Septic System Inspections and Biomat Evaluations in the Georges Pond Watershed

Maine Lakes & Lake Stewards of Maine
Joint Conference
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Presenters:
Jennifer Jespersen, Ecological Instincts
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Contributor:
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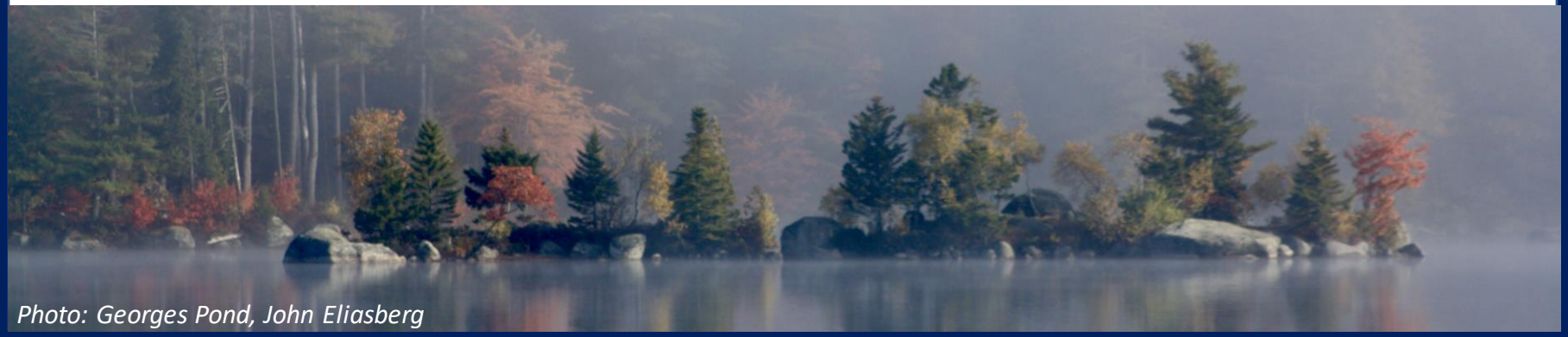


Photo: Georges Pond, John Eliasberg

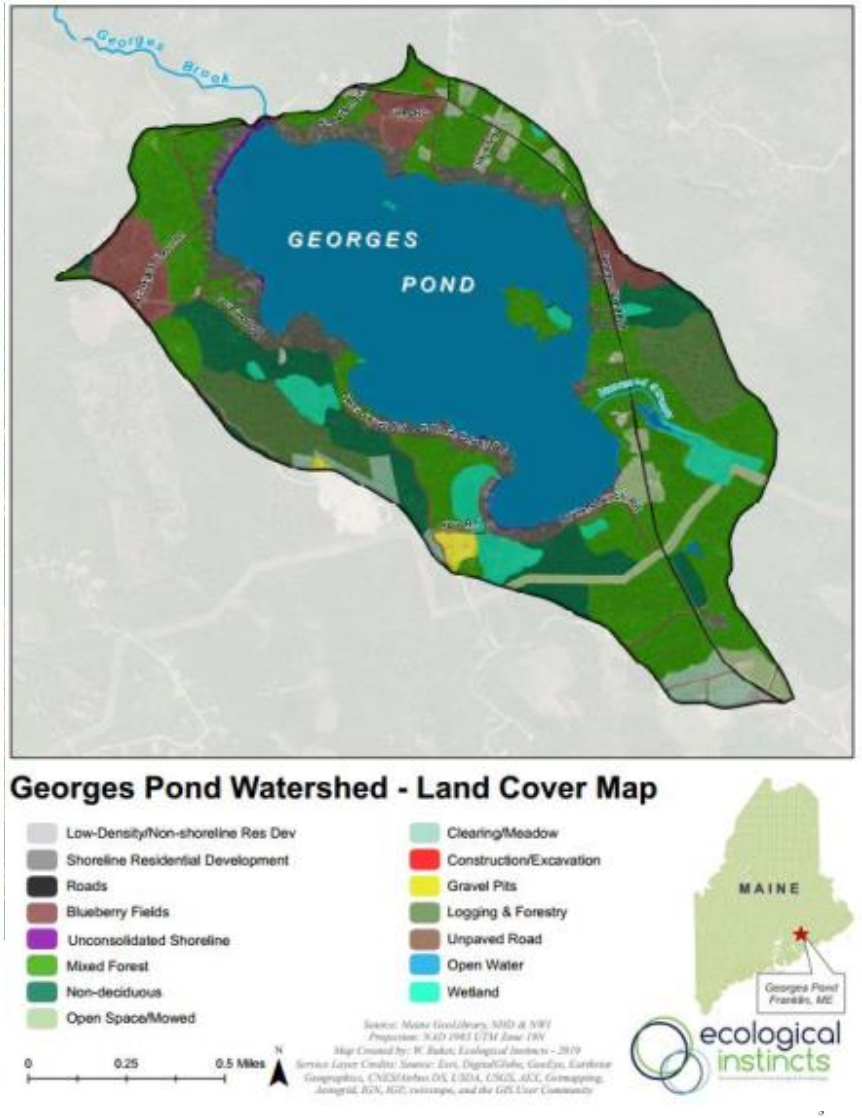
Overview

- Background & Project History
- Septic Vulnerability Analysis
- Septic Database & Septic Socials
- Septic Biomat Evaluation Selection
- 2022 Septic Inspections & Biomat Evaluations
- Summary of Findings
- Lessons Learned
- Next Steps

Photo: Septic Evaluation, John Eliasberg

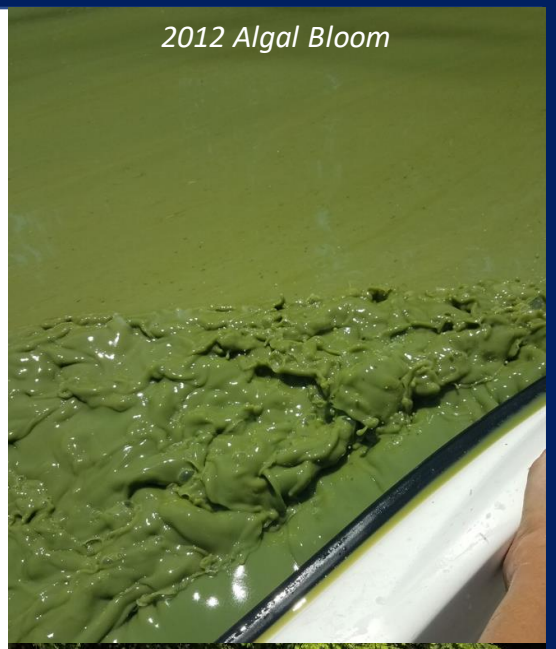
Background- Georges Pond

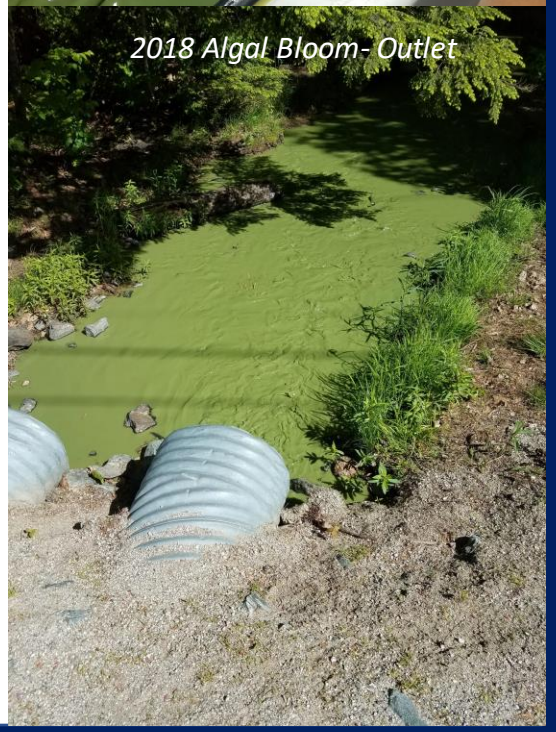
- 358-acre Great Pond
- Town of Franklin, ME
- Max Depth- 45 ft (14 m)
- Average Depth- 14 ft (4.3 m)
- Low flushing rate (0.45/yr)
- 1-square mile watershed
- Fed by Intermittent Drainages
- Single outlet- Georges Brook



Background

- NPS Priority Watersheds List “Threatened”
- Monitored since 1977
- **First Significant Algal Bloom in 2012**
  - Pre-2012 Average Total Phosphorus= 12 ppb
  - Pre-2012 Water Clarity= 4.6 m
- **Starting in 2012….**
  - Reoccurring algal blooms
  - Significant decrease in water clarity (< 2m)
  - Significant increase in Chl-a (10x historic)
  - Increase in area of anoxia (from 8m to 4m)


2012 Algal Bloom

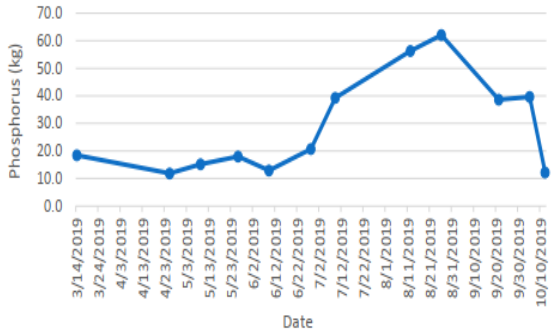

2018 Algal Bloom- Outlet

Photos: John Eliasberg

The Culprits

NPS Pollution

Gravel Roads
Shoreline Dev.
Agriculture



Internal P Loading

Build up of P
High % of Fe-P
Low levels of DO

Sandy Soils

Concern about
Septic Systems

Project History

- 2013 Watershed Survey
- 2018 Watershed Protection Plan
- 2018 Septic Survey & Database
- 2018-2019 Culvert & Roads Survey
- 2018 LakeSmart Program
- 2018 - 2019 Watershed Plan Development
  - Bathymetric mapping & sediment mapping
  - Sediment sampling & analysis
  - Intensive water sampling program
  - Watershed modeling
  - Septic vulnerability analysis
  - Water quality goal setting

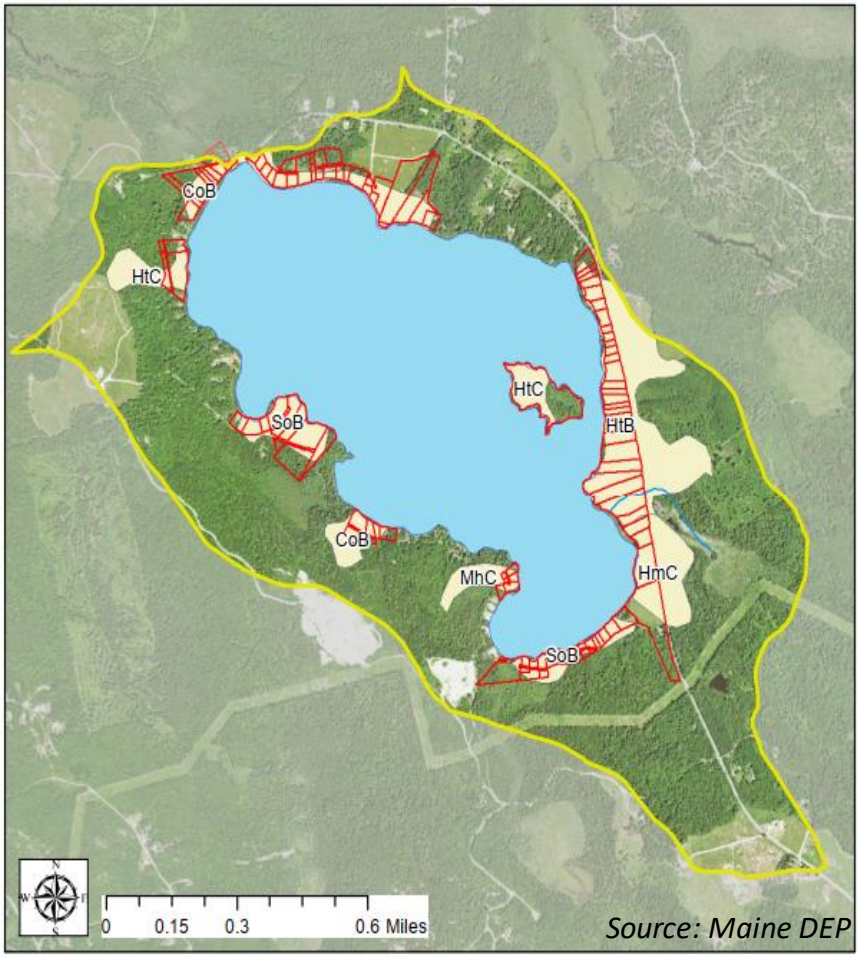
Photos: John Eliasberg, Map: Maine DEP

Vulnerability Analysis

- **Soils most susceptible to septic short-circuiting**
  - Deep, well-drained gravelly sandy loams (Colton & Hermon soils)
  - Course or gravelly soils adjacent to hydric soils w/shallow water tables
  - Rapid permeability

- **Sensitive Parcels w/in 150’ of Georges Pond**
  - High Risk = 102 properties
  - Added to GPA Septic Database
  - Prioritized based on age (Pre-1974 & Pre-1995)

Georges Pond Sensitive Shoreline Soils Map



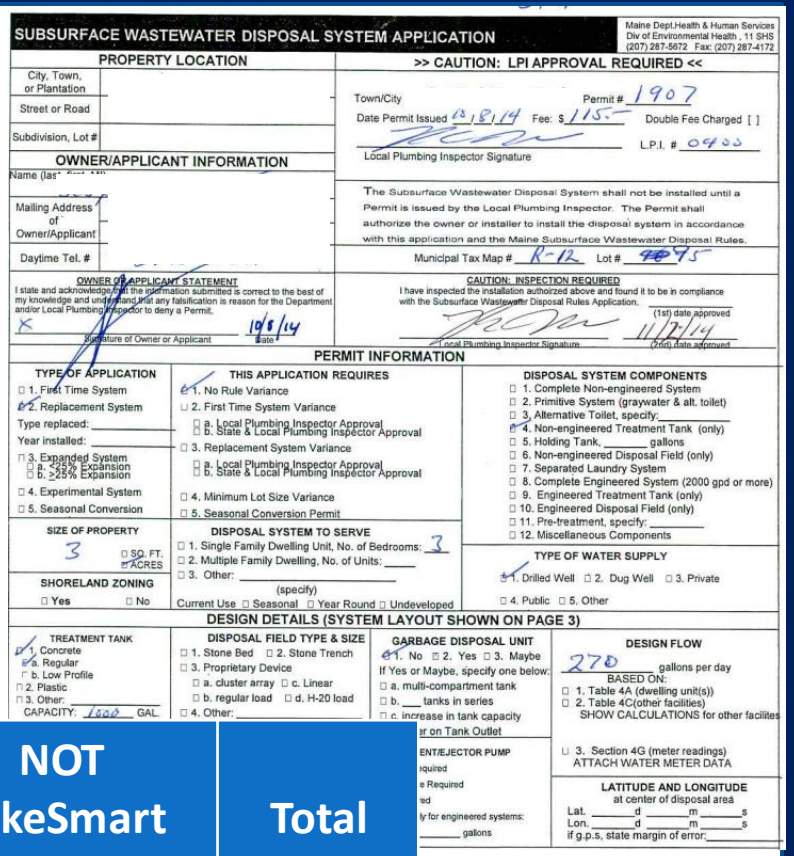
Legend

- Georges Pond Watershed
- Sensitive Shoreline Soils
- Sensitive Shoreline Tax Parcels

This map shows soils within 150 feet of the pond that are most susceptible to short-circuiting of subsurface wastewater disposal system effluent. Short-circuiting is a phenomenon whereby septic tank effluent is not properly treated in the leach field because the soils are coarse and porous, which allows the effluent to move through them too quickly. Shoreline tax parcels that contain these soils are also highlighted.

GPA Septic Database

- HHE-200 Online Search
- GPA Septic Survey
- LakeSmart Evaluations
- Town Record Search



SUBSURFACE WASTEWATER DISPOSAL SYSTEM APPLICATION

Maine Dept.Health & Human Services
Div of Environmental Health , 11 SHS
(207) 287-5672 Fax: (207) 287-4172

PROPERTY LOCATION

City, Town, or Plantation
Street or Road
Subdivision, Lot #

>> CAUTION: LPI APPROVAL REQUIRED <<

Town/City
Permit # 1907
Date Permit Issued 10/8/14 Fee: $ 115.- Double Fee Charged [ ]
Local Plumbing Inspector Signature
L.P.I. # 0405

OWNER/APPLICANT INFORMATION

Name (last, first, MI)
Mailing Address of Owner/Applicant
Daytime Tel. #

The Subsurface Wastewater Disposal System shall not be installed until a Permit is issued by the Local Plumbing Inspector. The Permit shall authorize the owner or installer to install the disposal system in accordance with this application and the Maine Subsurface Wastewater Disposal Rules.

Municipal Tax Map # R-12 Lot # 75

OWNER OR APPLICANT STATEMENT

I state and acknowledge that the information submitted is correct to the best of my knowledge and understand that any falsification is reason for the Department and/or Local Plumbing Inspector to deny a Permit.

X
Signature of Owner or Applicant
Date 10/8/14

CAUTION: INSPECTION REQUIRED

I have inspected the installation authorized above and found it to be in compliance with the Subsurface Wastewater Disposal Rules Application.

(1st) date approved
Local Plumbing Inspector Signature
11/7/14
(2nd) date approved

PERMIT INFORMATION

TYPE OF APPLICATION
☐ 1. First Time System
☑ 2. Replacement System
Type replaced:
Year installed:
☐ 3. Expanded System
☐ a. 25% Expansion
☐ b. >25% Expansion
☐ 4. Experimental System
☐ 5. Seasonal Conversion

THIS APPLICATION REQUIRES
☑ 1. No Rule Variance
☐ 2. First Time System Variance
☐ a. Local Plumbing Inspector Approval
☐ b. State & Local Plumbing Inspector Approval
☐ 3. Replacement System Variance
☐ a. Local Plumbing Inspector Approval
☐ b. State & Local Plumbing Inspector Approval
☐ 4. Minimum Lot Size Variance
☐ 5. Seasonal Conversion Permit

DISPOSAL SYSTEM COMPONENTS
☐ 1. Complete Non-engineered System
☐ 2. Primitive System (graywater & alt. toilet)
☐ 3. Alternative Toilet, specify:
☑ 4. Non-engineered Treatment Tank (only)
☐ 5. Holding Tank, _____ gallons
☐ 6. Non-engineered Disposal Field (only)
☐ 7. Separated Laundry System
☐ 8. Complete Engineered System (2000 gpd or more)
☐ 9. Engineered Treatment Tank (only)
☐ 10. Engineered Disposal Field (only)
☐ 11. Pre-treatment, specify:
☐ 12. Miscellaneous Components

SIZE OF PROPERTY
3 ☐ SQ. FT. ☑ ACRES

DISPOSAL SYSTEM TO SERVE
☐ 1. Single Family Dwelling Unit, No. of Bedrooms: 3
☐ 2. Multiple Family Dwelling, No. of Units:
☐ 3. Other:
(specify)
Current Use ☐ Seasonal ☐ Year Round ☐ Undeveloped

TYPE OF WATER SUPPLY
☑ 1. Drilled Well ☐ 2. Dug Well ☐ 3. Private
☐ 4. Public ☐ 5. Other

SHORELAND ZONING
☐ Yes ☐ No

DESIGN DETAILS (SYSTEM LAYOUT SHOWN ON PAGE 3)

TREATMENT TANK
☑ 1. Concrete
☑ a. Regular
☐ b. Low Profile
☐ 2. Plastic
☐ 3. Other:
CAPACITY: 1000 GAL.

DISPOSAL FIELD TYPE & SIZE
☐ 1. Stone Bed ☐ 2. Stone Trench
☐ 3. Proprietary Device
☐ a. cluster array ☐ c. Linear
☐ b. regular load ☐ d. H-20 load
☐ 4. Other:

GARBAGE DISPOSAL UNIT
☑ 1. No ☐ 2. Yes ☐ 3. Maybe
If Yes or Maybe, specify one below:
☐ a. multi-compartment tank
☐ b. ___ tanks in series
☐ c. increase in tank capacity
or on Tank Outlet

ENT/EJECTOR PUMP
quired
e Required
ed
y for engineered systems:
_____ gallons

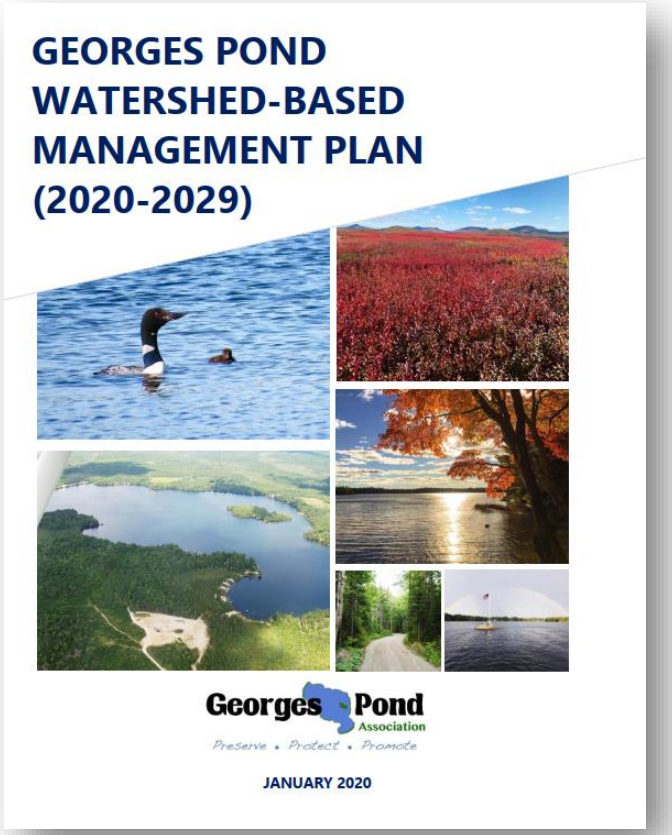
DESIGN FLOW
270 gallons per day
BASED ON:
☐ 1. Table 4A (dwelling unit(s))
☐ 2. Table 4C(other facilities)
SHOW CALCULATIONS for other facilites
☐ 3. Section 4G (meter readings)
ATTACH WATER METER DATA

LATITUDE AND LONGITUDE
at center of disposal area
Lat. ____d ____m ____s
Lon. ____d ____m ____s
if g.p.s, state margin of error:

Septic Installation	LakeSmart Surveyed	NOT LakeSmart Surveyed	Total
Pre-1974	8	0	**8**
Between 1974-1995	21	14	**35**
Post-1995	38	8	**46**
Do Not Know	19	36	**55**
Total	**86**	**58**	**144**

Implementation

- 10% Reduction in Watershed P Load
  - Phase I 319 Grant (2020-2021)
  - Phase II 319 Grant (2022-2023)
  - LakeSmart (86 of 144 properties surveyed, 28 LakeSmart Awards)
- 90% Reduction in Internal P Load
  - Aluminum Treatment 1 (2020)
  - Aluminum Treatment 2 (2021)



- ❖ *GPA Memberships (increased from 35 to 219)*
- ❖ *Clearest water on record in 2020-2022*
- ❖ *Watershed Plan goal of 10 ppb met in 2021*

GOAL

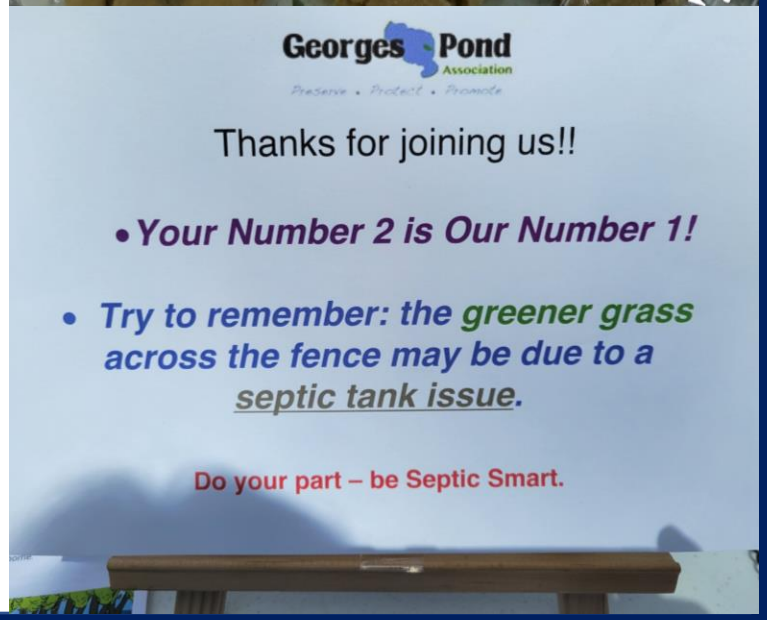
Georges Pond is free of Nuisance Algal Blooms

In-Lake P = 10 ppb
Annual P Load ~ 90 kg/yr

Septic Outreach

- **Septic Socials**
  - July 15, 2022 (16 attendees)
  - August 12, 2022 (15 attendees)

- **Septic System "Pilot" Project (2022)**
  - RFQ for Septic Contractors
  - Free Septic System & Biomat Evaluations
  - 5 Seasonal, 1 Year-Round



Photos: July 2022 Georges Pond Septic Social, Ecological Instincts

What is a "Short-Circuit"?

- Wastewater Effluent Passes Quickly through Soil or Bedrock
- Reaches the Groundwater Table
- Relatively Untreated/Little Nutrient Retention
- Can Move to a Waterbody

Not an official term (YET)

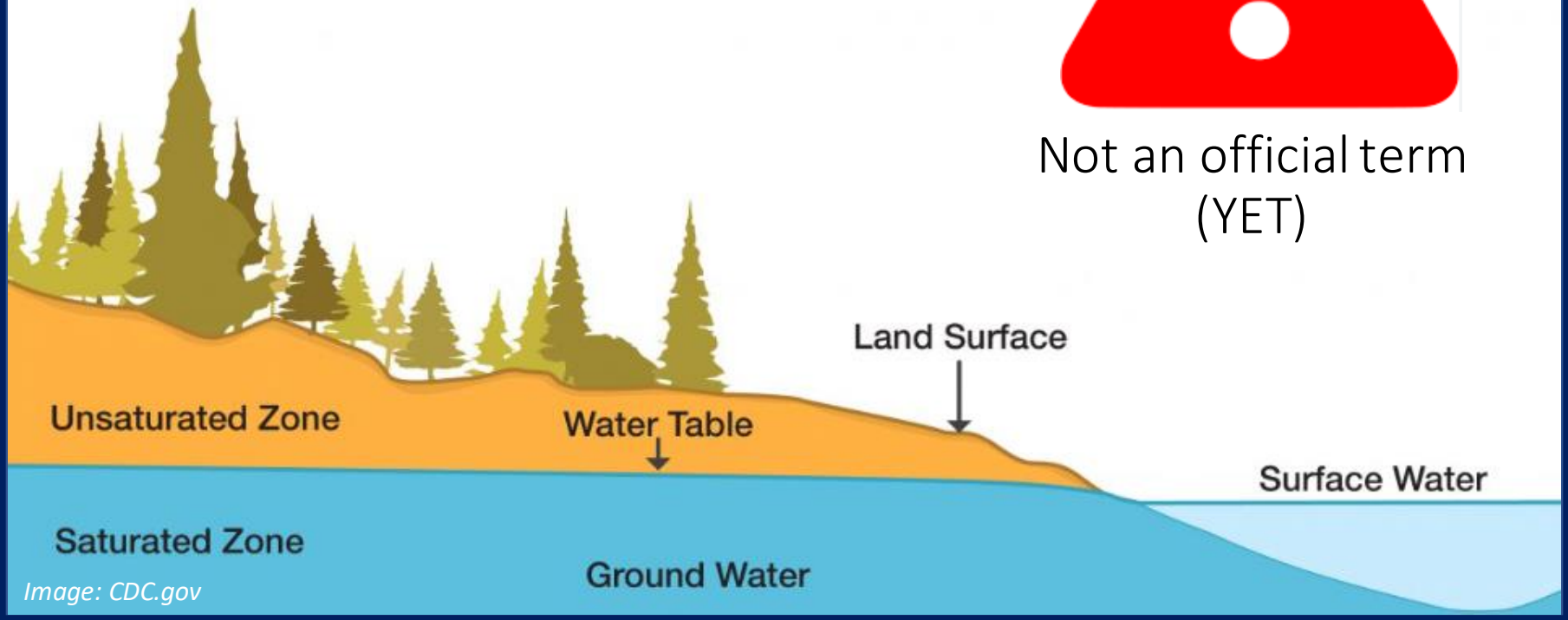
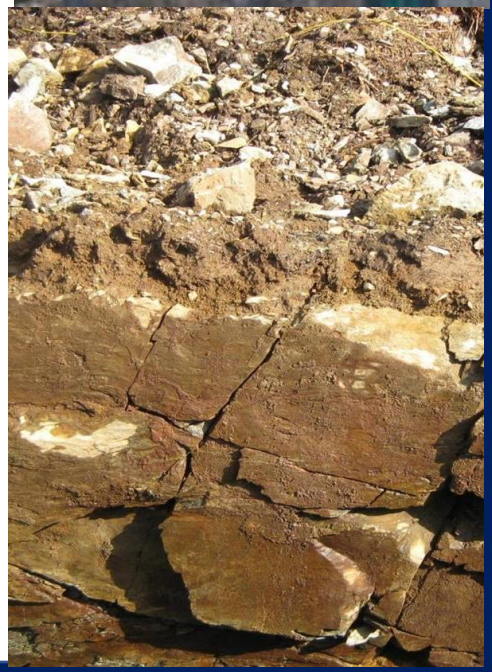


Image: CDC.gov

Mostly Likely to Occur

- Very Course Textured Sand & Gravelly Soils
- Course Textured Fill
- Fractured Bedrock
- Course Textured Soil Over Fractured Bedrock or Extends to a Drainage Way

*** Began as biomat evaluation but ended up as determining site specific threats to surface water quality**



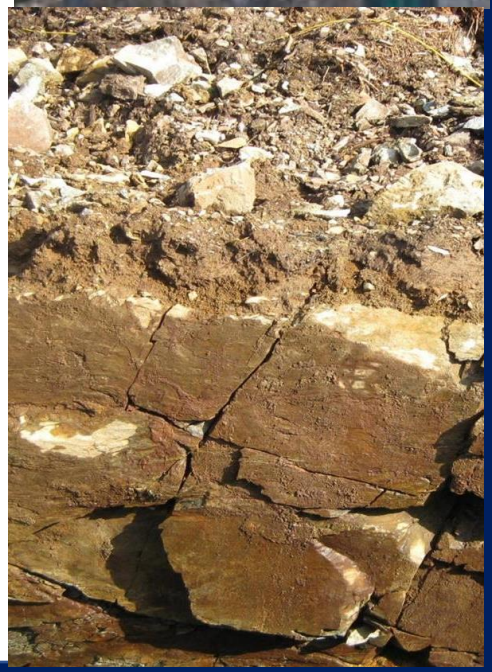
Top photo: Colton Soil (C.C., Doiron); Bottom Photo: Fractured Bedrock (Dave Rocque)

Concern Rating Scale

- Pre-1974 Systems
- Pre-1995 Systems in Sandy or Shallow Soils
- ATU systems in Sandy or Shallow Soils

*** If a pre-1974 system is used to any extent, it should have failed by now- most are in sandy or shallow soils**

*** Subsurface Wastewater Rules adopted in 1995 required a liner in systems installed in Sandy soils in the Shoreland Zone**



Top photo: Colton Soil (C.C., Doiron); Bottom Photo: Fractured Bedrock (Dave Rocque)

What is a "Biomat"?

- Black "slime" layer formed at the soil interface in the leach field
- Comprised of particles escaping the septic tank & the bodies of dead and living microbes
- Provides significant pathogen reduction
- **Indication there is NO Short Circuit**
- Does not significantly reduce nutrient levels

Disposal Field Biomat

Development Dependent On:

- Soil Type
- Wastewater Strength & Daily Wastewater Load
- How often the System is Used
- Age of the System
- NOT ALL DISPOSAL FIELDS WILL DEVELOP A Biomat

Determine the Soil Type for Likelihood of a Short-Circuit

NOT all Disposal Fields will Develop a Biomat

- Short-circuits
- Seasonal Use/Lightly Used
- Advance Treatment Systems
- Some Proprietary Disposal Systems

*** Though these systems may not have a biomat, it is not necessarily and indication they are short-circuiting**

Georges Pond Sites

#1- Seasonal Cottage & Shower House

- Two pre-1974 Systems
- Metal Tanks & Unknown Leachfields

Site Conditions

- Sandy Loam Soils
- Main house tank ~ 25 ft from the lake on a side slope toward the lake
- Shower house tank >100 ft from the lake on level ground separated by a berm

Camera Inspection

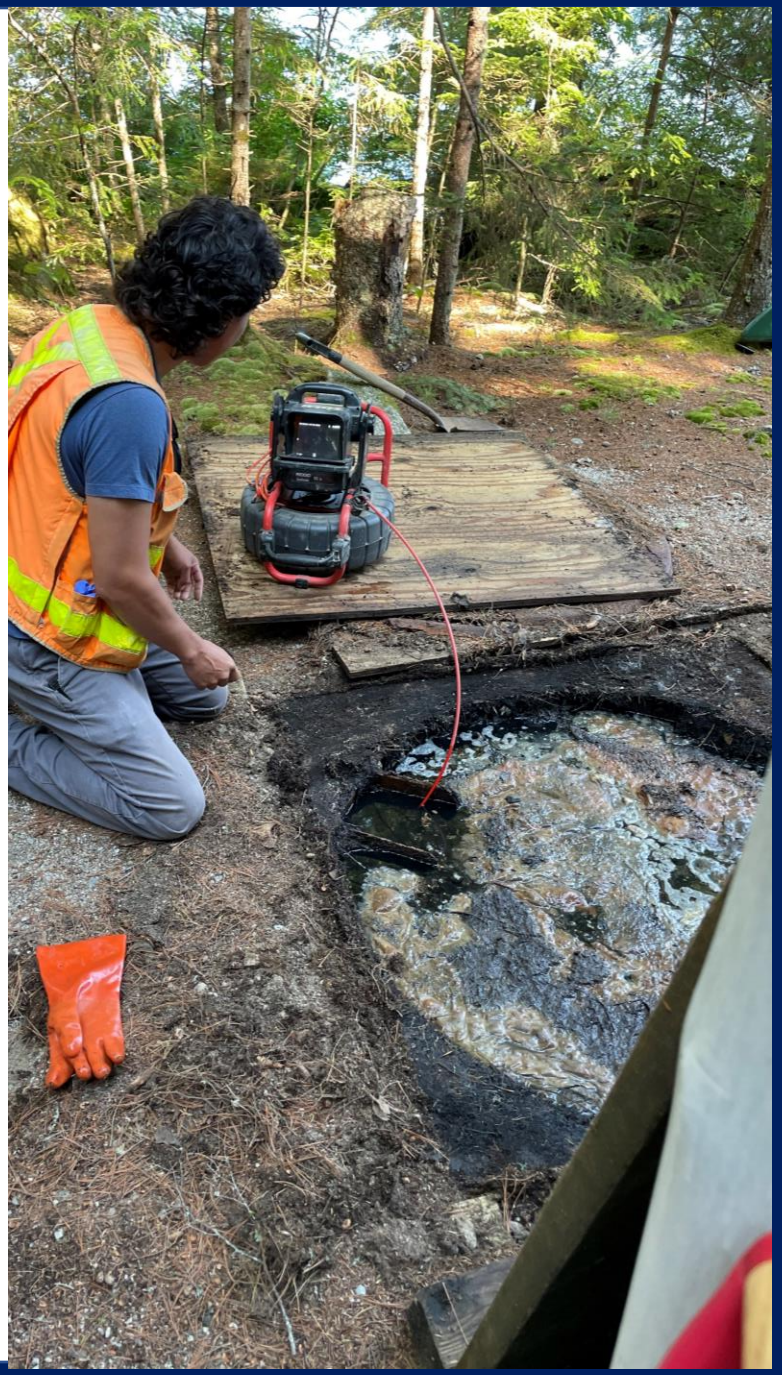
Site #1

Main House

- Septic tank had holes in it
- Outlet baffles were missing
- Outlets plugged with roots
- Overflowing with effluent

Shower House

- Septic tank had holes in it
- Outlets plugged with roots
- Not Overflowing with effluent



Site #1

Main House

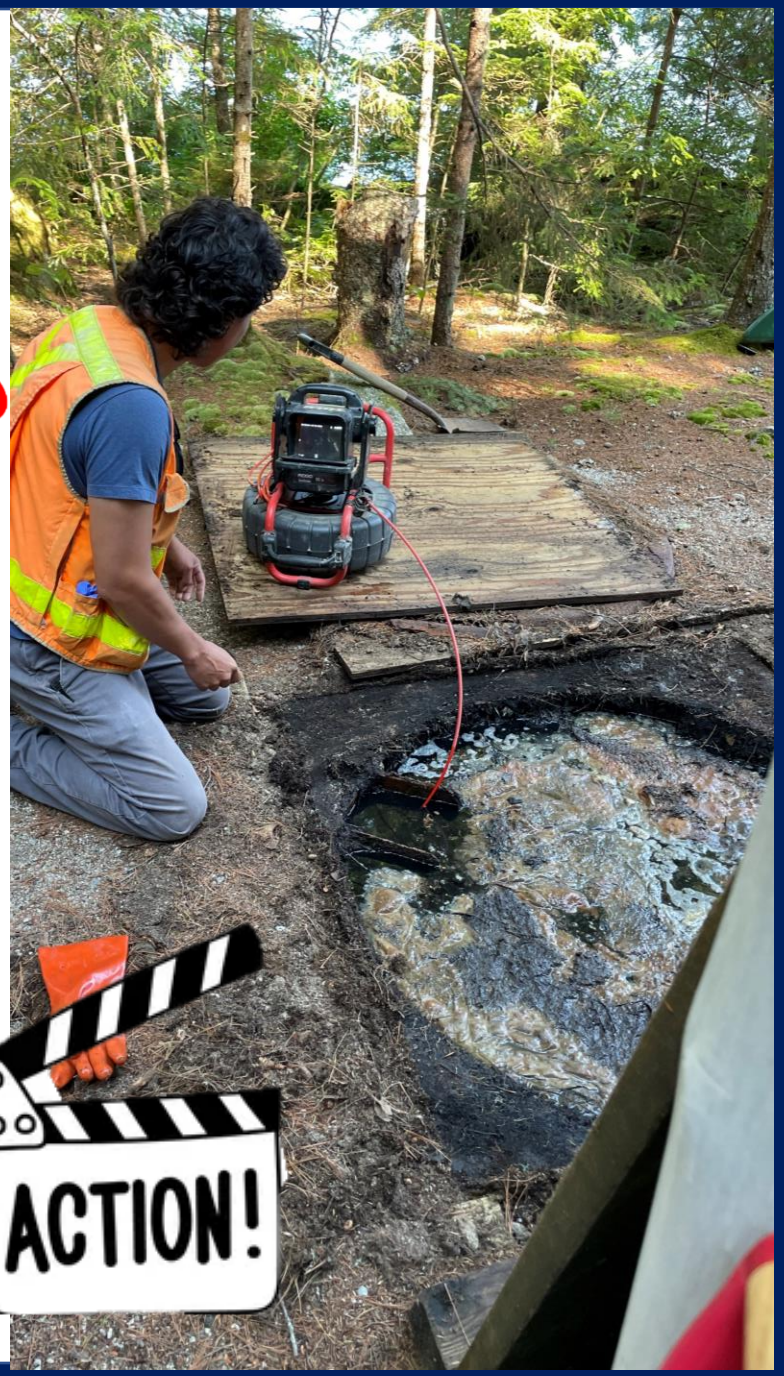
- Significant Current Threat
- Location & Condition of Tank

Shower House

- Not a Significant Current Threat
- Outlets plugged with roots
- Tank Undersized-Not Overflowing

Actions Taken

- Septic Tank Pumped the Same Day
- Replacement System Designed for 2023 Install



System # 2

- Seasonal Cottage
- 1993 Septic System
- HHE-200 Form on file
- Concrete tank w/proprietary disposal device

Site Conditions

- Fine Sandy Loam w/Pan
- Site sloping away from the lake

Survey Results

- Ponded effluent in the disposal field (evidence of Biomat)
- System functioning properly
- No short-circuit

System # 3

- Seasonal Cottage
- 1992 Septic System
- HHE-200 Form on file
- Concrete tank w/stone bed disposal field
- Design by same site evaluator and soil type as System # 2

Site Conditions

- Sandy Outwash Soils
- Disposal field across the road from the lake

System # 3

- Seasonal Cottage
- 1992 Septic System
- HHE-200 Form on file
- Concrete tank w/stone bed disposal field
- Design by same site evaluator and soil type as System # 2

Site Conditions

- Sandy Outwash Soils
- Disposal field across the road from the lake

Clean stone- no evidence of Biomat

Survey Results

- No evidence of Biomat
- Tree roots present in sand below disposal field stone (nutrient uptake)
- Short-Circuit

System # 3

Outcome

- Moderate threat to lake, replacement NOT immediate

1) **Limited Seasonal Use**
2) **Distance to the Lake (several hundred feet)**
3) **Higher priority if usage increases significantly and/or used year round**

Clean stone- no evidence of Biomat

Survey Results

- No evidence of Biomat
- Tree roots present in sand below disposal field stone (nutrient uptake)
- Short-Circuit

System # 4

- Seasonal Cottage
- Pre-1974 Septic System
- 300-gallon metal tank w/unknown disposal area

Site Conditions

- Fine sandy loam w/ a hardpan)
- Not near the lake
- Slopes down to a seasonal drainage way 55 ft away

System # 4

- Seasonal Cottage
- Pre-1974 Septic System
- 300-gallon metal tank w/unknown disposal area

Site Conditions

- Fine sandy loam w/ a hardpan)
- Not near the lake
- Slopes down to a seasonal drainage way 55 ft away

Survey Results

- Outlet of septic tank plugged w/roots
- Holes in septic tank
- Tank undersized
- Low levels of effluent

System # 4

Outcome

- System needs replacing but not deemed a significant threat as currently used

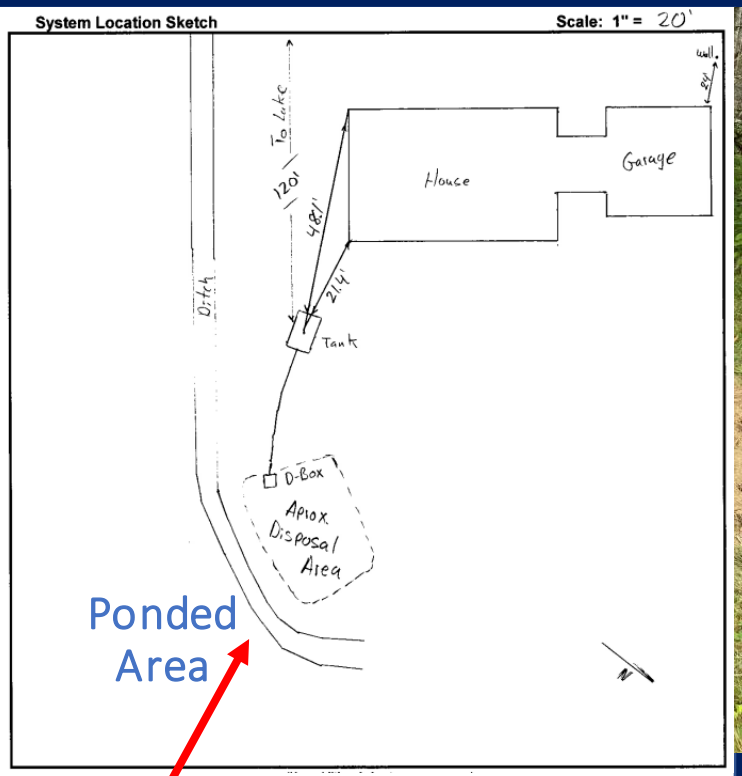
1) **Fine sandy loam soils not likely to short-circuit**
2) **Septic tank holes acting as cesspool**
3) **Elevate to moderate priority <u>if usage increases</u> significantly due to threat of seep into drainageway**

Actions

- Replace with modern system
- Owner has replacement system designed
- Costly due to slopes & set-backs

System # 5

- **Year-round** home on the lake
- Post-1974 Septic System
- No HHE-200 record on file
- Concrete tank in good working order



Site Conditions

- Installed in a natural drainageway
- Ponded area upslope of disposal field
- Excavated drainage swale adjacent to disposal field to drain to ponded area (evidence of ponded water)
- Natural drainage swale in woods connects excavated drainage swale to lake

System # 5

Survey Results

- One of the disposal field pipes located in gravel a couple of feet from excavated ditch
- Bottom of stone in disposal field lower in elevation than bottom of excavated drainage ditch

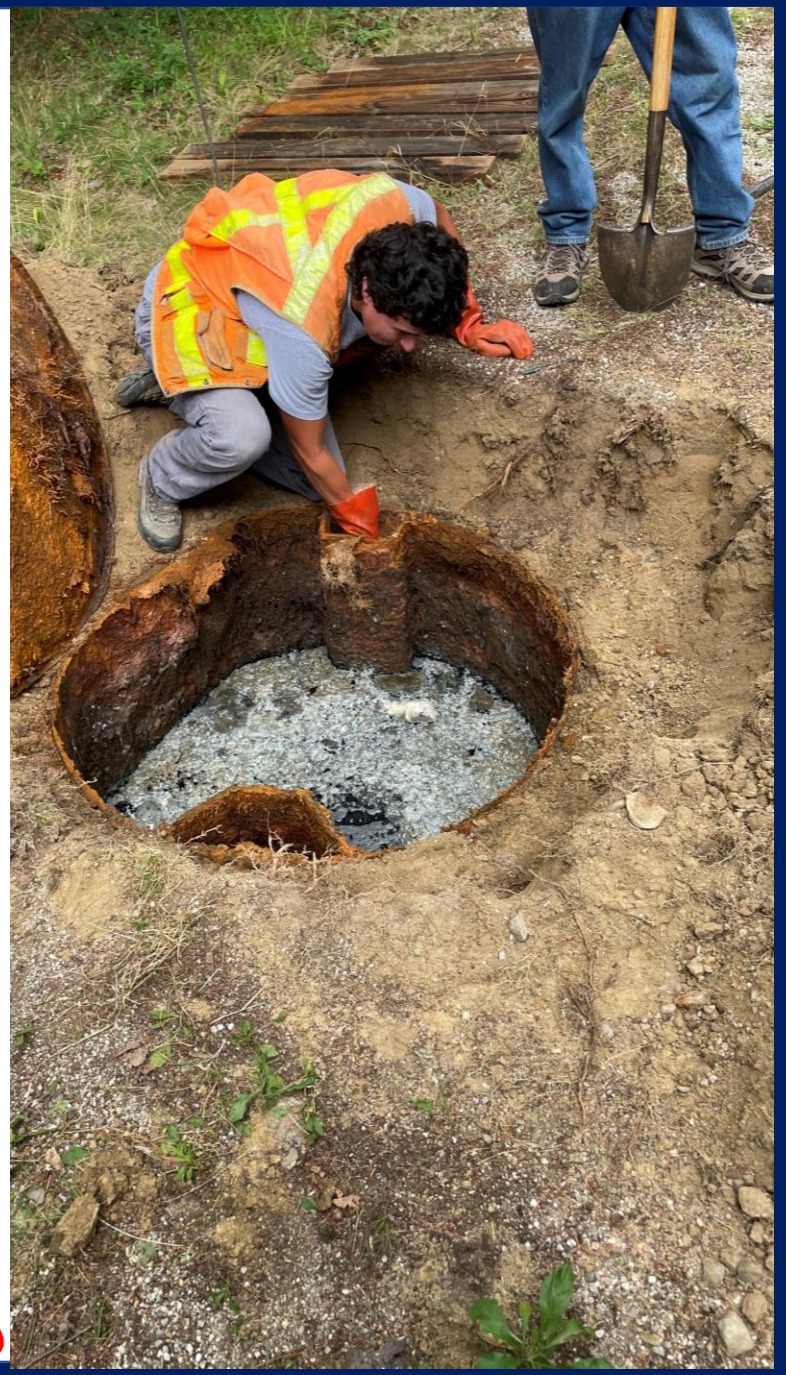
- ✓ **Direct connection to the lake**
- ✓ **Would likely have surfacing effluent if not for the connection to the ditch**

Actions

- Disposal field is a **significant threat** to the lake- Highest Priority
- Replace as soon as possible

Summary

- 5 septic inspections & 6 Biomat evaluations (3 pre-1974, 3 between 1974-1995)
- No significant concerns for only **1 out of 6 systems**
- Two systems were immediately pumped
- All three pre-1974 systems should be completely replaced
- Two 1974-1995 systems pose substantial immediate risk to water quality (1 direct connection & 1 short-circuit)



Lessons Learned

- **Determining a septic system's threat to water quality requires looking at multiple variables:**
  - ✓ Age/Condition
  - ✓ Use Pattern (Seasonal vs. Yr-Round)
  - ✓ Distance from Waterbody
  - ✓ Construction Details
  - ✓ Slope & Soil Type

- **Prioritizing which systems to replace or repair requires:**
  - ✓ Consideration of their current threat to water quality
  - ✓ Willingness of landowners to participate
  - ✓ Available resources

Lessons Learned

- Not meeting today's standards does not mean there is an impact on water quality & vice versa (e.g., System #3: Short Circuit)
- Site evaluators are not soil scientists or engineers & early years of site evaluations were less reliable than today
- No certification required for installers (e.g., System #5)

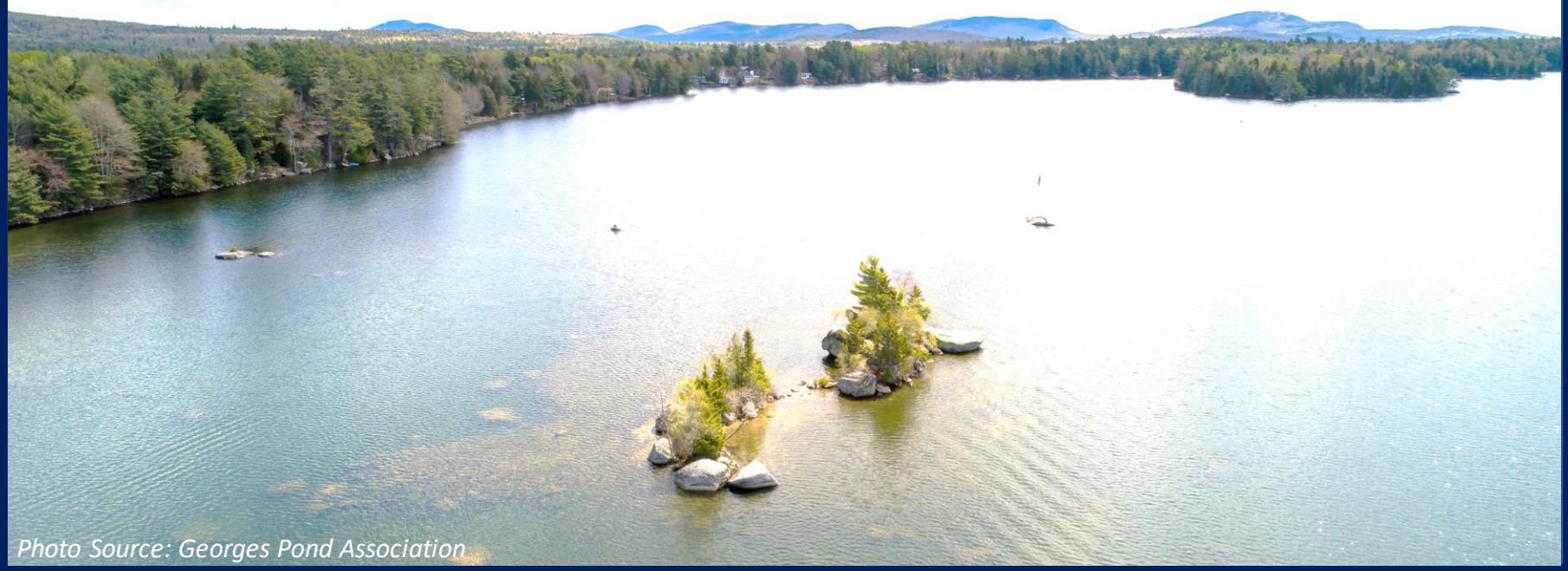


Photo Source: Georges Pond Association

Recommendations

- Prevent Short-Circuits on sandy or shallow soils by installing the drain field on or in the topsoil layer
- Avoid removing natural soil down to sand or bedrock and replacing it with sandy fill material
- Consider local ordinances requiring systems in the SLZ be built to avoid Short-Circuits
- Avoid placing gravelly fill right up to the edge of drainage ditches

Photo: Georges Pond, John Eliasberg

Project Outcomes

- Achieved the desired goal of providing a "snapshot" of the possibility of septic systems affecting lake water quality
- Need for more comprehensive study of septic systems in the Georges Pond Watershed

Next Steps

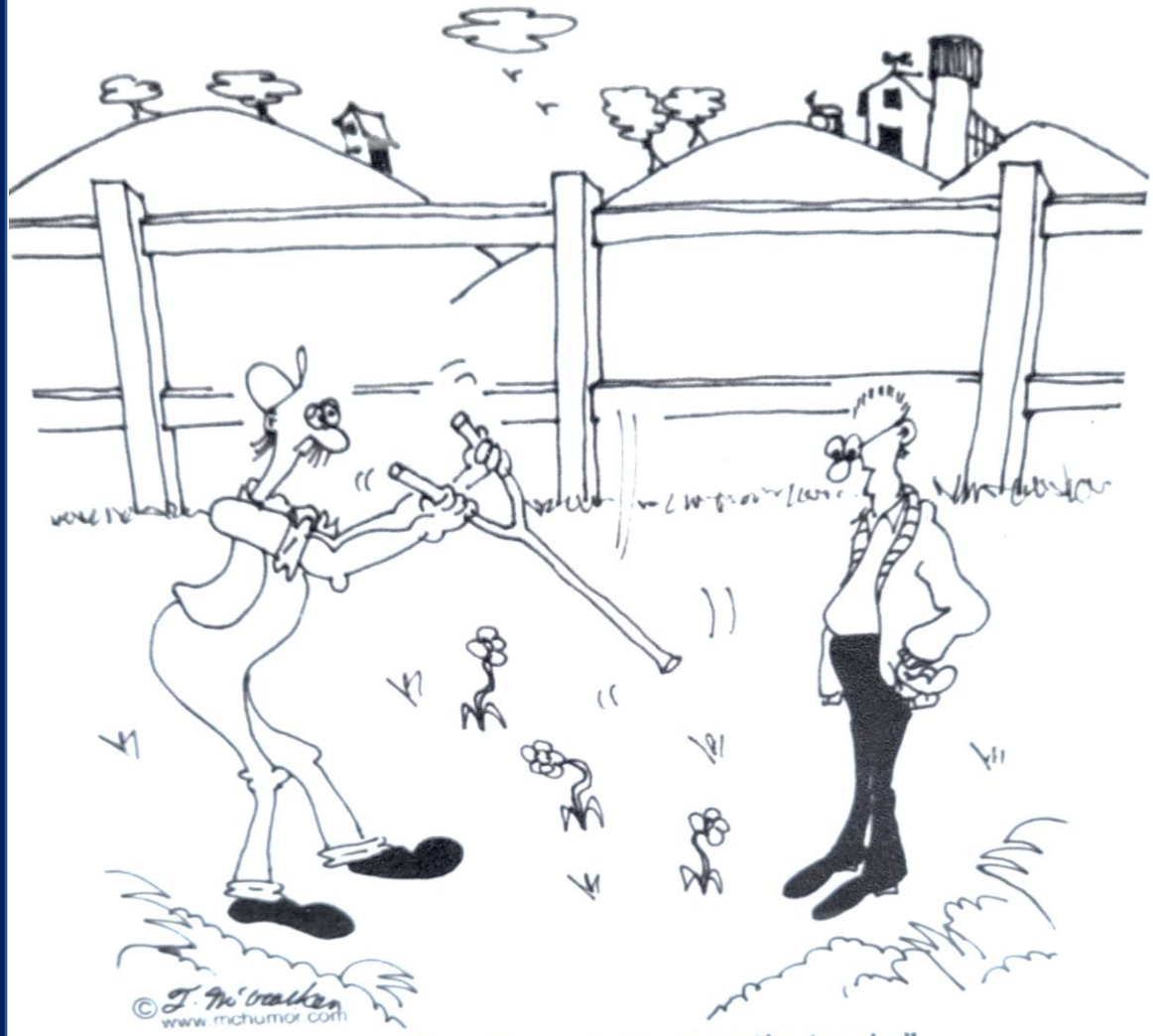
Launch of the GPA 2023 Septic System Inspection Program

"Proper maintenance is one of the most important steps every homeowner can take to protect the value of their camp and keep Georges Pond clean."

- GPA will schedule & coordinate septic inspections with the landowner and a licensed professional inspector
- Free inspections for pre-1974 and year-round systems
- 50% discount for 1974-1995 systems or rentals
- Post-1995, GPA will help schedule and coordinate inspections

Photo: Georges Pond, John Eliasberg

Septic Inspection Program Application: georgespondassociation.org



"Great. You found my septic tank."

Georges Pond Association

Preserve • Protect • Promote

ecological instincts

Environmental Consulting & Ecodesign

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