

Student Grant Program



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July 3–8

Beachwood Beach West: 320, 10000, 1333, 182, 160, and 132 cfu/100mL enterococcus

August 28–31

Beachwood Beach West: 1775, 240, 300, 5100 cfu/100mL enterococcus

August 20–23

Beachwood Beach West: 600, 230, 420, 240 cfu/100mL enterococcus

August 20

Avon Road West Pine Beach: 800 cfu/100mL enterococcus

2005

2006

2007

August: NRDC puts Beachwood Beach West on the Beach Bum list for exceeding the daily maximum bacterial standard with 30% of its 20 total samples

August: Beachwood Beach West on NRDC Beach Bum list for exceeding the daily maximum bacterial standard with 60% of its 35 total samples

Sources: njbeaches.org,
Nrdc.org,
njdep.marine.rutgers.edu

June 30–July 4

Beachwood Beach

West: 190, 820, 160,
850, 180 cfu

enterococcus/100mL

June 30–July 1

Avon Road West Pine

Beach: 130, 710 cfu

enterococcus/100mL

June 8–10

Beachwood Beach

West: 160, 3850,
580

cfu

enterococcus/100
mL

July 12–15

Beachwood Beach

West: 140, 30, 200,
380 cfu

enterococcus/100mL

July 15–16

Avon Road West Pine

Beach: 170 and 350 cfu

enterococcus/100mL

2008

2009

2010

August: Beachwood Beach West on NRDC Beach Bum list with 40% of its 25 total samples exceeding the daily maximum bacterial standard

July: Beachwood Beach West on NRDC Beach Bum list with 38% of its 29 total samples exceeding the daily maximum bacterial standard

August: Beachwood Beach West on NRDC Beach Bum list with 51% of its 47 total samples exceeding the daily maximum bacterial standard

June: NRDC states that 27% of Beachwood Beach West's water samples (33 total) and 15% of Pine Beach West Beach's samples (26 total) from 2010 exceeded the daily maximum bacterial standard

2011

**We begin our
monitoring here**

Sources: njbeaches.org,
Nrdc.org,
njdep.marine.rutgers.edu

Goals

- ▶ Use the most pertinent scientific methodology
- ▶ Testing in the interest of public safety & health
- ▶ Further water quality understanding of the Toms River



Procedures

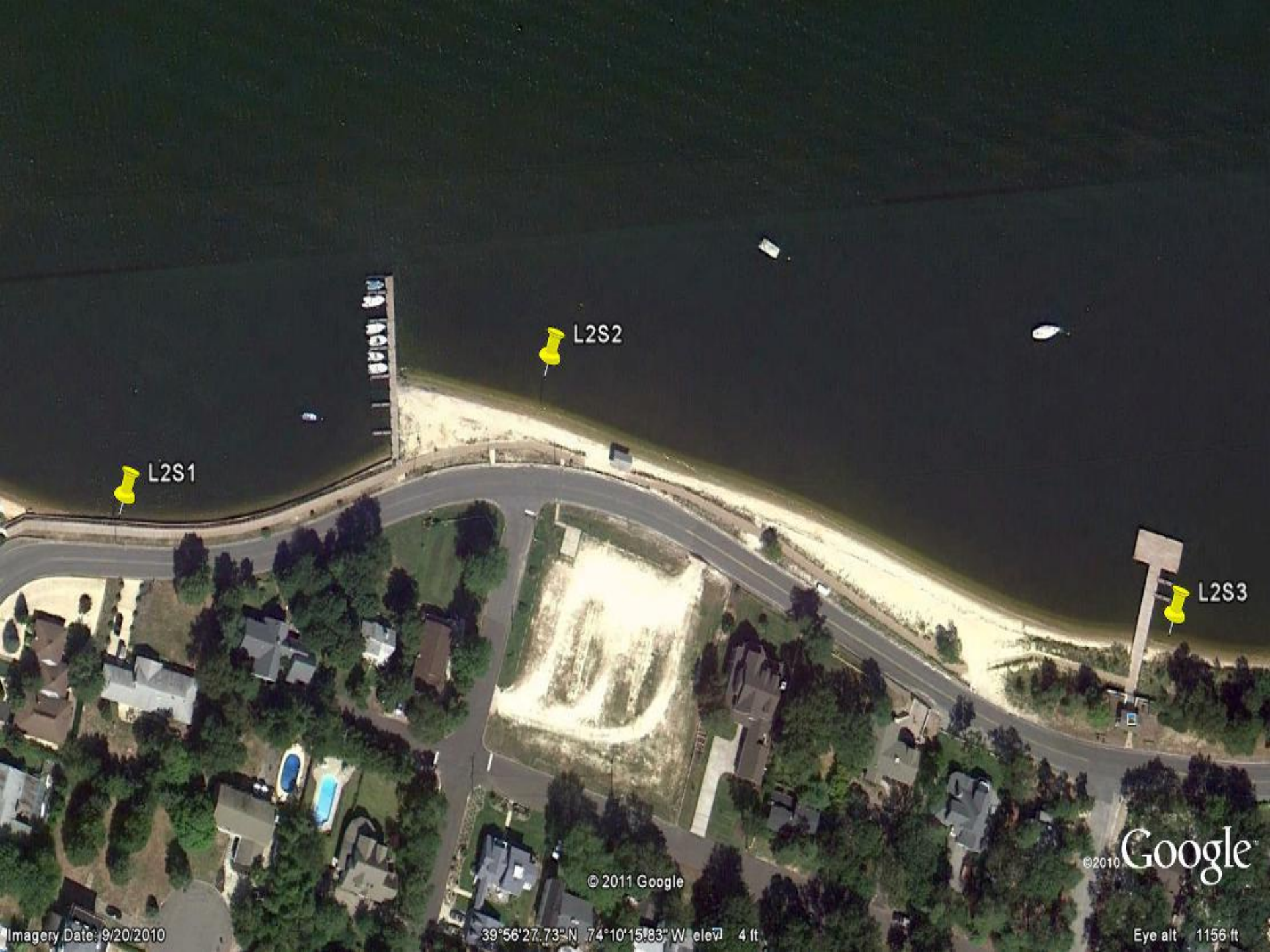
▶ Locations

▶ Quality Assurance

▶ Storm Plan

▶ Baseline Sampling





L2S1



L2S2



L2S3

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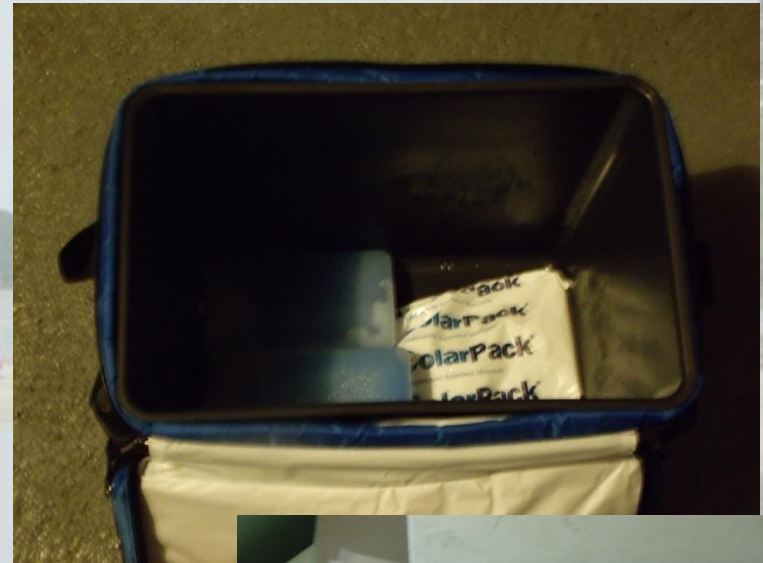
Imagery Date: 9/20/2010

39°56'27.73" N 74°10'15.83" W elev 4 ft

Eye alt 1156 ft

Quality Assurance

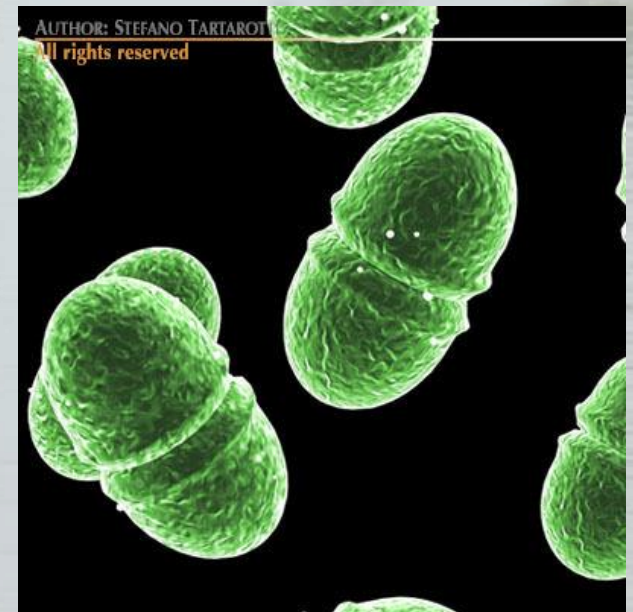
- ▶ DEP quality assurance measures
 - Tier B
- ▶ Recognition of research
- ▶ Accuracy of data



Sample Code	ES 01	Sample Code
Baseline Sampling	Times	Baseline Sampling
Date of Sample	7/18	Date of Sample
Time of Sample	10:00am	Time of Sample
Time of Incubation	11:17am	Time of Incubation
PSI Parameters	Values	PSI Parameters
Percent Saturation (%)	73.2	Percent Saturation (%)
Dissolved Oxygen (ppm)	5.74	Dissolved Oxygen (ppm)
Conductivity (mS/cm)	21.39	Conductivity (mS/cm)
Salinity (ppt)	13.0	Salinity (ppt)
Temperature (°C)	24.3	Temperature (°C)

Testing Information

- ▶ *Escherichia coli*
- ▶ *Enterococcus sp.*
- ▶ Optical Brighteners
- ▶ Water Quality Parameters



Relationships of Bacteria

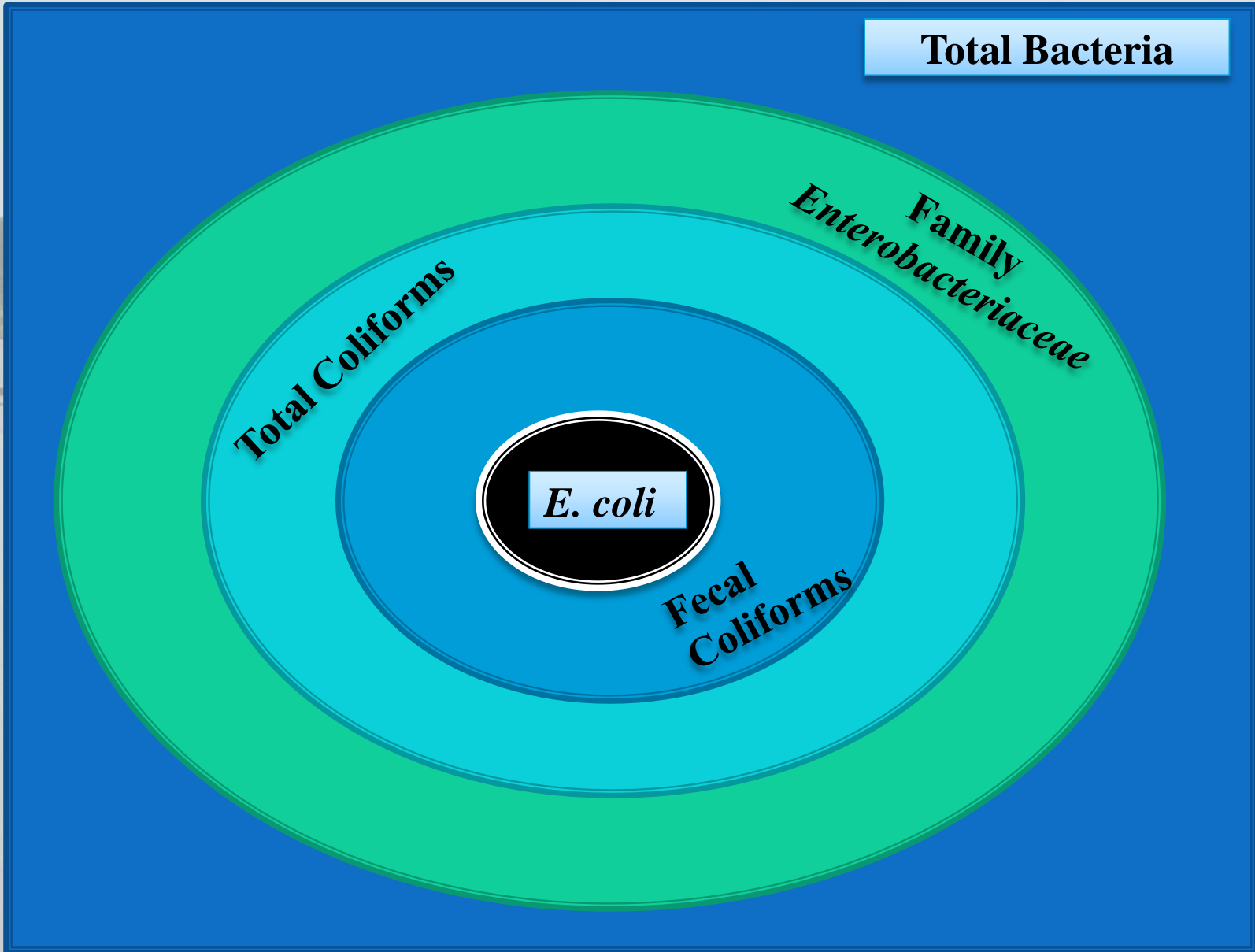
Total Bacteria

Total Coliforms

**Family
Enterobacteriaceae**

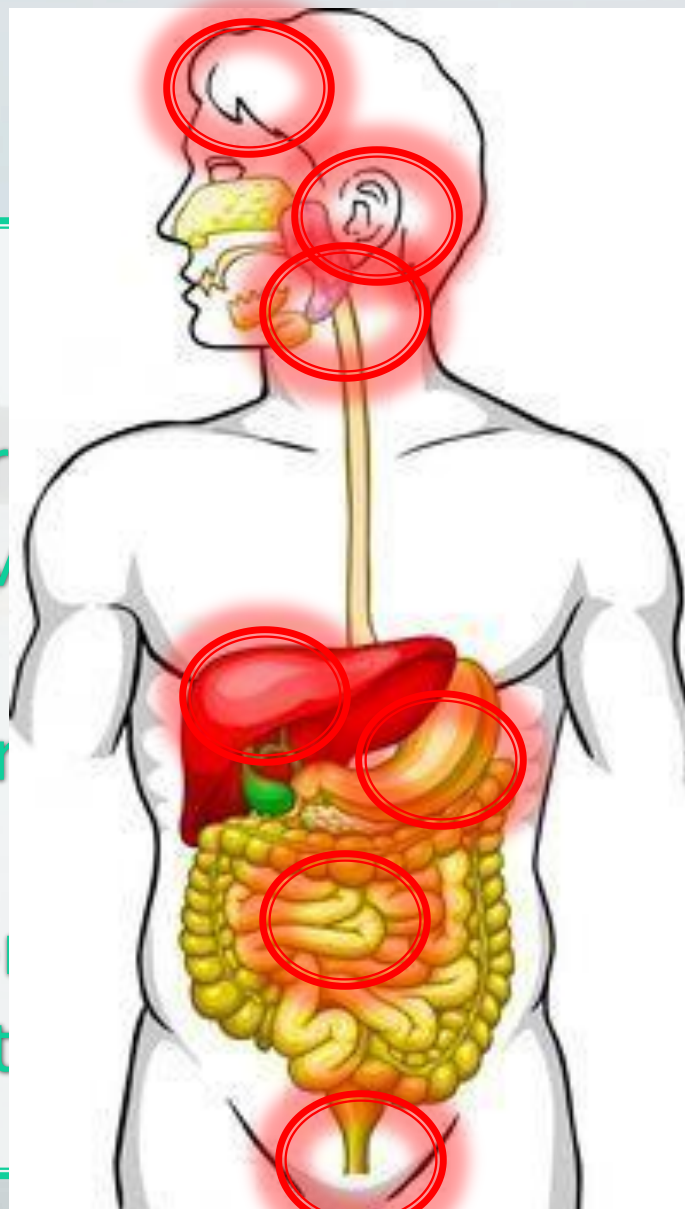
E. coli

**Fecal
Coliforms**



Illnesses

- ▶ Fever
- ▶ Nausea
- ▶ Stomach Cr
- ▶ Typhoid fev
- ▶ Hepatitis A
- ▶ Gastroenter
- ▶ Dysentery
- ▶ Ear infection
- ▶ Sore Throat



Pictures Courtesy
of webmd.com

Our Plan



Health Department Regulations

- ▶ Freshwater: *E. coli* 200 cfu/100 mL
- ▶ Marine: *Enterococcus* 104 cfu/100 mL
- ▶ Mondays
- ▶ Retesting
- ▶ Brackets



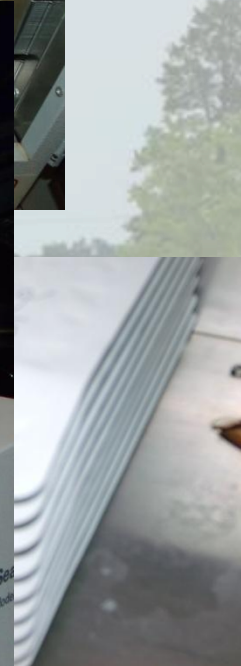
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▶ IDEXX

- Test
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- 10 m
- 10:1
- Black light



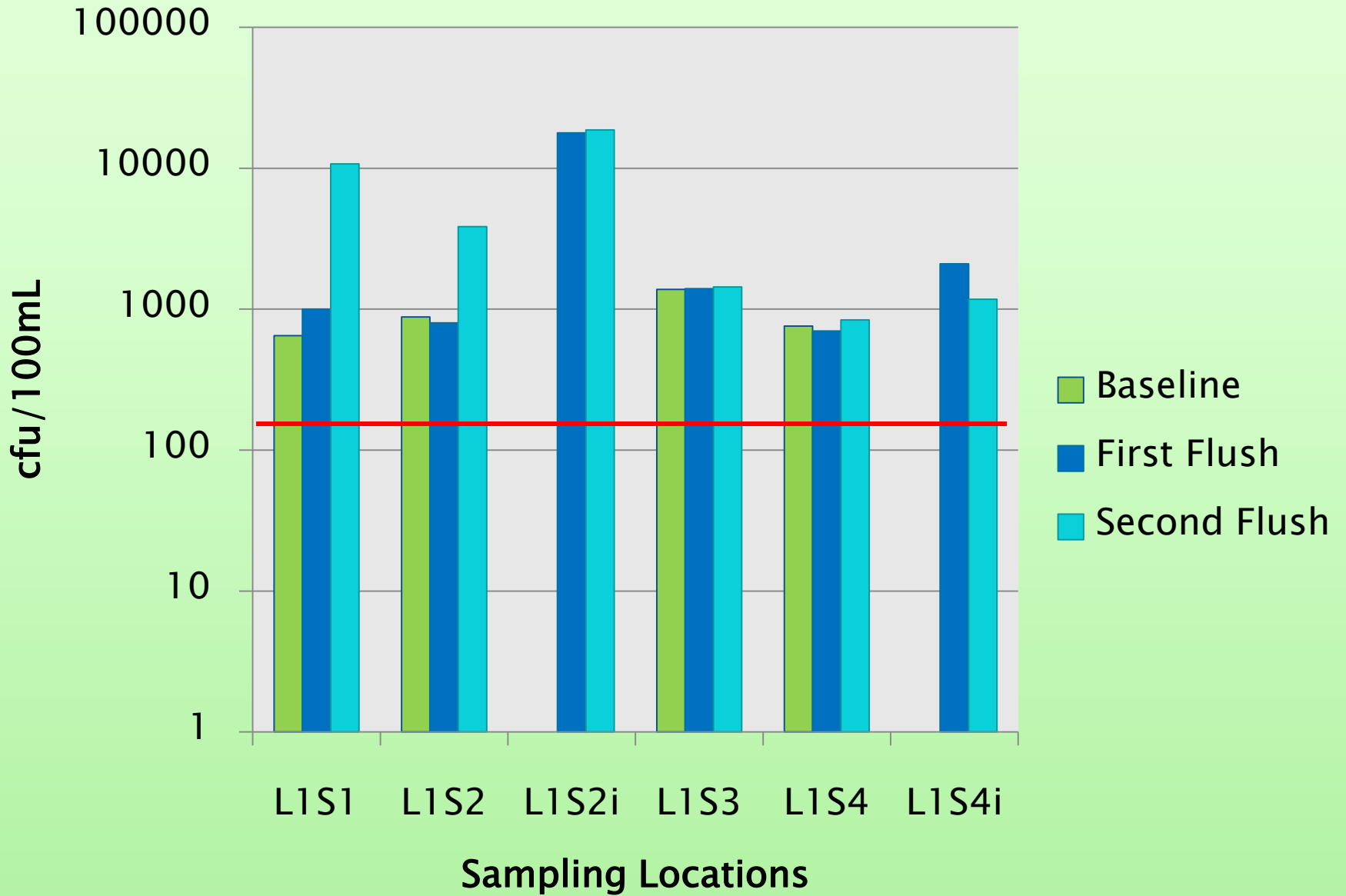
Matching

- ▶ The next slide we will display 3 Coliscan Easygel plates
- ▶ Take your guess as to where they came from!
 - Each colored dot on the plate represents a different strain of *E. coli*
- ▶ Choices:
 - Ocean County Utilities Authority Wastewater Treatment Plant Outflow
 - Beachwood Beach (stormy day)
 - Avon Road West in Pine Beach (sunny day)
 - Drinking Water

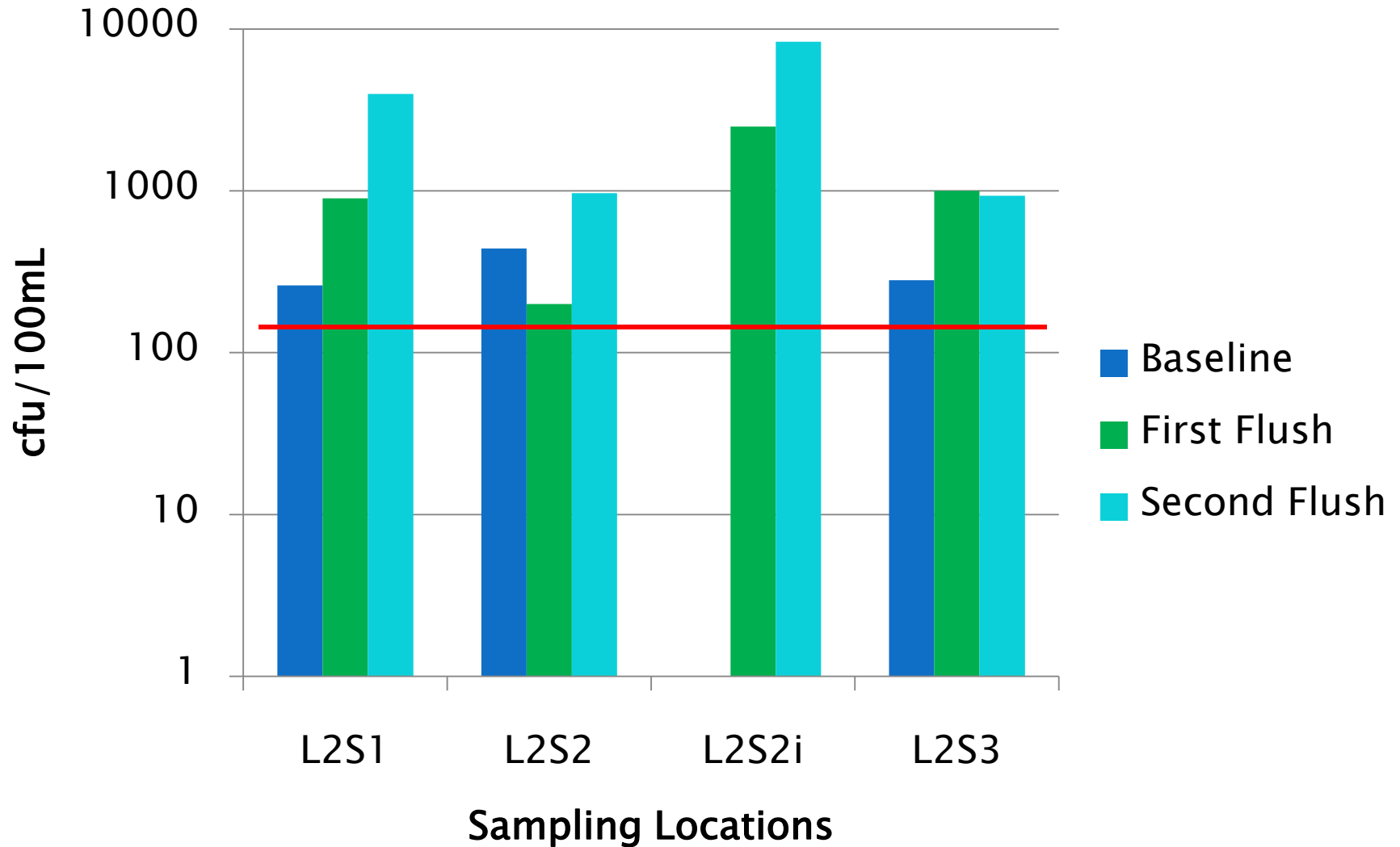


**Wastewater Treatment
Facility Outflow**

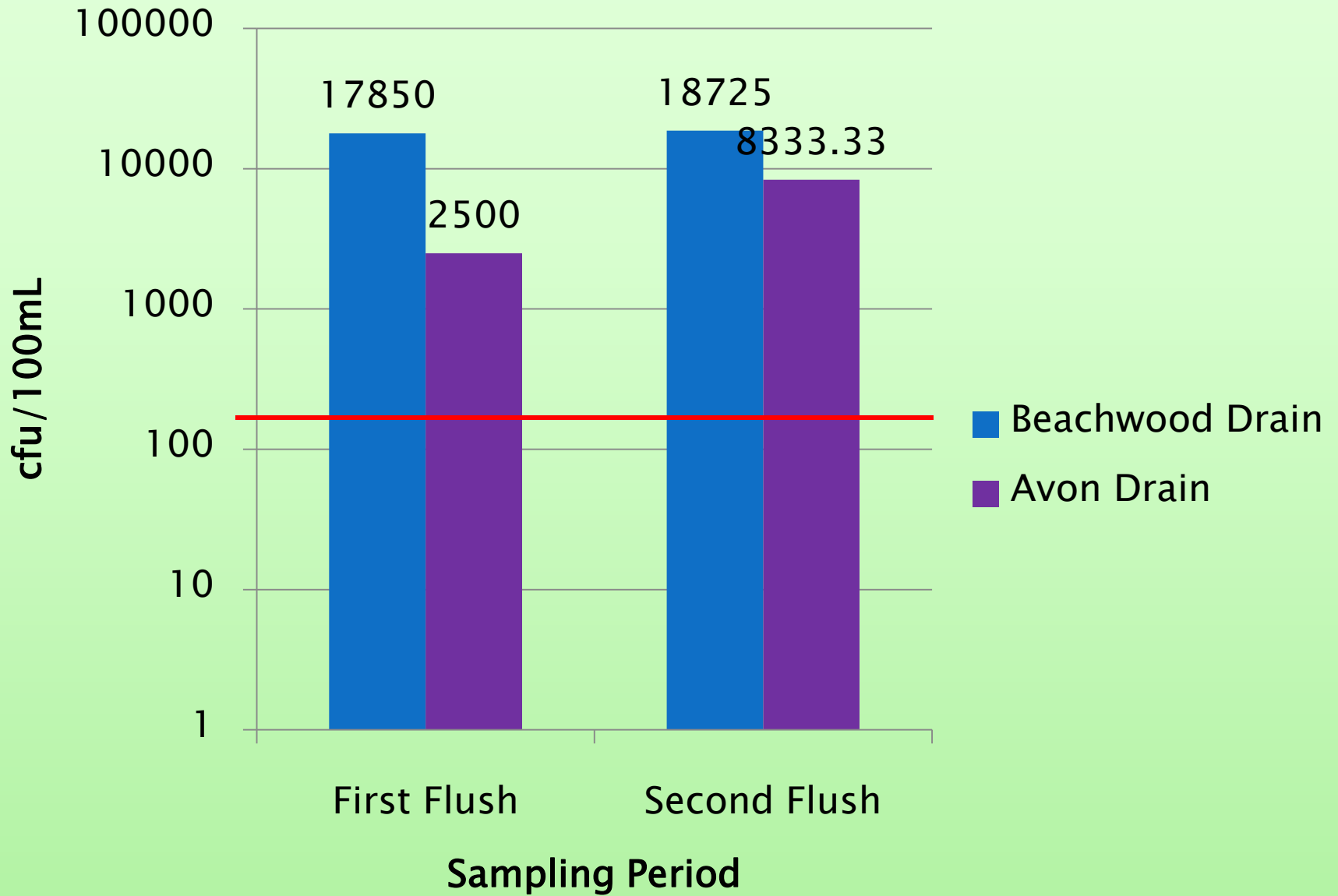
Mean Beachwood *E. coli* Levels



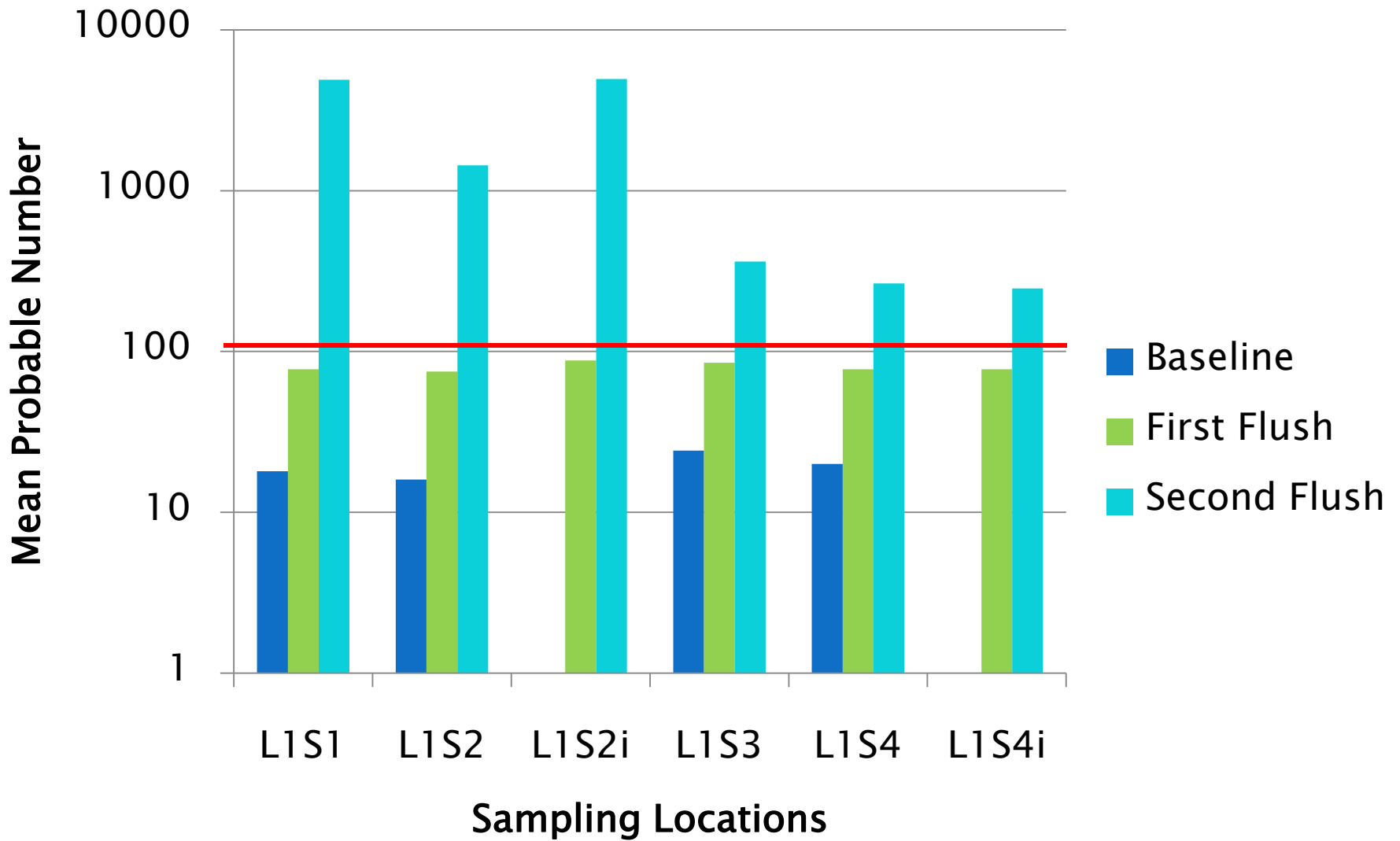
Average *E. coli* Levels at Avon Road Beach West (Pine Beach)



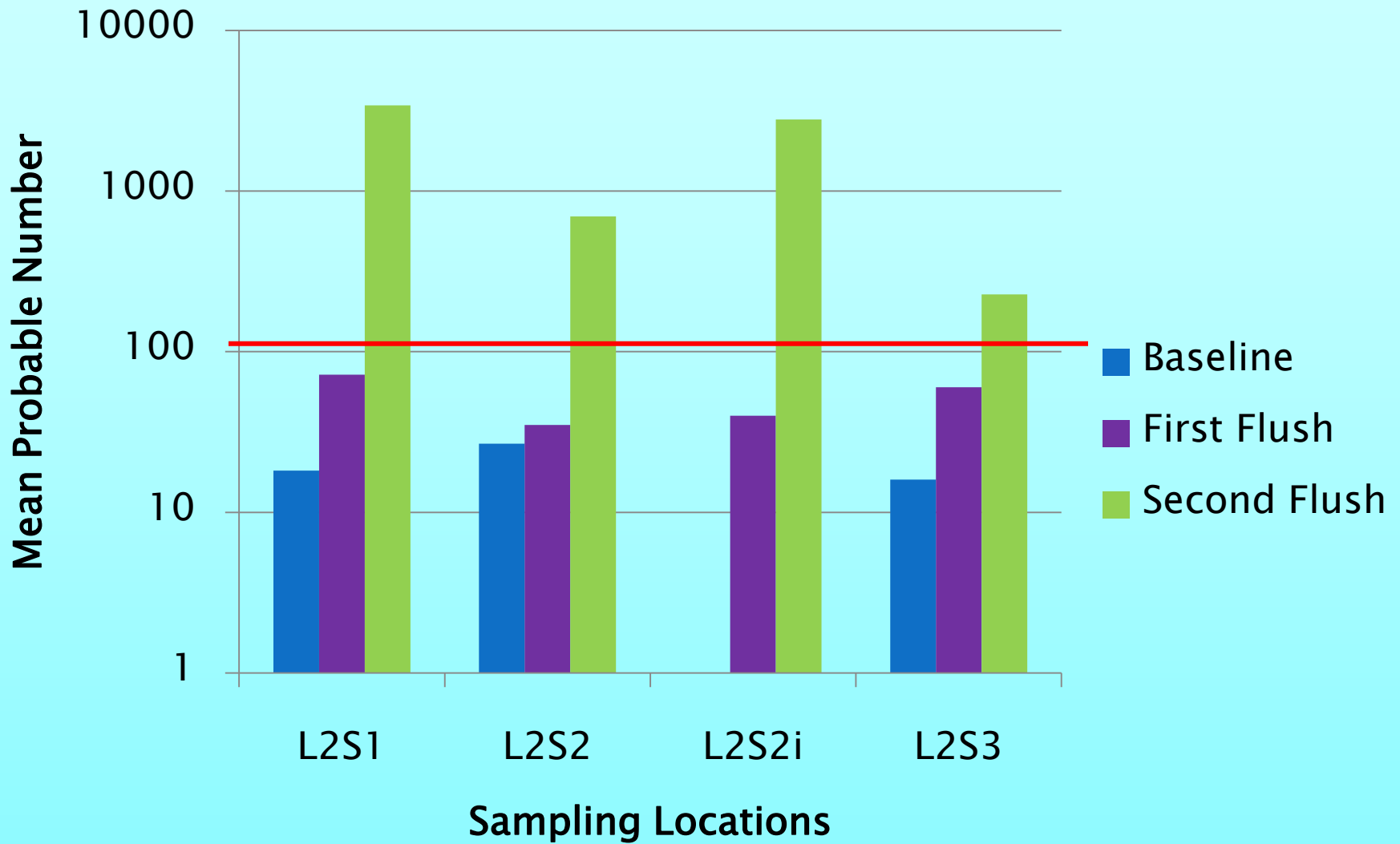
Average *E. coli* Levels in Problematic Pipes



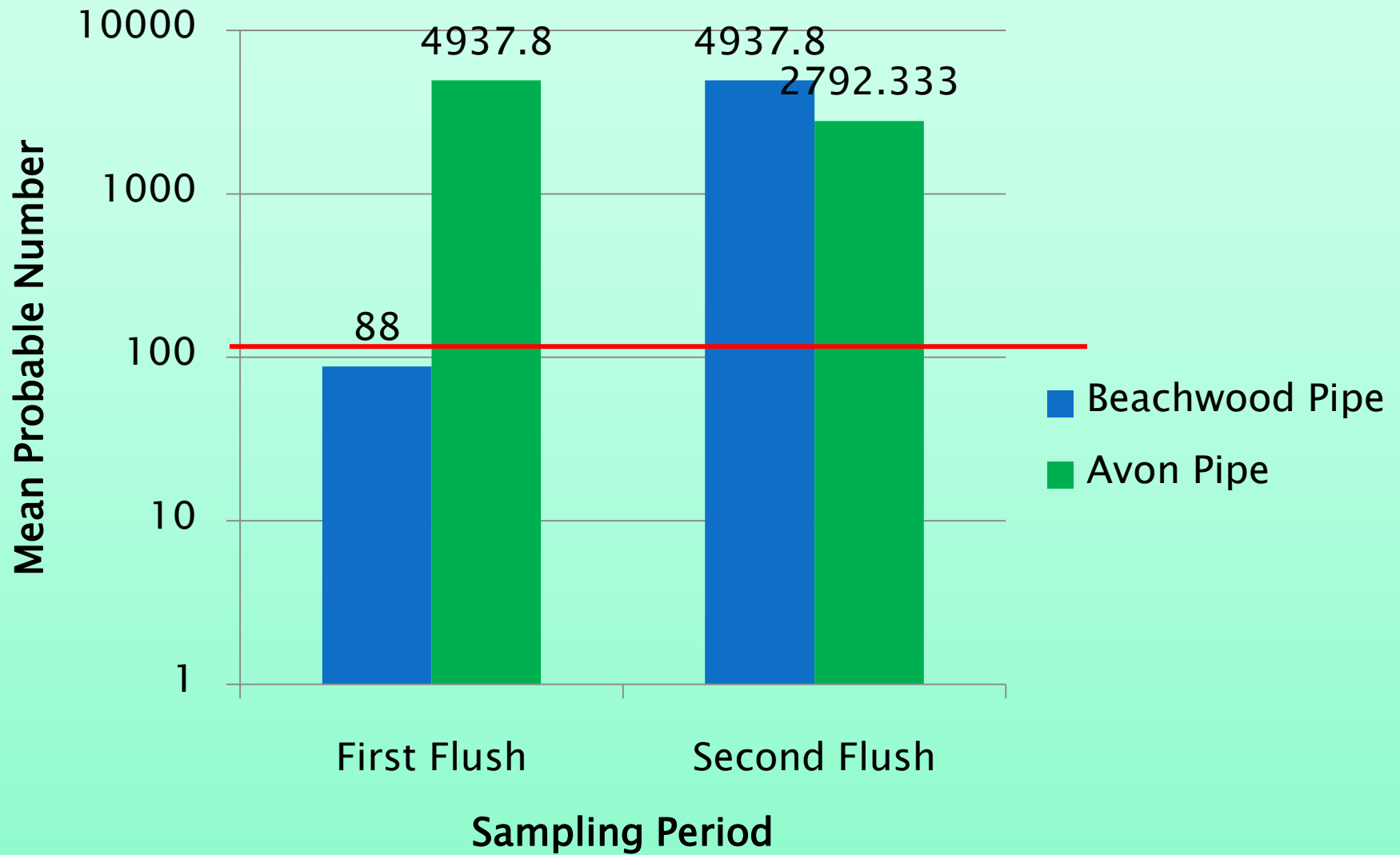
Enterococcus Bacteria Averages for Beachwood Beach



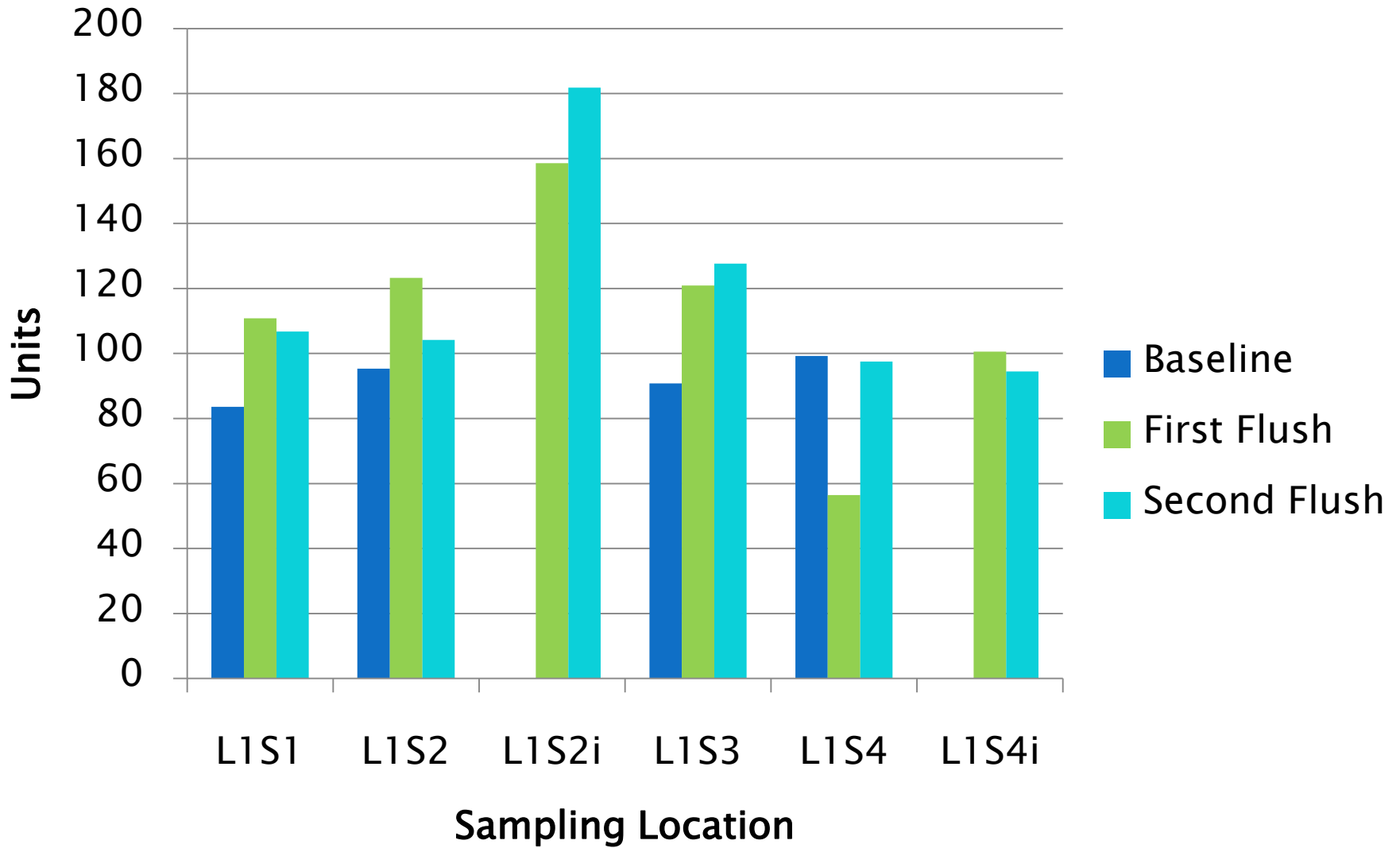
Enterococcus Bacteria Averages for Avon Road Beach West (Pine Beach)



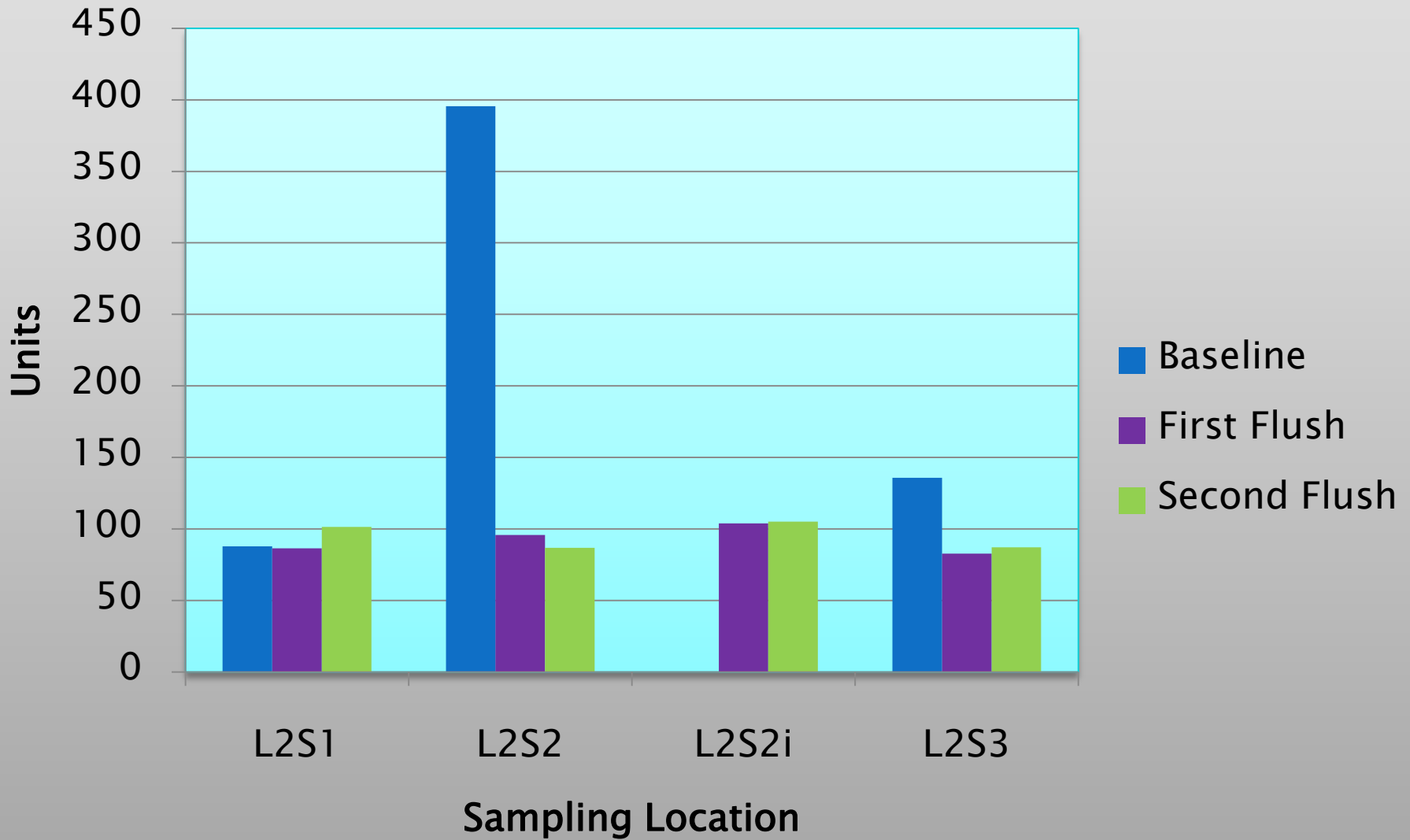
Mean *Enterococcus* Levels for Problematic Pipes



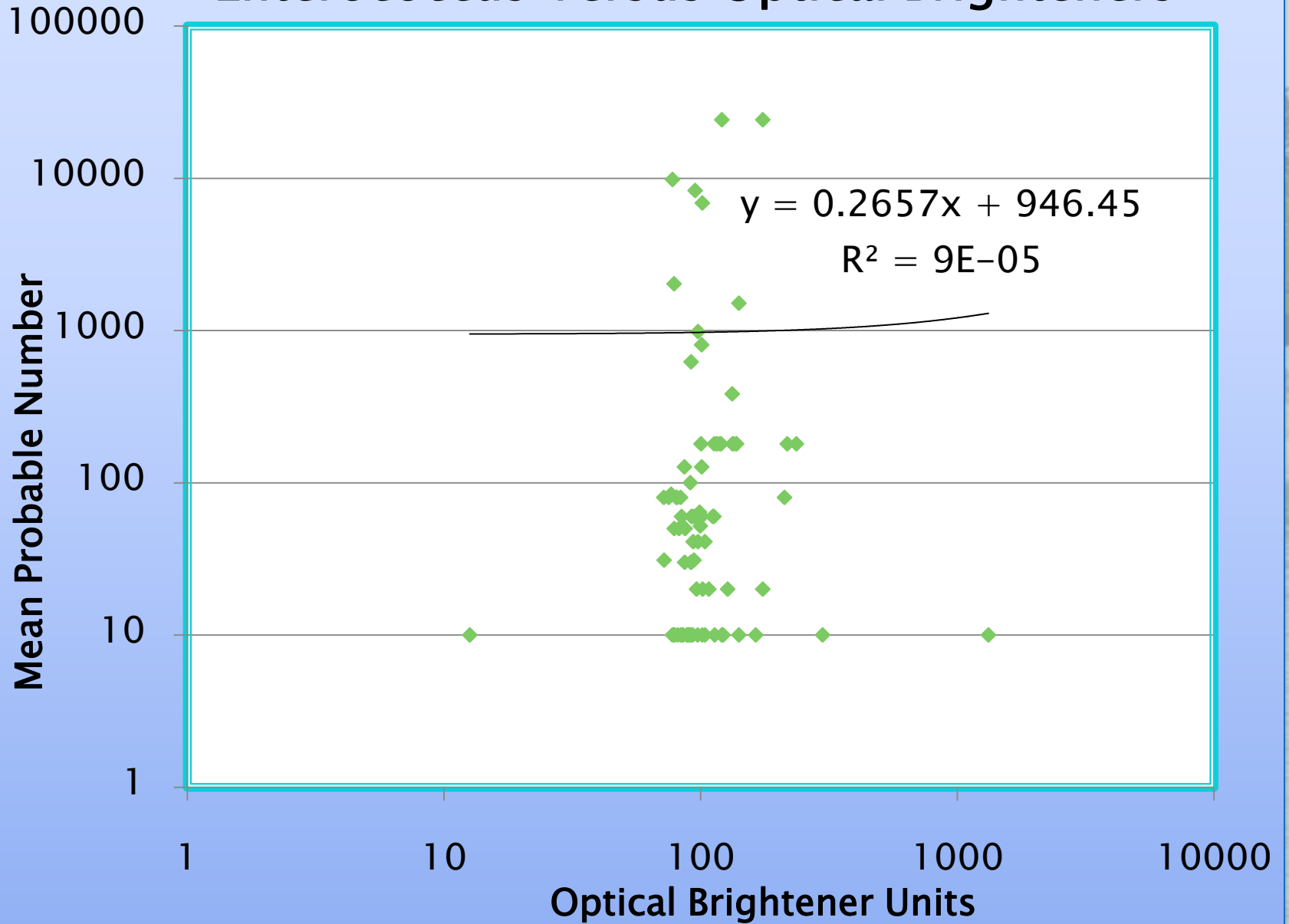
Mean Optical Brightener Levels at Beachwood Beach



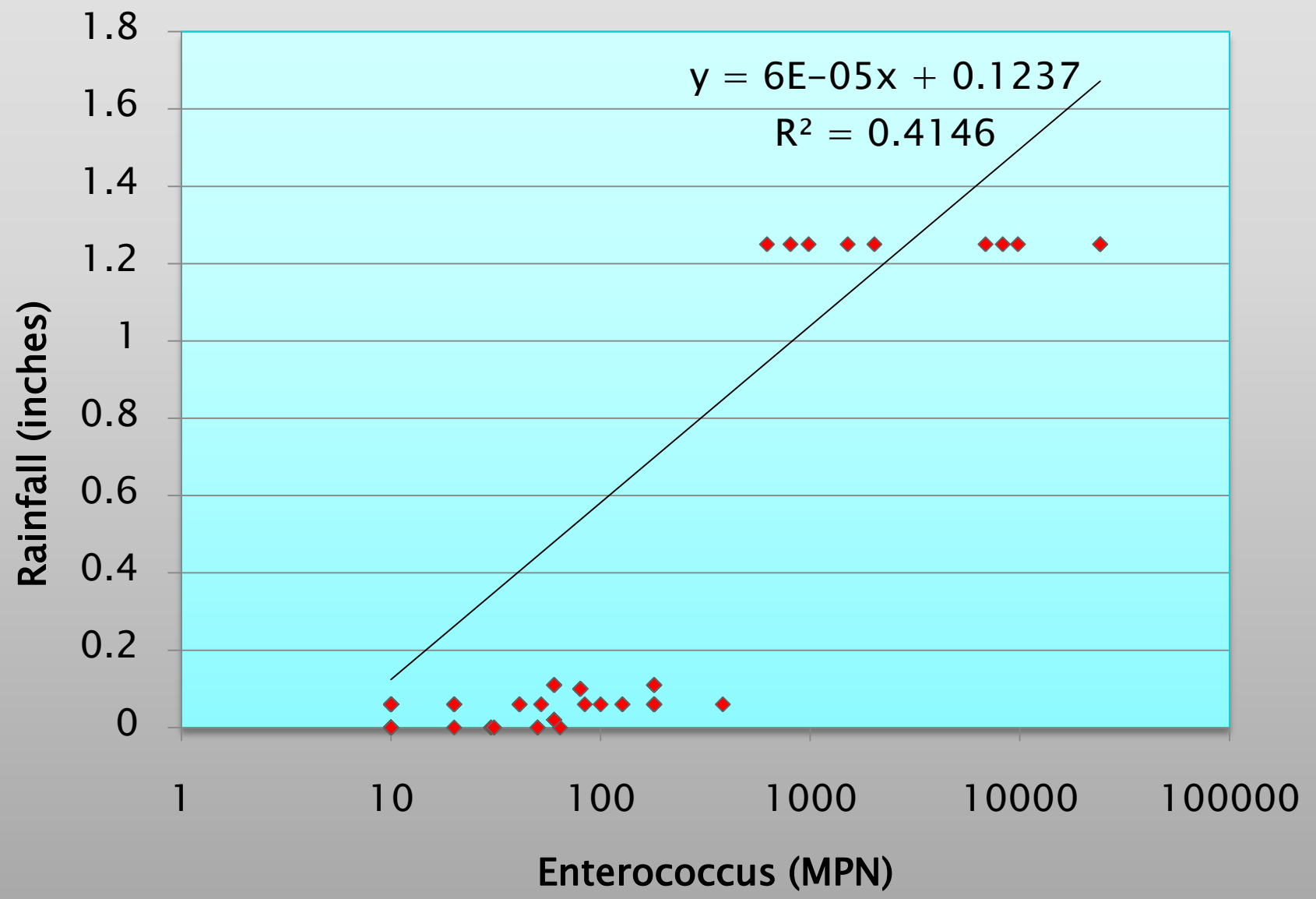
Mean Optical Brightener Levels at Avon Road Beach



Enterococcus Versus Optical Brighteners

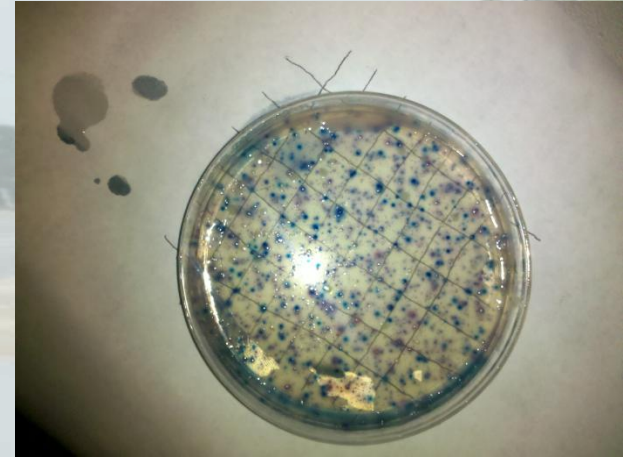


Enterococcus Levels Versus Rainfall



Statistics

- ▶ Analysis of Variance (ANOVA)
- ▶ Student t-test
- ▶ Linear Regression



Statistics

▶ Second Flush

- *Enterococcus* ($P = 0.023$, $F = 5.130$, $df = 1$)
- *E. coli* (Beachwood; $P = 0.026$, $F = 5.304$, $df = 1$)
- Optical Brightener (Beachwood: $P = 0.002$, $F = 7.421$, $df = 1$; Avon: $P = 0.002$, $F = 10.793$, $df = 1$)



Date	Beachwood (CFU/100 mL)		Avon (CFU/100 mL)	
	Health Dept.	Ours (Average)	Health Dept.	Ours (Average)
6/27/11	10	11.892	34.641	18.371
7/18/11	10	10	10	10
7/25/11	40	13.269	10	14.581
8/1/11	20	11.892	30	18.566

Location	Leed's (CFU/ 100 mL)	Ours (CFU/100 mL)
L1S1	30	10
L1S2	20	10
L1S3	37	10
L1S4	3	20

Conclusions

- ▶ Our data suggests that during rainfall events, the elevated bacteria levels at Beachwood Beach are a potential hazard for human health and exceed the Ocean County Health Department's standard for safe swimming water
- ▶ Our data also suggests that the underwater storm drain at Avon Road Beach West in Pine Beach may potentially pose a problem if the problem is not addressed quickly

Recommendations

- ▶ As per our results, we would recommend a 72 hour beach closing after a storm of 0.10 inches
- ▶ Storms over 0.05 inches can provide unhealthy increases in bacteria levels
- ▶ To prevent these dangerous conditions, it is recommended to inspect & clean storm drains on a monthly basis
- ▶ Inspections can be made by using the Ocean County Health Department's free available storm drain cameras to inspect for debris or infrastructure problems

Acknowledgements

- ▶ We would like to thank the following for all of their assistance with our project:
 - Student Grant Program
 - Save Barnegat Bay
 - The Marine Academy of Technology and Environmental Science
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 - The Rutgers Cooperative Extension
 - The DEP Leed's Point Lab Staff

Acknowledgements

- ▶ We would also like to thank our three mentors for this project; without their help, support, and guidance throughout the whole project, our final results would have been impossible
- ▶ Thank you to:
 - Dr. John Wnek (MATES)
 - Mrs. Danielle Donkersloot (NJDEP)
 - Ms. Cara Muscio (Rutgers Co-Op)

Questions?



References

- ▶ National Resources Defense Council. (2011). *Testing the Waters: A Guide to Water Quality at Vacation Beaches*. Retrieved July 28, 2011 from <http://www.nrdc.org/water/oceans/ttw/ttw2011.pdf>
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