixture turns the whole wastewater amount into blackwater, which requires complex treatment before discharge. Greywater on the other hand can be reused for various purposes requiring very little treatment. Fortunately, there are varieties of household greywater reuse systems (GWS) available in the market that can make good use of this resource, by reusing this huge amount of generated greywater, drastically reducing the utility bill. On the other hand, the lesser amount of blackwater reduces the pipe diameter, as well as the resource required for wastewater treatment, opening the possibility for smaller wastewater treatment plants. These smaller wastewater treatment plants will result in a significant reduction in costs for the city, as well less environmental impact. The economic assessment indicates that although dual plumbing and greywater system installation initially adds costs to the set, the reduction in pipe diameter, wastewater treatment plant, and utility bills results in a 25.26% cost decrease overall.

OBJECTIVE

- ▶ Conduct an Economic Assessment on the implication of Greywater Systems in every household.
- ▶ Compare the overall Cost Increasing and Decreasing Factors of the new system
- ▶ Determine the economic feasibility of this system

HYPOTHESIS

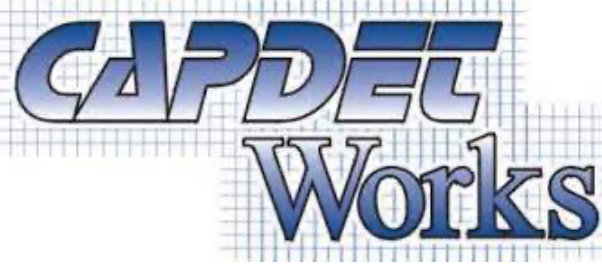


The increased cost of greywater system installation will be substantially superseded by the reduction of costs in wastewater treatment plants and utility bills.

TOOLS AND APPLICATION

RSMeans data
from **GORDIAN**

Construction
assembly, labor and
maintenance cost
calculation



WWTP Construction,
Operation and
Maintenance Cost
Calculation



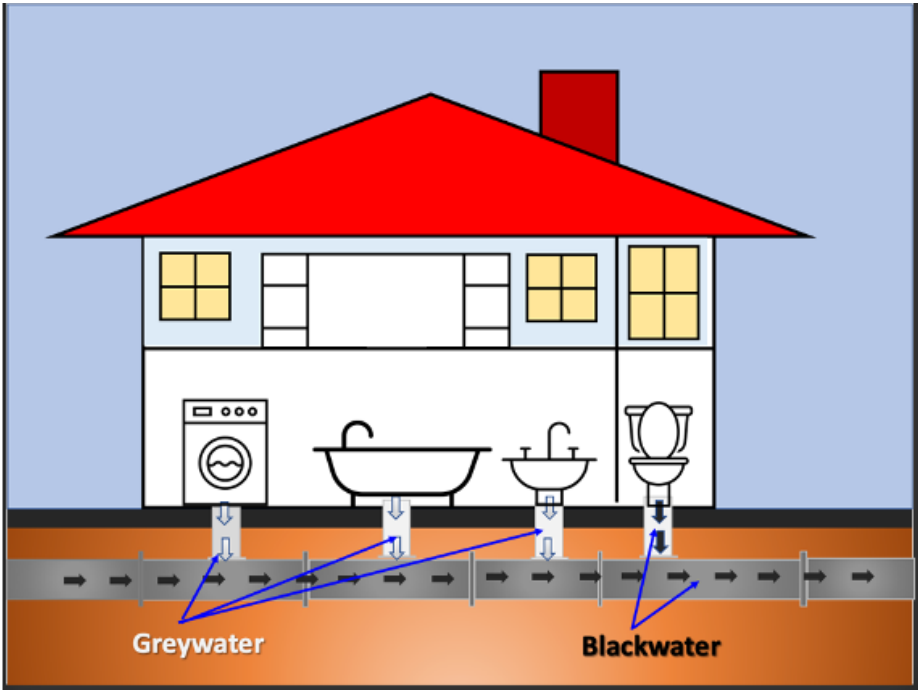
Case by case
wastewater
generation amount
estimation



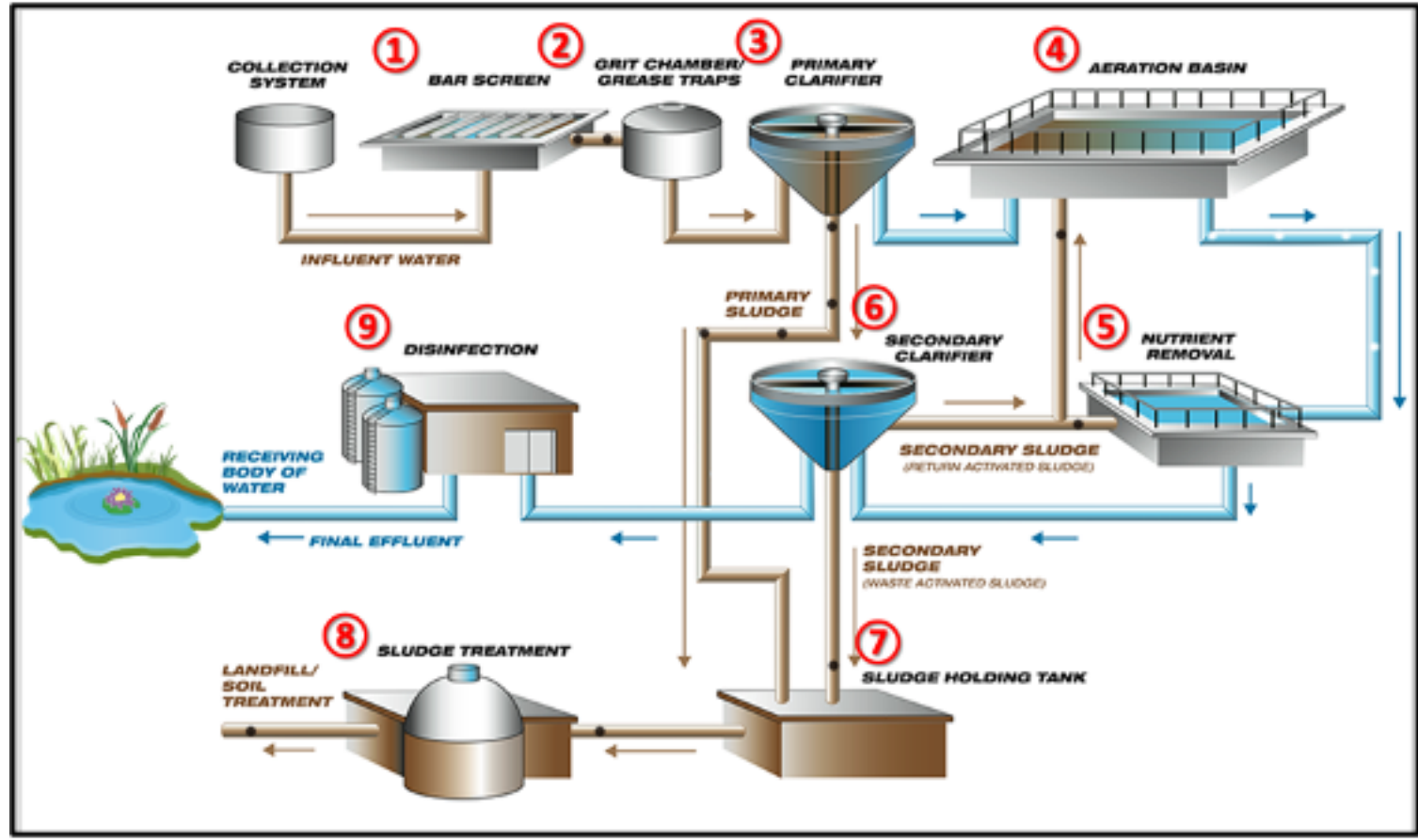
Mathematical
Calculations and
Graphical
Interpretation

INTRODUCTION

Water shortage is a current and will carry on as a future worldwide problem. World water consumption is anticipated to rise by 55 percent by 2050, resulting in shortage and competition among water users. However, if this level of usage and wastage can be controlled, or recirculated properly, the wastage can be lowered down to a very minimum. It can be possible through separating and reusing Greywater, which holds the major share in household wastewater.



Unfortunately, in conventional plumbing scenario, Greywater and blackwater gets mixed and passes through the same sewage pipe as blackwater.



Blackwater requires 9 stages of extensive treatment before it can be discharged safely outside. Reusing requires even further treatment.

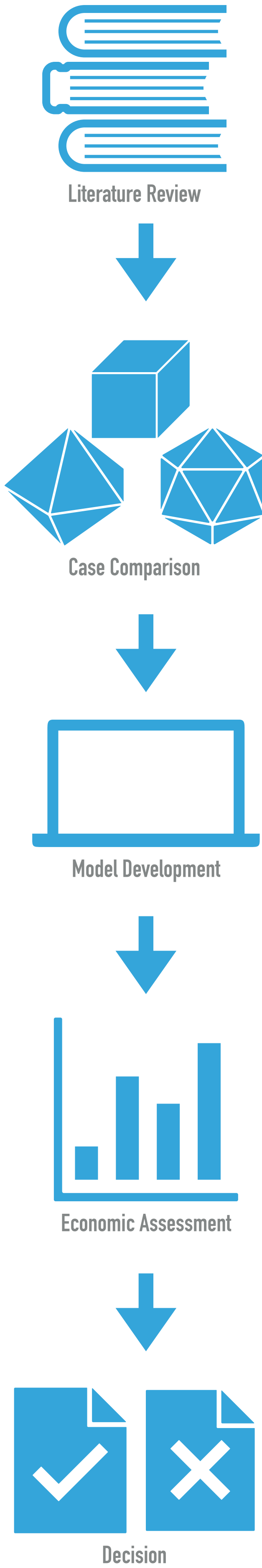
Increased water usage requiring more and more resources for treatment., harming both economically and environmentally.

GREYwater CAN BE DISCHARGED WITHOUT TREATMENT.
SIMPLE FILTRATION OPENS UP NUMEROUS REUSE POTENTIAL.

PROBLEM STATEMENT

- ▶ All the previous research focuses on decentralized treatment, which requires the wastewater to be generated first before reaching treatment phase, or collected separately through dual plumbing.
- ▶ No previous design with centralizing Greywater, although it comprises the largest amount of residential wastewater.

METHODOLOGY



RESULTS

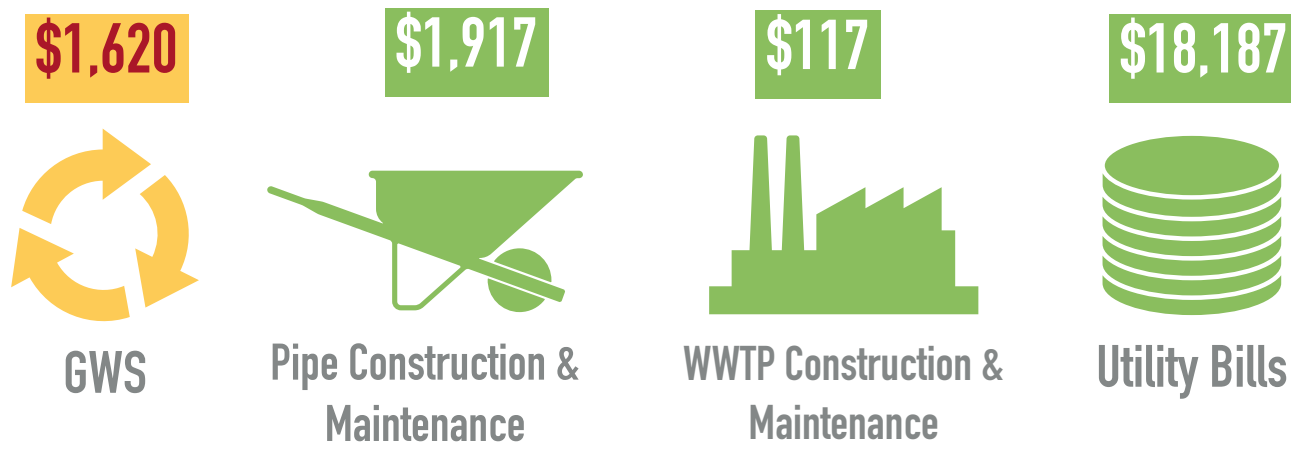
LIFE CYCLE COSTS OF 40 YEARS | RESIDENCES OF HOUSTON CITY

PER CAPITA COSTS, CONVENTIONAL SETTINGS



**TOTAL
COST/CAPITA
\$29,225**

PER CAPITA COSTS, GWS INSTALLED



**TOTAL
COST/CAPITA
\$21,840**

NET SAVINGS: \$17.02B

**COST
REDUCTION/CAPITA
\$7,385**

CONCLUSION AND FUTURE WORK

- ▶ Implementation of this system will result in a net benefit
- ▶ Countrywide assessment can demonstrate the overall feasibility of this system on a large scale
- ▶ Weather scenario and uncertainty analysis can achieve higher accuracy
- ▶ Conducting Life Cycle Analysis can demonstrate the environmental impacts

ACKNOWLEDGMENT

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- ▶ R. Ruegg and H. Marshall, Building Economics: Theory and Practice, Softcover reprint of the original 1st ed. 1990 edition. Springer, 2013.
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- ▶ Y.-K. Juan, Y. Chen, and J.-M. Lin, "Greywater Reuse System Design and Economic Analysis for Residential Buildings in Taiwan," Water, vol. 8, no. 11, Art. no. 11, Nov. 2016, doi: 10.3390/w8110546.