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Detection of *E. coli*/total coliforms and antibiotic resistance genes in drinking water collected from Pine Creek First Nation in Manitoba

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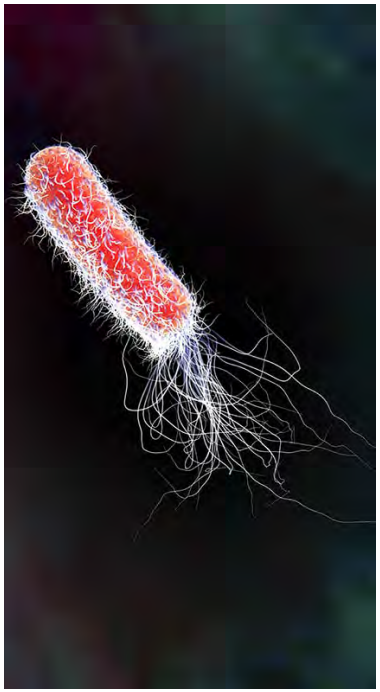
E.coli and total coliforms

- ***Escherichia coli* (*E. coli*)**: commonly found in the lower intestine of warm-blooded organisms
- **Total coliforms**: commonly found in e.g., water, soil and feces.
- > 100 Water Advisories are issued to First Nations reserves



Source: BIOCOTE team

Antibiotic resistance

Antibiotic resistance genes:

- the key of resistance
- e.g., produce proteins to inactivate antibiotics

Antibiotic resistance:

- bacteria is not (readily) killed by the antibiotics
- Increased hospital stays and/or mortality in humans

Objective

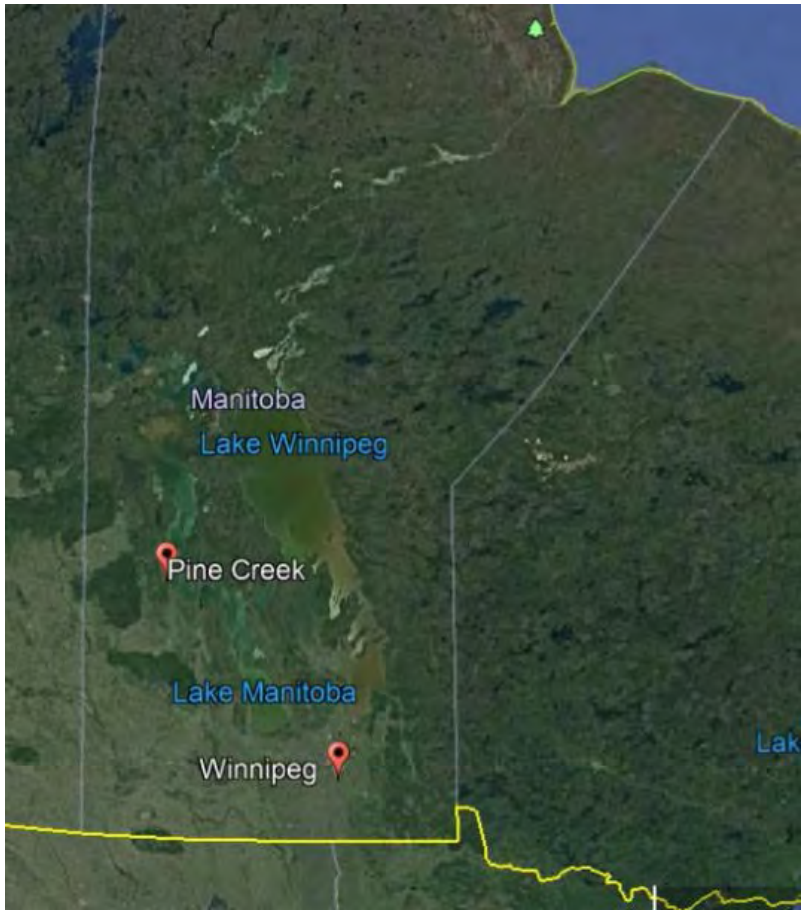
This project was designed to investigate drinking water quality in Pine Creek First Nation by detecting:

- ***E. coli*/total coliforms,**
- **Antibiotic resistance genes, and**
- **Free chlorine concentration**

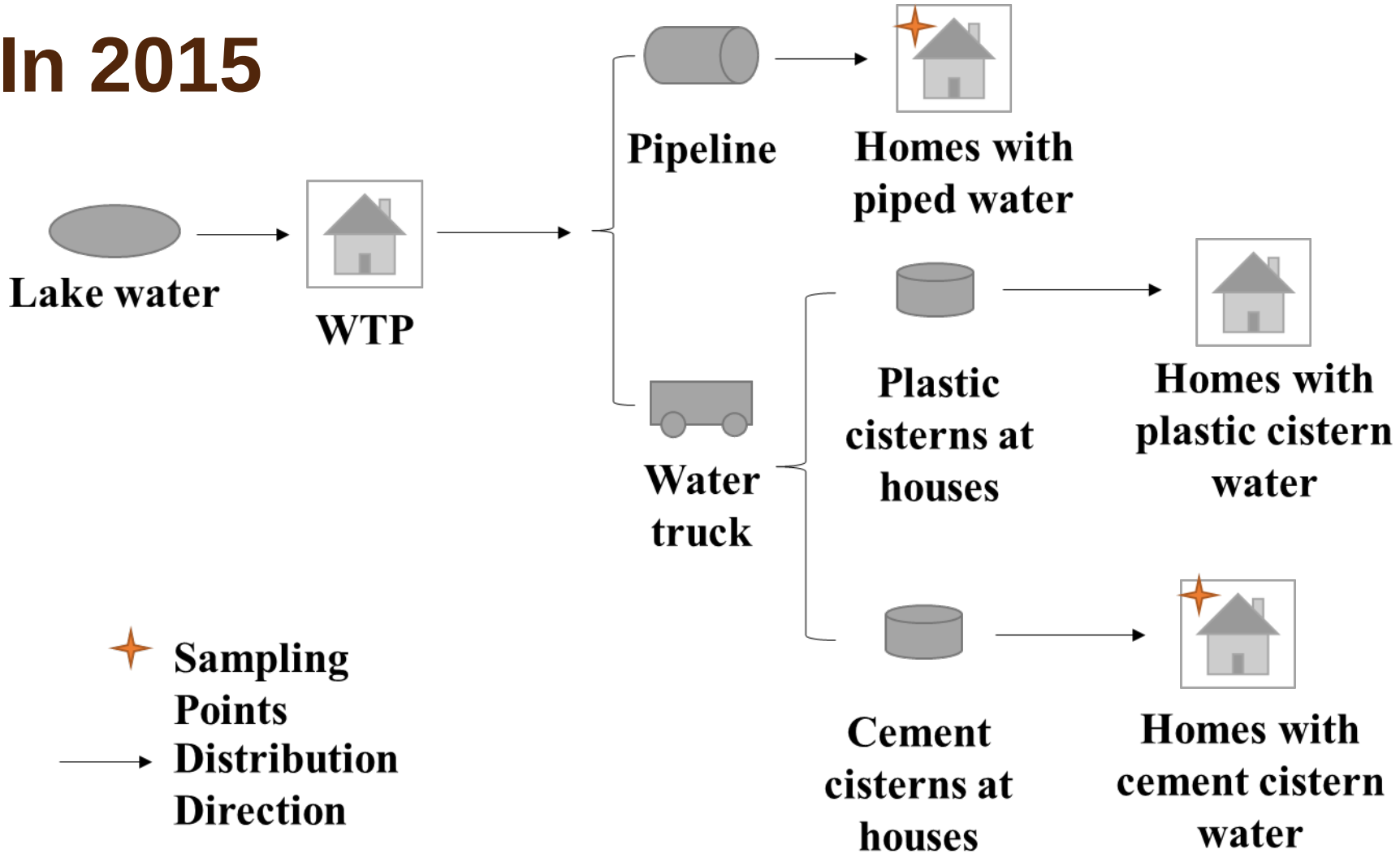
Study in 2015

- **West Region Tribal Council**

- **~ 400 km from Winnipeg**



In 2015


Pipeline
Homes with piped water
Lake water
WTP
Water truck
Plastic cisterns at houses
Homes with plastic cistern water
Cement cisterns at houses
Homes with cement cistern water
Sampling Points
Distribution Direction

Free residual chlorine concentration and total coliform detection

Sampling time	Distribution system	Free residual chlorine range (mg L-1)	% <0.2 mg L^{-1} *(HC guide)*	% detection of total coliforms
03/15	Piped	0.04 – 1.28	38	50
	Cistern	0 – 0.07	100	90
05/15	Piped	0.01 – 3.4	57	57
	Cistern	0.02 – 0.38	78	78
10/15	Piped	0 – 0.82	50	12
	Cistern	0 – 0.31	86	43
Overall	Piped	0 – 3.4	48	39
	Cistern	0 – 0.40	88	73

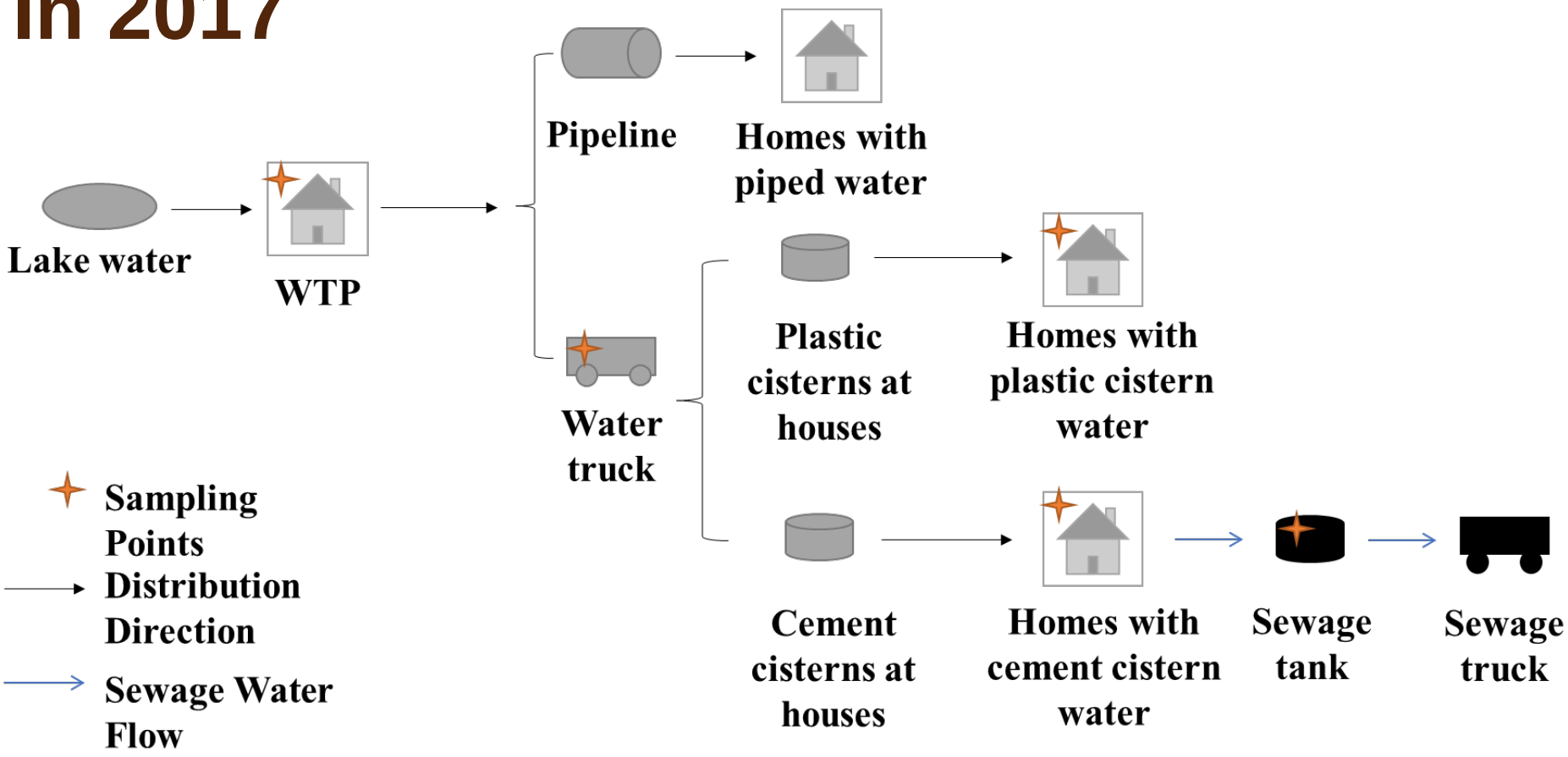
(Health Canada total coliform guide – 0 CFU/100mL; free residual chlorine guide – 0.2 mg L^{-1} in distributed water)

Study in 2017

- Focus on cisterns in Pine Creek
- Cisterns are under houses or underground, and some of them are cracked
- Concrete cisterns and plastics
- Usage time > recommendation
- About 8m to sewage tank

- Free chlorine, fecal bacteria and ARGs were detected

In 2017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Sewage tank
Sewage truck
Sampling Points
Distribution Direction
Sewage Water Flow

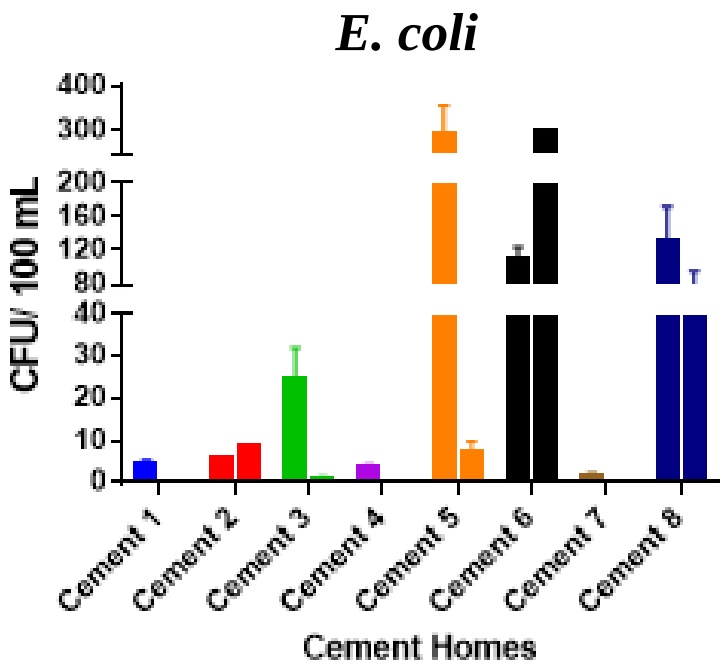
Results: free chlorine residuals

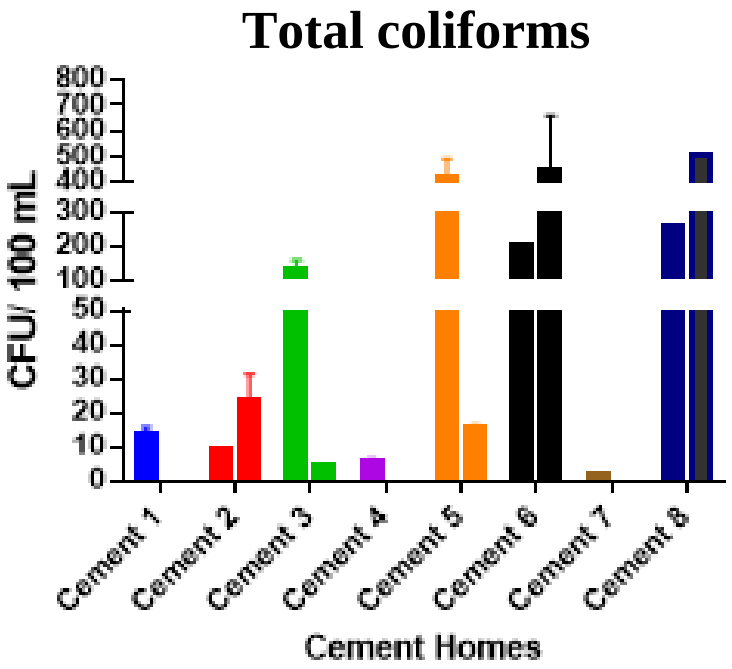
- Free chlorine concentrations in WTP were in the range 0.4 – 2.0 mg/ L
- Recommendation level: ≥ 0.2 mg/ L

First Nations	Trip	% of cement < 0.2 mg/ L	% of plastic < 0.2 mg/ L
Pine Creek	1	100	100
	2	75	86

Results: *E. coli* and total coliforms

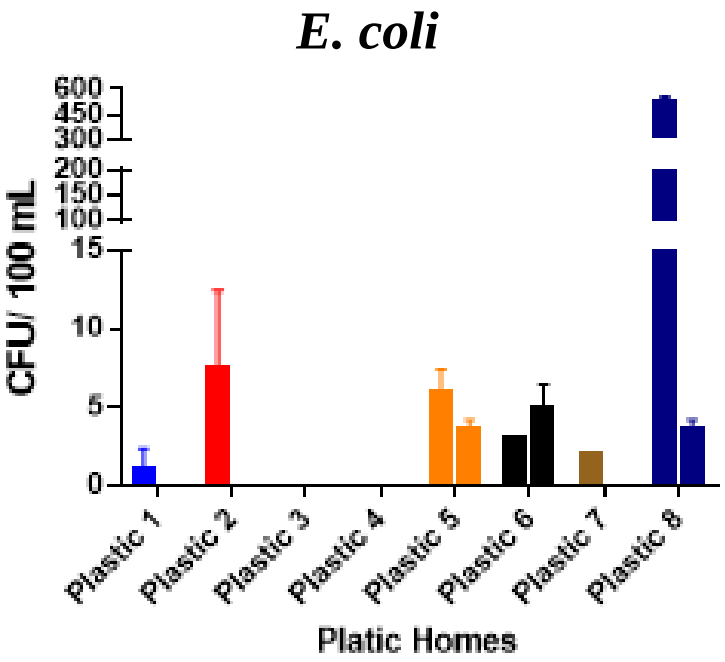
- Cement cistern samples

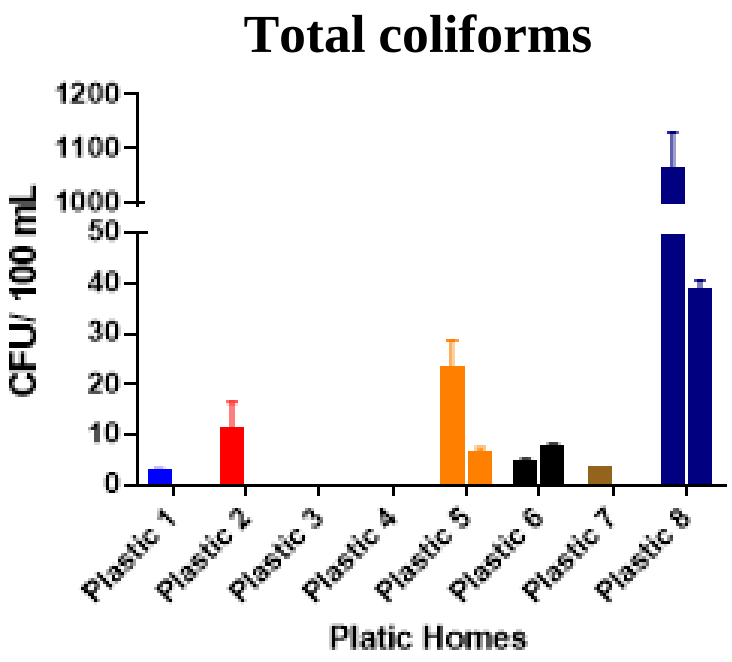




Results: *E. coli* and total coliforms

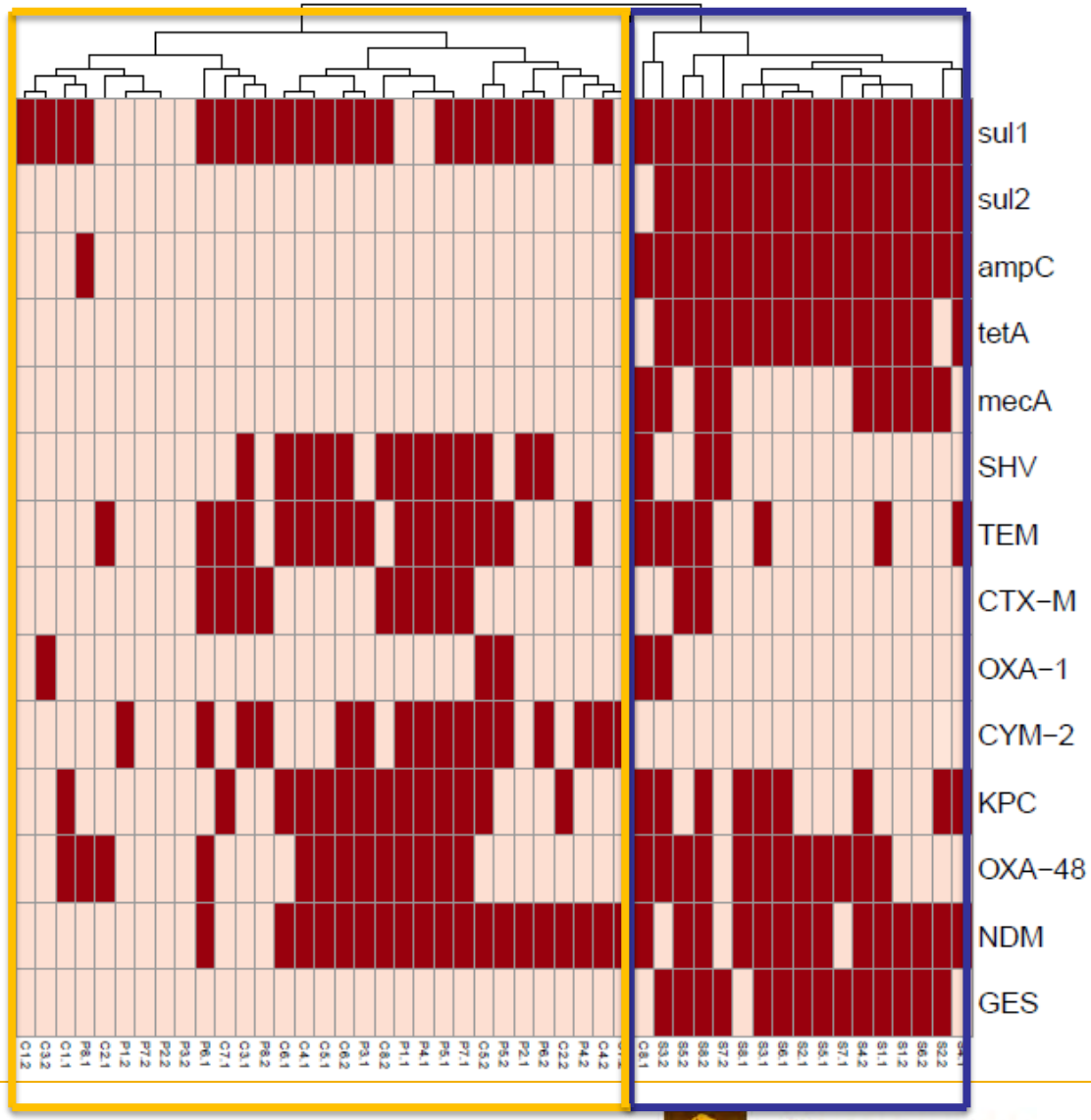
- Plastic cistern samples





Detection of antibiotic resistance genes

- ***sul1*** gene was also detected positive in WTP
- Dark cell => positive
- Light cell => negative



Summary

- Free chlorine concentration in cistern water barely met the recommended level
- *E.*coli/total coliforms were tested positive in many cistern samples
- Some ARGs were frequently detected in a few samples
- Results illustrate that drinking water quality was poor in homes with cisterns in Pine Creek
- Changing cisterns is necessary for homes with both bacteria and antibiotic resistance genes presenting in drinking water

Acknowledgements

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