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## Abstract

Environmental issues tend to arise because of the complicated protocols established by regulatory agencies that undermine the splendor of natural and environmental resources and confuse the citizens who abide to validly protect them. The matter may be understood through this study, which considers the impacts of individual wastewater and disposal systems under Puerto Rico's governing code system. A breakdown of the regulatory agencies and their current policies regarding septic systems was completed. Based on data and calculations, a comparative examination of regulations was completed, which helped determine the important factors contributing to the advantages and disadvantages of septic tanks while following proper and improper, but inexpensive, design measures to implement these systems. The research understood the importance of improving compliance measures and the necessity of amending the systematic structures within the government for communal welfare and environmental well-being throughout the island.

## Introduction

Water resource protection stands as a convoluted process that intertwines political, sociological, technical, and environmental concepts in Puerto Rico. Groundwater, lakes, creeks, and streams are known to be commonly contaminated, especially by septic systems.

### Septic Tank Systems

- Underground septic tanks that treat wastewater before underground water injection, which occurs when conveyance technology uses gravitational force to discharge fluids into or above a source of water
- Physical and biological treatments processes

#### Advantages

- Simple, durable, reliable
- Inexpensive maintenance
- Underground location
- Resource and public health preservation

#### Disadvantages

- Odor problems
- Expensive maintenance
- Surcharged tank
- Resource contamination
- Health issues

## Background

Fifty percent of communities in Puerto Rico rely on individual septic systems for discharging wastewater. Such systems were not regulated until 2010. During the end of 2010, the Joint Permit Regulation, adopted by the Planning Board of Puerto Rico, required permits for all septic systems and established general norms for their construction, operation, inspection, and closing.



**Permits Management Office (PMO)** regulates matters related to individual septic systems.



**Department of Natural and Environmental Resources (DNER)** regulates matters related to any septic system, except individual.

## Problem

This study analyzed the impacts of individual wastewater and disposal systems under the policies established by different regulatory agencies in Puerto Rico. The research involved an analysis of the agencies and their regulations, which included a comparison of regulations that helped comprehend the effects of onsite systems using different statutes.

## Methodology

### CASE A

Proper practices following PMO regulations and International Private Sewage Disposal Code 2018 (IPSDC) guidelines

#### Septic Tank Design and Volume

- Design:** According to Volume
- Volume:** According to number of bedrooms

#### Soil Percolation Test

- At least three (3) percolation tests; average value
- Dug or bored hole
- Hole dimensions (l,w,h): (0.33 x 0.33 x 2) ft<sup>3</sup>

#### Soil Absorption System

- According to percolation rate determined during test

#### Inspection/Maintenance

- Inspection:** Annual
- Maintenance:** Not specified

### CASE B

Improper practices following DNER regulations and Puerto Rico Aqueduct and Sewer Authority (PRASA) guidelines

#### Septic Tank Design and Volume

- Design:** According to Volume
- Volume:** According to DNER Calculation Sheet

#### Soil Percolation Test

- One (1) percolation test; single value
- Dug hole
- Hole dimensions (l,w,h): (0.33 x 0.33 x 2) ft<sup>3</sup>

#### Soil Absorption System

- According to DNER Calculation Sheet

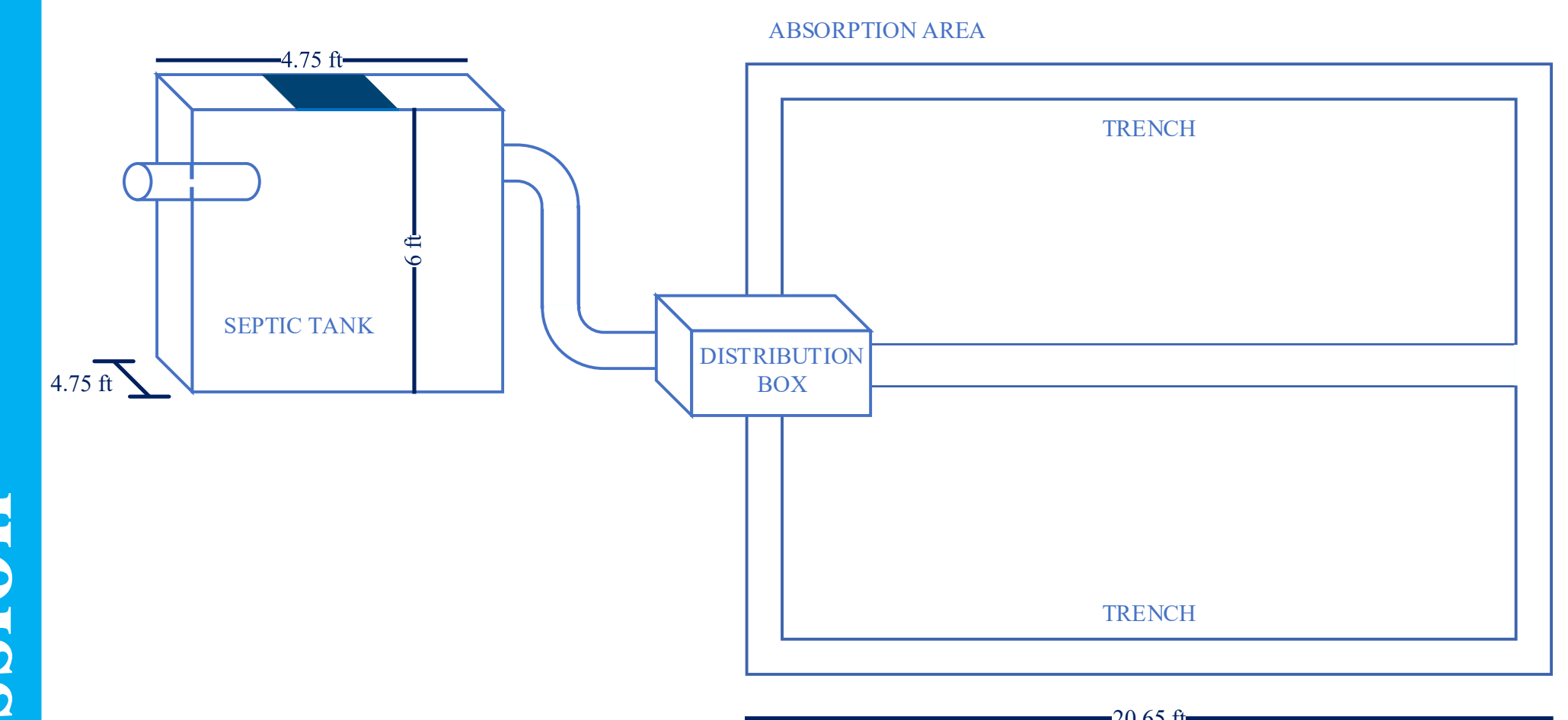
#### Inspection/Maintenance

- Inspection:** Not specified
- Maintenance:** Not specified

## Results and Discussion

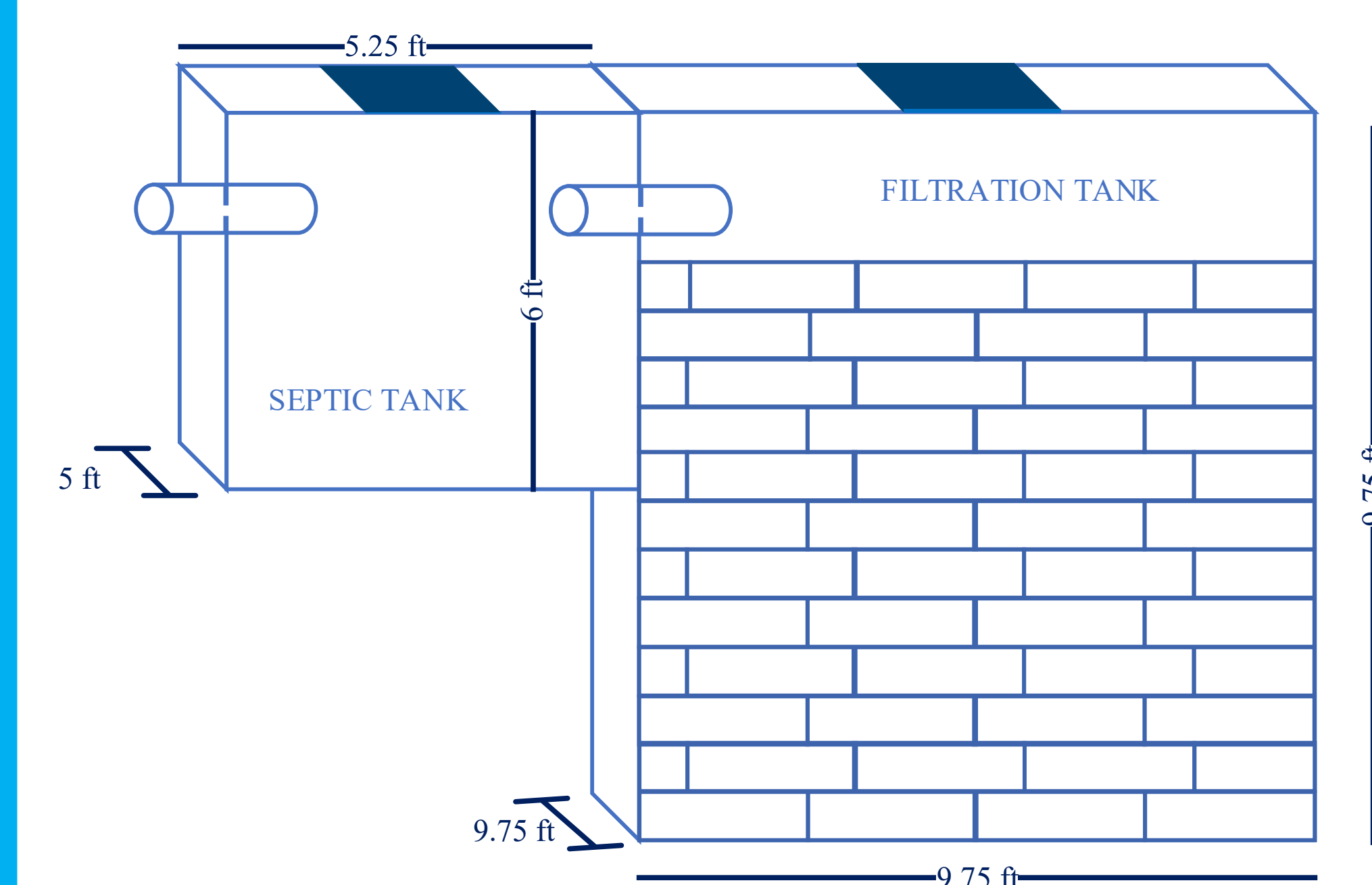
Case A design presented statistical results as it considered an adequate tank volume and a suitable absorption area to allow for final wastewater treatment.

CASE A	
<b>Regulations/Codes</b>	PMO-IPSDC
<b>Dwelling</b>	1
<b>Bedrooms</b>	3
<b>Septic Tank Volume</b>	
<b>Minimum</b>	750 gpd
<b>Tabulated</b>	1000 gpd
<b>Soil Absorption System</b>	
<b>Minimum Area</b>	
<b>Trenches</b>	495 ft <sup>2</sup>
<b>Beds</b>	615 ft <sup>2</sup>



Case B design considered a slightly greater tank capacity, but a smaller filtration area than Case A.

CASE B	
<b>Regulations/Codes</b>	DNER-PRASA
<b>Dwelling</b>	1
<b>Bedrooms</b>	3
<b>Septic Tank Volume</b>	
<b>Minimum</b>	350 gpd
<b>Calculated</b>	1178 gpd
<b>Soil Absorption System</b>	
<b>Minimum Area</b>	
<b>Filtration Tank</b>	373 ft <sup>2</sup>



A smaller filtration area does not allow for a final and thorough wastewater treatment and would eventually cause negative impacts to the populace and environment.

## Conclusion

The impacts surge as the ambiguity of regulations established by the politically influenced PMO and DNER affects the decisions made by individuals. The PMO, mainly a permits regulatory agency, does not seem to count with resource management capabilities to protect the environment or personnel to enforce their rules. Therefore, it should not be the main agency to control the use of individual septic system, but somewhat an ally to the DNER, which serves as the island's agency to regulate environmental matters. Due to these findings, the regulatory policies shall be uniformed to establish appropriate directives that truly protect the people and conserve the resources of Puerto Rico.

## Future Work

Offer collaborative work to the regulatory agencies. This work may help determine the best techniques to properly corroborate and process septic system permits, maintain updated records of approved permits, and establish a better structure for inspecting onsite systems.

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