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## Problem Statement

The small island of Cortes Island near Vancouver, British Columbia has about 1,000 residents that need a more reliable water supply. The existing system in place is frequently under water stress due to the remoteness of the island. The municipal government of Cortes Island requires a solution in the form of a rainwater treatment system. This team will design the rainwater equalization of the stormwater, and the filtration and disinfection system for potable use by the residents of Cortes Island.

## Assumptions

The rainwater filtration system was designed based on the following five assumptions:

- Precipitation occurs uniformly across Cortes Island,
- Population of 1,050 people is split evenly between 2-person and 4-person households,
- Average roof area is 150 square meters,
- Roof and pipe materials add no contaminants to the runoff, and
- Water loss associated with rainwater harvesting is 20%

## Introduction

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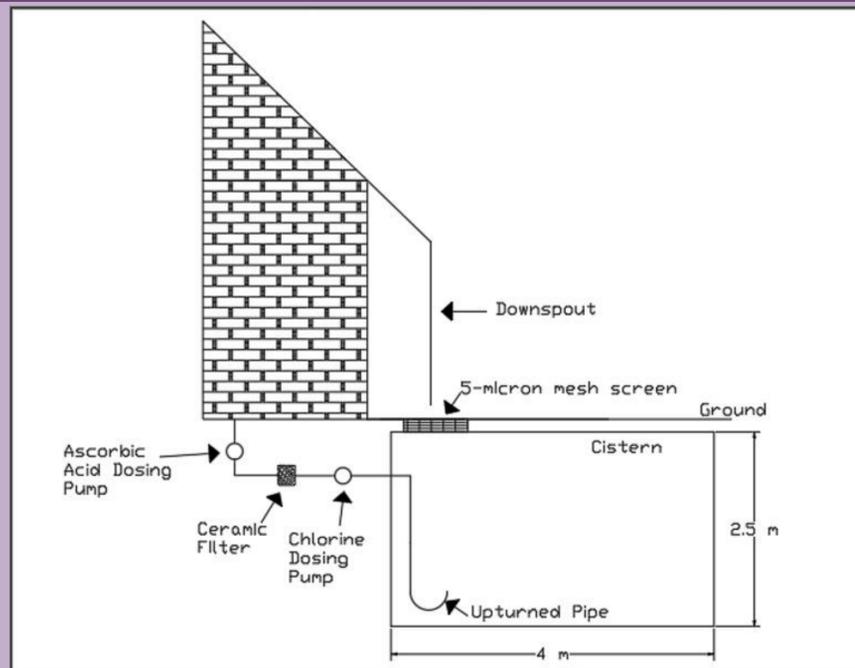
## Construction materials and Costs

Each collection system will have each of the following, including their cost:

Material	Amount	Price
Dispersion Pumps	2	\$65
Cistern	1	\$5000
PVC Schedule 40	5 meters	\$55
Ceramic Filter	1	\$40
Upturn Pipe	1	\$70
PVC Cement	1	\$10
PVC Adapters	11	\$77
Chlorine	2.3 kg	\$30
Ascorbic Acid	4.5 kg	\$50
Excavation Cost	20 cubic meters ~\$65/cubic meter	\$1,300
<b>Total</b>		<b>\$6697</b>

All joints in the pipe run will be sealed with PVC cement to ensure no leaks will occur in the system. The cistern is a 2200 L cistern, sized to meet supply.

## Design



## Operation and Maintenance

The first component will be the gutter fitting. This will be attached to the preexisting gutter system where the gutter connects to the downspout. Flow will come through the gutter system and into the downspout and diverter valve. The diverter pipe will move flow through the filtration device to remove large debris. The filtration device is a 5-micron mesh screen that leads into a storage cistern located underground. The 5-micron mesh screen will remove debris from entering the storage cistern and be located on ground level. Inside this cistern is an upturned U-shape intake pipe. The water then exits from a pipe connected to the bottom of the cistern to move water to the filtration system. This system includes a chlorine disinfectant mechanism, a ceramic filter, and an ascorbic acid disinfectant mechanism.

The system will be maintained by two parties: the homeowners and the Cortes Island municipality. The homeowners will be responsible for:

- Clearing the gutter system of leaves at least monthly
- Clearing the mesh screen of leaves, etc. with a plastic brush

The Cortes Island Municipality will be responsible for:

- Cleaning and replacing ceramic filters
- Supplying liquid chlorine and powder ascorbic acid
- Replacing chemicals in their respective pumps

## Quality of Discharge & Equalization of Rainwater

### Constituents of Rainwater

Rainwater can contain:

- Dust and smog
- Sea water
- Chlorine by-products such as chloramines, chlorites, and chlorates
- Electrolytes such as potassium, magnesium, calcium, sodium, and sulfate

None of these are of concern because of their low concentration or the inability to form, as is with the chlorine by products which can only form when organic matter is present.

### Microbial quality guidelines.

The guidelines for these are stringent. Maximum allowed concentration (MAC) as set by Health Canada for E. coli, for example, is none detectable per 100 mL. For protozoa, the guideline is none active or 3 log removal.

### Chemical and Radiological Quality Guidelines

Lead may be a cause for concern, and the MAC is only 0.005 mg/L. Since there is no nuclear leaching that will be happening near the rainwater, radiological parameters do not apply to our design

### Aesthetic Quality and Operational Guidelines

Water without these guidelines can be consumed safely, it might not be appetizing. The taste of chlorine is the main concern for our design, which is why the chemical neutralization with vitamin C was added to the system to neutralize the chlorine.

The system that is planned for Cortes Island will follow all these guidelines to filter and treat potable water for the residents using the rainwater.

## Acknowledgements

Our team would like to acknowledge Dr. Cara Poor and Ashley Cantlon for their contribution and guidance during the research and execution of this project.