Water Distribution System Design for Northern Vallecito, Panama

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Outline

- Background
- Data Collection
- Design
- Cost Estimate & Schedule
- Maintenance & Sustainability
- Conclusions
- Acknowledgements



Definitions

Toma = Spring or Water Source
Arriba = Above
Abajo = Below





Existing Problem

Several scattered, aging systems

30% percent of the community is not connected to a water system

Consumption of surface water

Large river crossing



Design Goals

- Design a gravity fed water distribution system to provide potable water for Abajo residents of Northern Vallecito, Panama
 - Provide 30 gallons/person/day
 - Serve approximately 41 people (15% of the community)
 - 10 Households
 - Provide alternatives for problem areas



Design Challenges

High and low pressures problems due to mountainous topography

Large river crossing with dramatically changing water levels

Financial constraints

Community desire for a unified system

Data Collection

System Survey
 Elevation Data
 Abney Level
 X,Y-Coordinates
 GPS

Water Supply

- Toma 1 25,000 L/day
- Toma 2 72,000 L/day
- System Demands
 - ▶ 5,000 Liters/day





Proposed Design

Two Separate Gravity Fed Systems

Toma 1 (7 houses)

Toma 2 (3 houses)

Serves all houses in Northern Vallecito

Deviates from original surveyed route



Toma 1

Serves 7 households





Elevation Profile: Toma 1



EPANET: Toma 1



Spring Box Profile View

◇PROFILE VIEW: SPRING BOX



Spring Box Plan View

◇PLAN VIEW: SPRING BOX



Storage Tank



Air Release Valves



Bridge



Units: meters Vertical: Horizontal 2:1

Chlorination

MINSA provided in-line chlorinators and tablets

Design for a "Ct" value of 75mg*min/L

Contact time of 2 hours



Tap Stands

◇PROFILE VIEW: TAP STAND



Toma 1 Options

 Full system to Clemente's house following topographic reroute
 Cost: \$9,300

Full system as surveyed to Clemente's House

Cost: \$8,600

 Partial system with rainwater catchment at Clemente's house
 Cost: \$7,000



Decision Matrix Toma 1

Weight of Criteria	4	3	4	2	3	2	4	
Criteria	Cost	Community Perspective	Ease of maintenance	Potential Lifespan	Quality of water delivered	Convenience	Supply Reliability	Total
Surveyed Full System	6	10	8	7	9	9	5	165
Reroute Full System	7	9	8	7	9	6	9	176
System to Felix's, rainwater for Clemente	9	5	8	8	7	8	7	164

Toma 2

Serves 3 households





Toma 2 Options

Gravity fed, communal tap stand
 Cost: \$380

Rainwater catchmentCost: \$2,000

Full system with solar-powered pump
 Cost: \$1,200



Elevation Profile: Communal Tap



Distance (m)

Rainwater Catchment



http://sdwebx.worldbank.org/climateportal/index.cfm



http://www.oas.org/dsd/publications/Unit/oea59e/p034.GIF

Pump Components







northerntool.com

Pump Design

PUMP DESIGN



Decision Matrix Toma 2

Weight of Criteria	4	3	4	2	3	2	4	
Criteria	Cost	Community Perspective	Ease of maintenance	Potential Lifespan	Quality of water delivered	Convenience	Supply Reliability	Total
Rainwater catchment for all	3	4	8	9	7	8	7	139
Gravity-fed Communal Tap	9	6	6	8	8	5	8	160
Solar-powered pump	5	9	2	2	8	9	8	133

Design Conclusion

Toma 1Rerouted system

Toma 2
 Communal Tap Stand



Cost Estimate: Proposed Design

Component	Cost
Pipeline	\$4,400
Spring Box	\$360
Storage Tank	\$343
Bridge	\$2,300
Valves	\$20
Tap stands	\$85
Transportation	\$1,050
Total+10%	\$9,400

Schedule

Time to complete
 Approximately 2 months

Labor

- Assume volunteer labor with PCV supervision
- 8 person crew can lay 0.25 km in a day



Maintenance

Agua de Abajo recommends

- Keeping materials on hand
- Burying PVC pipe
- Monitor and clean spring box
- Adding chlorine tablets once every 2 months



Vallecito has an Aqueduct Constitution that

- Formed a Water Committee, describes responsibilities
- Describes permitted uses and defines penalties for water waste
- Defines owner responsibilities and requirements for new users
- Requires employment and training of a plumber, describes duties
- Sets monthly maintenance fee at \$5 per month

http://rooterguys.net/pipe_repairs

Sustainability

Toma 1 System



Cost 1

- 2 3 Community Perspective
- Ease of Maintenance
- Potential Lifespan 4
- Quality of Water Delivered 5
- Convenience 6
- Supply Reliability 7

Toma 2 System



Conclusions

- Designed affordable, sustainable water distribution systems for Northern Vallecito, Panama
- Proposed Design
 - Toma 1: Topographic reroute to full system
 - Toma 2: Communal tap 30 m from houses
- Provided estimate, schedule, and maintenance tips to guide the project completion



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