Bolen Consulting
Houghton, Michigan

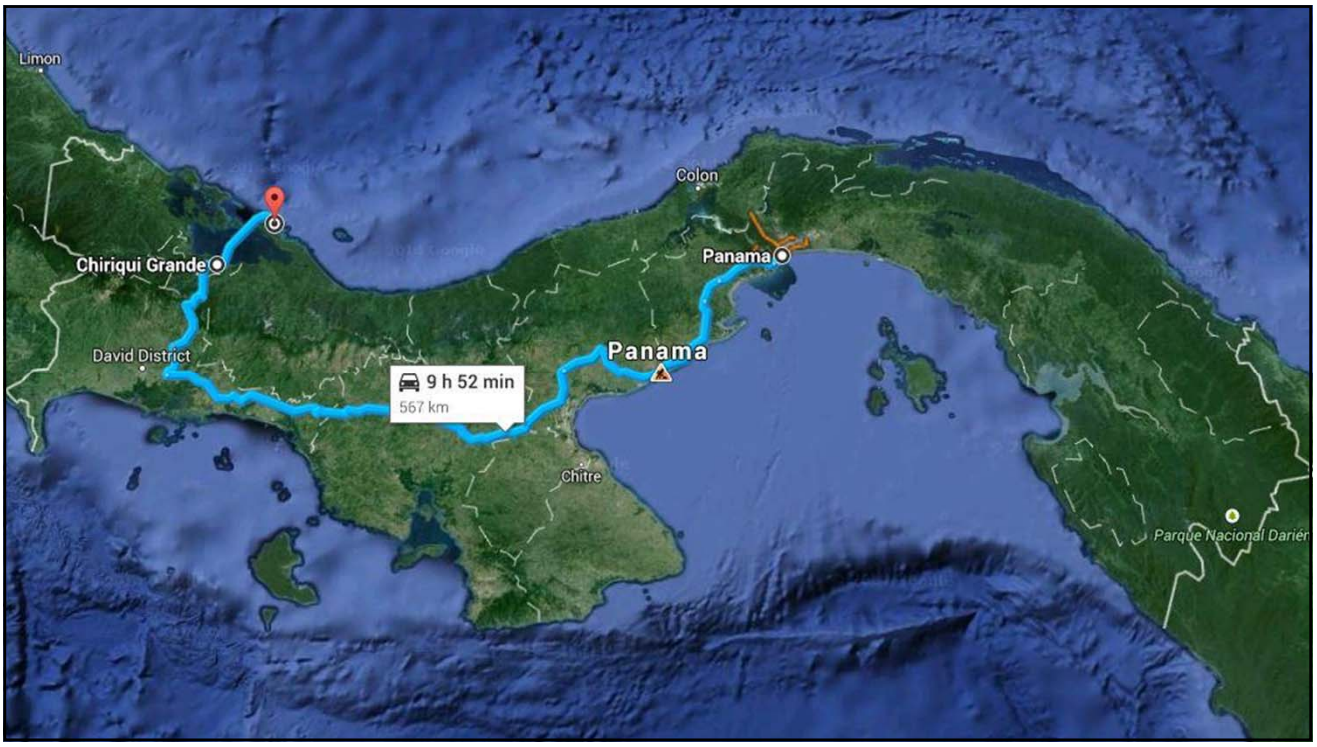
Water Supply System Designs for Nidori, Panama

La Ensenada - Nidori, Panama

Logan Anderson, Kellie Heiden, Madie Martin, Tia Scarpelli, and Adam Tuff

Topics

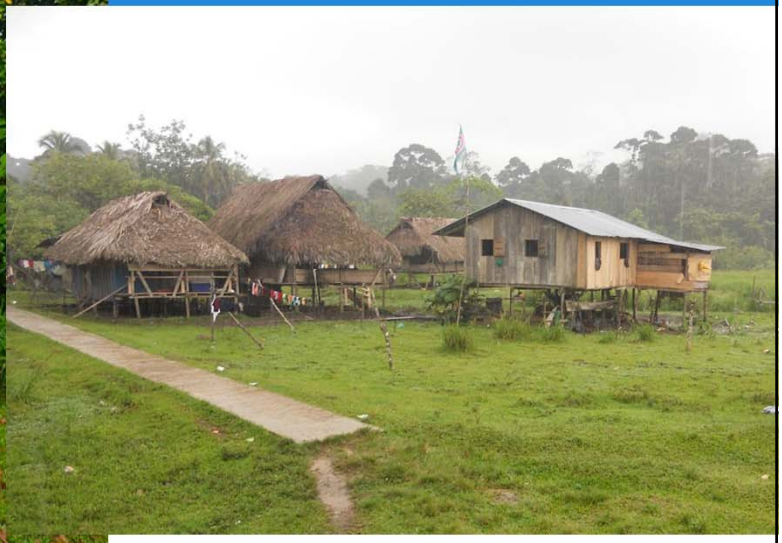
Our Travels
Community Background
Data Collection
Design
Cost Estimate & Schedule
Conclusions

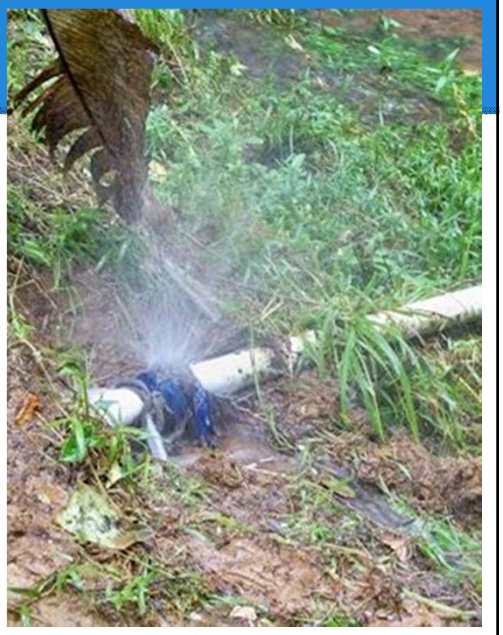

Limon
Colon
Chiriqui Grande
Panama
David District
Panama
9 h 52 min
567 km
Chitre
Parque Nacional Darién

Peace Corps Volunteer: Colleen Hickey

Community Background

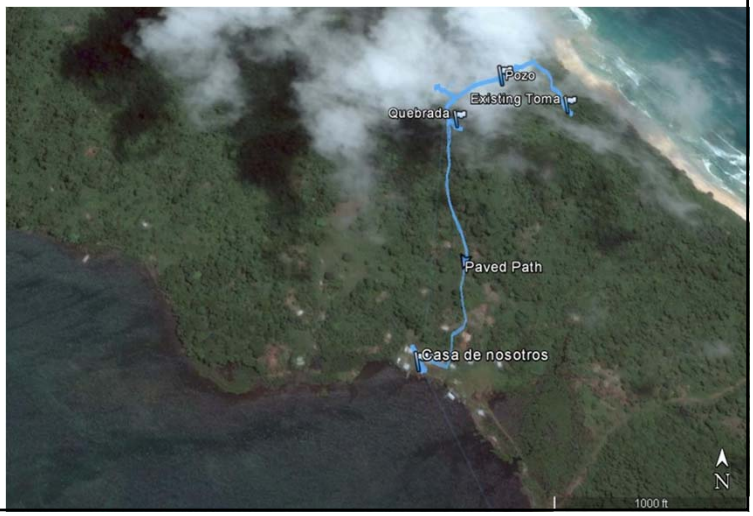

PM 4:27 AUG/16/2014





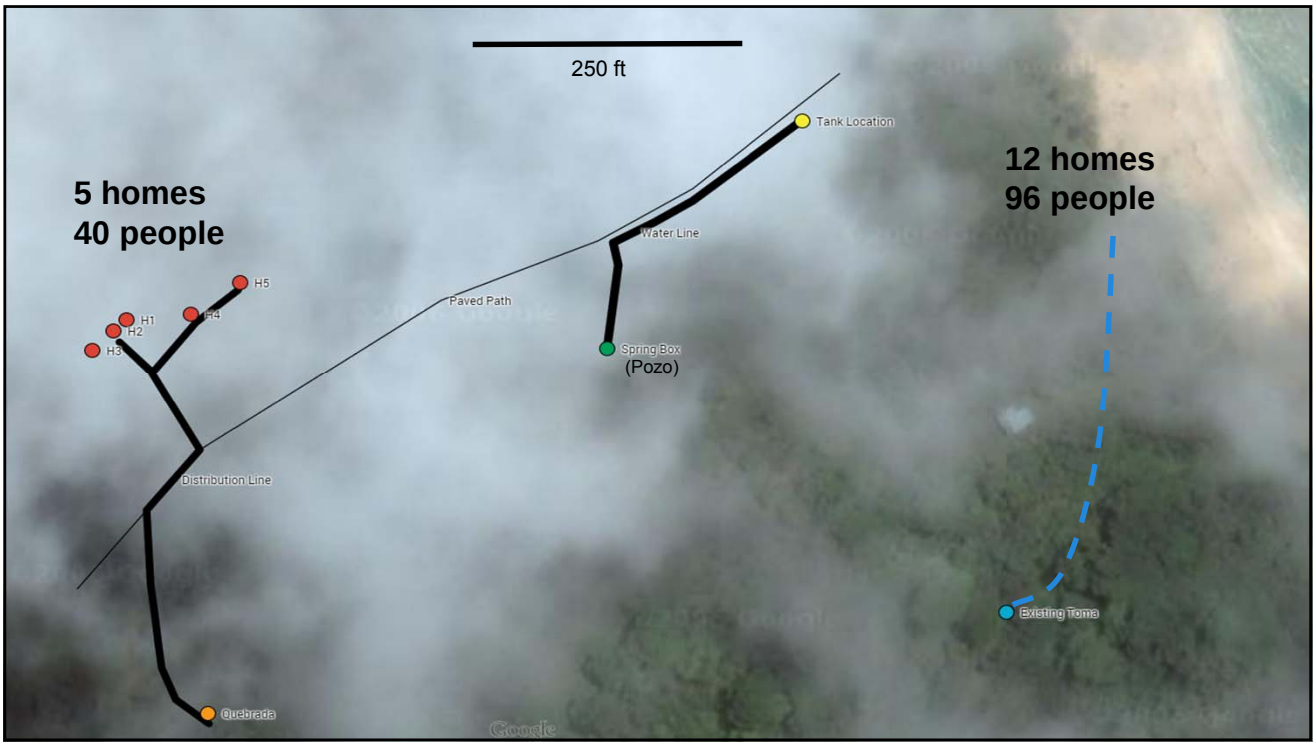
Existing/Proposed Water Systems

- Two systems in place
  - Community
  - Personal
- We designed two systems
  - Quebrada
  - Pozo



Slide 14

1 Move closer to beginning
Adam Tuff,

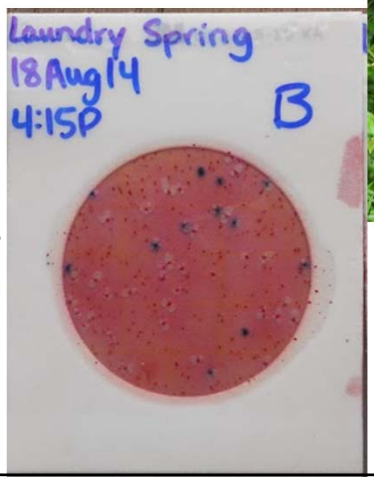


Goal of New Design

- Quebrada - Bring water into 5 houses not connected to a system
- Pozo - Make access easier during the dry season
- Improve quality of life

Data Collection

- Surveying
  - Nikon Forest Pro
- Water Quality
  - 3M Petri-films
- Hydraulic analysis
  - Data from PCV



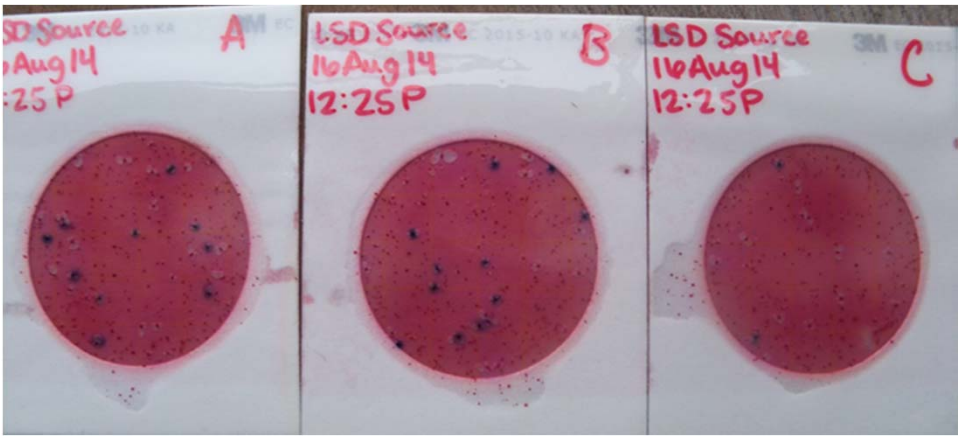
Quebrada: Project Background

- 5 Homes
  - No current system
- Water Collection
  - Open stream source
- Distribution
  - Finca
  - Concrete path
  - Sloped clay path

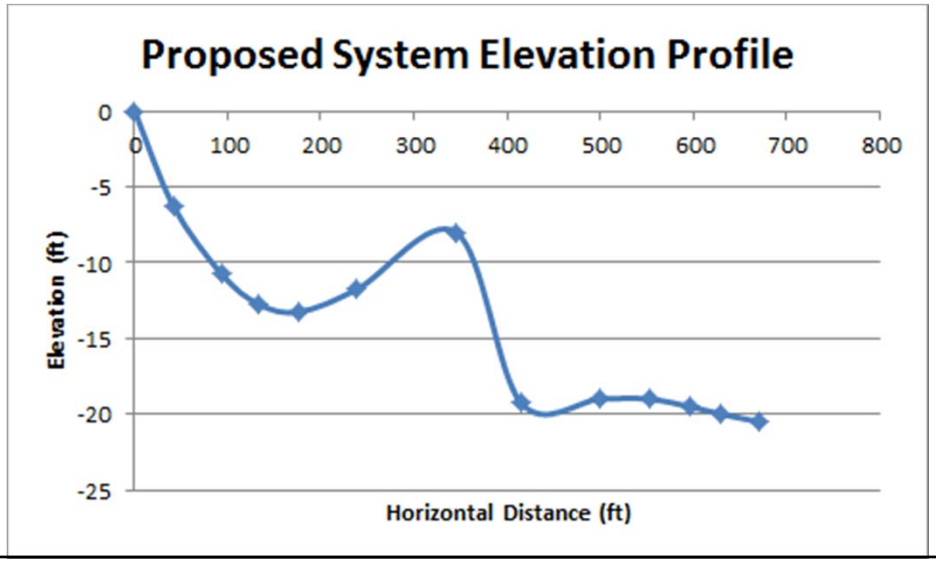
Slide 18

2 Add Quebrada and Pozo to each slide.
Adam Tuff,

Quebrada: Water Quality Assessment

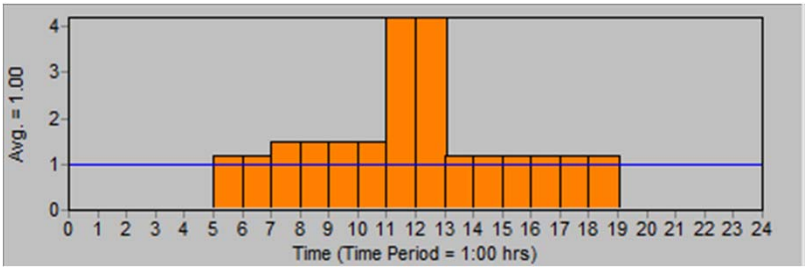


Quebrada: Vertical Profile

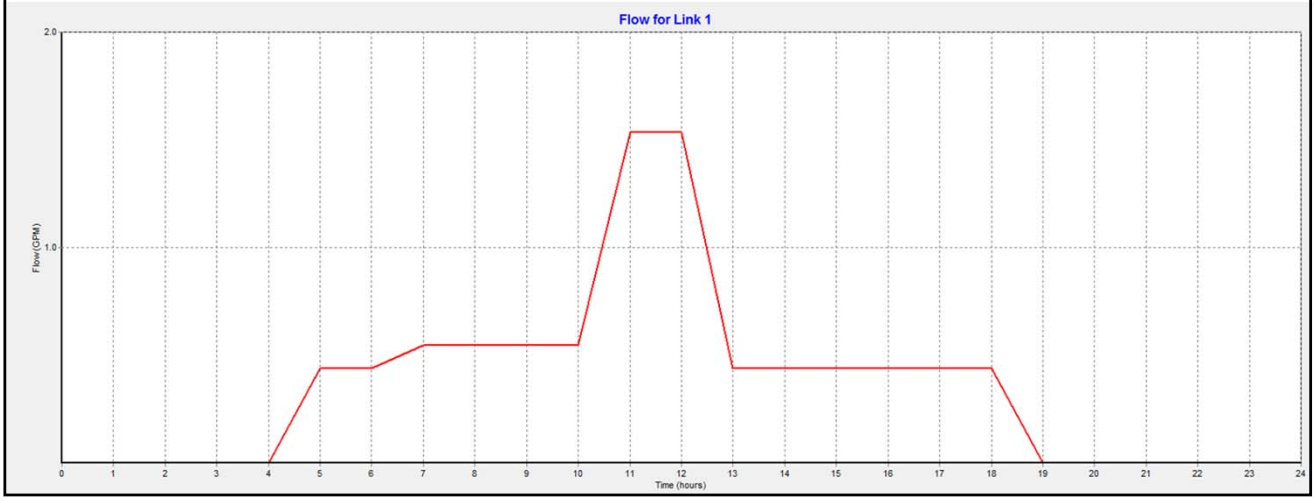


Quebrada: Water Availability v. Demand

- Water demand pattern
- 50 GPM available from the stream



Quebrada: Water Availability v. Demand



Slide 21

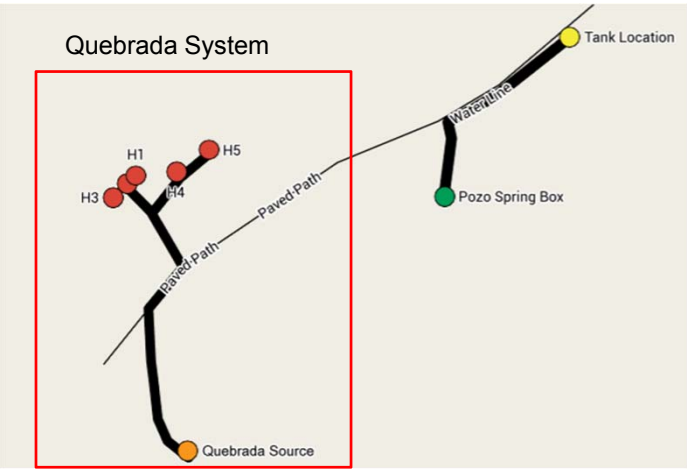
1 be prepared to justify this demand pattern, different from the previous group and our other pattern. Say that it is because it is plumbed in, and we tried it in epanet with both demand patterns and both worked

Madelaina Martin,

Quebrada: Technical Design

Major Design Components

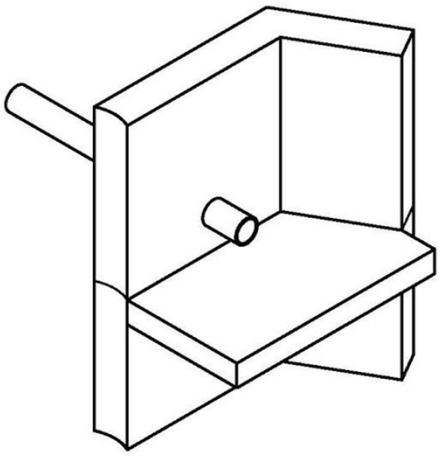
1. Stream Dam
2. Distribution Line



Quebrada: Dam Design

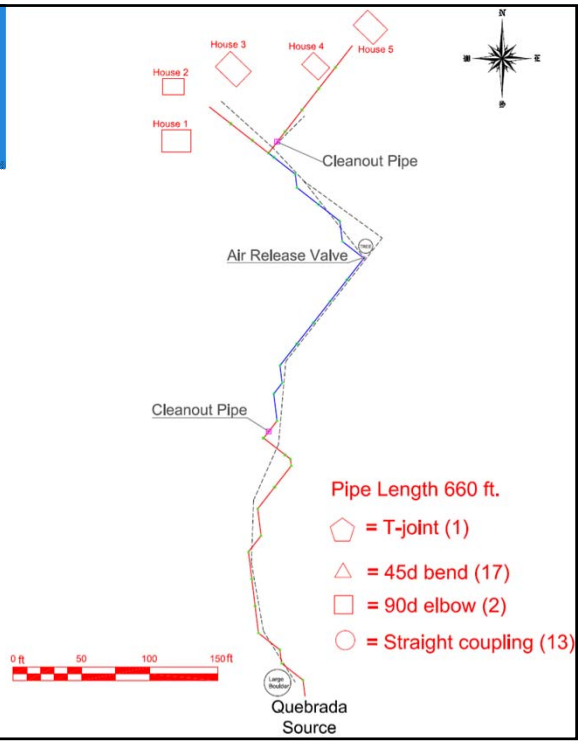
Stream Dam

- Cast-in-place concrete
- Rebar reinforcement
- Gravel filter

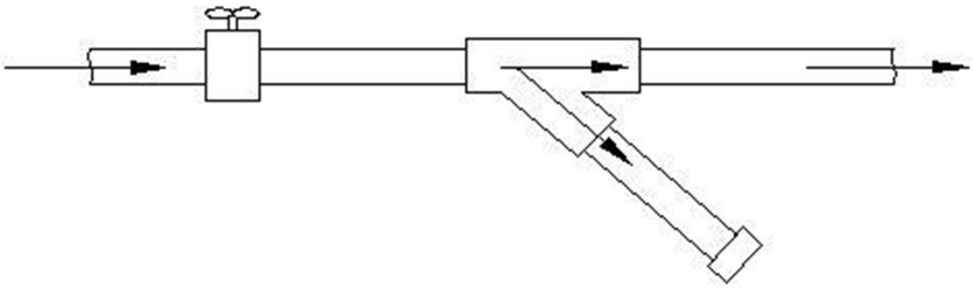


Quebrada: Pipeline

- Total pipe length: 660 ft
- 1” SDR 21 PVC pipe
- 33 Joints
- Air release valve
- Cleanout pipe



Quebrada: Cleanout Pipe



Quebrada: System Cost Estimate

Project Component	Unit	Quantity	Labor	Equipment	Materials	Total Estimate
Mobilization	1	LSUM	$0	$0	$356	$356
Clearing	1935	SYD	$0	$20	$0	$20
Dam	1	LSUM	$0	$71	$222	$293
Pipeline	645	LFT	$0	$44	$265	$309
Total:			**$0**	**$135.00**	**$843.00**	**$978.00**

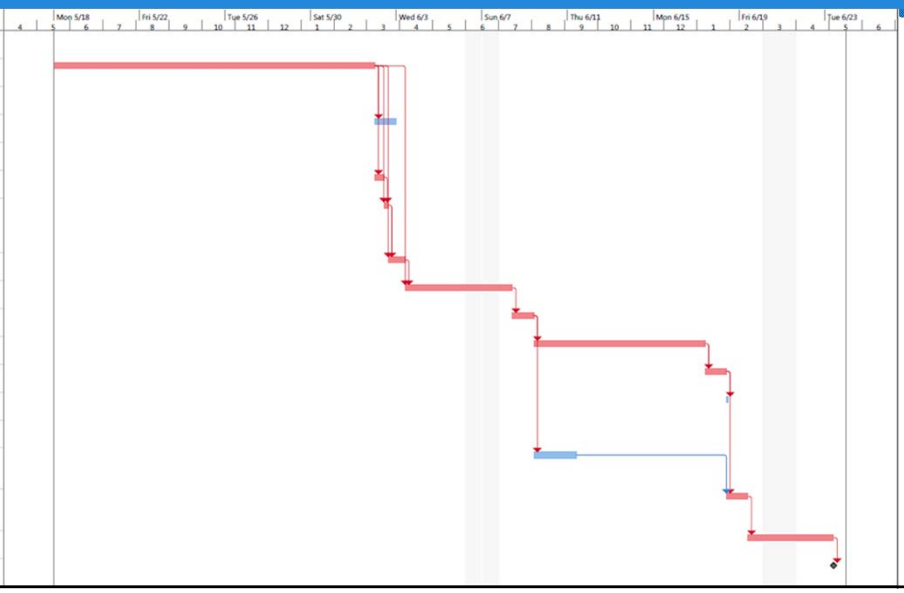
Quebrada: Construction Schedule

Total Construction Time: 28 days (940 man hours)

Major Tasks	Duration (days)
Mobilization	12
Clearing	1
Dam Construction	12.5
Pipeline Construction	10

Quebrada: Critical Path

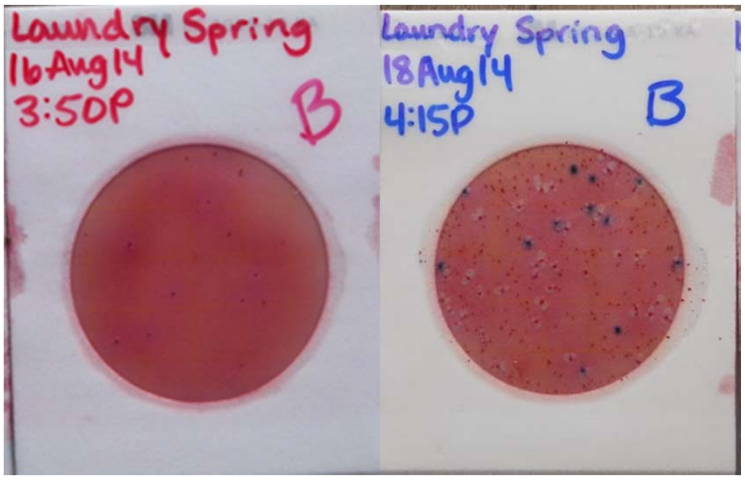
ID	Name
1	**Mobilization**
2	Ship supplies from David to La Ensenada
3	**Clearing**
4	Clear pipeline route of all vegetation
5	**Dam Construction**
6	Remove existing dam and stop water flow.
7	Create level space for spring box- excavate current pond base and remove excess vegetation to expose rock face and spring.
8	Place Gravel Subbase.
9	Form walls and floor. Place interior pipes.
10	Mix and place concrete (0.8CYD)
11	Let concrete cure for 5-7 days
12	Strip forms.
13	Place filter fabric and gravel around inlet.
14	**Pipeline Construction**
15	Excavate trench to bury pipe- also remove material to meet planned elevation.
16	Connect pipeline from spring box to tank. Cut pipe as needed and use noted joint.
17	Fill and compact excess material to cover pipe.
18	End of project



Pozo: Project Backgr

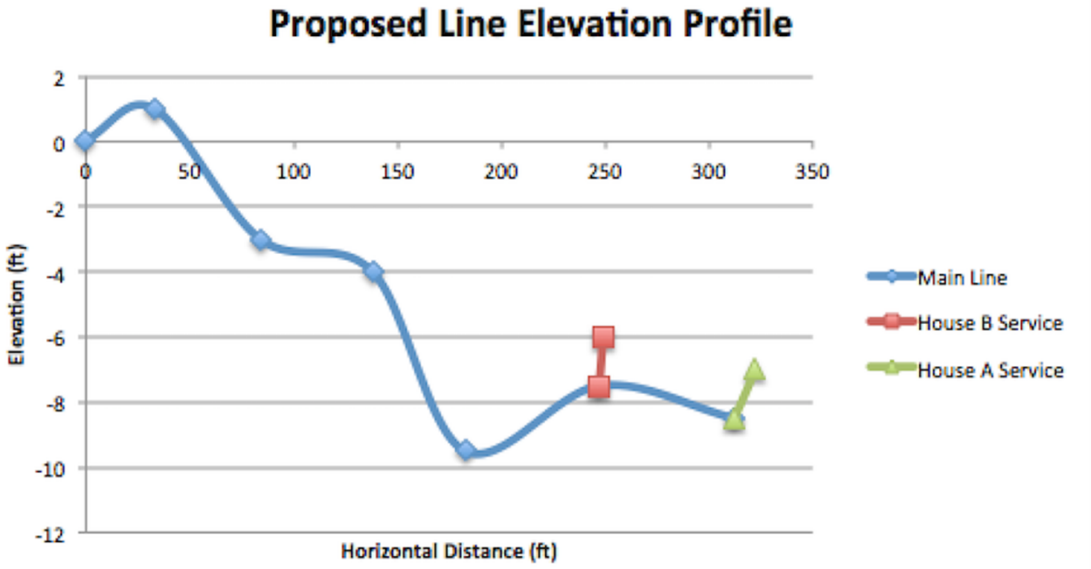
- 12 Houses (seasonally)
- Spring and laundry area
- Existing line to 2 houses

Pozo: Water Quality Assessment



		Colony Types	
Location	**Plate**	***E. coli***	**Other Coliform Types**
Source	Average	0	5
Tap	Average	10	38

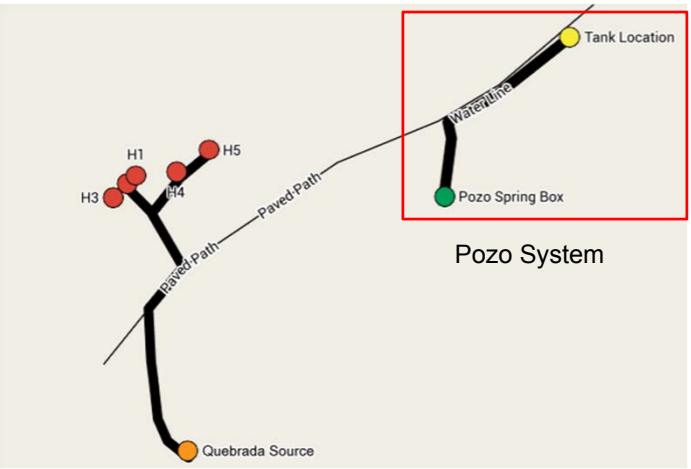
Pozo: Vertical Profile



Pozo: Technical Design

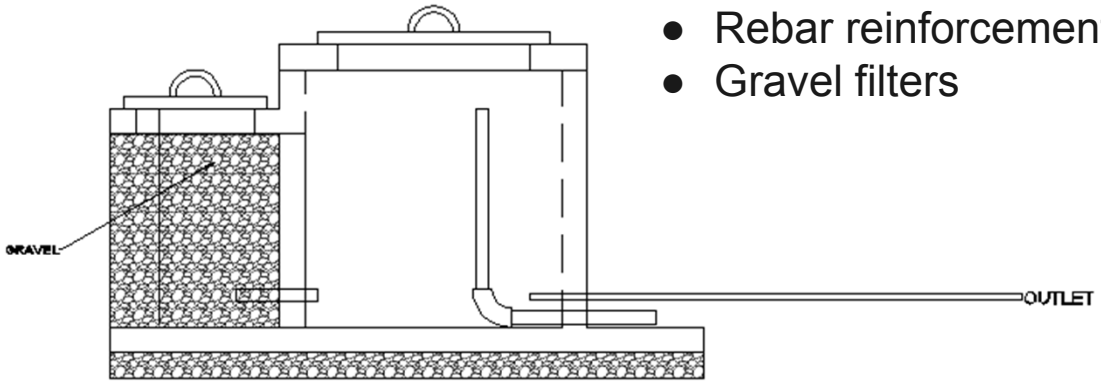
Three Major Components

1. Spring Box
2. Concrete Tank
3. Piping System



Pozo System

Pozo: Spring Box Design

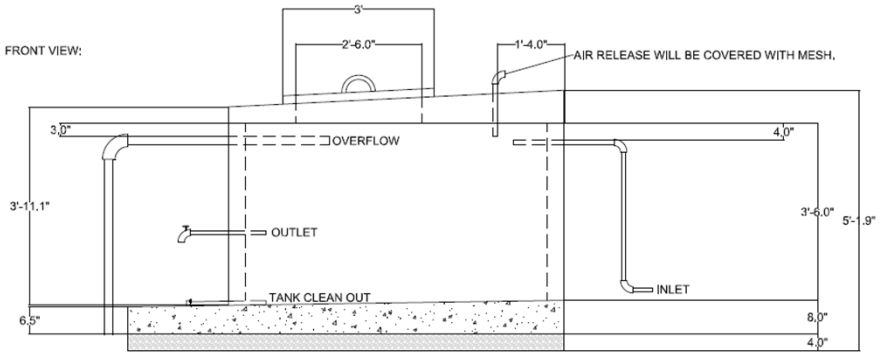


Spring Box

- Cast-in-place concrete
- Rebar reinforcement
- Gravel filters

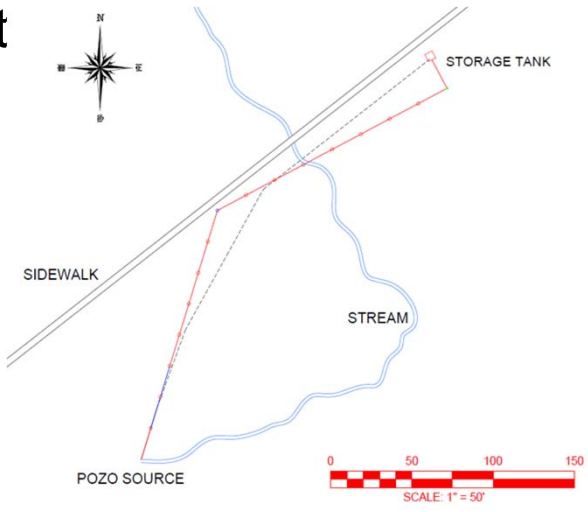
Pozo: Storage Tank Design

- Cast-in-place concrete
- Rebar reinforcement
- Additional piping
- Daily water use



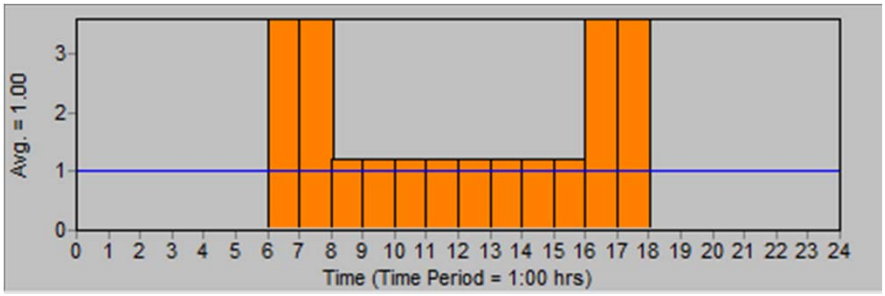
Pozo: Pipeline

- Total pipe length: 350 ft
- 1” SDR 21 PVC pipe
- 18 Joints

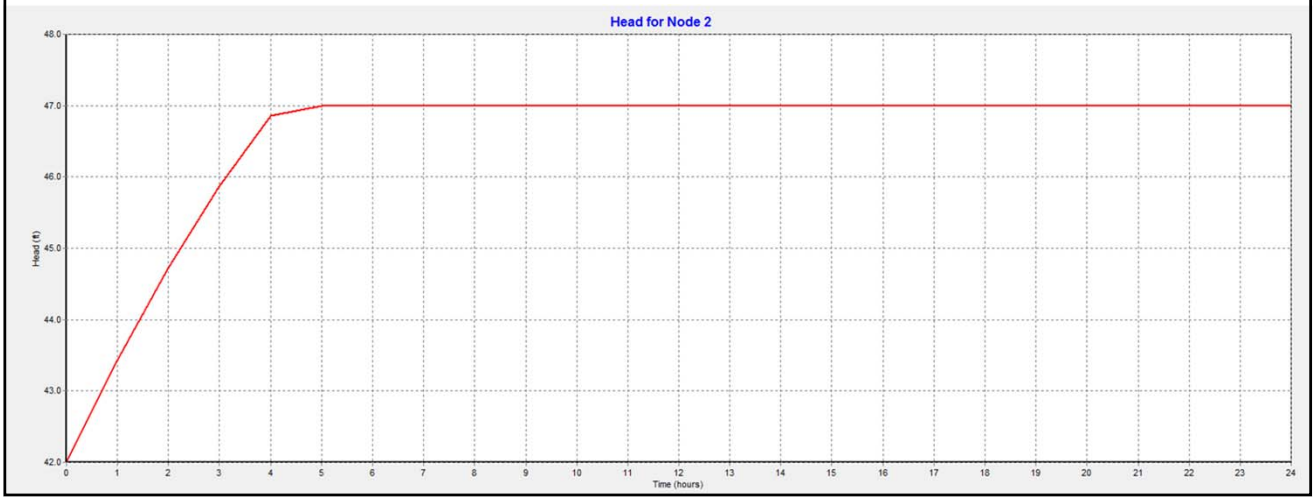


Pozo: Water Availability v. Demand

- Water demand below
- 140 GPM available from the spring



Pozo: Water Availability v. Demand



Pozo: System Cost Estimate

Project Component	Unit	Quantity	Labor	Equipment	Materials	Total Estimate
Mobilization	1	LSUM	$0	$0	$267	$267
Clearing	1020	SYD	$0	$13	$0	$13
Spring Box	1	LSUM	$0	$42	$465	$507
Pipeline	350	LFT	$0	$37	$130	$167
Tank	1	LSUM	$0	$42	$762	$808
Total:			**$0**	**$135**	**$1,625**	**$1,762**

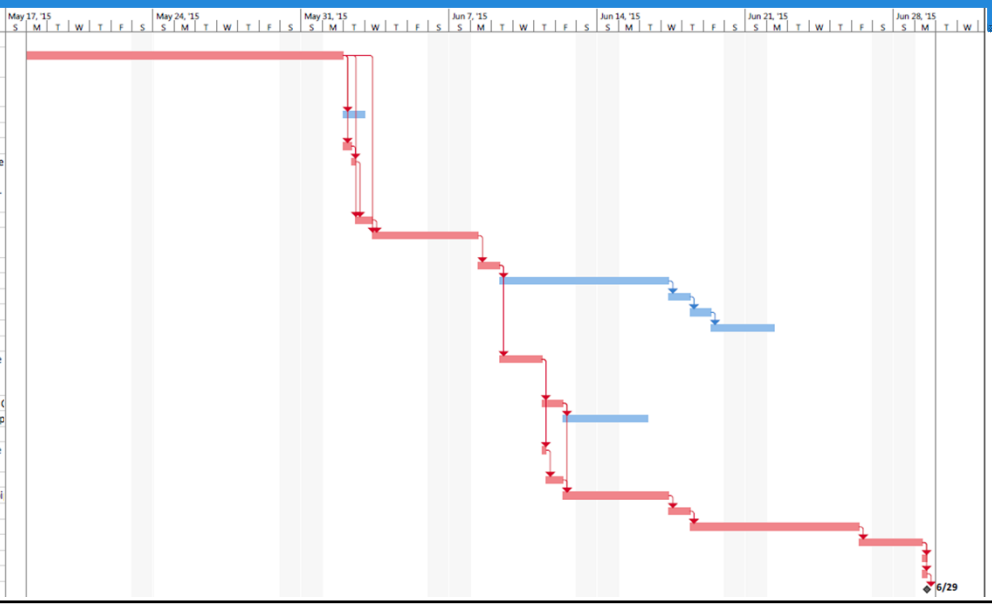
Pozo: Construction Schedule

Total Construction Time: 32 days (1340 man hours)

Major Tasks	Duration (days)
Mobilization	12
Clearing	1
Spring Box Construction	15
Pipeline Construction	5
Tank Construction	12.5

Pozo: Critical Path

ID	Task Name
1	**Mobilization**
2	Ship supplies from David to La Ensenada
3	**Clearing**
4	Clear pipeline route of all vegetation
5	**Spring Box Construction**
6	Remove existing dam
7	Create level space for spring box- excavate current pond base and remove excess vegetation to expose rock face and spring.
8	Place Gravel Subbase.
9	Form base, sides, wings, and top. Place interior pipes.
10	Mix and place concrete (2.1 CYD)
11	Let concrete cure for 5-7 days
12	Strip forms.
13	Place filter fabric and gravel around inlet.
14	Lift and set lid over both chambers.
15	**Pipeline Construction**
16	Excavate trench to bury pipe- also remove material to meet planned elevation.
17	Connect pipeline from spring box to tank. (
18	Fill and compact excess material to cover p
19	**Concrete Storage Tank Construction**
20	Remove vegetation and create level space for tank.
21	Place gravel subbase.
22	Form base, sides, and top. Place interior pi
23	Mix and place concrete (1.2CYD)
24	Let concrete cure for 5-7 days
25	Strip forms.
26	Attach external piping
27	Lift and set lid over tank.
28	End of Project



Water Treatment

1. Add 16 drops of regular bleach to 1 gallon
2. Mix water well with clean instrument
3. Wait 30 minutes before using

Conclusions

Construction Manual
Maintenance Manual
Water Treatment

⇩

Community Health & Development

Acknowledgements

Mike Drewyor, PE, PS
Dr. David Watkins, PE
PCV Colleen Hickey
La Ensenada-Nidori
Community Members


Thank You!

Slide 45

2

Mention community culture: ngobe

Slow down.

Watch umms.

mention more about community, education levels, livelihoods.

Eliminate photos on project intro map.

Average number per home. Population per system.

Madelaina Martin,