

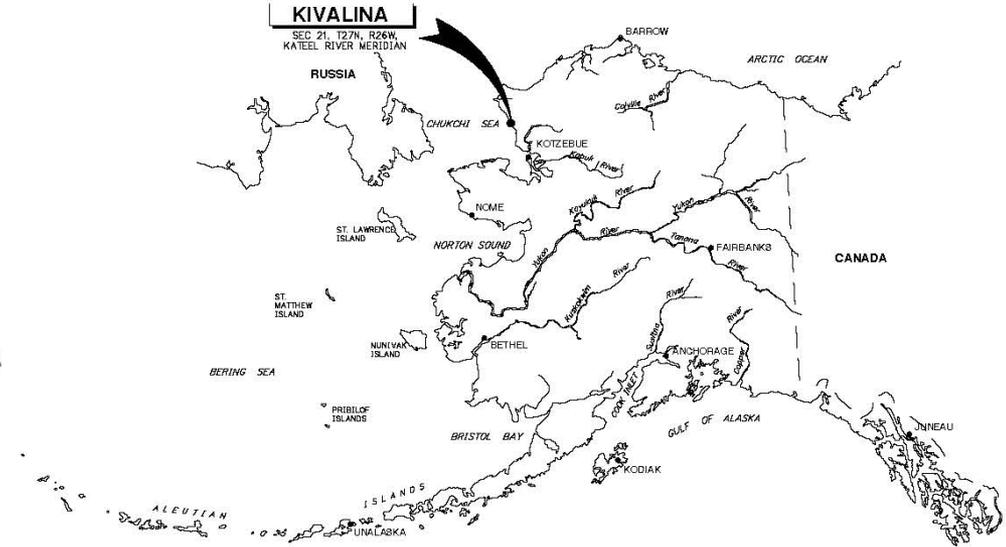
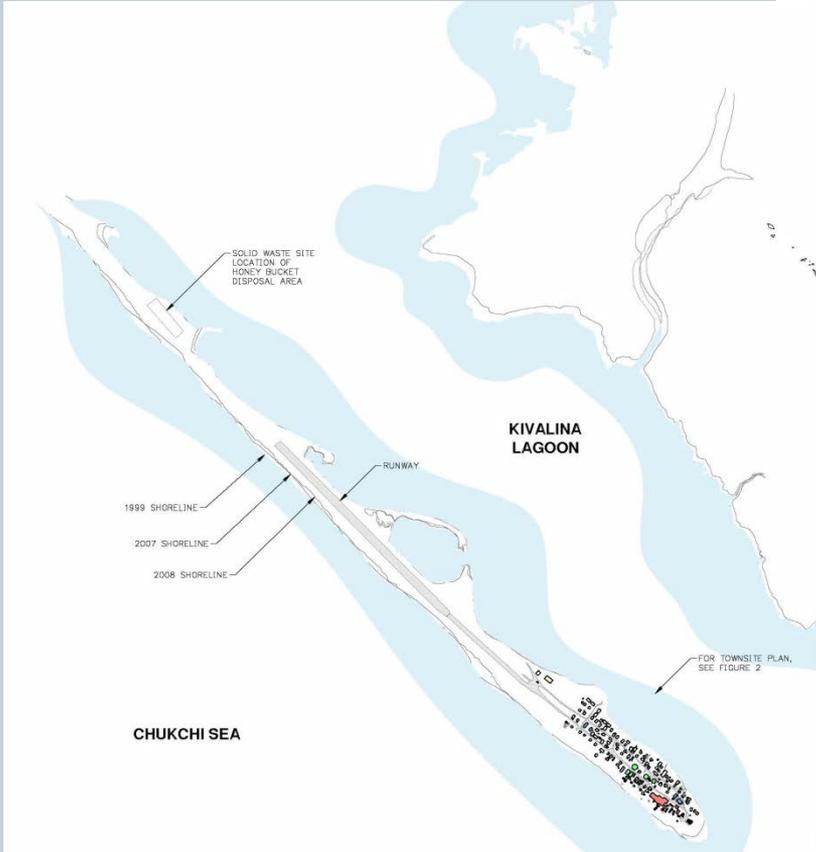
Alternative Approaches to Sanitation



KIVALINA

Mia Heavener, P.E.
Senior Civil Engineer
ANTHC, DEHE

Kivalina



Kivalina- Current Water Service



Water from the River

**Raw Water Storage Tank:
692,000 gal**

Finished Tank: 500,00 gal



Watering Point

Kivalina- Current Sanitation



Landfill/Honey Bucket Dump Site



Grey Water Disposal



Honey Bucket

Need for a Project



- **Water Rationing**
 - Increases the chances of contracting skin infections
- **Exposure to Raw Sewage during the spring**
 - Community members are exposed to fecal coliform bacteria, such as E. Coli

Typical Sanitation Design and Delivery



**New Water Treatment Plant
and Washeteria in Kasigluk**

Typical Sanitation Design and Delivery



Piped Water and Sewer





Unique Challenges



- **Water Limitations**

- Any project would increase water usage.
- How can the existing water volume be supplemented and provide adequate health?

- **Future Relocation**

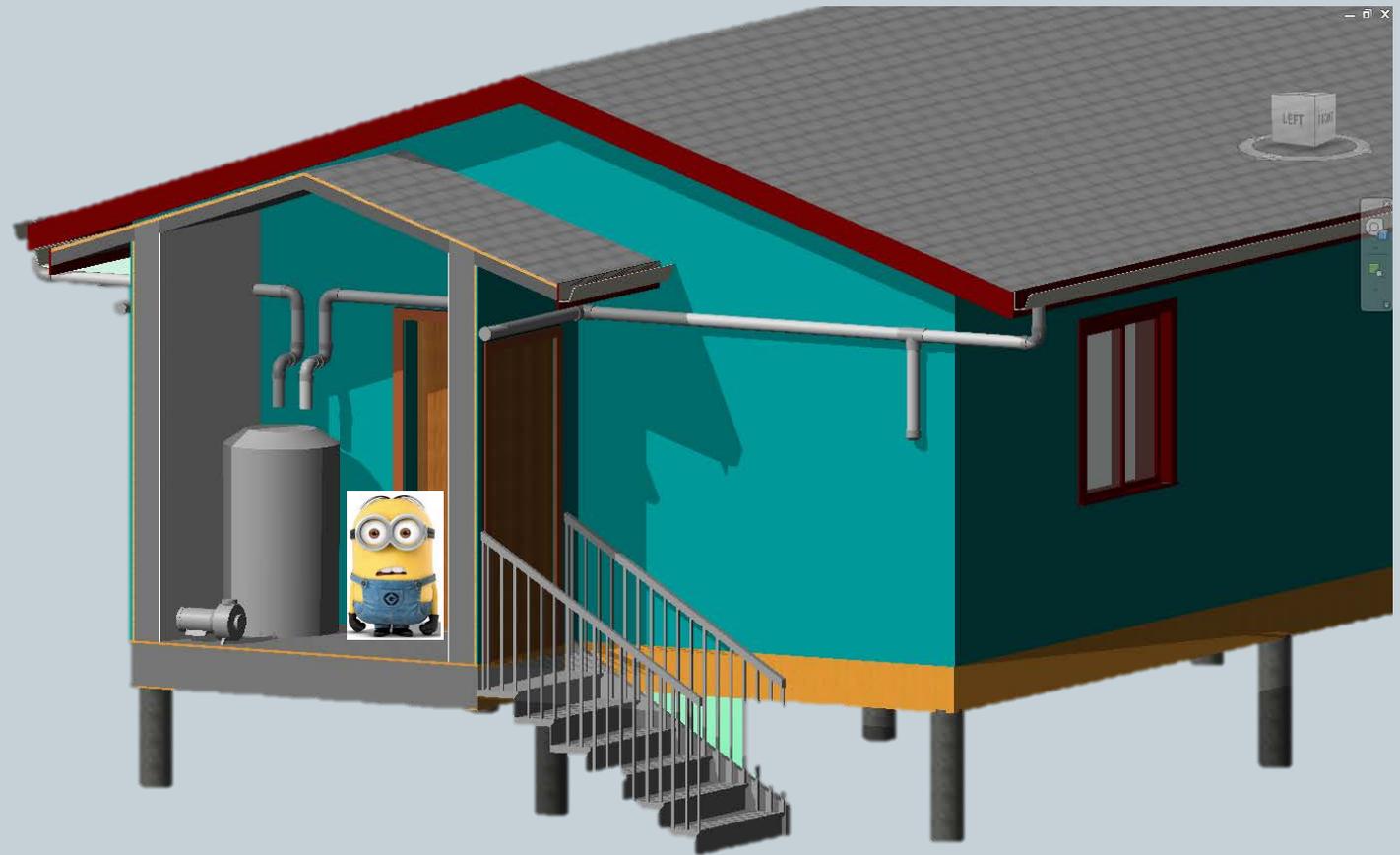
- In-home Sanitation that can be transported with the community.

Unique Design Opportunities



- **How can the local topography and environment be part of the solution?**
 - Summer Rain
 - Groundwater Depth
 - Outside air

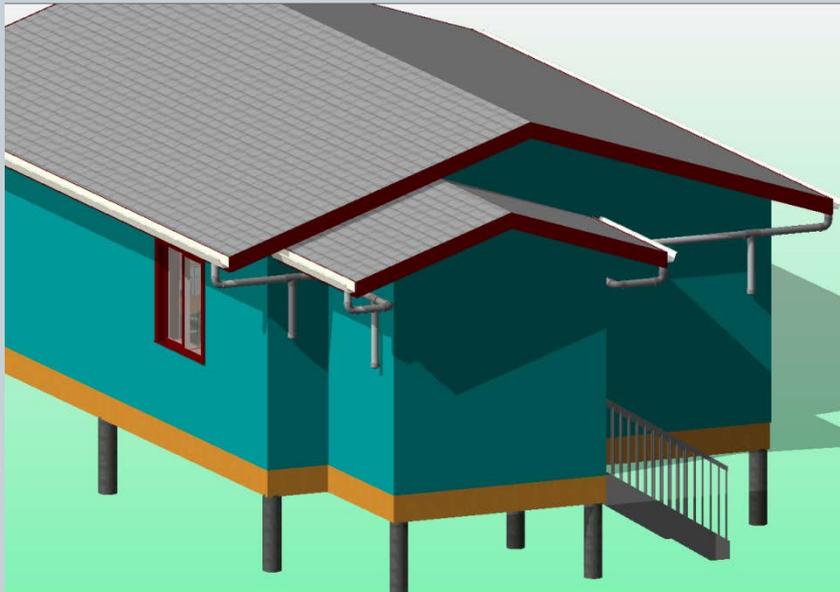
Rain Catchment System



Water Supplementation (Summer Rain)

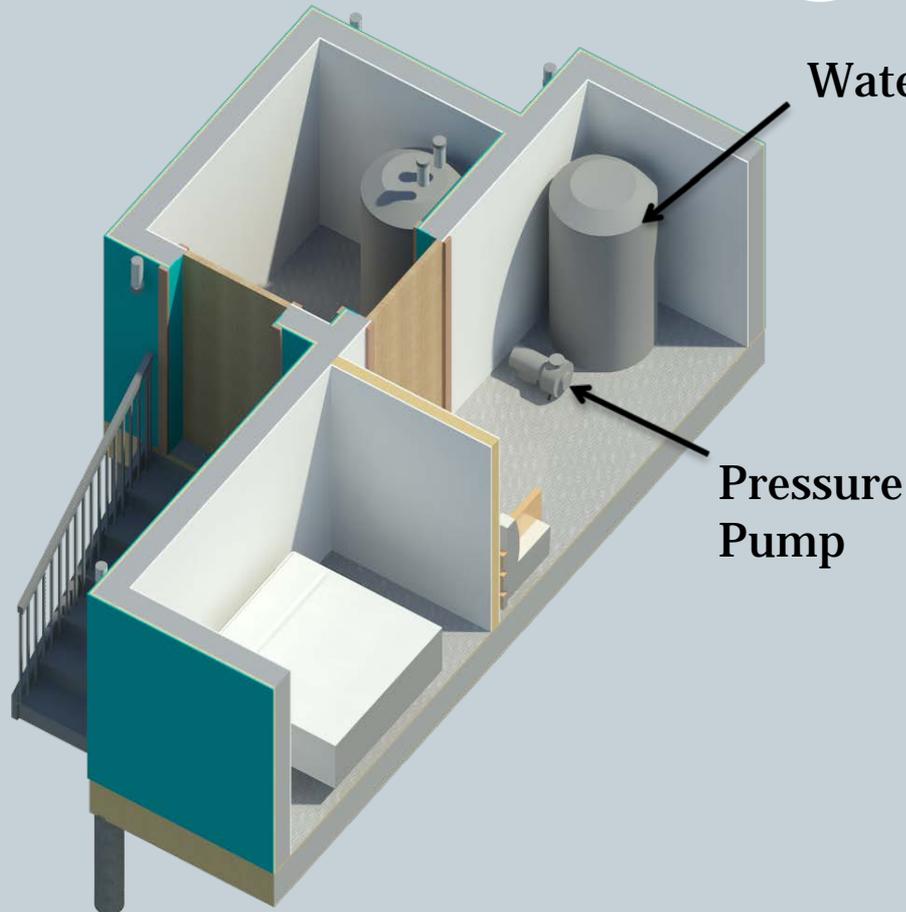


Month	J	F	M	A	M	J	J	A	S	O	N	D
Mean Precipitation (in)	0.62	0.6	0.44	0.5	0.41	0.58	1.45	2.1	1.58	1.01	0.77	0.76
Snowfall (in)	9.1	9.6	5.9	5.1	1.2	0	0	0	0.8	6.1	10.5	11.5



Example:
Home: 960 SF
11 inches
60% Recovery
3,800 Gallons Annually

Rain Catchment/Water Treatment

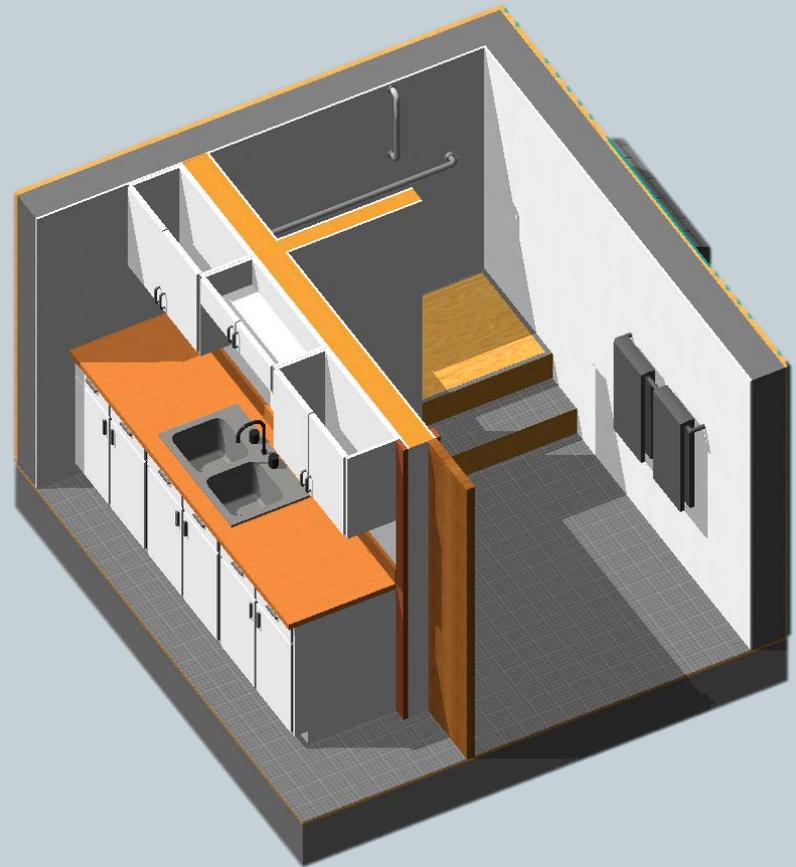


FU2 Water Treatment System-
CampWater Water Treatment
Systems

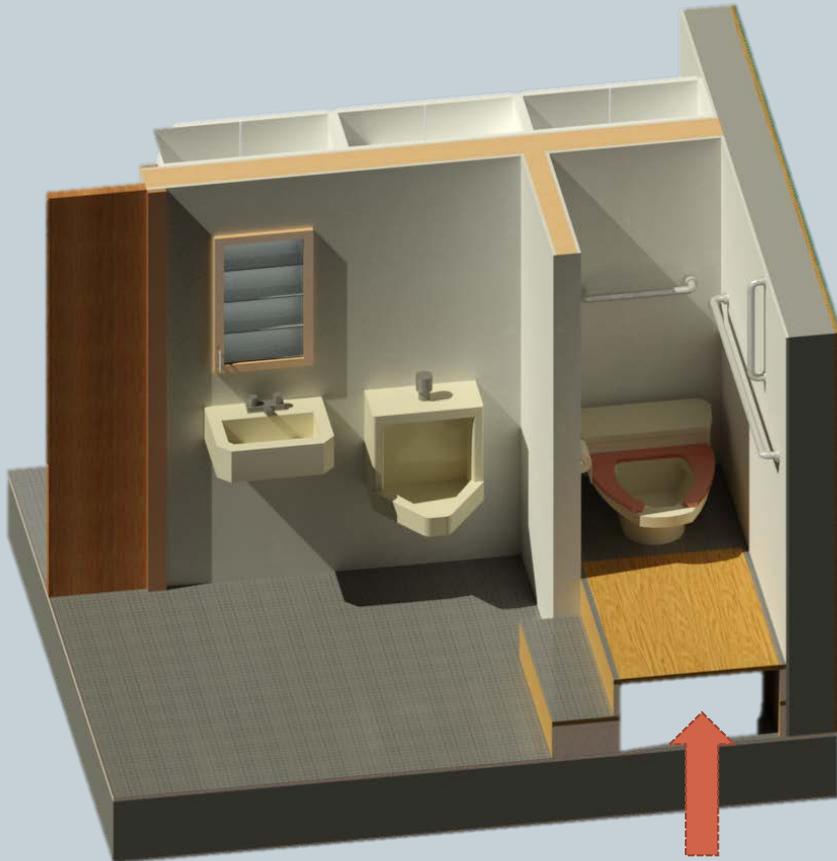
Kitchen w/Plumbing Wall



- Water Heater
- Grease Separator
- Kitchen Sink with faucet aerator (0.8gpm)
- POU water filter



Example of Typical Bathroom



Grey Water Tank

- Sink with low flow faucet (0.5 gpm)
- Waterless Urinal
- Diverting Toilet
- Grey Water Tank

Diverting Toilet



Feces aka Poop

Urine



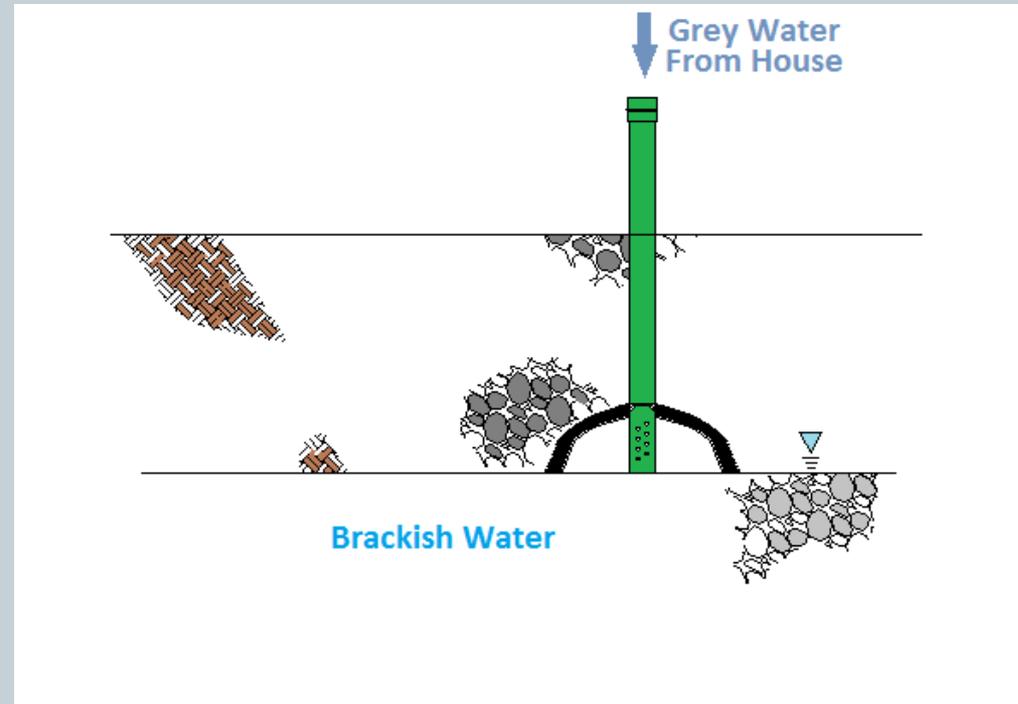
Solids Removal (Outside Air)

- Waste is collected in biodegradable waste bag
- A 12 volt fan runs at all times to dry out the waste
- Ventilation to the outside to increase the drying capacity
- The dried waste can be then disposed in the landfill
- Complements Re-Locate Kivalina's and Climate Foundation's biochar reactor.



Grey Water Disposal (Groundwater Depth)

Brackish water is a natural Disinfectant for urine and grey water



Monthly User Cost Estimate



Rain Catchment/Separation Toilet O&M Estimate		
Manufacturer's Data		
Fan (W)		19
Pressure Pump (W)		585
4- gallon Instant Hot Water Heater (W)		1,500
Cost Analysis		
Electrical Usage	Continual Electrical Use (W)	19
	Daily Electrical Usage (kW-hr/home)	0.456
	Daily Electrical Cost	\$0.10
	Monthly Pressure Pump Usage (kW-hr/home)	16
	Monthly Hot Water Heater Usage (kW-hr/home)	8
	Monthly Electrical Usage (kW-hr/home)	37.908
	Monthly Electrical Cost (dollar/home)	\$8.36
Disposables	Compostable Bag (Unit Price)	\$1.55
	Uses Per Bag	15
Total Monthly Cost		\$24.12

Per Home Estimate



Item	Unit Cost	Qty	Total Cost
Water Tanks	\$800	2	\$1,600
Sediment Filter Kit-50 Micron	\$700	1	\$700
Pressure Boosting Pump-3/4 hp, 120V	\$600	1	\$600
Aluminum Gutter	\$200	1	\$200
Grease Separator- Rockford G-710	\$400	1	\$400
Kitchen Sink with faucet aerator (0.8 gpm)	\$600	1	\$600
Bathroom Sink with faucet aerator (0.5 gpm)	\$400	1	\$400
4-Gallon Electric Water Heater	\$200	1	\$200
Separating Toilet	\$3,000	1	\$3,000
Waterless urinal	\$400	1	\$400
Levelator Water Tank Level Guage	\$200	1	\$200
Grey Water Tank-50 gallons	\$250	1	\$250
Infiltrators-22"x 53"	\$500	4	\$2,000
2" PVC Valterra Gate Valve	\$50	1	\$50
Arctic HDPE Pipe-3" Bend and Leg	\$2,500	1	\$2,500
Misc. Tools/fitings	\$1,000	1	\$1,000
Misc. Plumbing	\$3,000	1	\$3,000
Building Modifcations	\$9,000	1	\$9,000
	Freight		\$2,400
	Contingency	15%	\$3,915
	Total		\$32,415

Project Schedule



Project Partners:

The National Tribal Water Center

*ANTHC -Division of Community Health-
Clinical and Research Services*

Cold Climate Housing Research Center



Study:
Completed
May 2014

Design:
December
2014-April
2015

Installation:
4-10 Homes
Summer 2015

Evaluation:
2015-2016

Selected Volunteers in Kivalina



Questions?

