

Gravity-fed Water Distribution System in Nidori, Panama

Logan Anderson, Kellie Heiden,
Madelaina Martin (PM), Tia Scarpelli, Adam Tuff

Michigan Technological University
Department of Civil and Environmental Engineering
International Senior Design, Fall 2014

Community Background



- Kusapin Peninsula, Ngöbe-Buglé Comarca
- Dry season: May-August
- ~400 people
- Community members belong to Ngöbe indigenous group
- Primary transportation via canoes
- Primary education

Current Water Distribution Systems in Nidori:

- 12 homes have a distribution line that feed right into their home during the wet season only.
- 5 homes have no in-home water access, so they hike long distances to fill 5-gallon buckets twice a day.
- No water treatment.
- An ineffective Water Committee leads to poor maintenance.

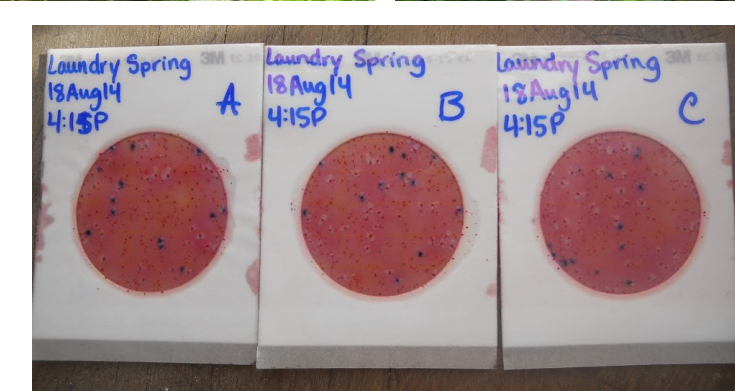


Figure 1. Map of Quebrada system (orange) and Pozo system (green).

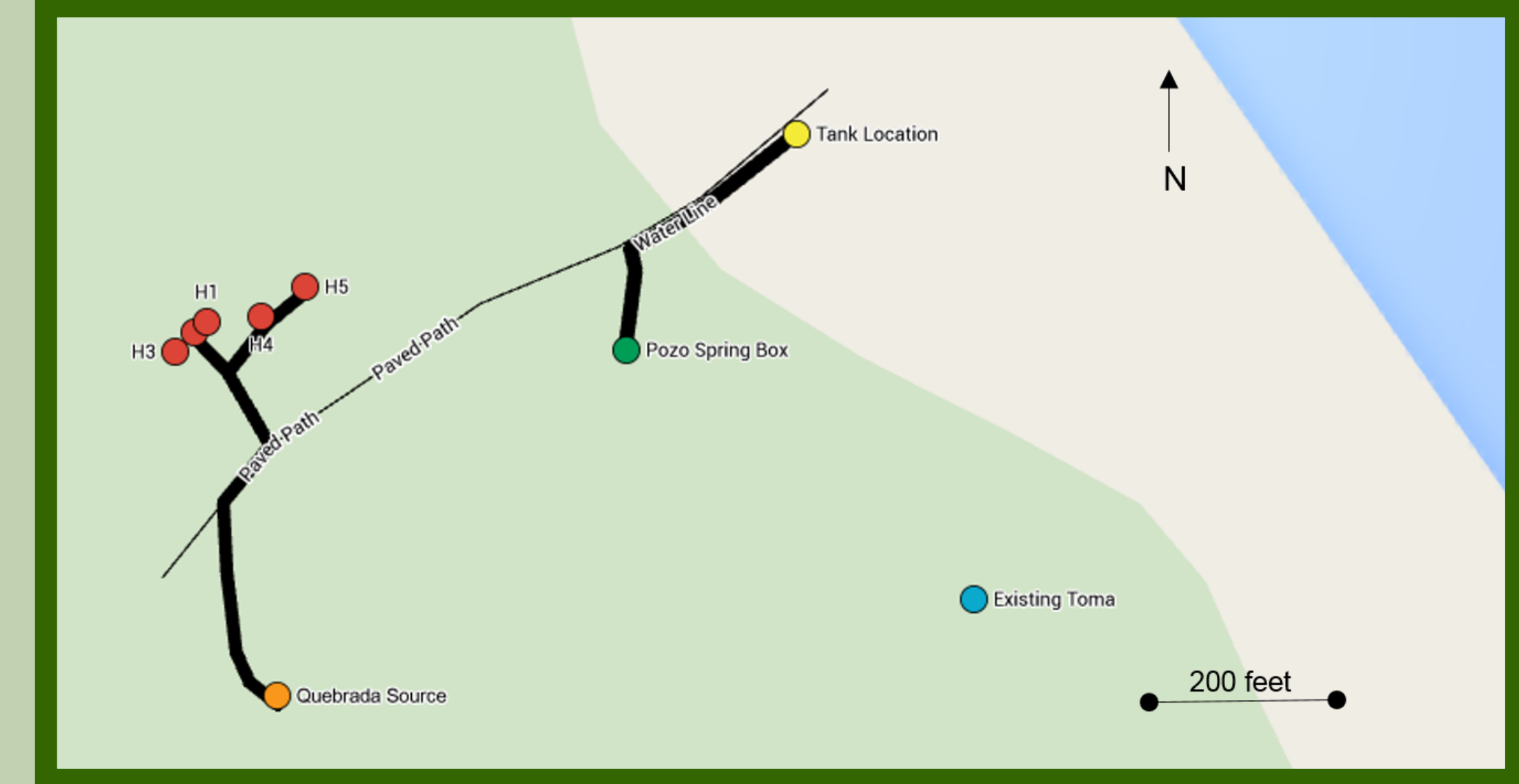


Figure 1. Map of Quebrada system (orange) and Pozo system (green).

PROJECT GOAL

To provide the community of Nidori with year-round accessibility to improved water.



Figure 2. Quebrada source.



Figure 3. Community homes.



Figure 4. Community home.

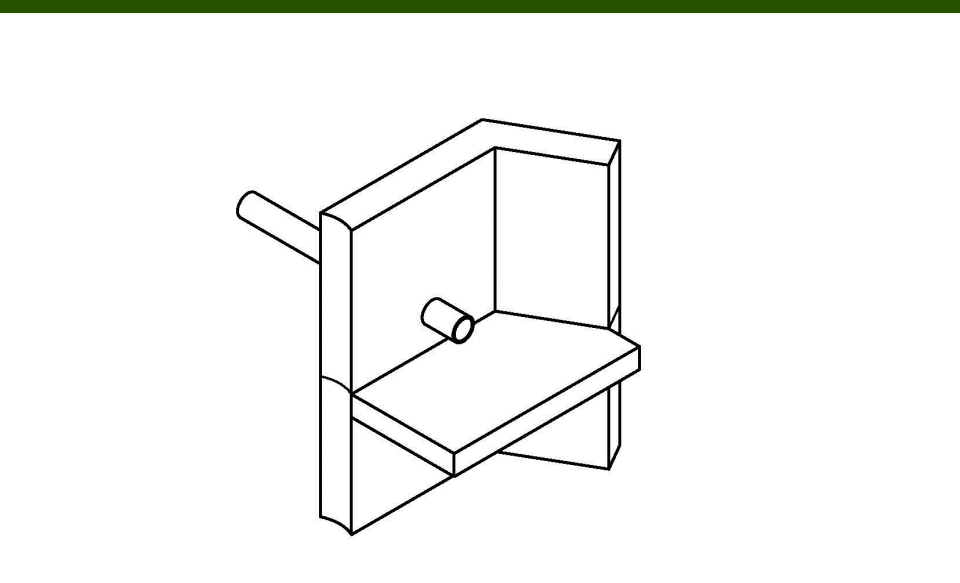


Figure 5. Pozo source.

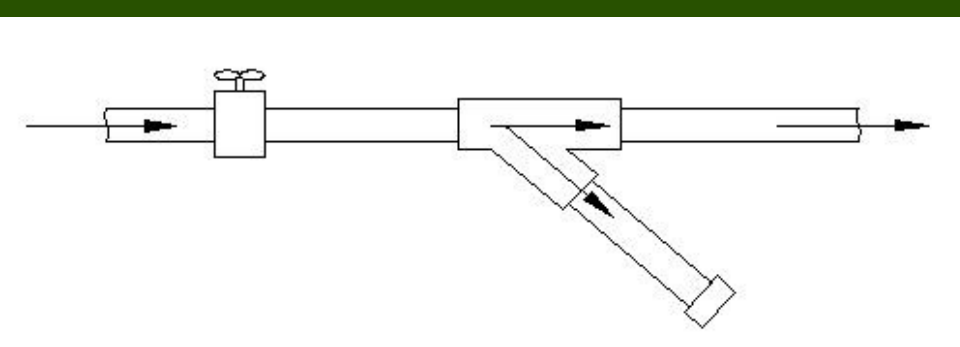
QUEBRADA SYSTEM

This system will utilize a newly found stream as its source (see Figure 2). The water will be dammed to allow for collection and transported to 5 homes (~40 people) that currently have no water distribution system (Figures 3 & 4).

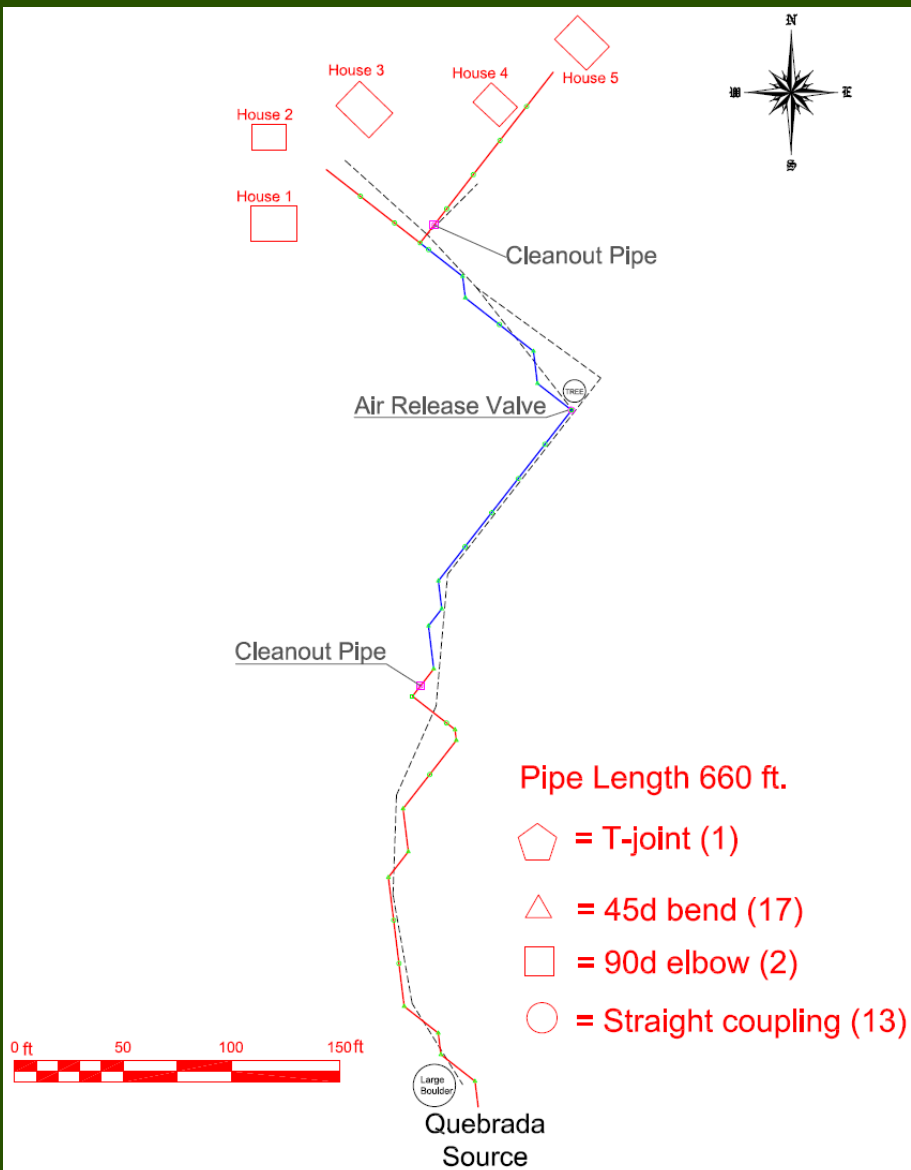
Final Design



Quebrada Stream Dam (Fig. 6)



Washout Pipe (Fig. 8)



Quebrada Aqueduct (Fig. 9)

- Figure 6:
- Type-4 rebar
 - Gravel filter
 - Wire mesh filter

- Figure 7:
- 1" SDR 21 PVC
 - 660 ft
 - 33 joints
 - Air release valve
 - 2 washout pipes

- Figure 8:
- Shut-off valve for maintenance

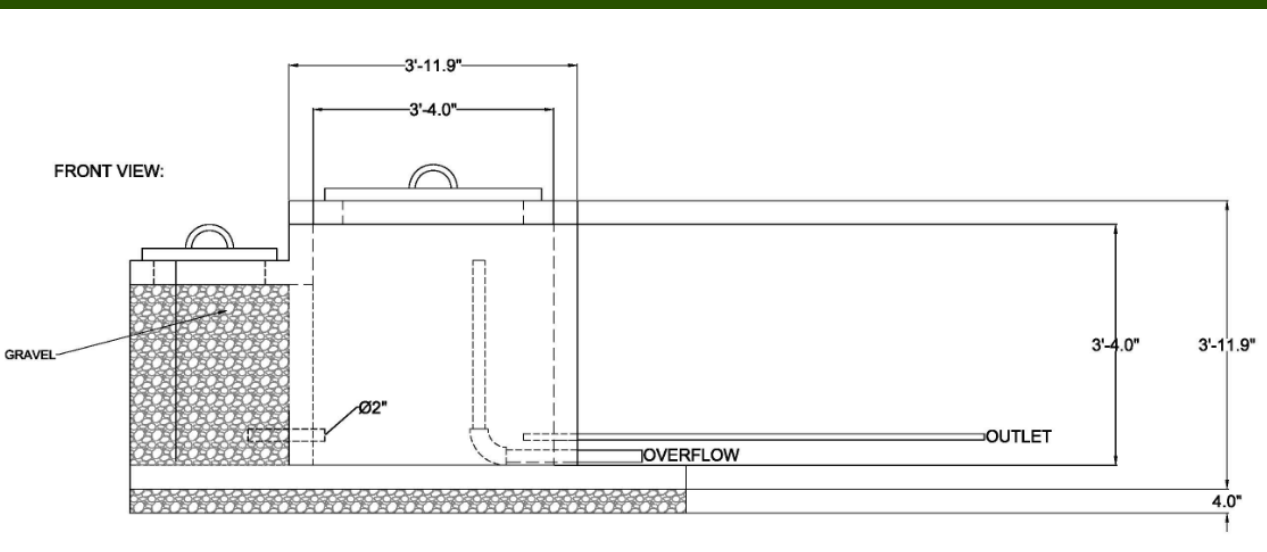
Cost Estimate & Construction Schedule

Project Component	Unit	Quantity	Labor	Equipment	Materials	Total Estimate	Major Tasks	Duration (days)
Mobilization	1	LSUM	\$0	\$0	\$356	\$356	Mobilization	12
Clearing	1935	SYD	\$0	\$20	\$0	\$20	Clearing	1
Dam	1	LSUM	\$0	\$71	\$222	\$293	Dam Construction	12.5
Pipeline	645	LFT	\$0	\$44	\$265	\$309	Pipeline Construction	10
Total:			\$0	\$135	\$843	\$978	Total:	28

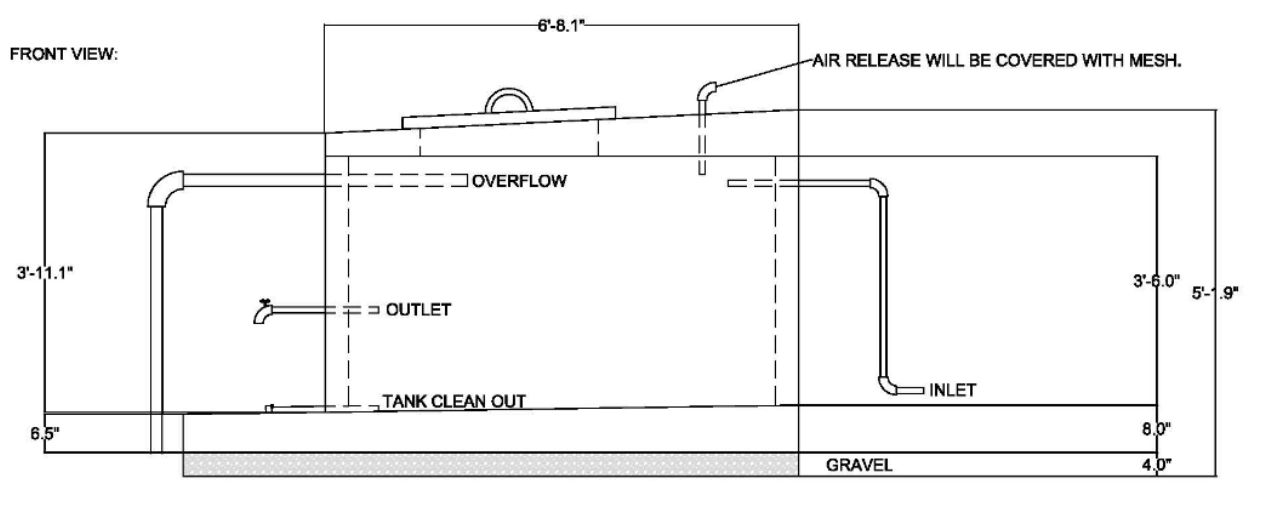
POZO SYSTEM

This system will utilize a spring source that has a distribution line and laundry area (Figure 5). A spring box will collect water and a distribution line will carry it to a tank that will serve the 12 homes that have no water during the dry season (~120 people).

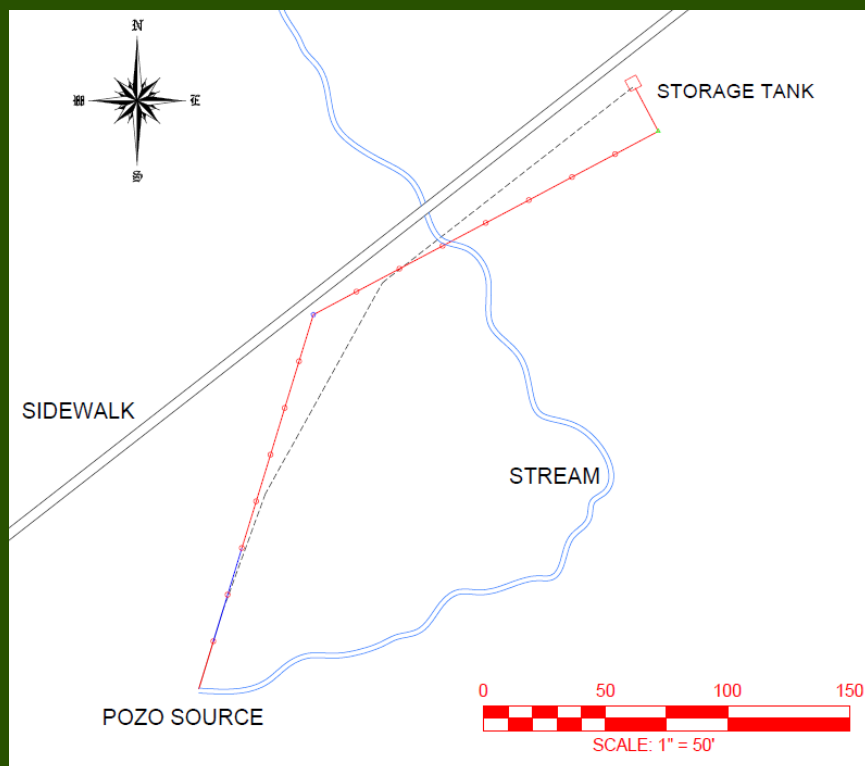
Final Design



Pozo Spring Box (Fig. 9)



Pozo Water Storage Tank (Fig. 11)



Pozo Aqueduct (Fig. 10)

- Figure 9:
- 260 gal capacity
 - Type-4 rebar
 - Gravel filter

- Figure 10:
- 1" SDR 21 PVC
 - 350 ft
 - 18 joints

- Figure 11:
- 940 gal capacity
 - Outlet, aeration, and overflow pipes

Cost Estimate & Construction Schedule

Project Component	Unit	Quantity	Labor	Equipment	Materials	Total Estimate	Major Tasks	Duration (days)
Mobilization	1	LSUM	\$0	\$0	\$267	\$267	Mobilization	12
Clearing	1020	SYD	\$0	\$13	\$0	\$13	Clearing	1
Spring Box	1	LSUM	\$0	\$42	\$465	\$507	Spring Box Construction	15
Pipeline	350	LFT	\$0	\$37	\$130	\$167	Pipeline Construction	5
Tank	1	LSUM	\$0	\$42	\$762	\$808	Tank Construction	12.5
Total:			\$0	\$135	\$1,625	\$1,762	Total:	32

RECOMMENDATIONS

- In-home chlorination to remove disease-causing pathogens
- Monthly maintenance following the instructions in the maintenance manual provided to the community.



Acknowledgements

Advisors: Michael Drewyor, P.E., Dr. David Watkins, P.E. PCV
Colleen Hickey, La Ensenada-Nidori community members