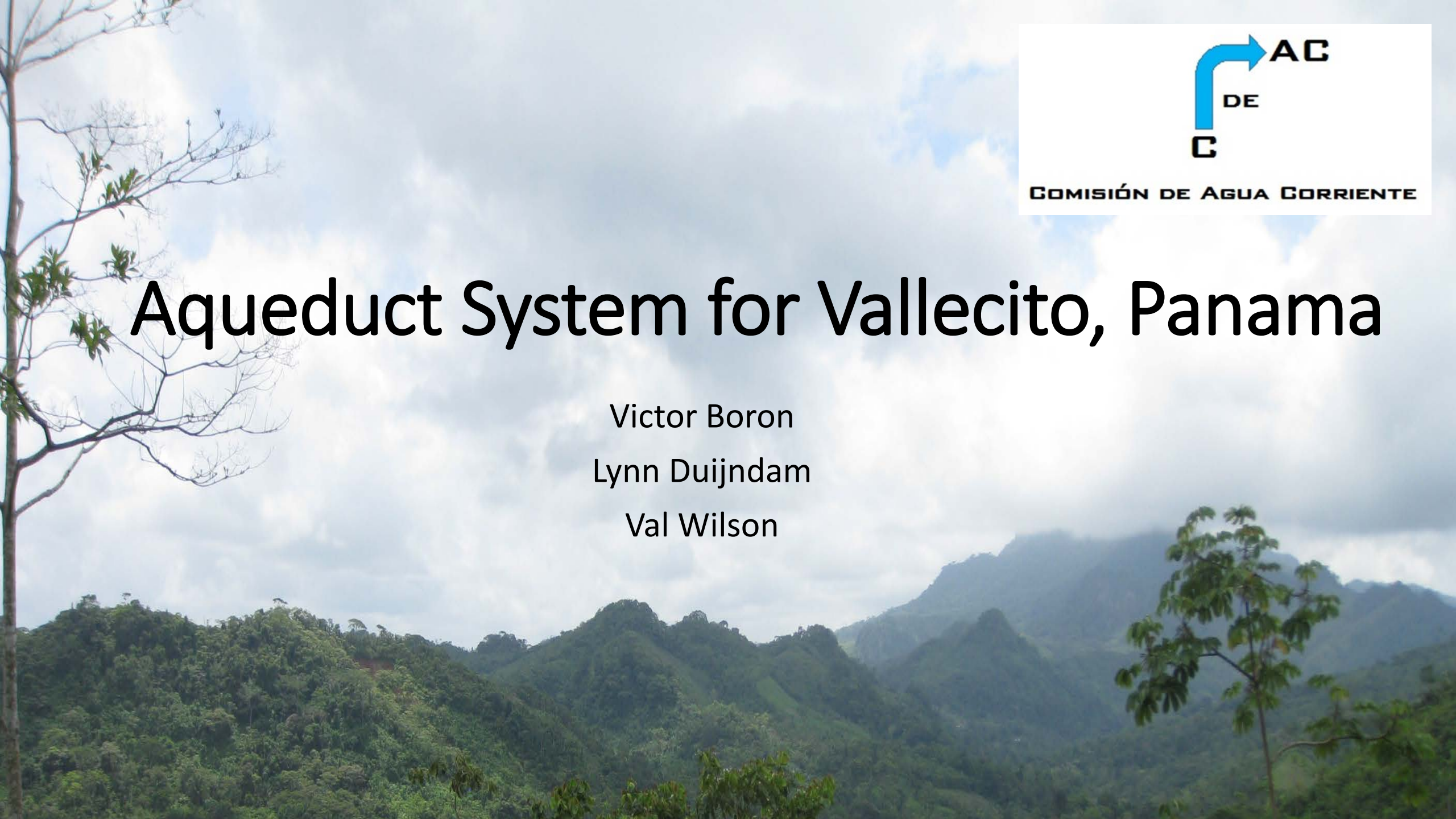


Aqueduct System for Vallecito, Panama

Victor Boron

Lynn Duijndam

Val Wilson

Outline

- Team Introductions
- Site Location
- Community Background
- Existing System
- New Design & Project Details
- Recommendations
- Conclusion
- Questions

Introductions

Comisión de Agua Corriente

- Lynn Duijndam
- Victor Boron
- Valerie Wilson

Vallecito, Panama

http://www.educatecentralamerica.org/images/panama-map-col.jpg

Regional Landscape

Vallecito

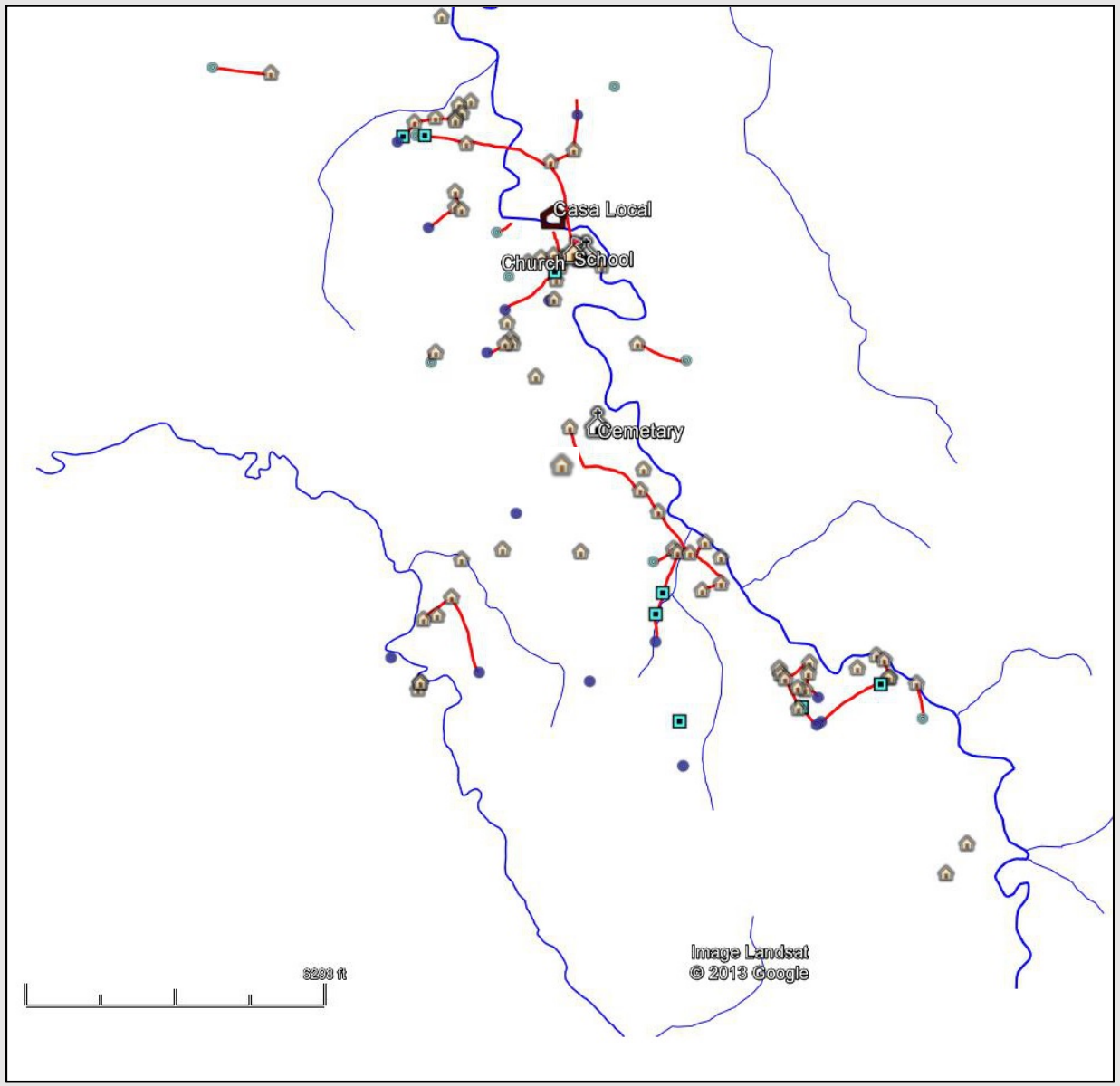
- Settled area ~70 years ago
  - Approximately 70 households
  - Wooden huts and latrines available
- School (Est. 1948)
- Church and central town area
- Local Stores

People

- Latino
- Spanish Language
- Agriculture
  - Subsistence Farming
  - About $5 per day
- Coffee, Bananas, Oranges, Rice, Beef Chicken, etc.
- Activities
  - Baseball, dancing, swimming

Existing Aqueduct Systems

- About 13 scattered, single household systems



Existing private aqueduct system

Water sources

Streams & rivers

Existing private tanks

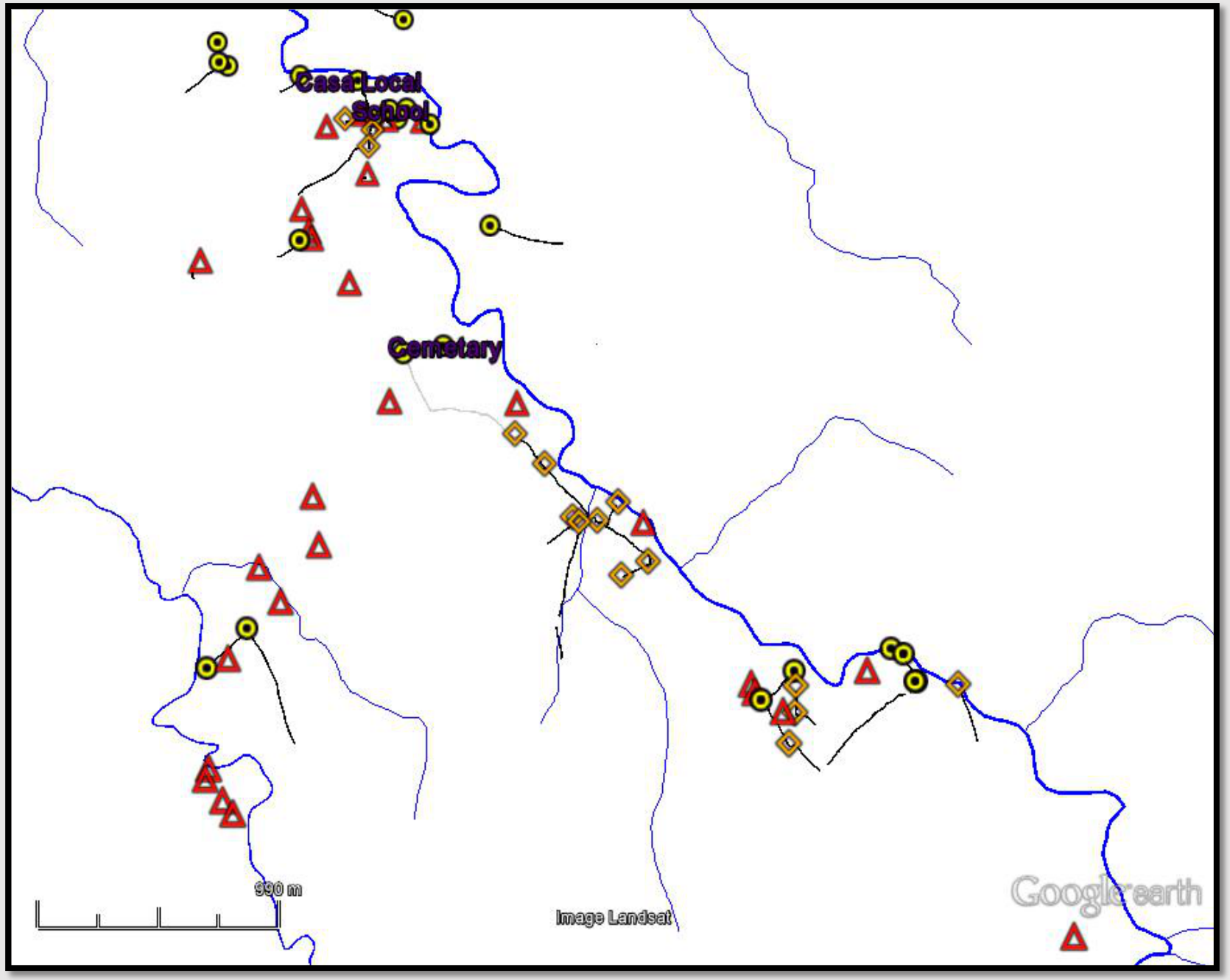
House

Existing Aqueducts: Problems

- Functional but aging, often 20 yrs+
- Mostly unburied – exposed to agricultural activity
- Inefficient, decentralized layout

Existing Sources - Problems

- Unprotected: runoff contamination
  - Cow and horse feces - E. coli/coliforms
  - Fertilizer & pesticides
- Households without taps must walk to sources (springs)
- Lack of household water treatment



Acceptable service

Improvements required

Bucket carrying households

River

Existing System Problems: Town Center

- Public facilities at town center:
  - School
  - Church
  - *Casa local*, a public gathering pavilion/kitchen

- Source for town center located on private land
- Pesticides to be used near source

Goal of New Design

- Create a new water system to serve southern Vallecito
  - Main aqueduct
  - Service line branches
  - In-line chlorination
  - Water committee

The Water Level

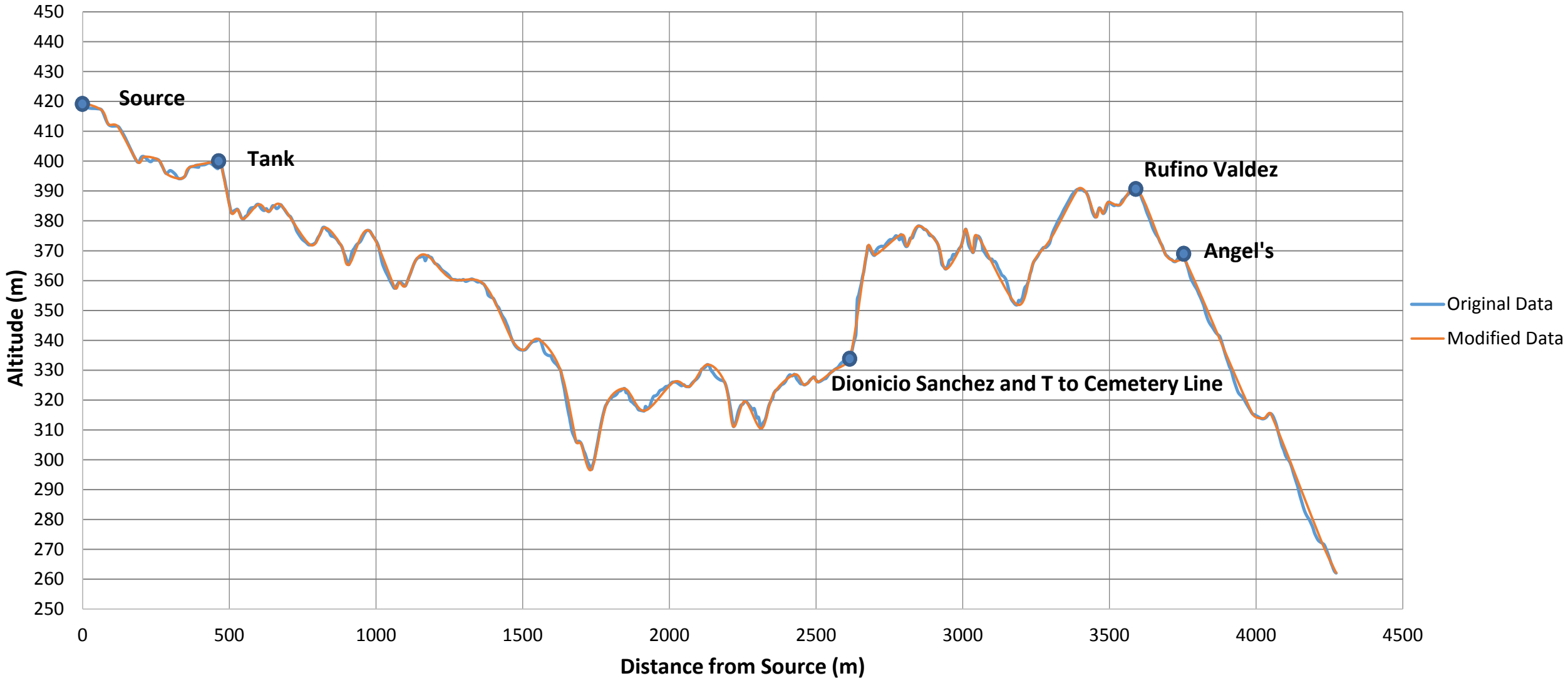
Components

- PVC reservoir: always uphill
- ≈ 6 m (20 ft) plastic tube
- Wooden rod: always downhill
  - Tube rises up rod
  - Measuring tape also attached

Water Level Surveying

1. Record benchmark
2. Move forward with appropriate end
3. Person holding wooden rod watches for spilling
4. Measure linear distance
5. Measure elevation difference
6. Record compass bearing (and GPS waypoint, if necessary)
7. Repeat

Vallecito- High Line System Profile



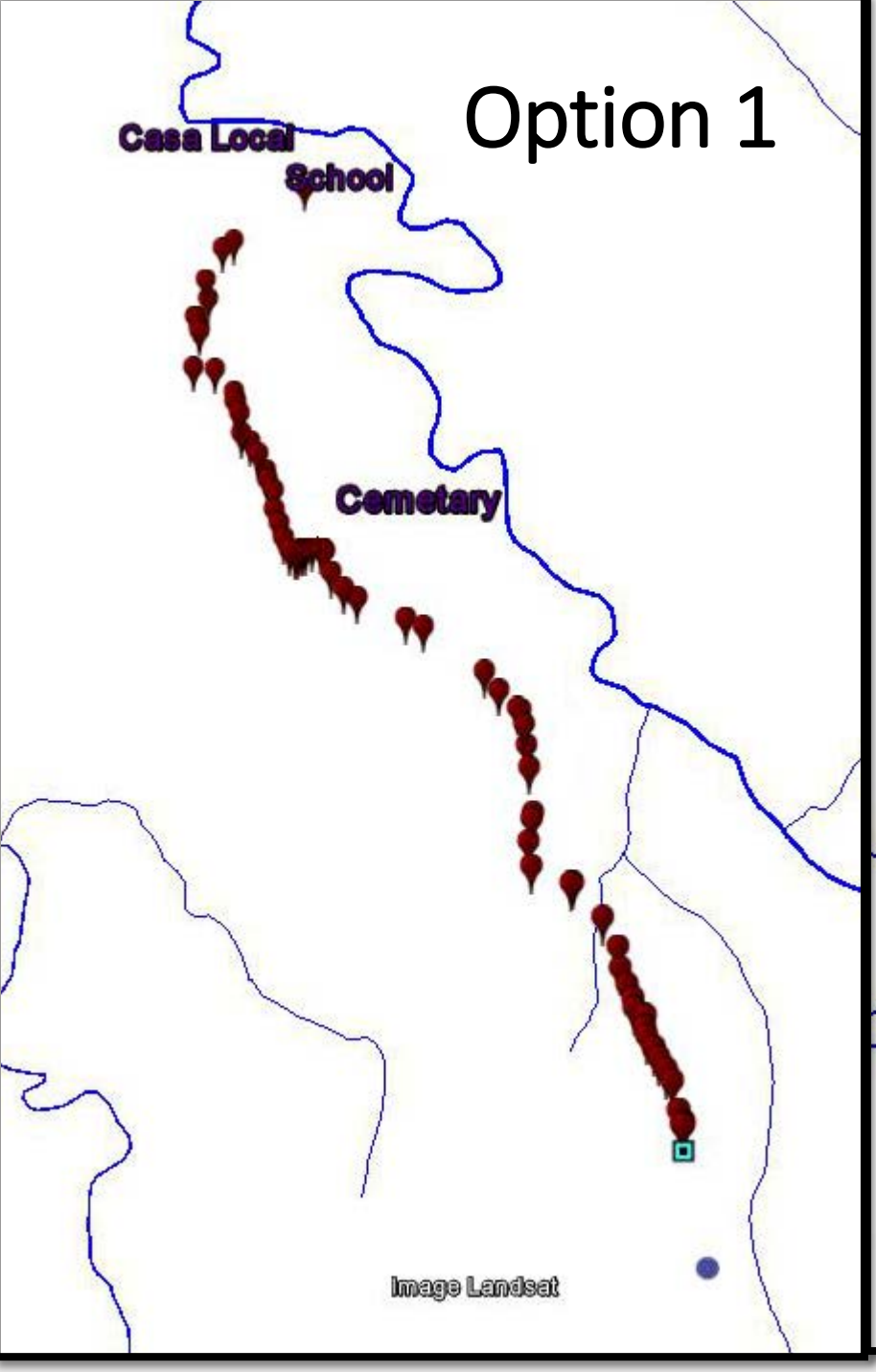
Supply & Demand

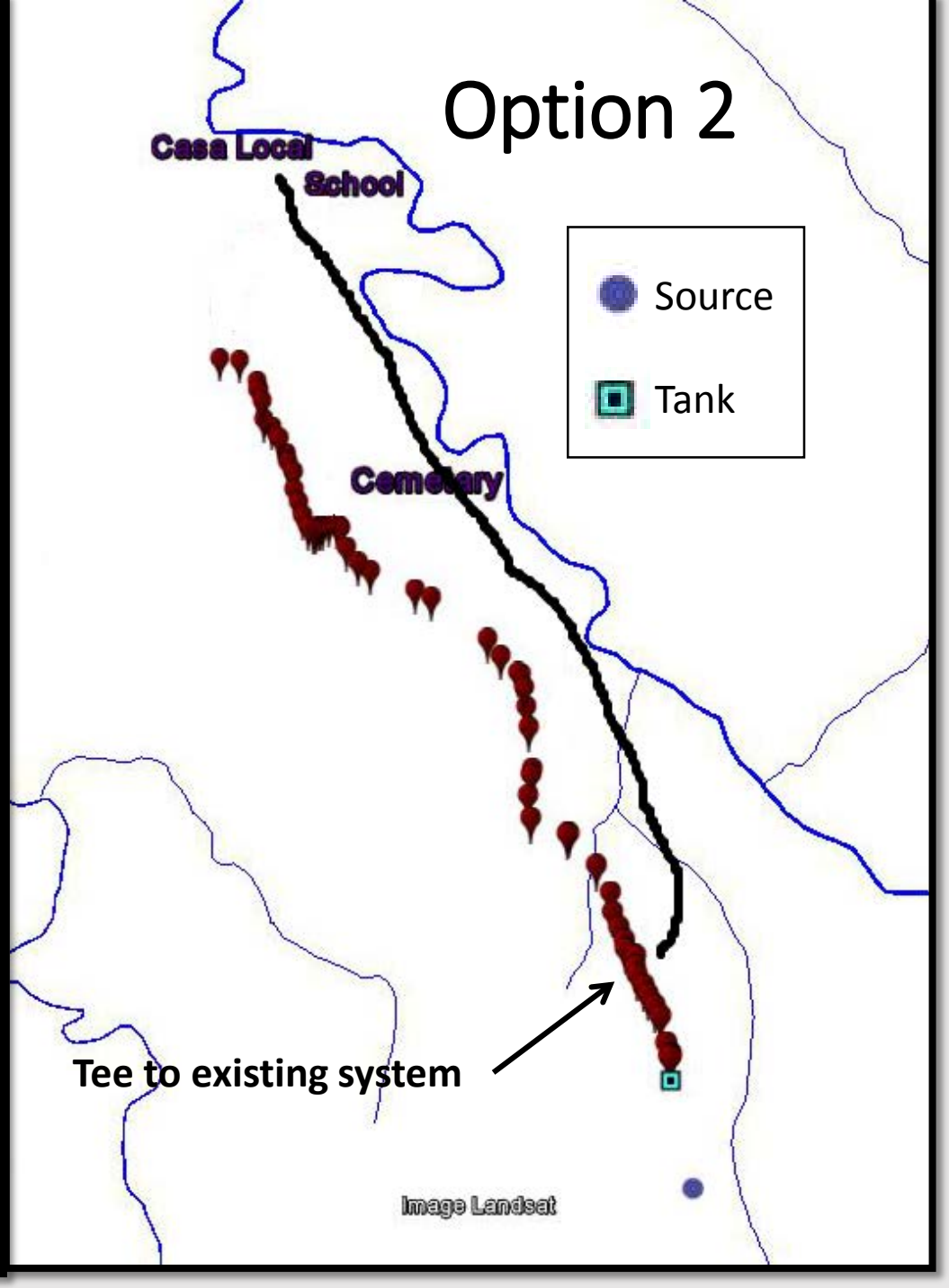
Total persons served
=50 households x 6 persons/household = **300 persons**

Recommended rate of water consumption (MINSA)
= **30 gal/person/day**

Total daily community demand = **9600 gal/day**

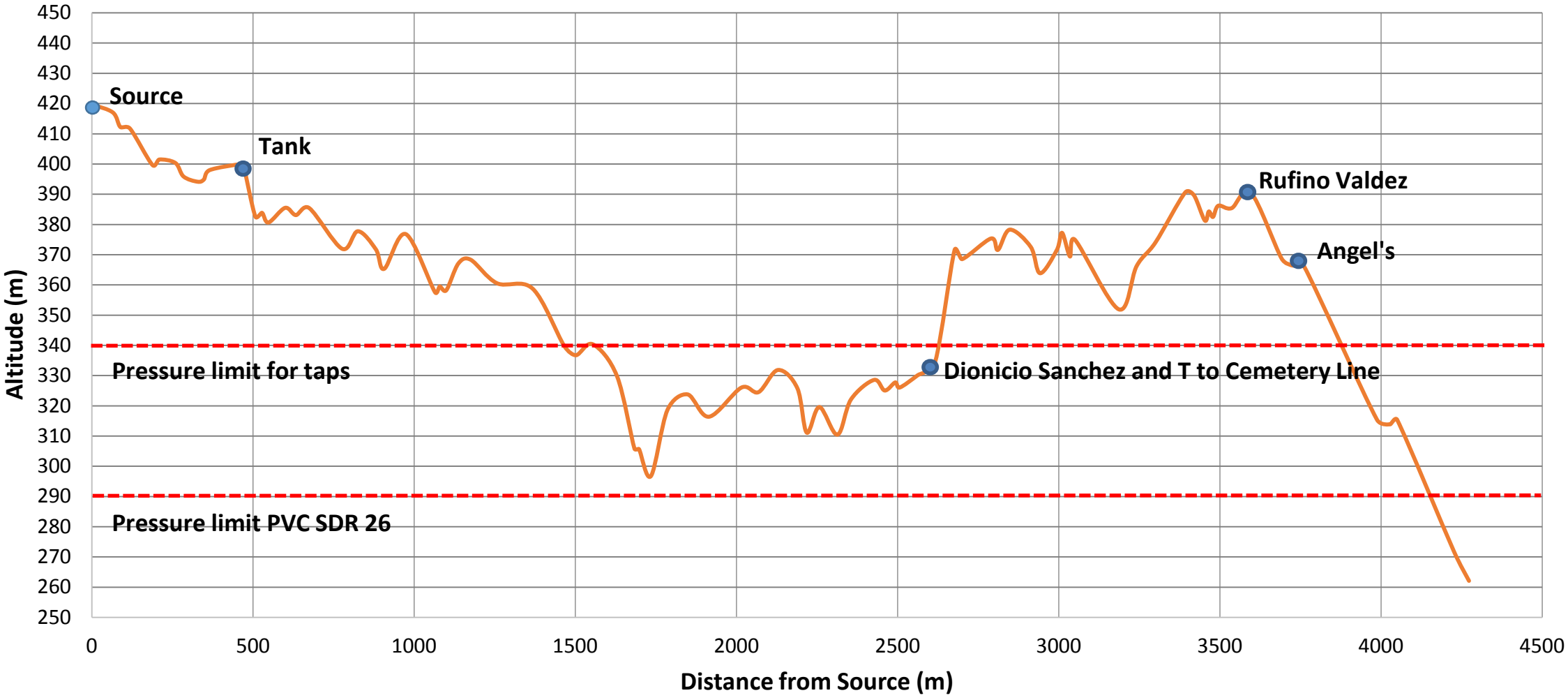
Total dry season daily supply of source = **13,000 gal/day**



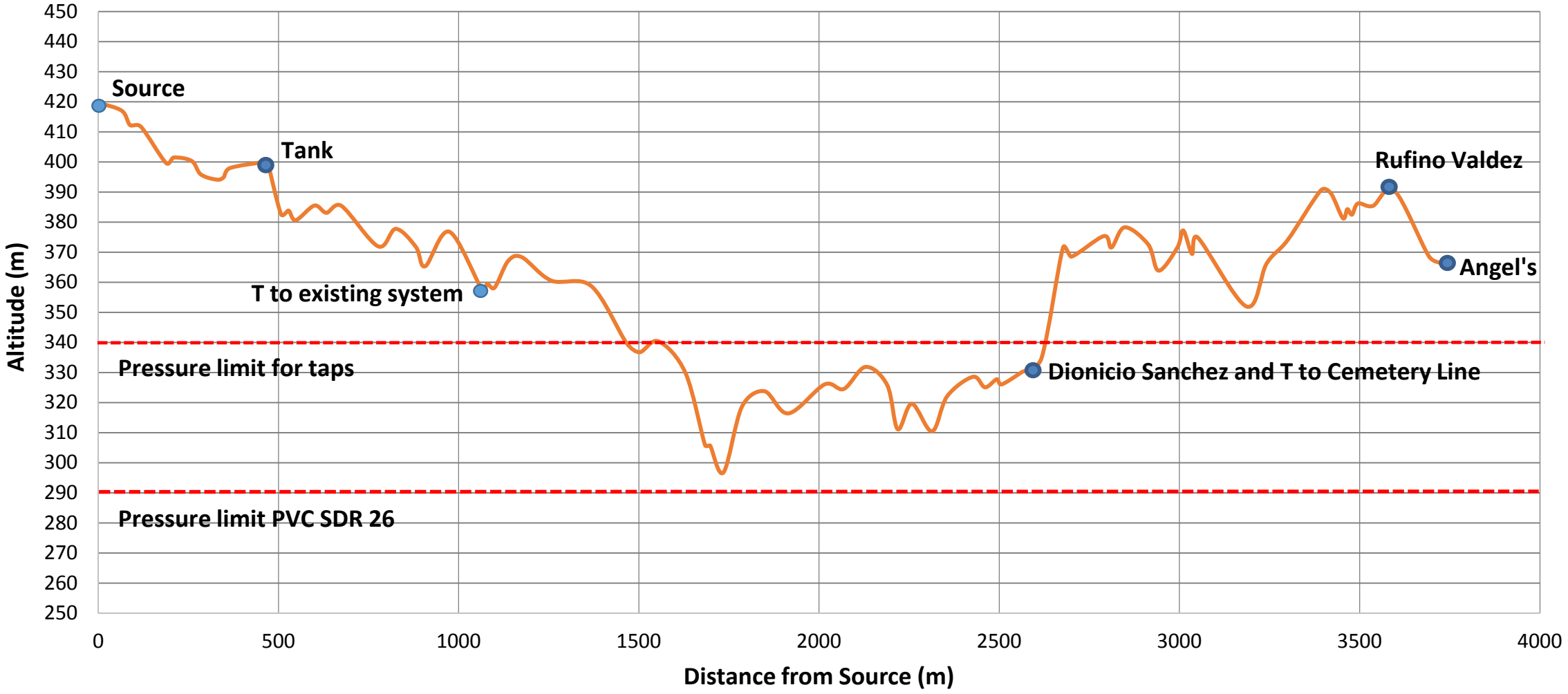


- Option 1: 4.2km
- Option 2: 3.5km

Vallecito Water Distribution System Profile (Option 1)



Vallecito Water Distribution System Profile (Option 2)



Pipe Sizes

Option 1: Pipe Information			
Section of Pipe	Distance (m)	Nominal Size (in.)	SDR
Conduction Line	463	1 1/2	13.5
High Line	3810	2	26
Cemetery Service Line	534	1/2	13.5
Other Service Lines	-	1/2	13.5

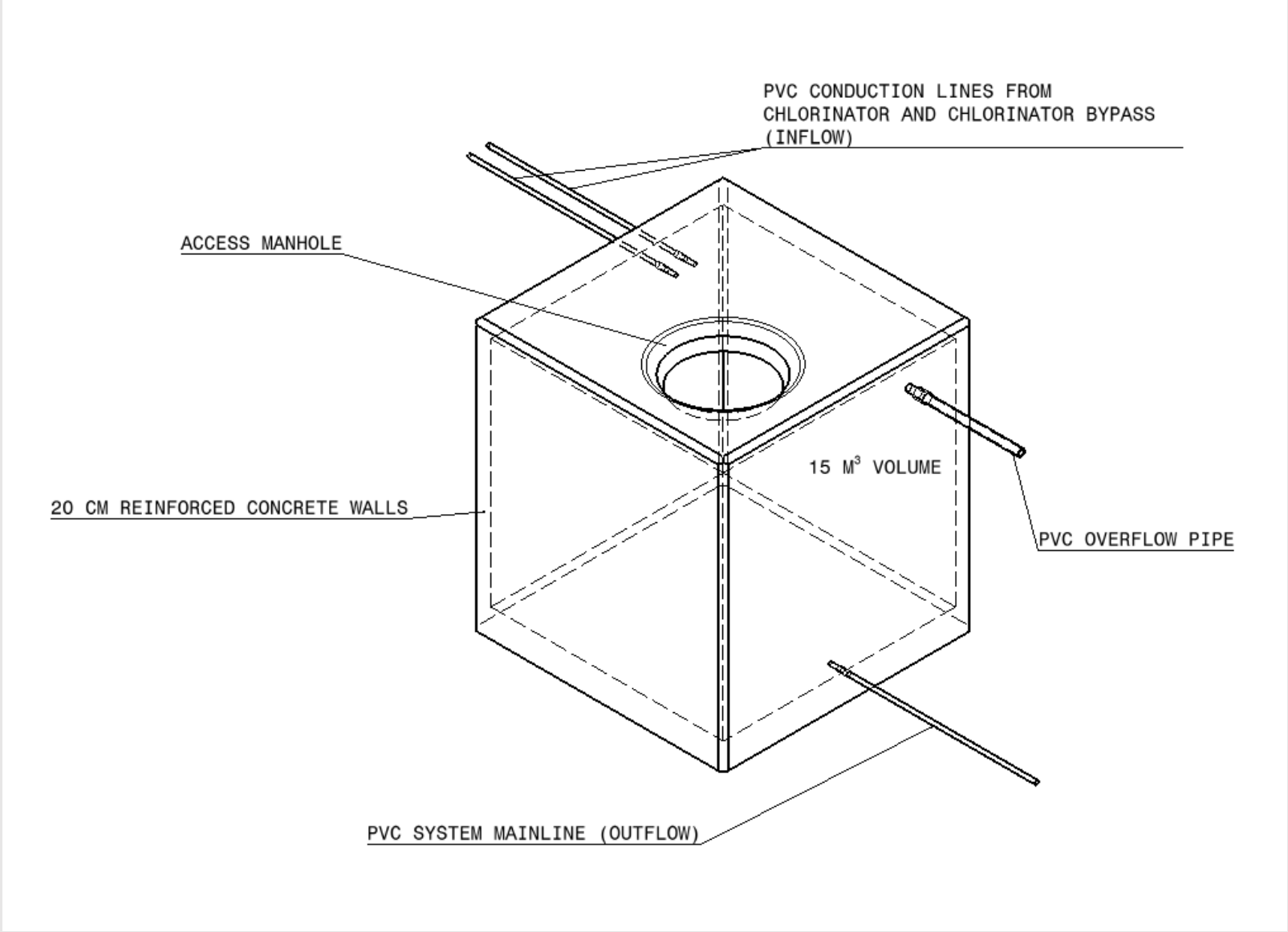
Option 2: Pipe Information			
Section of Pipe	Distance (m)	Nominal Size (in.)	SDR
Conduction Line	463	1 1/2	13.5
High Line to connection to existing system	602.2	3	26
Continuation of High Line	3299.1	2	26
Cemetery Service Line	534	1/2	13.5
Other Service Lines	-	1/2	13.5

Spring Box

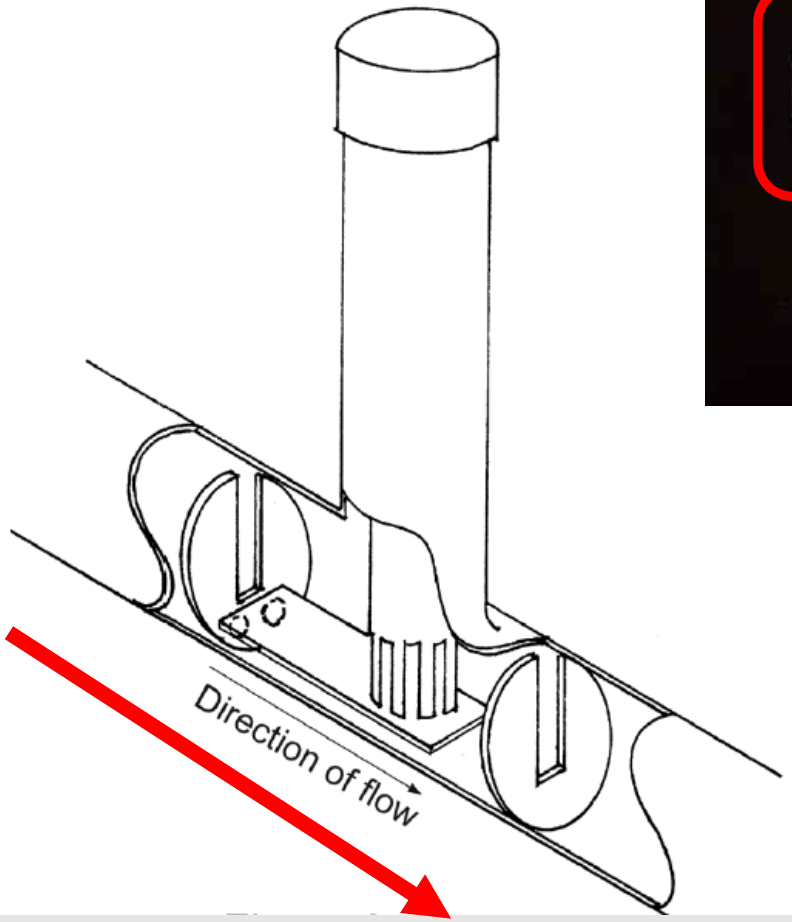
- Already constructed by previous Peace Corps volunteer
- Conduction line needed between spring box and storage tank
  - 1.5” dia. SDR 26

Storage Tank

- 15 m^3 tank already constructed
- 2 Purposes:
  - 1. Store water for peak demand
  - 2. Contact time for chlorine disinfection
- Size based on flow & peak demand 20 years in future



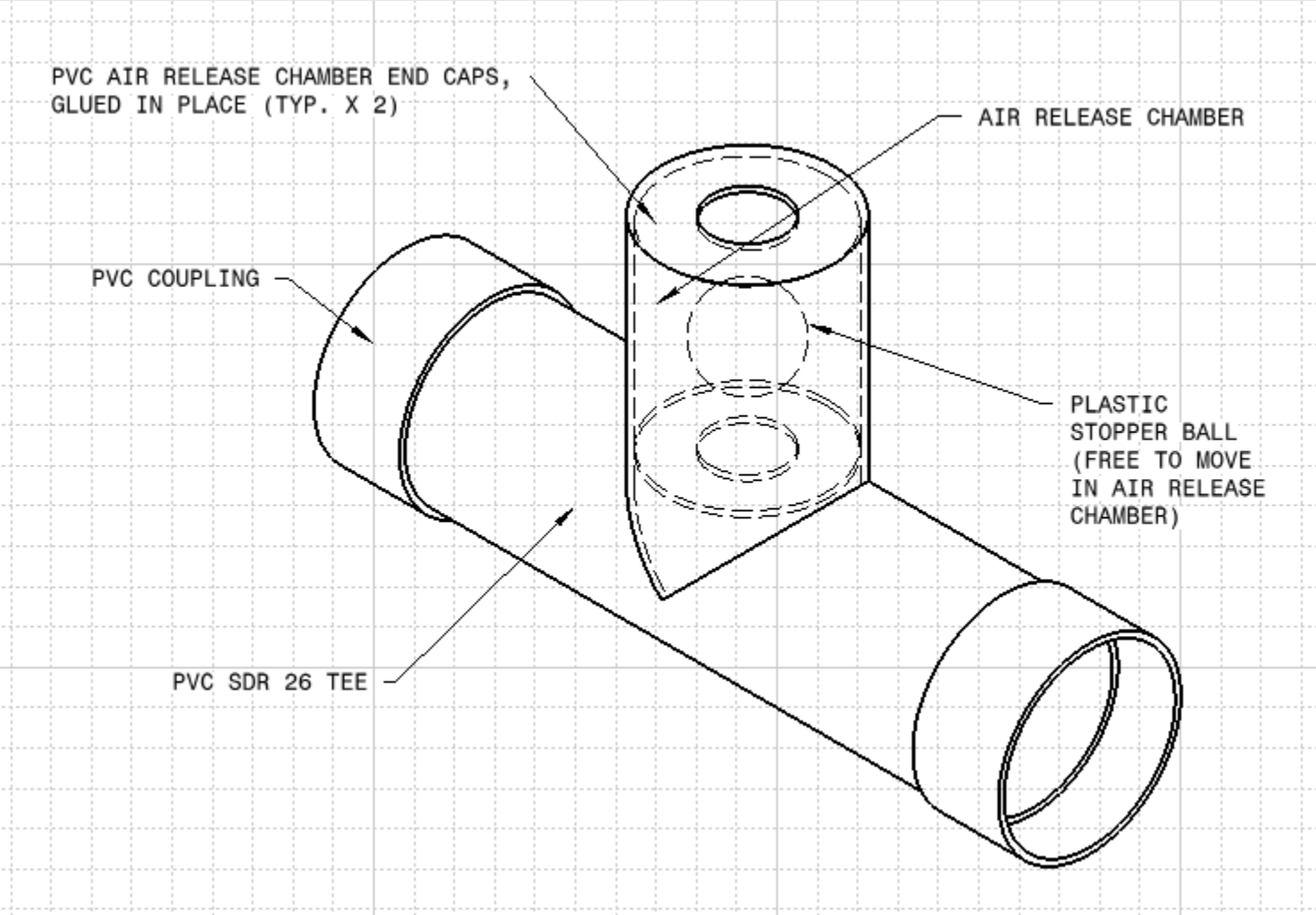
Water Treatment



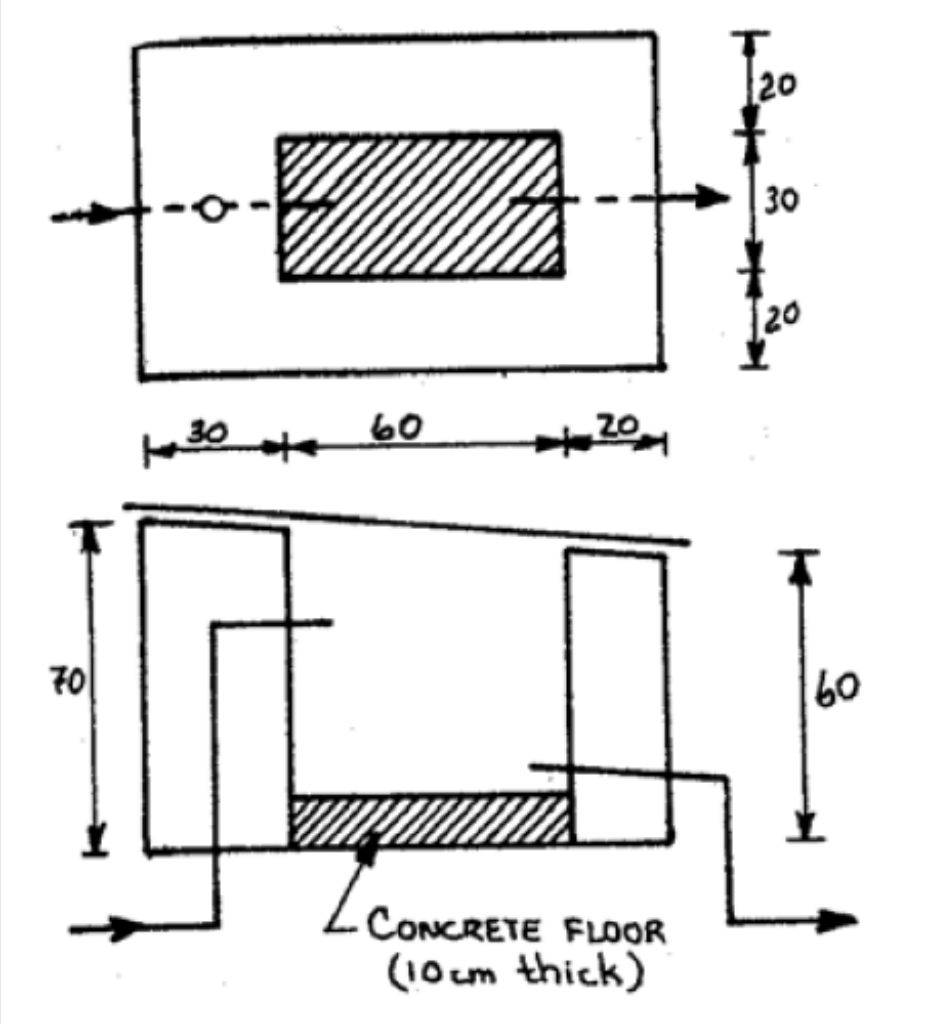
https://www.engineeringforchange.org/news/files/CTI8%20InformationManual11.1-pdf.pdf

http://www.bikudo.com/product_search/details/101343/chlorine_disinfectant_tablet_tcca.html

Air Release Valves



- Relieve air trapped at system high points
- Floating stopper ball free to move
  - Rises to plug end cap when no air
  - Drops to allow air release
- Made of modified PVC tee connection

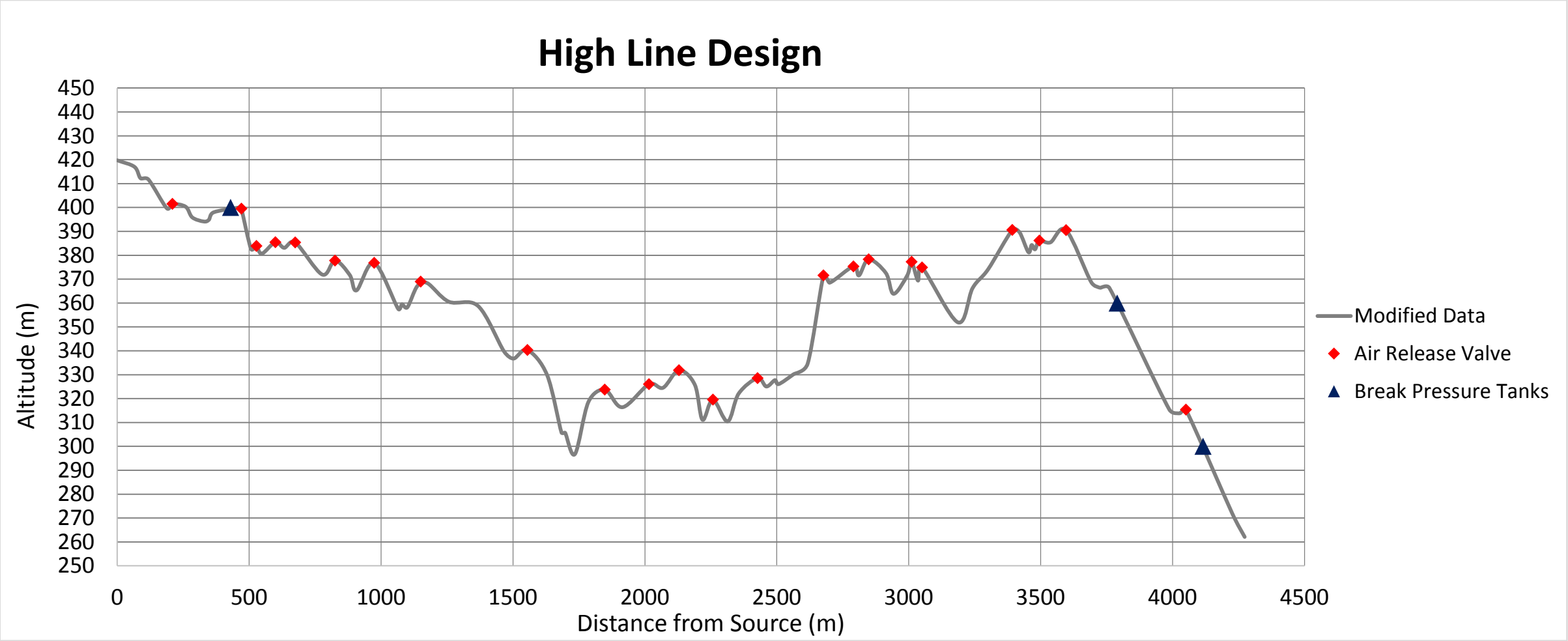


Break Pressure Tanks

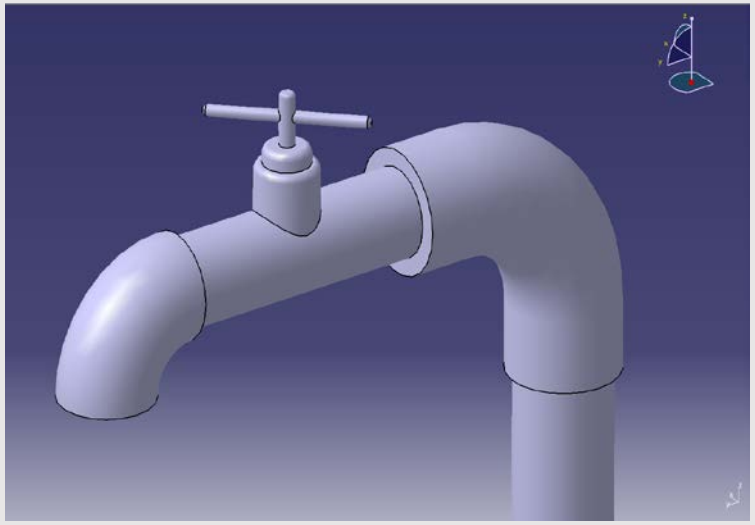
- Release pressure buildup at system low points
- Hollow masonry box with cast-in-place reinforced concrete floor
- Inflow = outflow

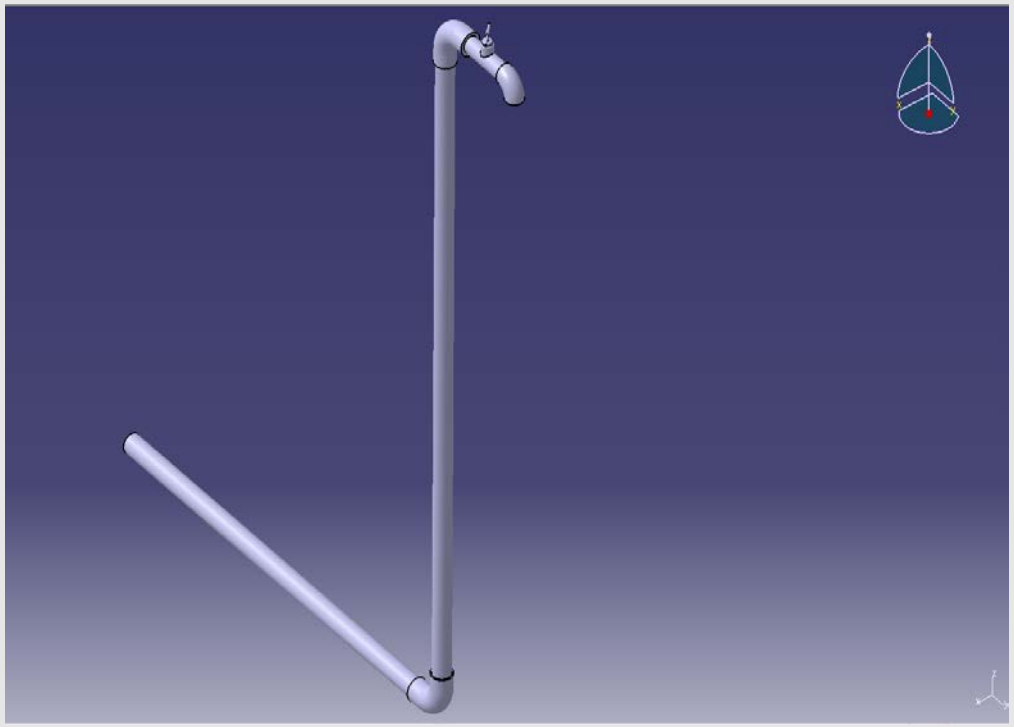
A Handbook of Gravity-Flow Water Systems, Thomas D Jordan Jr., UNICEF 2010.

Break Pressure Tanks and Air Release Valves



Tap Stands





- Service line to vertical pipe & spigot
- 1” PVC pipe
- Plastic or steel spigot

Cost Estimate

Scheduled for 6 months

Estimated Construction Cost Summary (Option 1)

Design Component		Estimated Cost
Conduction Line		469
Chlorinator		54
Main Line Pipe		4560
Service Line (Cemetery) Pipe		216
Tapstand		171
Air Release Valve		119
Break Pressure Tank		181
Miscellaneous		1887
Total Estimated Cost (before contigencies)		$ 7660
Design Contingency	10%	766
Estimate contingency	8%	612
Total Estimated Cost (after contingencies)		$ 9040

Cost Estimate

Scheduled for 9 months

Estimated Construction Cost Summary (Option 2)

Design Component		Estimated Cost
Conduction Line		469
Chlorinator		54
Main Line Pipe		9323
Service Line (Cemetery) Pipe		216
Tapstand		171
Air Release Valve		110
Break Pressure Tank		67
Miscellaneous		1887
Total Estimated Cost (before contigencies)		$ 12300
Design Contingency	10%	1230
Estimate contingency	8%	984
Total Estimated Cost (after contingencies)		$ 14520

Final Recommendations

- Initial Design (Option 1)
  - Less expensive
  - Efficient layout
- Maintenance: Water committee
  - Collect tax
  - Closely monitor chlorine

Conclusion

- Traditional Latino farming community
- Existing aqueducts are failing to meet needs
- New aqueduct system to ensure clean and adequate supply
- Must be practical to construct & maintain

Acknowledgments

Peace Corps Volunteers

- Siobhan Girling
- Danielle Renzi

Senior Design Advisors

- David Watkins, Ph.D., PE
- Michael Drewyor, PE, PS

Supplemental surveying

- Team Agua de Abajo

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Questions?