



# CERRO ORTIGA II GRAVITY-FED WATER SYSTEM

## CERRO ORTIGA, NGÖBE-BUGLÉ PANAMA



### Project Description

#### Design a gravity fed water system

- Distribute and disinfect the water
- Serves 13 homes, approximately 78 people

#### Previous gravity-fed water system

- Constructed by Panamanian government
- No longer functioning
- Much of the infrastructure still exists



Figure 1. Hiking in Cerro Ortiga II

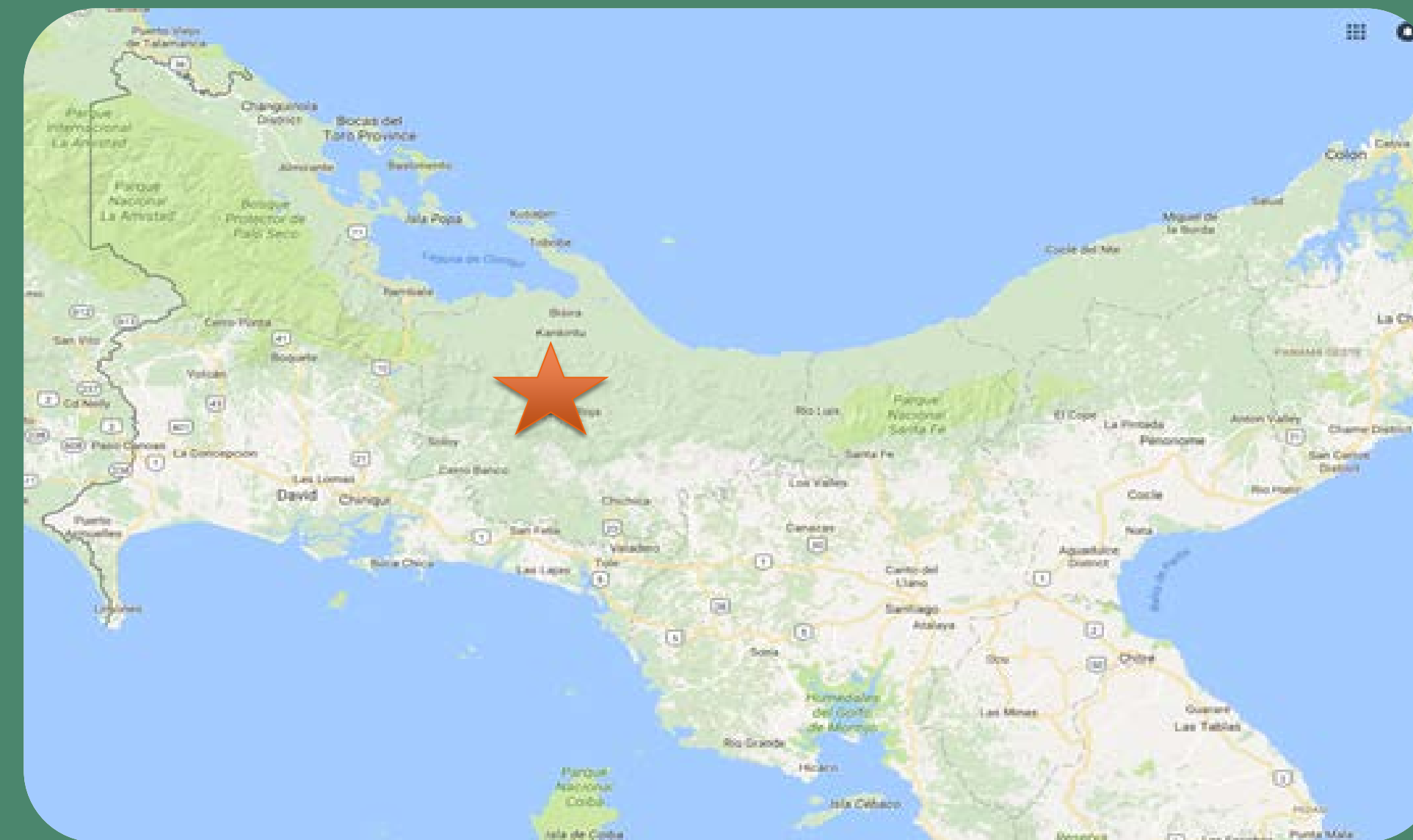


Figure 3. Location of Cerro Ortiga II in Panama



Figure 4. Pluma Inc.'s Peace Corps Volunteer

### Design Details

#### Spring Box

- Contain and direct water coming from a natural spring
- Constructed from reinforced concrete

#### Rainwater catchment

- Provide water to a laundry area that is located in front of the spring box
- capture approximately 145-180 gallons/month of water

#### Chlorinator

- Release free chlorine into the water to eliminate bacteria
- Located before holding tank

#### Storage tank

- Hold 270 cubic feet, or just over 2000 gallons
- Constructed from reinforced concrete

#### Pipeline

- Approximately 5654 feet with a total elevation change of 375 feet
- Constructed of 1.5 inch and 1 inch SDR 26 PVC piping
- The main line will be 1.5 inch, and the branches will be 1 inch in diameter

#### Pipe Crossings

- Five pipe crossings
- Suspension bridges will be constructed for each crossing

#### Air valve

- Release air trapped in the pipeline

#### Pressure release valve

- High pressures occur in the pipeline
- Reduce pressures from approximately 150 psi to 45 psi

#### Tap Stands

- A tap stand built at each of the 13 homes
- Constructed of 4-inch by 4-inch wooden posts that the PVC pipe will be clamped to

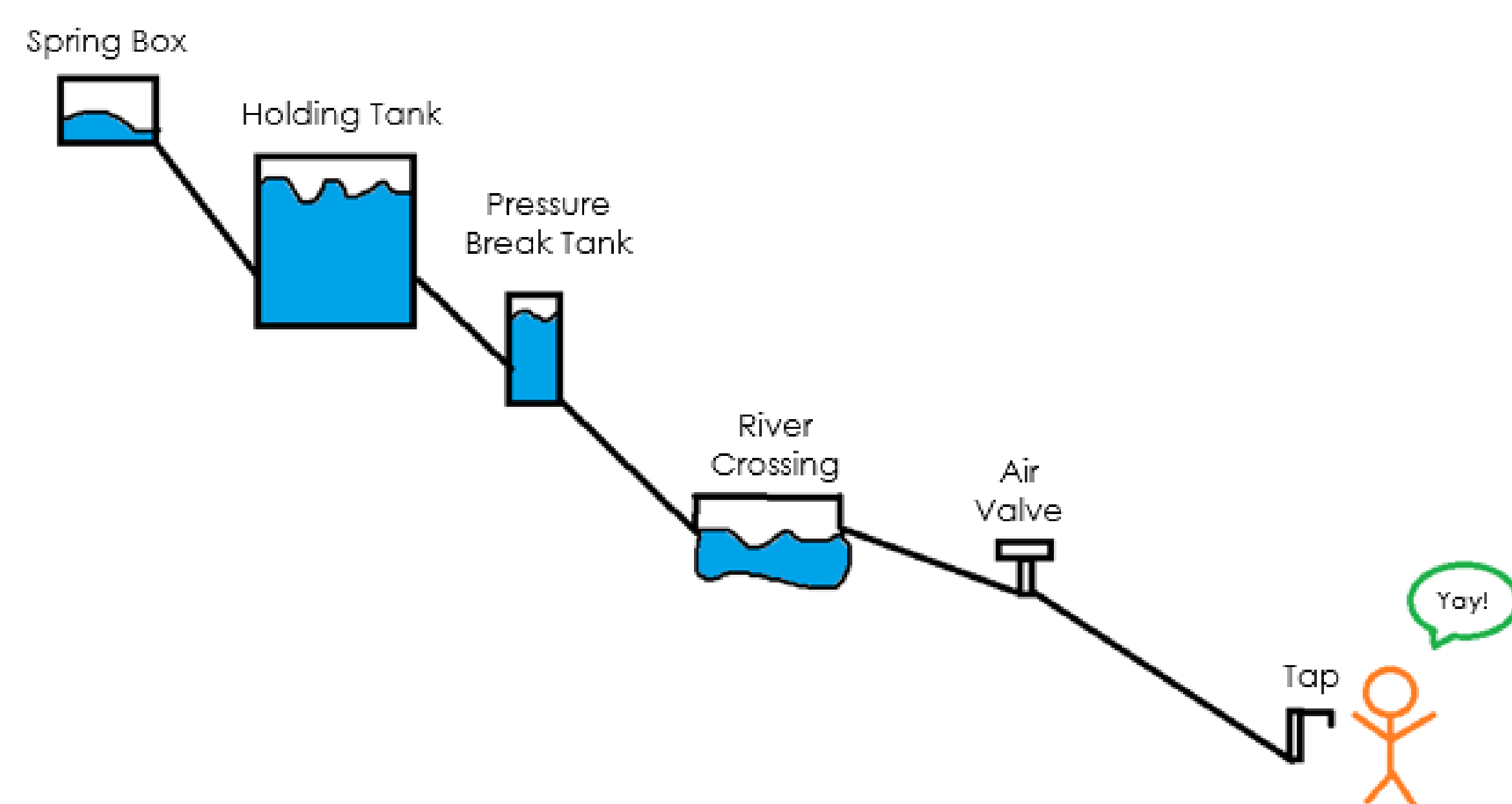


Figure 2. Schematic of basic gravity fed water system

### Data Collection

#### Community Surveying

- Surveyed distances and elevations of the system.
- Steep hills and thick vegetation
- Equipment
  - digital rangefinder
  - abney level
  - tape measure
  - GPS

#### Spring Flowrate

- Nalgene water bottle with known volume was filled
- Time to fill was recorded

#### Water quality

- Tested spring source for microbes using 3M petrifilm



Figure 5. Surveying using the digital range finder

### Community Background

#### Cerro Ortiga II

- Subsection of the larger community Cerro Ortiga
- Located in the Comarca of Ngöbe-Buglé
- Approximately 600 citizens
- Sprawls across approximately 15-20 square miles
- 1.5-to-2- hour hike from the nearest bus stop
- Steep and rocky terrain

#### Common issues

- Remote location
  - Transportation of materials
  - Medical attention
- Lack of sanitation and clean water sources
- Lack of water during the dry season (February through April)



### Data Analysis

#### EPANET model

- Designed using the data collected
- Simulate:
  - the demands
  - pressures throughout the system
  - tank water level

#### Hydraulic Grade Lines (HGL)

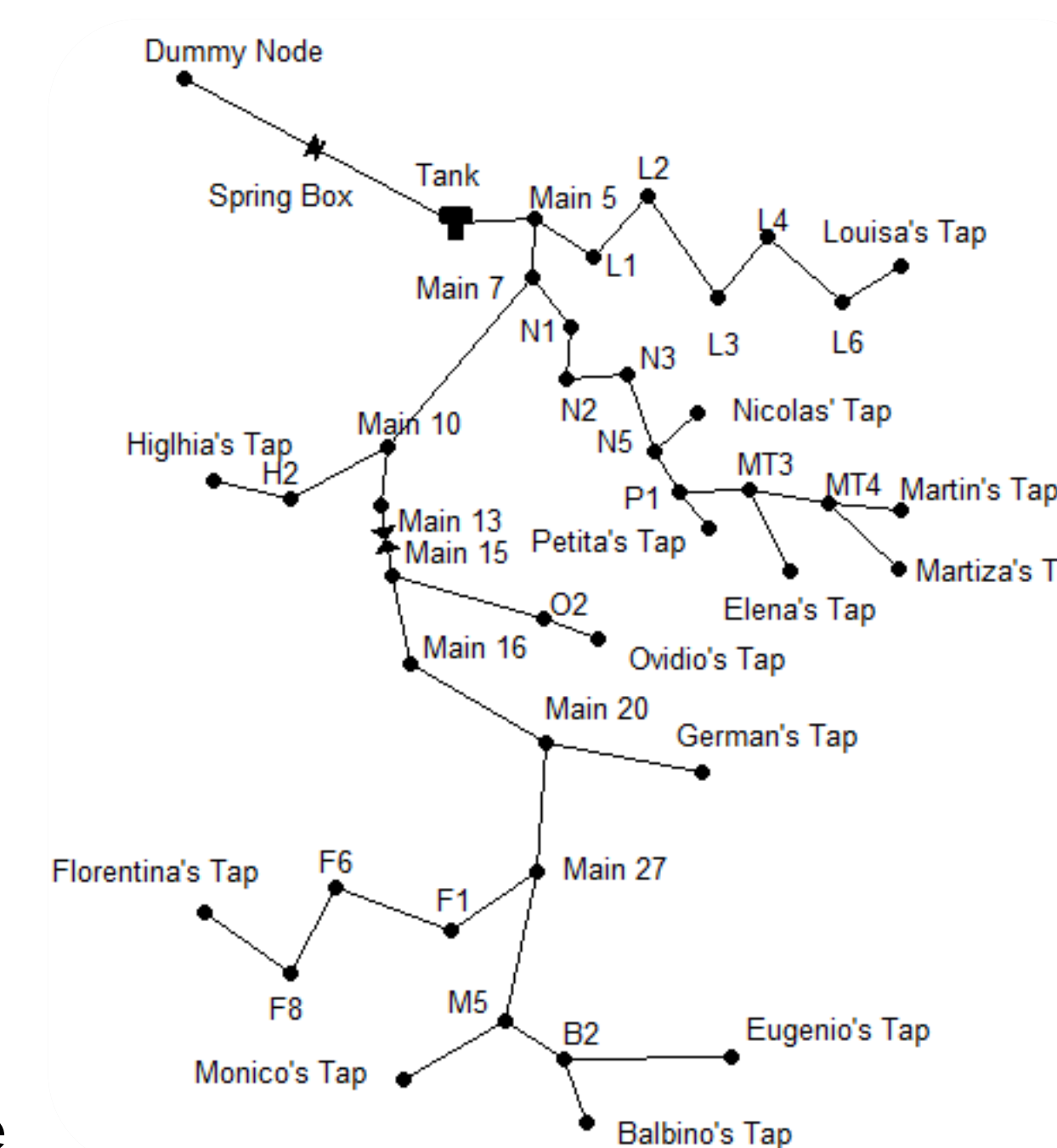
- Ensure no negative pressures
- Ensure within safe pressure limits

#### Spring Flowrate

- The rate was measured at 1.13 gpm

#### Water quality

- Average of 11.6 colonies per petrifilm
- No E-coli was found at the spring source



### Cost Estimate and Construction Schedule

#### Cost estimate

- Community will apply for a government grant of \$8,000 to fund the project
- Final cost is estimated to be \$7,900
- Includes all materials and equipment
- Labor costs are not needed
  - community members will be constructing the system

#### Construction Schedule

- August 1, 2017 to October 26, 2017
- During the rainy season

Item	Cost
Infrastructure	\$4,000
Pipeline	\$3,500
Equipment	\$400
<b>Total</b>	<b>\$7,900</b>

