

# Seasonal Performance of Innovative/Alternative Septic Systems in Barnstable County

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This is why you're all in this room right now.

# Two Questions



## Question #1

Do Seasonally-Used I/A Systems  
remove nitrogen as well as systems  
used year-round?




## Question #2

What influence does the highly-variable occupancy of “summer rental” properties have on nitrogen removal performance?

Back to basics...

# What is an I/A System?



Innovative/Alternative (I/A)  
septic systems are mini  
wastewater treatment plants.

# I/A Systems are More Complex

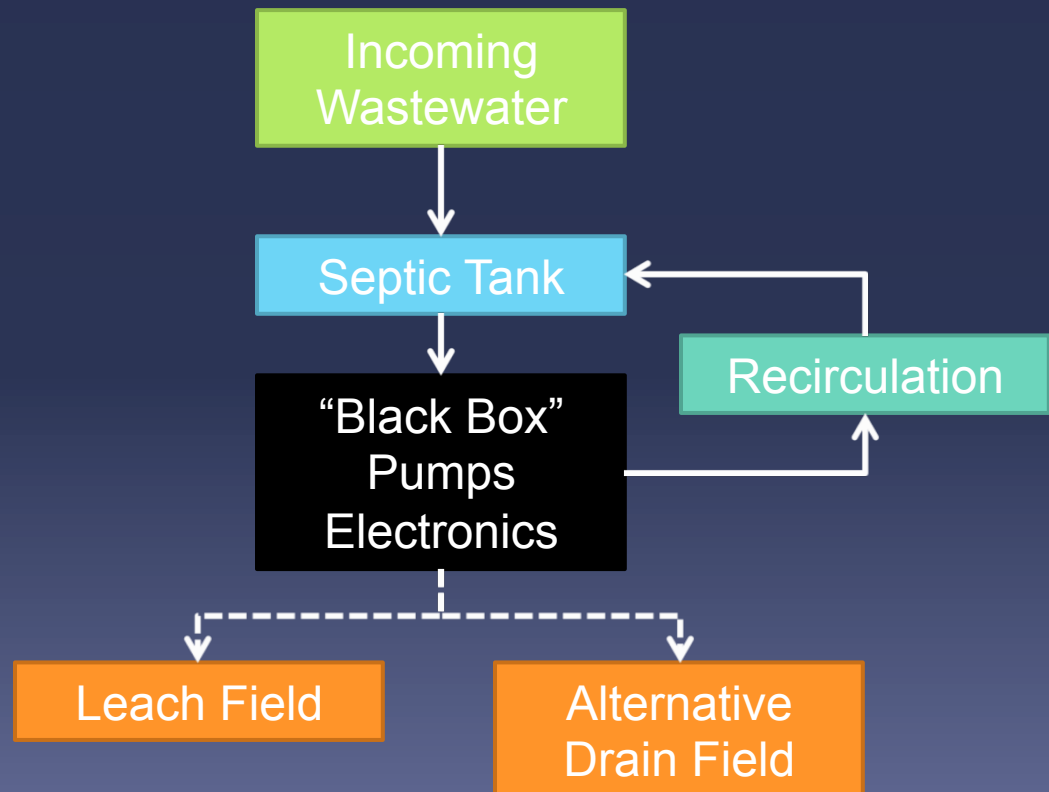
“Standard” Septic System

**Passive**



I/A Septic System

**Active**





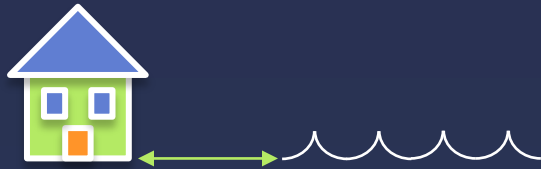
I/A Systems are  
Installed where  
Enhanced  
Wastewater  
Treatment is  
Needed or  
Desired





# Situations Where we see I/A Systems Installed

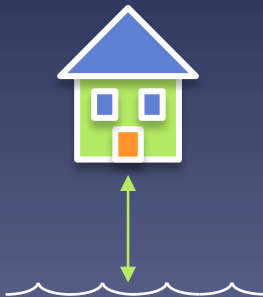
Proximity to Surface Water



Adding Bedrooms on a Small Lot



Proximity to Ground Water



Building Eco-Friendly Bat Cave





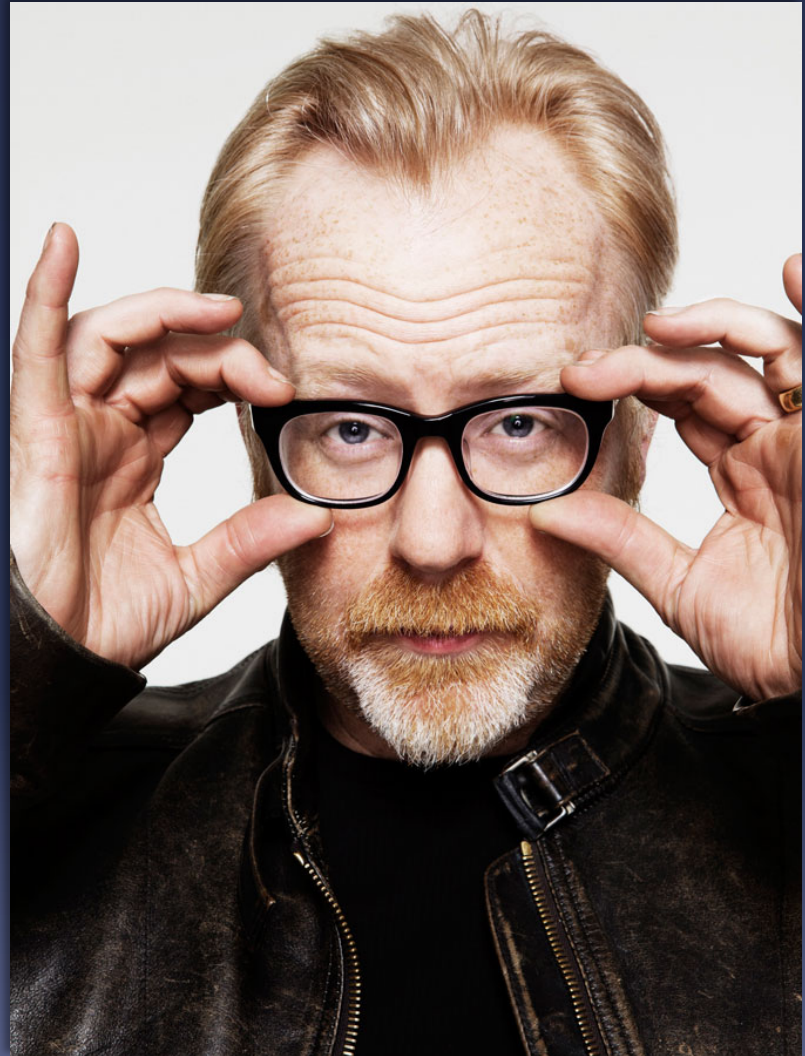
Let's not waste words, captain...


# Where does Our Data Come From?



“Failure  
is  
always  
an  
option.”

-Adam Savage,  
Mythbusters





A comprehensive plan to maintain  
and monitor I/A systems is  
imperative.

# Ways to Track I/A Compliance



	A	B	C
1	Site Address	Date Sampled	Total Nitrogen
2	4380 Route 6	9/9/2014	0.61
3	39 Mayflowe	8/28/2014 10:30:00 AM	20
4	48 Phyllis Ro	8/20/2014 4:00:00 PM	12.27
5	4380 Route 6	8/14/2014	14
6	689 Gifford S	8/6/2014 11:45:00 AM	51.56
7	62 Oak Grove	8/6/2014 10:30:00 AM	3.44
8	5 Samoset Rc	7/29/2014 9:40:00 AM	44.8
9	668 Route 28	7/22/2014 10:00:00 AM	
10	4380 Route 6	7/21/2014	15.5
11	19 Burning B	7/18/2014 11:49:00 AM	7.63
12	10 Captains C	7/16/2014 3:00:00 PM	25.38
13	142 Whidah V	7/16/2014 11:00:00 AM	17.12
14	163 George R	7/8/2014 9:30:00 AM	53.26
15	70 Country C	7/7/2014 12:00:00 PM	18.05
16	335 Main Stre	7/2/2014 2:00:00 PM	9.74
17	172 Captain	7/2/2014 1:45:00 PM	30.63
18	120 Highmea	7/2/2014 12:45:00 PM	6.73
19	65 Dow Drive	7/2/2014 12:00:00 PM	14.17
20	289 Cotuit Rq	7/2/2014 10:15:00 AM	10.18

I'm also going to need you to go ahead and come in on Sunday...

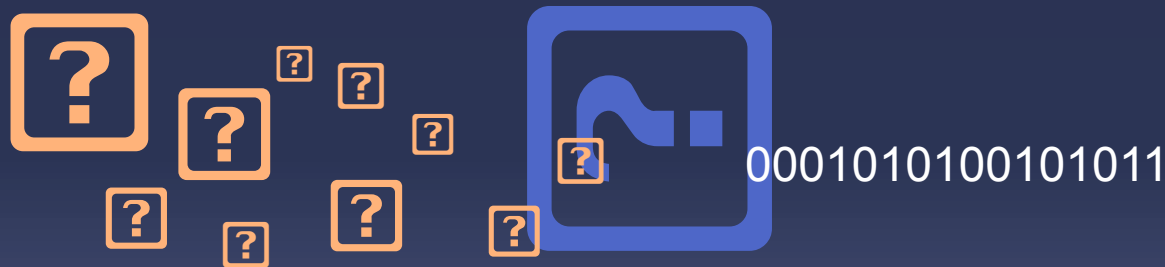


Leverage technology to do the  
hard work for you.

(and save some trees in the process!)



# System Operators Report Directly to the Tracking Database






# Database Calls Attention to Potential Problems



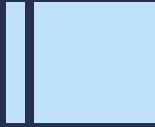
# Follow-up Initiated by Staff





93% of Contract Issues are  
Resolved without Involving Local  
Board of Health or it's Agent.

# Many, Many Reports...



2,045  
I/A Systems

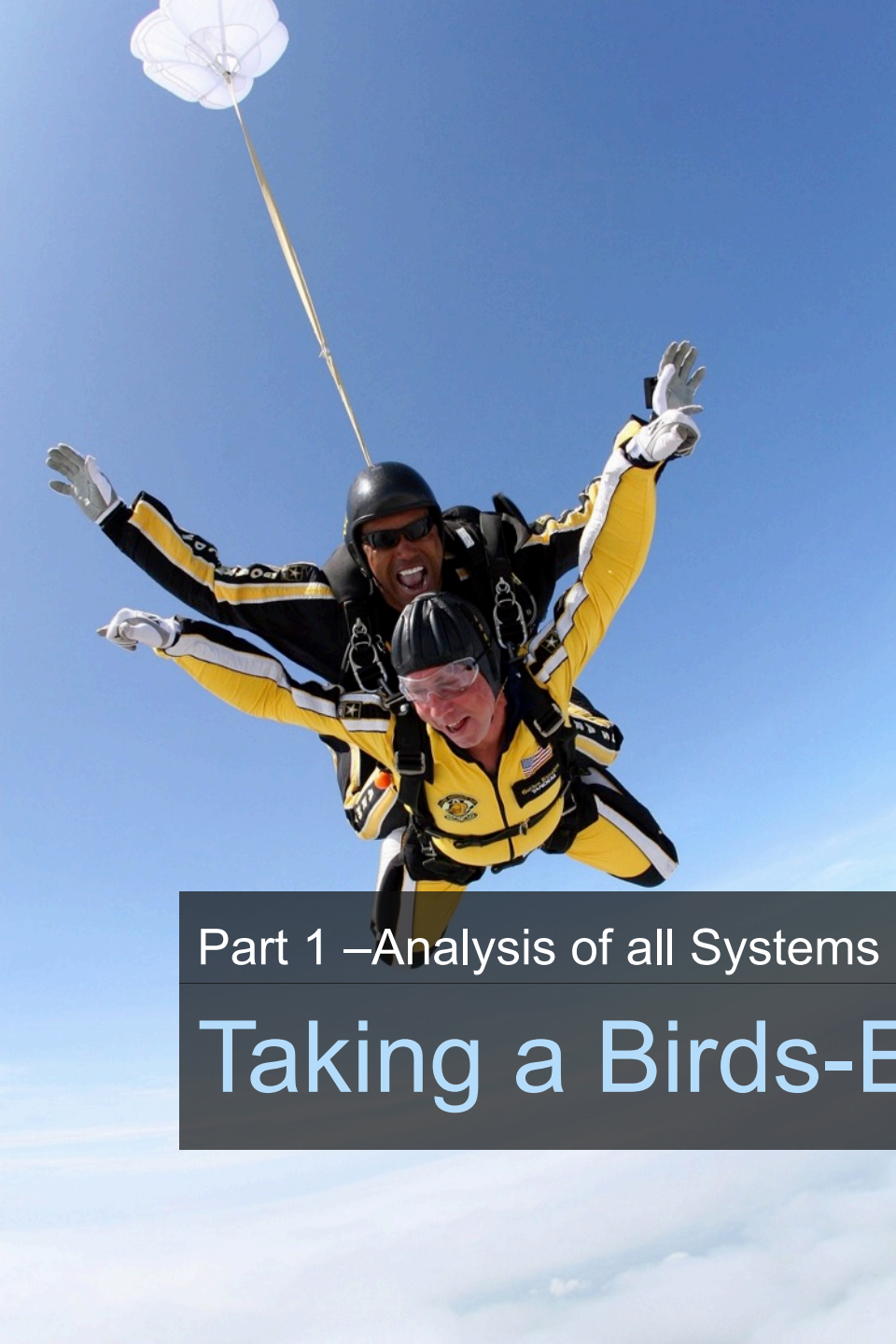


17,600  
Sample Reports



127,260  
Data Points





You won't be having as much fun as these guys... sorry

Part 1 –Analysis of all Systems

# Taking a Birds-Eye View

**ALRIGHT DAVE,  
LET'S TALK NUMBERS**

**KEEP IN MIND I CAN ONLY  
COUNT TO THREE**

made on imgur



Method #1

Graph all of the Data.

Highest Median

July

18.9 mg/l

Greatest Spread

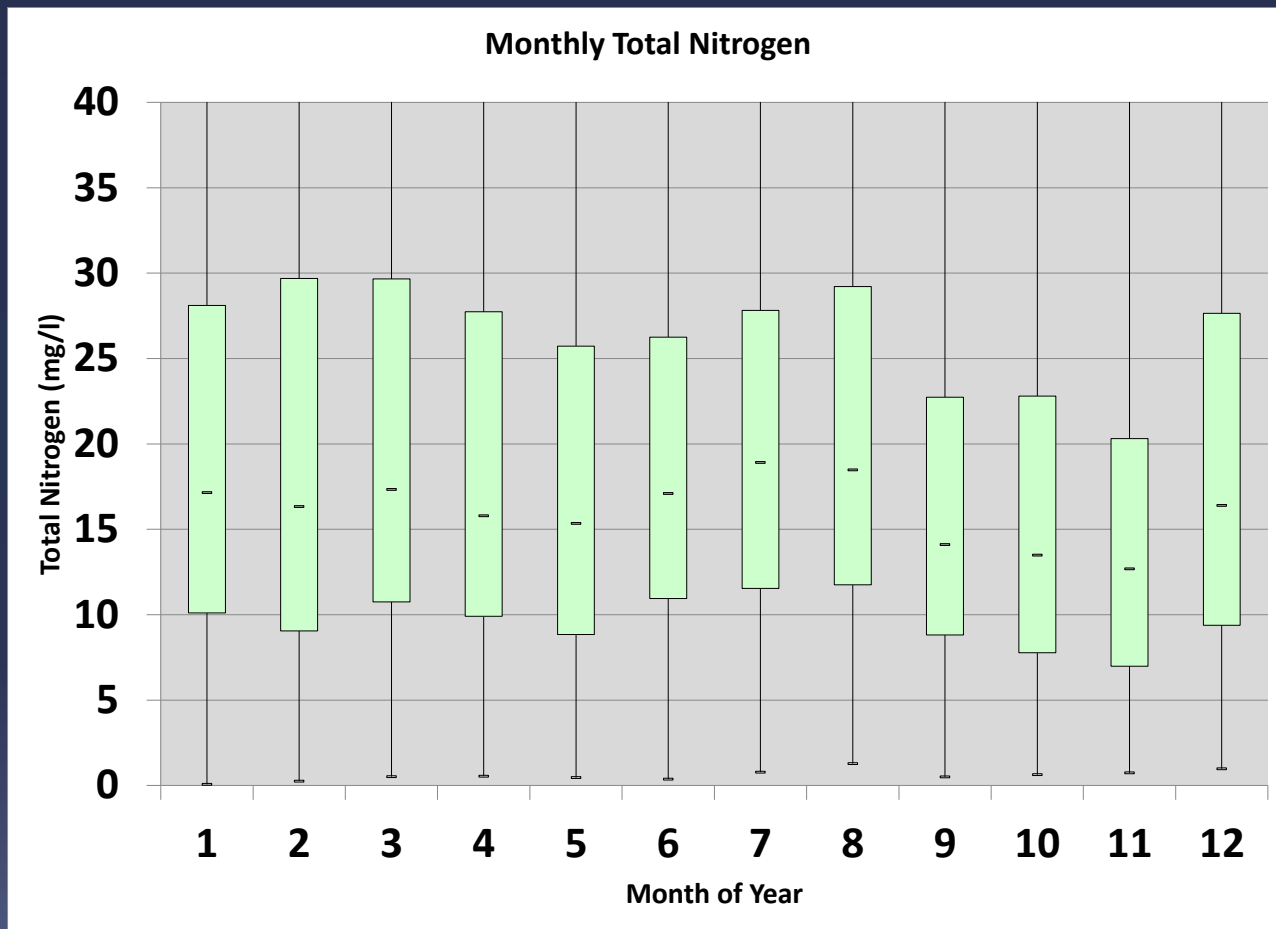
February

20.6 mg/l

Best Performance

November

12.7 mg/l







Method #2

Just Graph the Seasonal Data.

# Problem

No concrete data on what systems are used seasonally vs. year-round

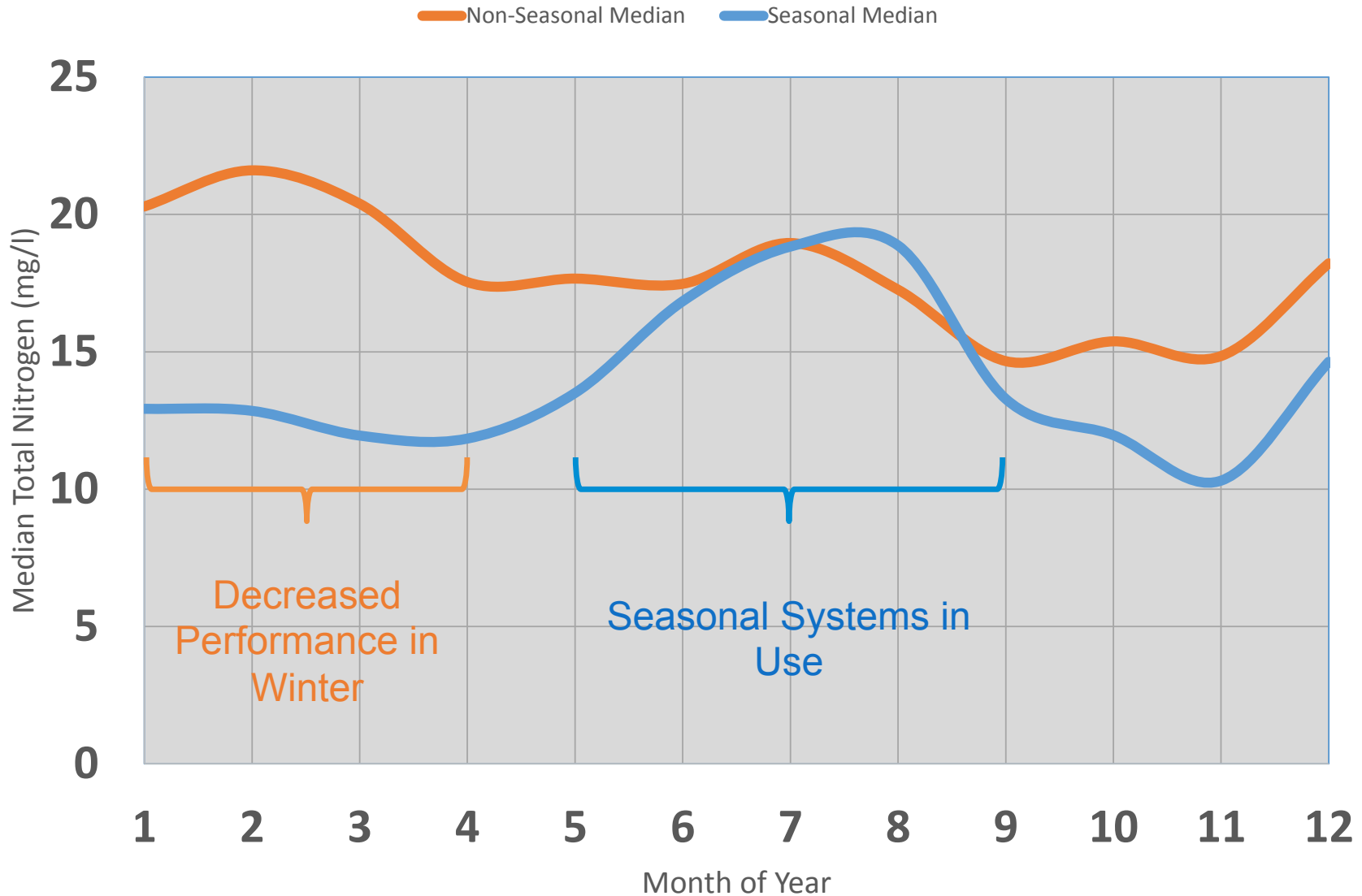


# Solution?

Compare owner mailing address to physical system address.

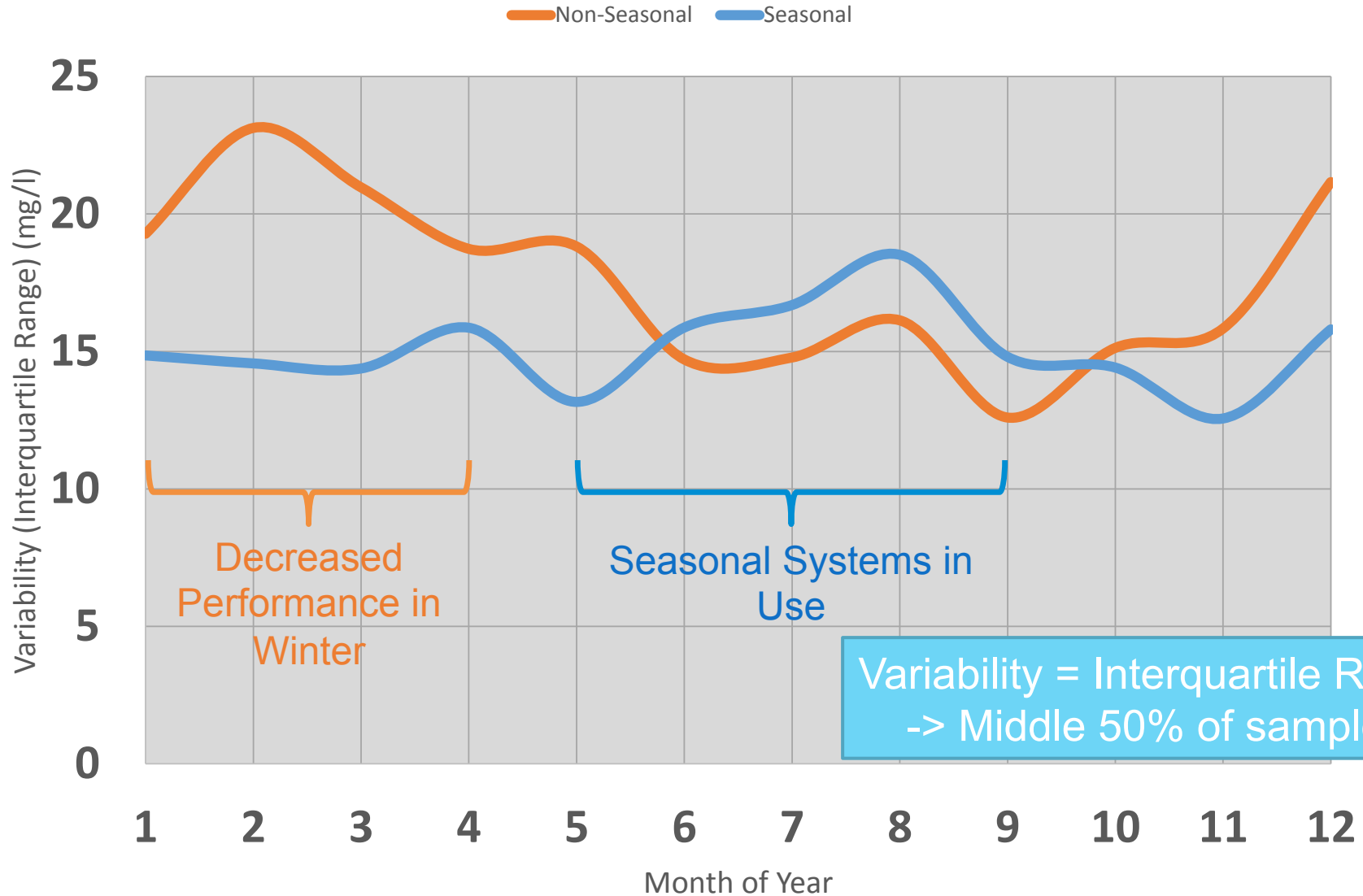
# Median Total Nitrogen

Seasonal vs. Non Seasonal Median TN by Month (2009-2015)



# Total Nitrogen Variability

Seasonal vs. Non Seasonal TN Variability by Month (2009-2015)

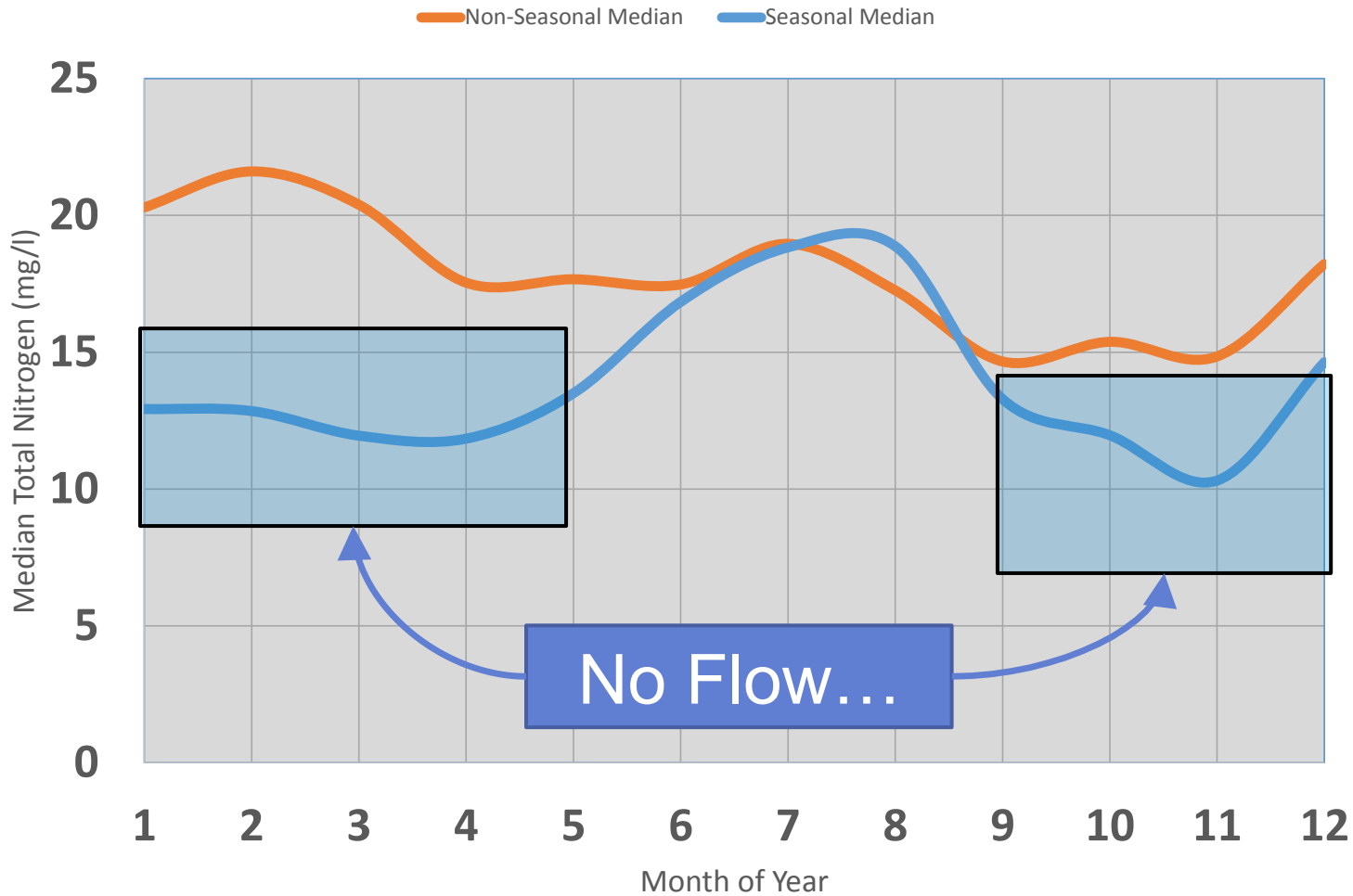


	Median	Variability
Seasonal (May-Sep)	16.84 mg/l	15.80 mg/l
Non-Seasonal (Full Year)	17.60 mg/l	17.61 mg/l
Non-seasonal (May-Sep)	17.48 mg/l	15.40 mg/l

Seasonal use I/A systems seem to perform **at least as well** as year-round use I/A systems at removing nitrogen.

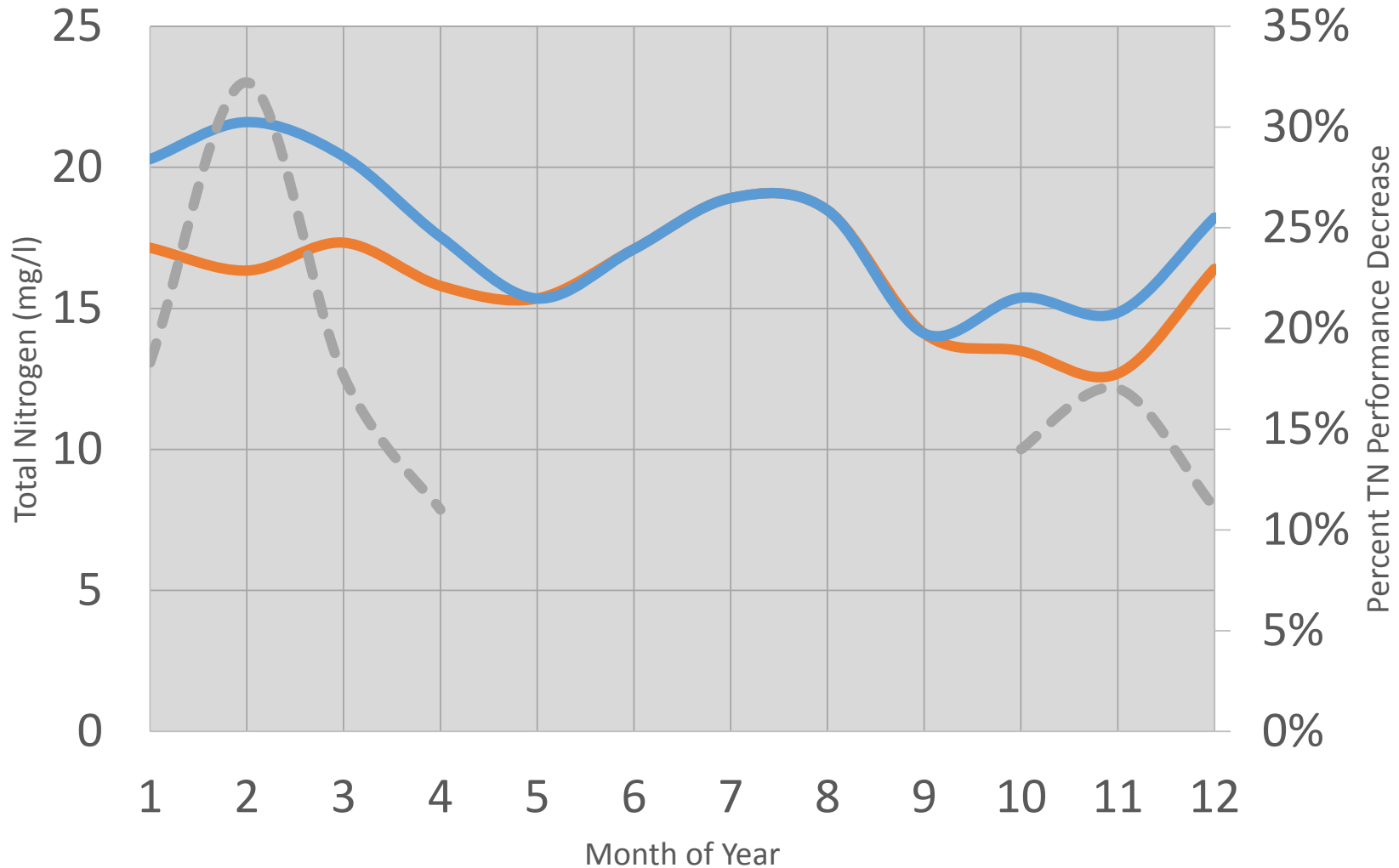
# Something to Consider...

Seasonal vs. Non Seasonal Median TN by Month (2009-2015)



# Seasonally-Adjusted Median Total Nitrogen, All Systems

All Data   Off-Season Removed   Pct Change



Remember kids, with  
great data comes  
great responsibility!



\* This presentation is not endorsed by Spiderman.

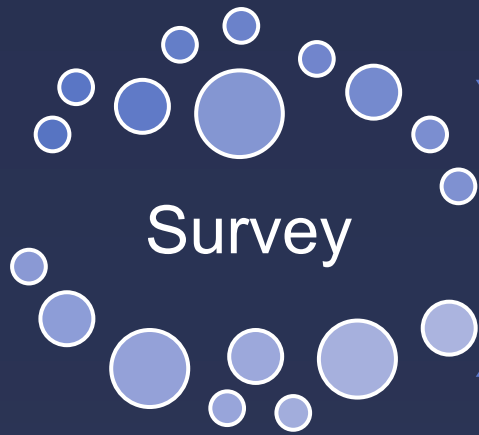




Part 2 – Detailed Analysis of a Subset of Systems

# Getting Down in the Trenches





- Sent to 600+ system owners
- **20 responses**

## Tabulation

- Survey results
- Water use
- Nitrogen data



- Calculate mass load
- Compare year-round and seasonal use

Lesson: People don't answer surveys.

A red curved arrow originates from the text 'Lesson: People don't answer surveys.' and points directly to the '20 responses' bullet point in the Survey stage.

# Seasonal Use Systems

	System #1 (S1)	System #2 (S2)	System #3 (S3)
Occupancy	May-September	May-December	June-October
# Occupants	3	2	4
Rental?	No	No	Yes
Irrigation	Lawn Only	Lawn Only	No
Outdoor Shower?	No	Regular Use	Occasional Use

# Mass Load Assumptions

**Mass Load** = Amount of **nitrogen** excreted by a person in a year

Massachusetts DEP

Kelsay et Al, 1978

**2.9**

**4.75**

(kilograms nitrogen per person per year)

# Seasonal Use System #1

## INPUTS

Median Effluent TN  
**16.74 mg/l**

Median Water Use  
**100 gpd**

Occupancy  
**3 res. / 5 mo.**



## OUTPUTS

Mass Load  
**3.6-5.9 kg/yr**

Calculated Influent TN\*  
**63-103 mg/l**

TN Reduction  
**73-84%**

\* Mass Load used – 2.9 kg/person/year, 4.75 kg/person/year

# Seasonal Use System #2

## INPUTS

Median Effluent TN  
**11.23 mg/l**

Median Water Use  
**300 gpd**

Occupancy  
**2 res. / 8 mo.**



## OUTPUTS

Mass Load  
**3.9-6.3 kg/yr**

Calculated Influent TN\*  
**14-23 mg/l**

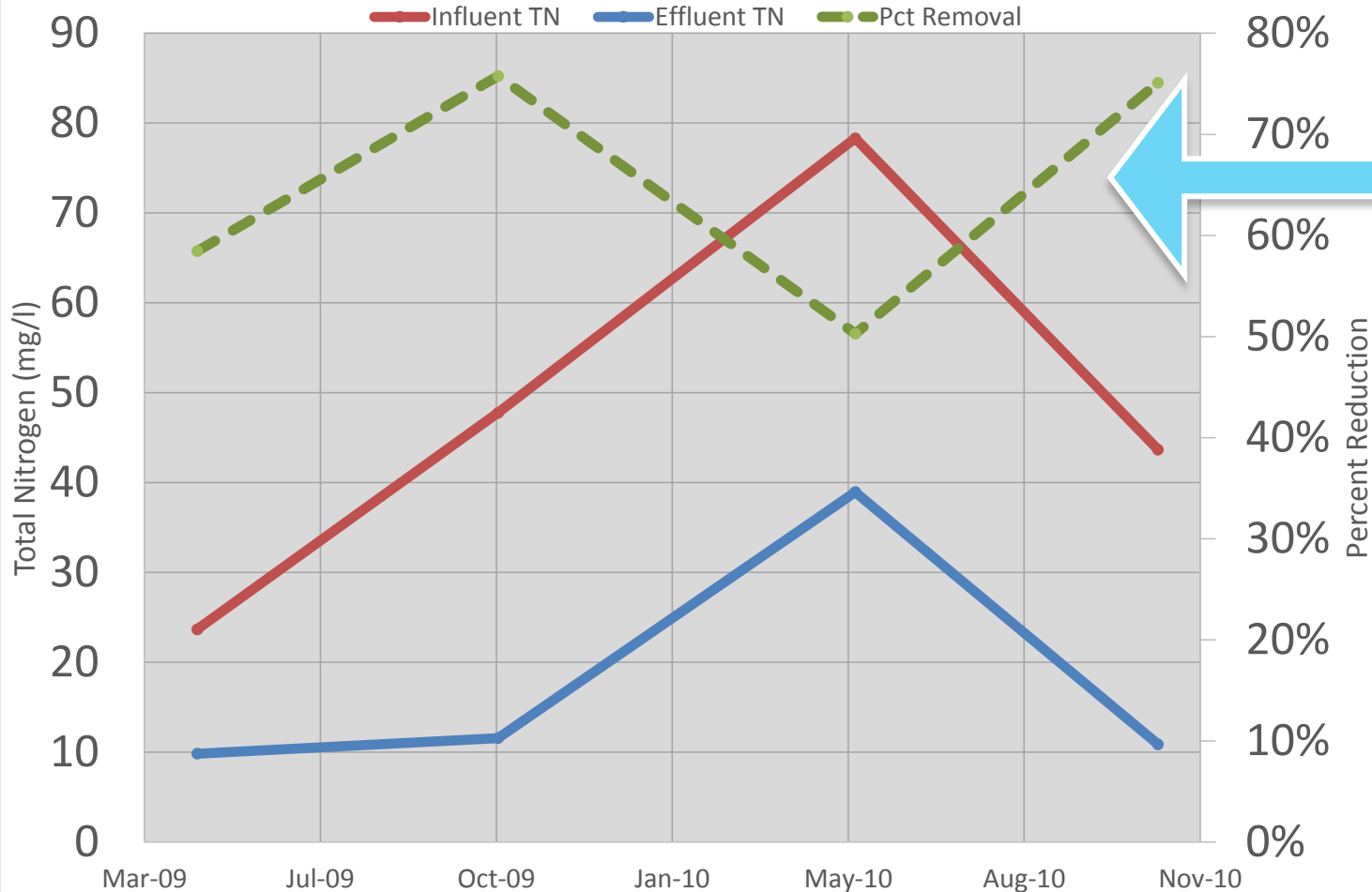
TN Reduction  
**20-51%**

\* Mass Load used – 2.9 kg/person/year, 4.75 kg/person/year

# Seasonal Use System #2

We have Influent Numbers!

## Seasonal System #2 TN Removal



About  
**65%**  
Removal

# Seasonal Use System #3

## INPUTS

Median Effluent TN  
**12.14 mg/l**

Median Water Use  
**135 gpd**

Occupancy  
**4 res. / 5 mo.**



## OUTPUTS

Mass Load  
**4.8-7.9 kg/yr**

Calculated Influent TN\*  
**62-102 mg/l**

TN Reduction  
**80-88%**

\* Mass Load used – 2.9 kg/person/year, 4.75 kg/person/year





Seasonal use performance on par with what we see elsewhere.

System	Percent Reduction
#1	73-84%
#2	20-51% (65%)
#3	80-88%

I/A in general – 74-76% reduction

# Added Bonus for Seasonal Use Systems!

50% Reduction in TN because the home is empty 50% of the time.



What does it all Mean?


# Conclusions





## Question #1

Do Seasonally-Used I/A Systems  
remove nitrogen as well as systems  
used year-round?



Seasonal use I/A systems seem to perform **at least as well** as year-round use I/A systems at removing nitrogen.

# Some Considerations...

## Seasonal-use systems are used...

half of the year – for two months – for a couple of weeks – a weekend or two

as summer rentals – as winter rentals (and the cleaners never use harsh chemicals...)

by a couple of retirees – by a family of four – beyond legal occupancy

“it’s usually me and my wife during the summer but the grandkids sometimes stay for a week or a month...”

Seasonal-use properties have high turn-over rates

Year-round-use properties frequently convert to seasonal use and vice-versa

# In Other Words...

Influent from  
a single home



Influent at a  
municipal  
WWTP



## Question #2

What influence does the highly-variable occupancy of “summer rental” properties have on nitrogen removal performance?

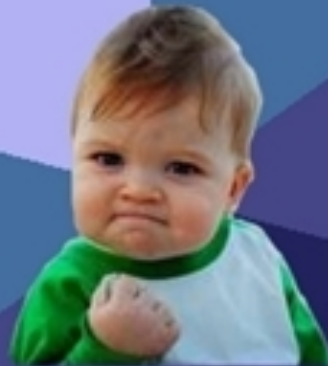




## Conclusion Number 2

Not much, according to our **single**  
example system.

Installed I/A Systems to  
Remove Nitrogen

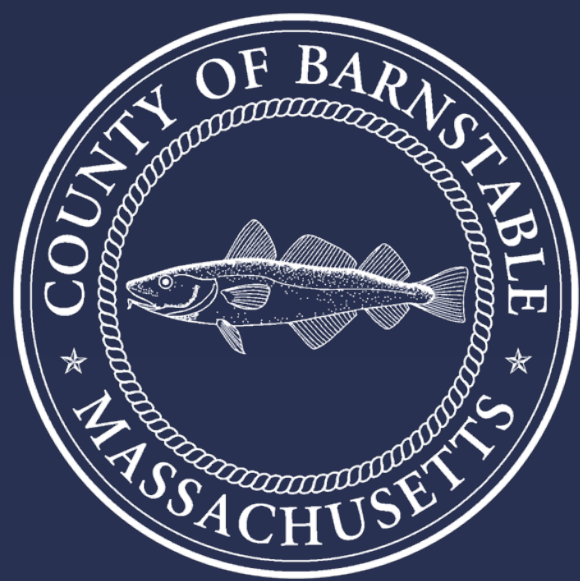


Turns Out they Work Pretty  
Good

# More Data Online!

<https://septic.barnstablecountyhealth.org/category/data-and-statistics>





[septic.barnstablecountyhealth.org](http://septic.barnstablecountyhealth.org)

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