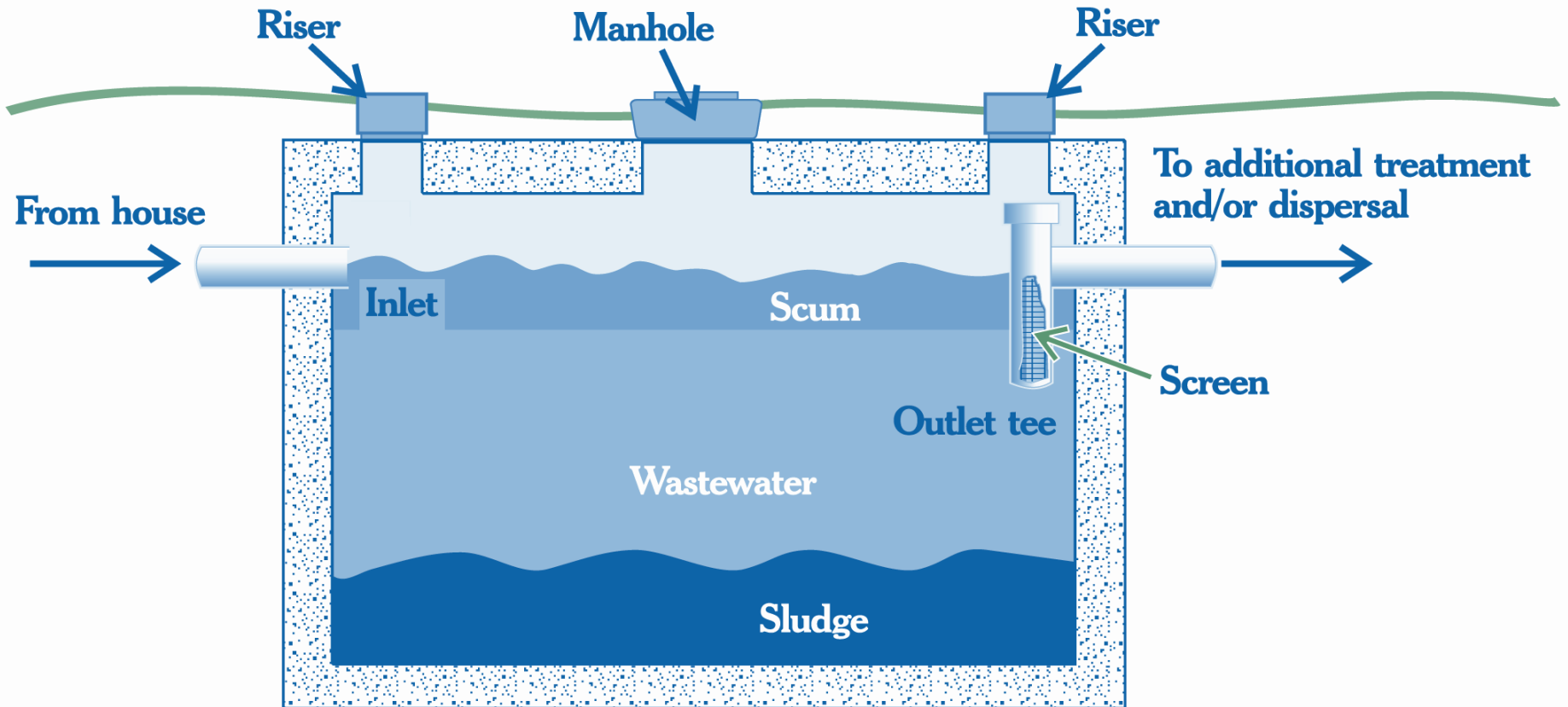


# Barry-Eaton District Health Department

*Caring for the Community Since the 1930's*

## Lets *Think-TANK* *Septic Tank Purpose & Function*

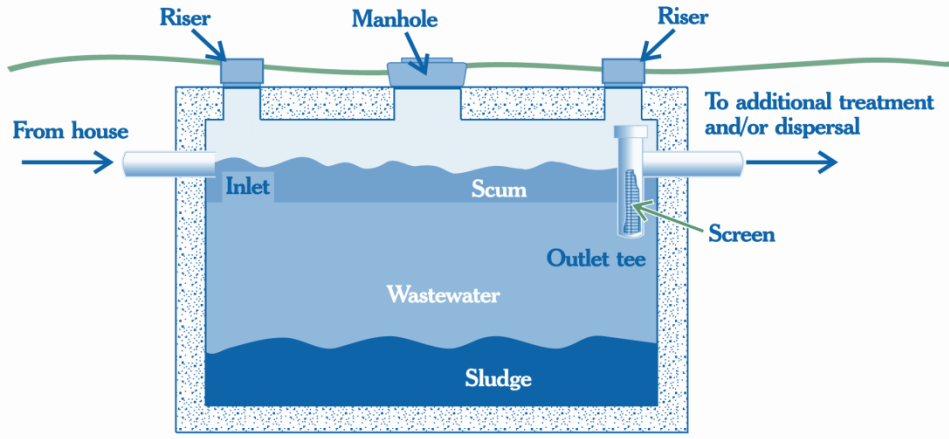


# Septic Tank Purpose & Function

- Collects and treats wastewater
- Separates sewage into 3 distinct zones
  - *Sludge & scum* (floaters) & *clear zone* in middle
- Anaerobic\* digestion of organic matter
- Function correlated with design
  - Sized for occupancy and long-term storage
  - Settling of solids & floatation of scum requires a calm (quiescent) flow to promote growth of bacteria
  - Multiple compartments &/or effluent filters improve function
  - Proper design & functionality critical to improving effluent quality leaving the tank

\*without air

# Septic Tank Purpose & Function



- Anaerobic Digestion
  - Bacteria are the similar as those in the human digestive system
  - Bacteria use the organic matter as a food source
  - Very limited removal of disease causing organisms (treatment occurs later & in the aerobic drainfield system)
  - Reduction in organic matter or Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS) and Fats, Oils & Greases (FOG)

# Septic Tank Purpose & Function

- Structural soundness & water tightness are vital to tank performance
- Maintenance is key
  - Pump out frequency varies with use & occupancy
  - Routine inspection of the tank to determine if pumping is actually *needed* saves money
  - Pumping is necessary when the depth of solids + depth of scum is equal to or greater than  $\frac{1}{3}$ <sup>rd</sup> of the tank's liquid depth --- approximately every 3- 5 years
  - Routine assessment of outlet device & tank integrity also needed.

The importance & function of the septic tank is commonly disregarded ....yet science & experience proves their importance.

The following pictures are from sites where a time of sale or transfer evaluation (TOST) was performed between 2007 and 2010 in Barry or Eaton County, Michigan.....



# Structural Condition & Safety

- The corner support post of an elevated, large wooden deck was installed on top of this septic tank.
- The deck post was re-located avoiding the collapse of the septic tank and potential simultaneous collapse of the large deck



# Structural Condition & Safety



Pictures showing the  
open hole from the  
collapsing septic tank





# Structural Condition & Safety

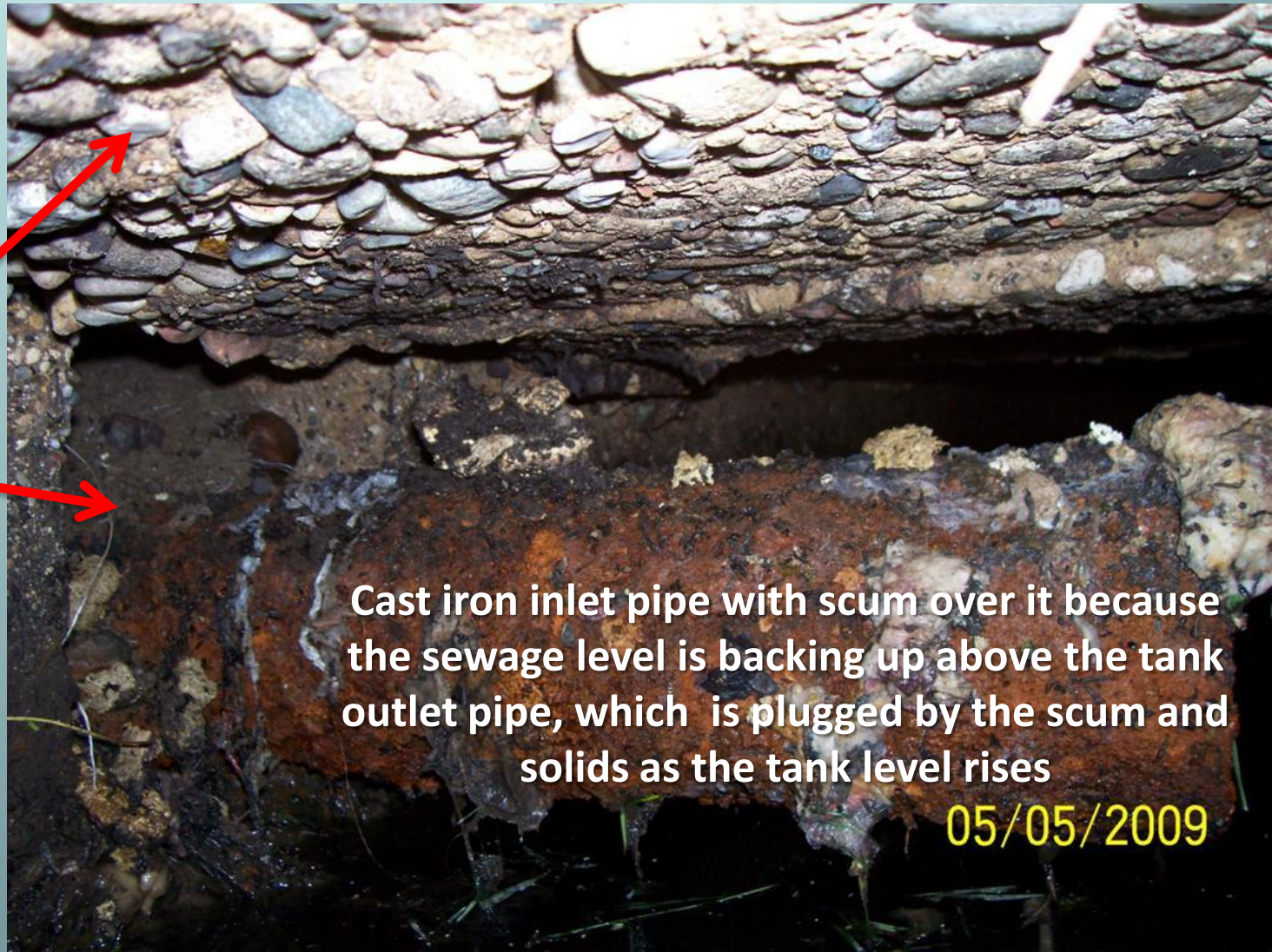
Unsafe lid,  
collapsing tank  
& broken  
outlet pipe





# Structural Condition & Safety

Inside this septic tank the corrosion of the concrete is evident in the exposed stone & in the large hole around the inlet pipe.



Cast iron inlet pipe with scum over it because the sewage level is backing up above the tank outlet pipe, which is plugged by the scum and solids as the tank level rises

05/05/2009

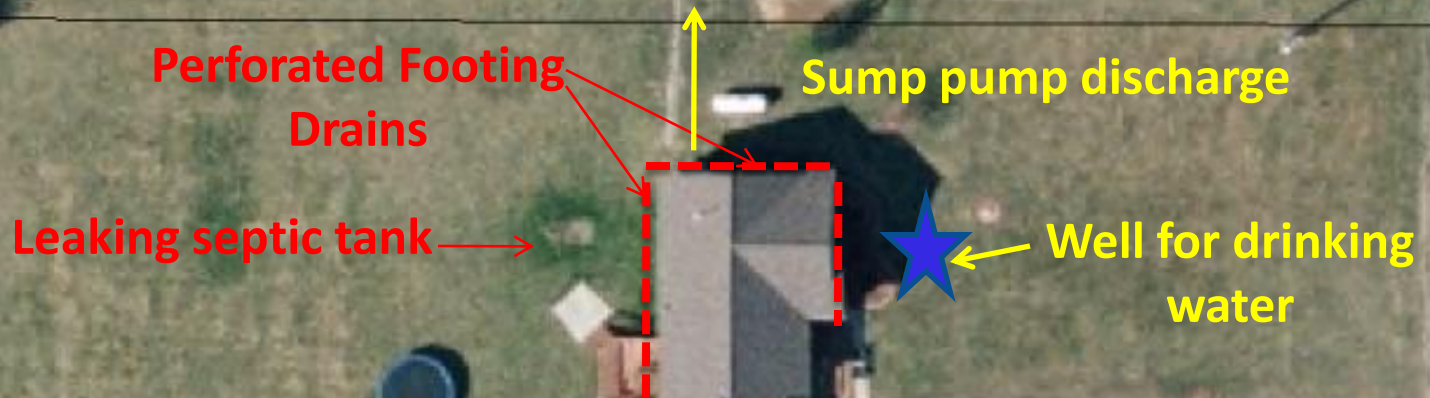
# Septic Tank Location

- Setback distances regarding the location of septic tanks are based on *watertight conditions*
  - 50' minimum from residential wells
  - 75' minimum from non-residential wells
  - 10' minimum from basement walls
  - 5' minimum from building foundation (no basement)
- Accessible for cleaning and inspection
  - No pools, sheds, patios, decks, or structures over



# Septic Tank Location

Sewage from leaking septic tank intercepted by the footing drains, drained to the sump pump basin in the basement and then pumped out to the neighboring property



# Septic Tank Location

- This unplugged well was found 42' away from the leaking septic tank
- The current in-use well (not shown) was 28' from the old improperly abandoned well & 35' from the leaking fuel oil tank

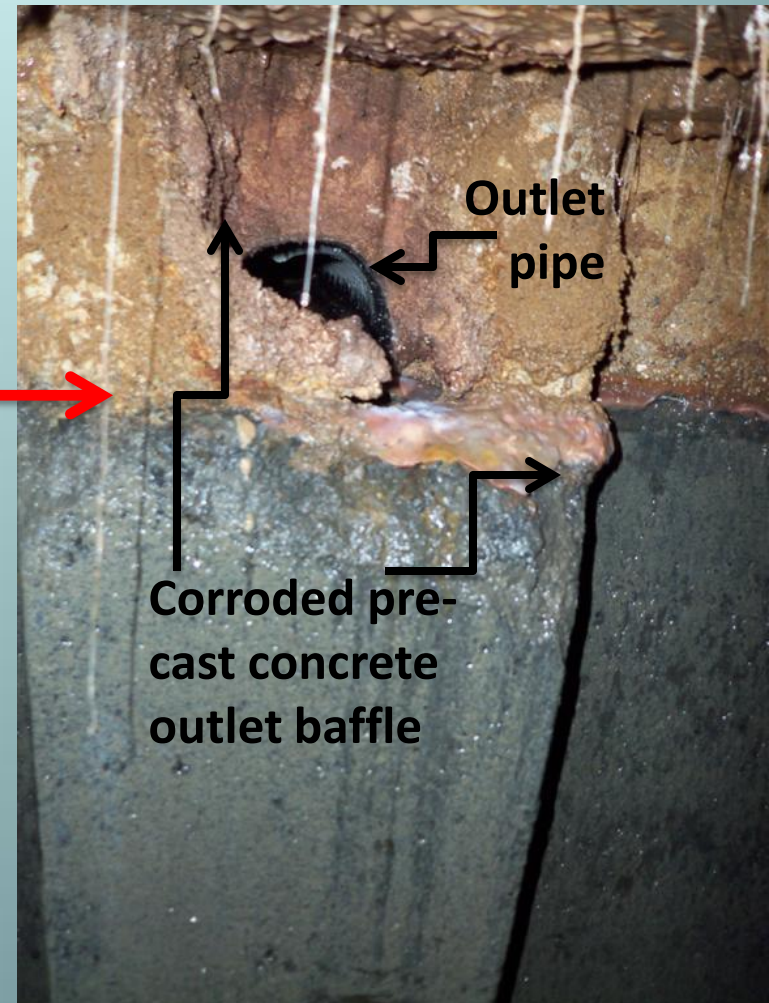


Coliform bacteria were detected in the in-use well.



# Outlet Devices & Risers

- The corrosion of the concrete which *was* part of the outlet baffle for this septic tank will allow scum (grease & floaters) to overflow out to and eventually plug the absorption system
- Corrosion caused by “acidic” gases above the water level in the tank



# Outlet Devices & Risers

The outlet tee, effluent filter, or concrete baffle found in a septic tank extends down into the clear zone which serves to allow only the clearest wastewater to exit the tank each time water is used....

...when an outlet device is missing or damaged, scum can exit the tank plugging the drain tile.

Looking down into a tank with a new outlet tee to replace the corroded concrete baffle (outlined in red)





# Risers & Outlet Devices



No outlet tee or  
baffle found in this  
tank.....

...the bucket & trash can  
lid over the tank opening  
is a safety hazard--  
especially for children.

Note: buckets and barrels are not considered to  
be of safe or structurally sound construction.





# Risers & Outlet Devices



An example of a proper septic tank riser. Note the riser lid extends to the ground surface & there is a manhole cover over the septic tank opening.



# Watertight Septic Tanks

*“The performance and success of a properly sized tank relies on its structurally-adequate, watertight design and construction. If these simple criteria are not met, infiltration or exfiltration will fix the fate of the system.”*

*From Design and Performance of Septic Tanks*

*T.R. Bounds, P.E.*

# Watertight Septic Tanks

- NO Infiltration: can surface or groundwater leak in?
  - Tank can become flooded & then the sludge & scum wash out to clog the drainfield
  - Drainfield overloaded with excess water creating backups, &/or saturated, anaerobic conditions &/or premature failure
- NO Exfiltration: can sewage leak out?
  - Sludge layer and scum layer squished together, i.e. loss of stratification
  - When sewage level in the tank returns to operating level, the mixed or homogenized layers (solids and scum) wash out into drainfield stressing operation &/or causing premature failure
  - Loss of separation between leaking sewage and the groundwater table

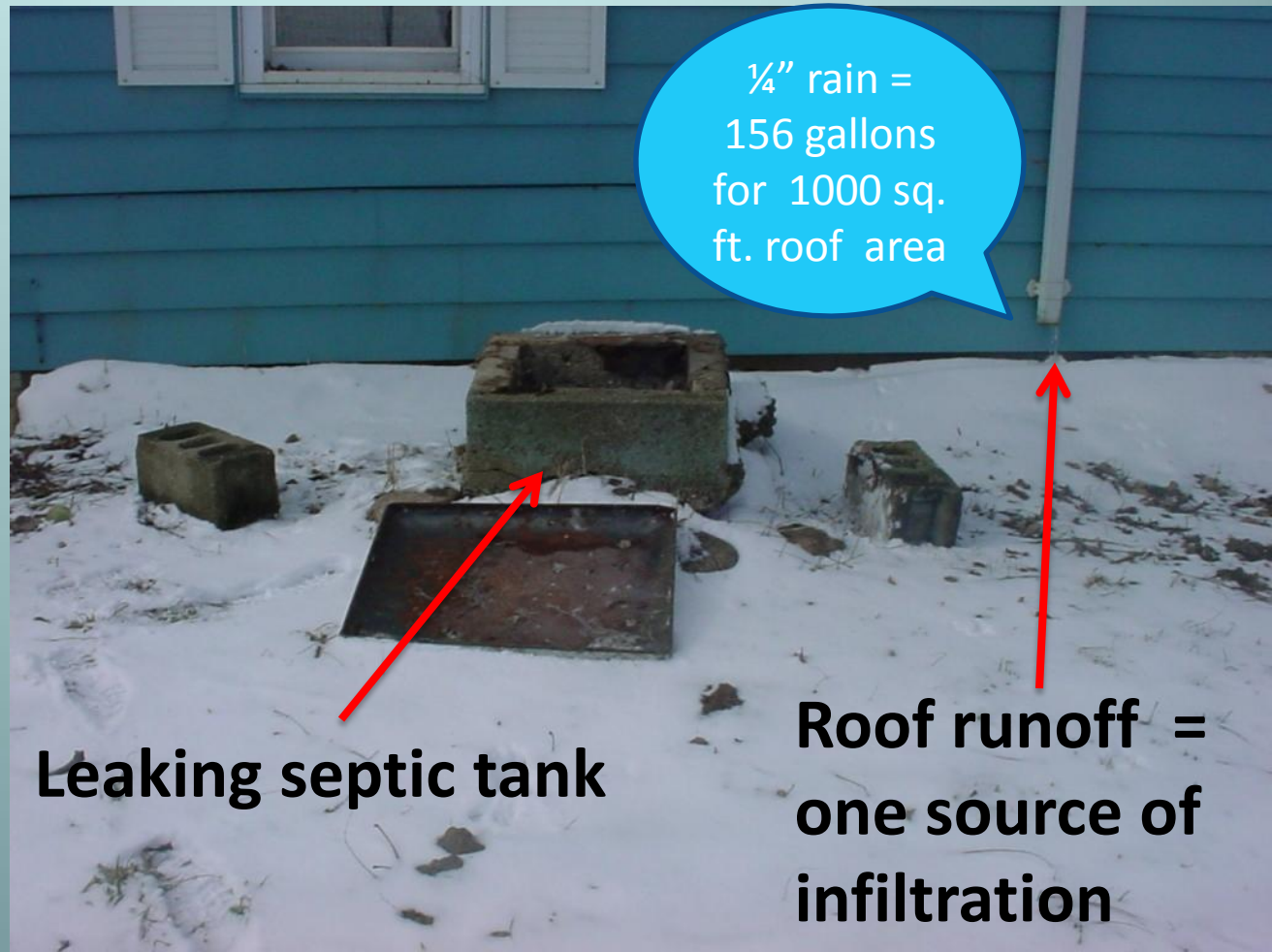


# Watertight Septic Tanks

## Infiltration

Clear water from the ground surface and/or high water table that enters a leaking septic tank causes:

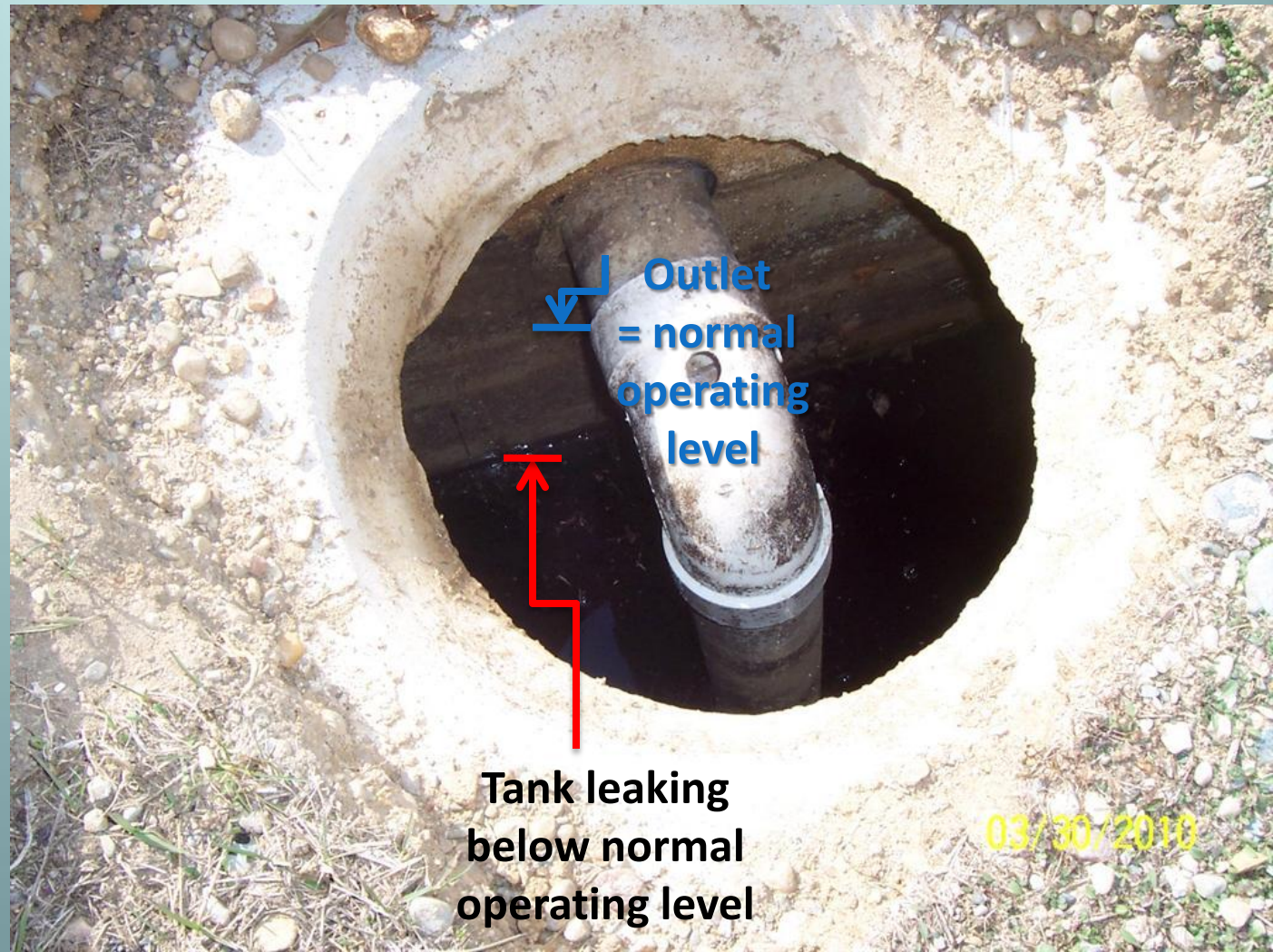
- Tank flooding & solids/floaters wash out to clog the drainfield
- Drainfield to be overloaded with excess water & oxygen displaced from that system



# Watertight Septic Tanks

## Exfiltration

Sewage  
leaking out  
of a tank...  
but not  
through the  
outlet as it is  
with a  
properly  
functioning  
septic tank







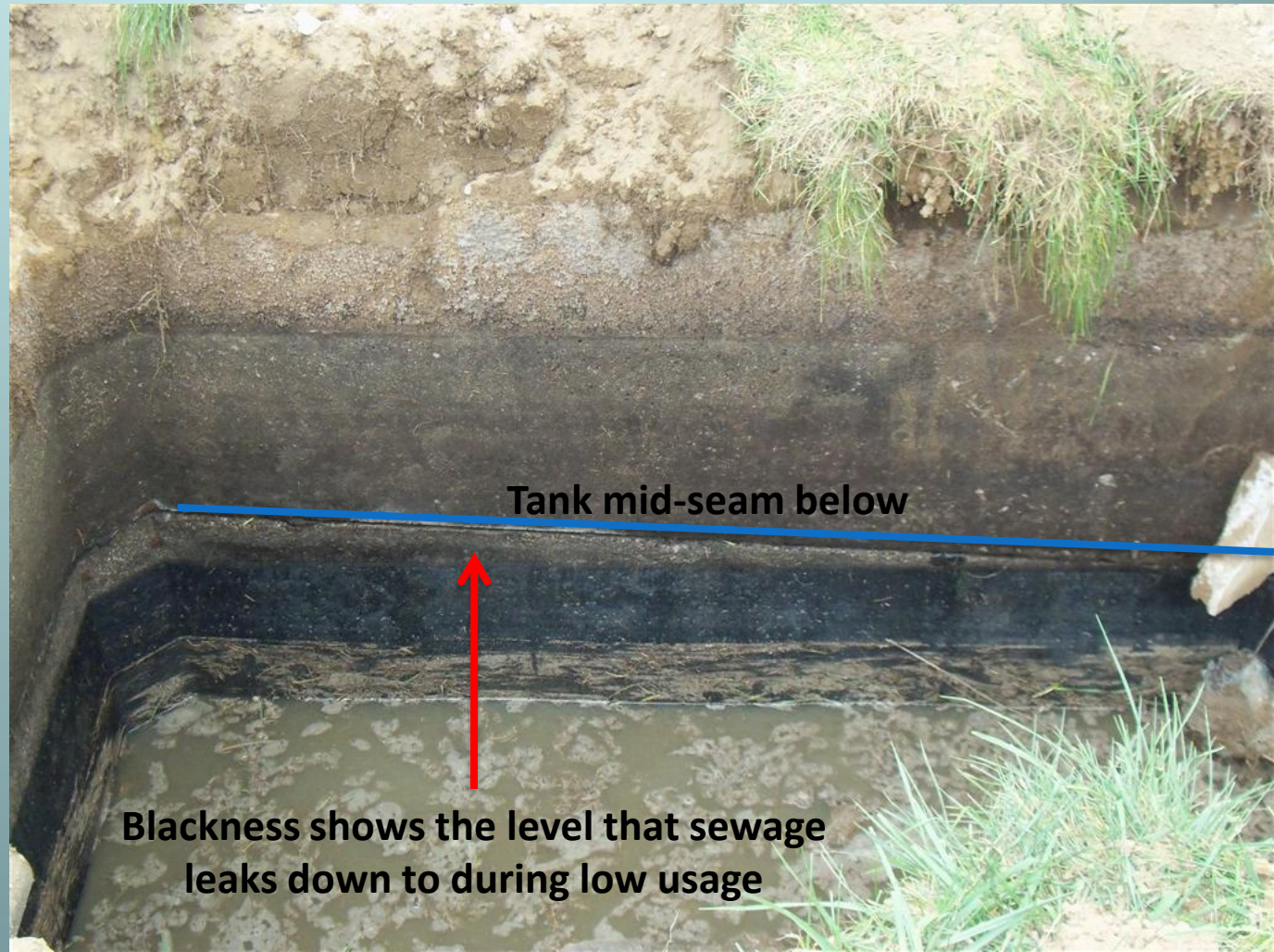
*Common notion:*

*“What’s the big deal, it’s all going  
into the ground anyway.”*

# Watertight Septic Tanks

## Exfiltration

- This septic tank leaks at the mid-seam (& its out of level).
- When a tank leaks out, the sewage *does not* go out to the drainfield where treatment occurs



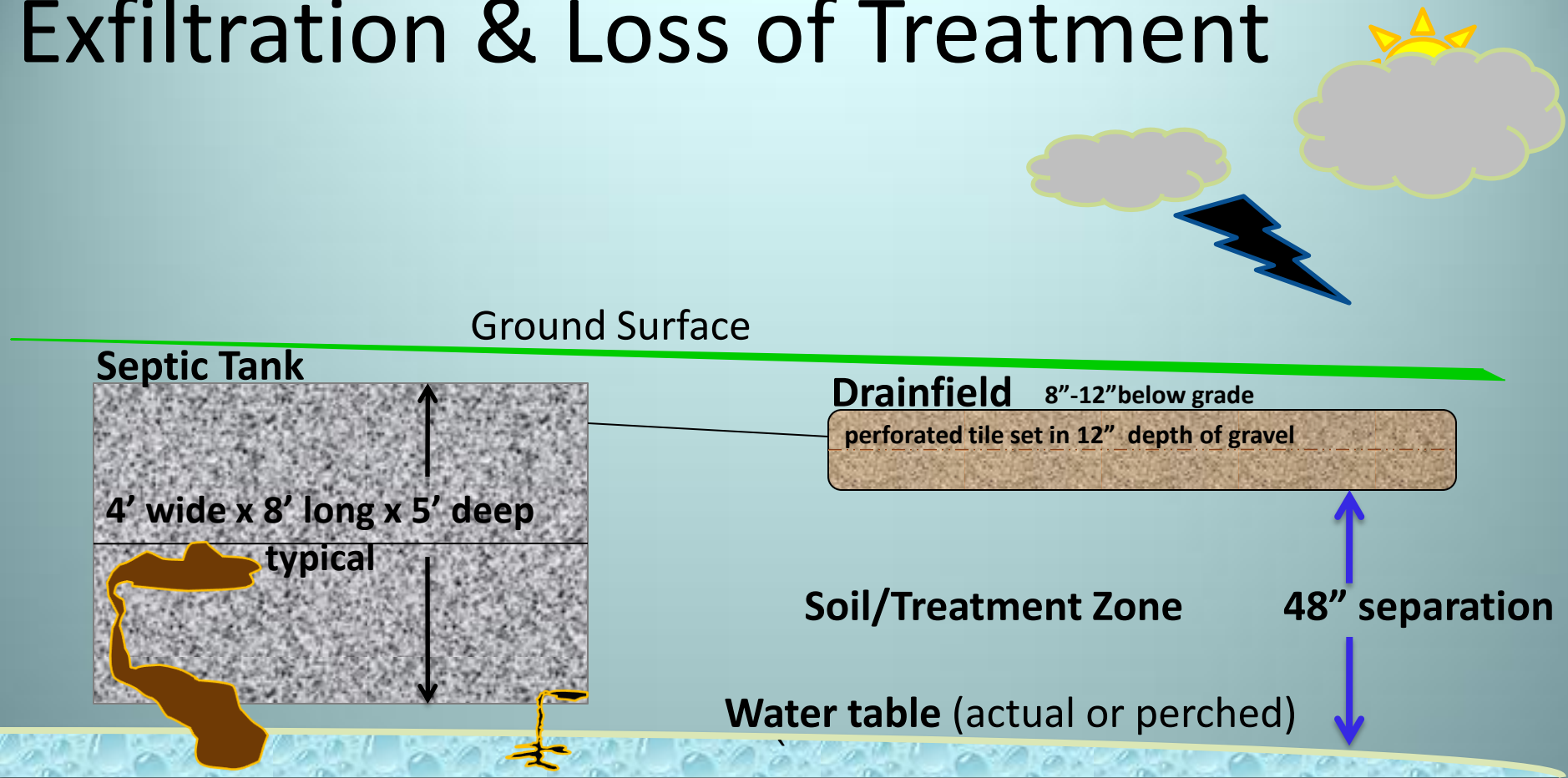


# Watertight Septic Tanks

## Exfiltration

- Much work is done when permitting a drainfield installation to keep the partially treated sewage above the groundwater
  - Vertical separation between the drainfield and the groundwater table is necessary for sewage **treatment**
  - When a septic tank leaks all of the work to maintain a treatment zone or separation between the groundwater & the sewage is *null and void*
  - The raw sewage can leak directly into the groundwater

# Exfiltration & Loss of Treatment



**When a septic tank leaks all of the work to maintain a treatment zone or separation between the groundwater & the sewage is *null and void***



# Watertight Septic Tanks

## Exfiltration

- Exfiltration slows down digestion in the tank
  - the sewage leaving the tank is higher strength,
  - Slower digestion increases expensive pump out frequencies
- Both exfiltration and infiltration can occur on sites where the groundwater table fluctuates up and down throughout the year

# Infiltration & Exfiltration: This house had both....



The sewage on the ground, sewage flowing back into the basement and into the sump pump at this site was caused by a leaking septic tank...

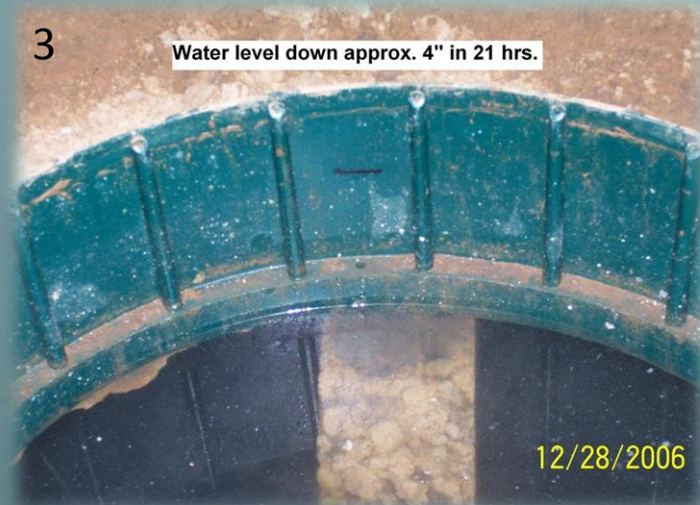




# After the back up, the tank was leak tested using water & observed over 24 hours



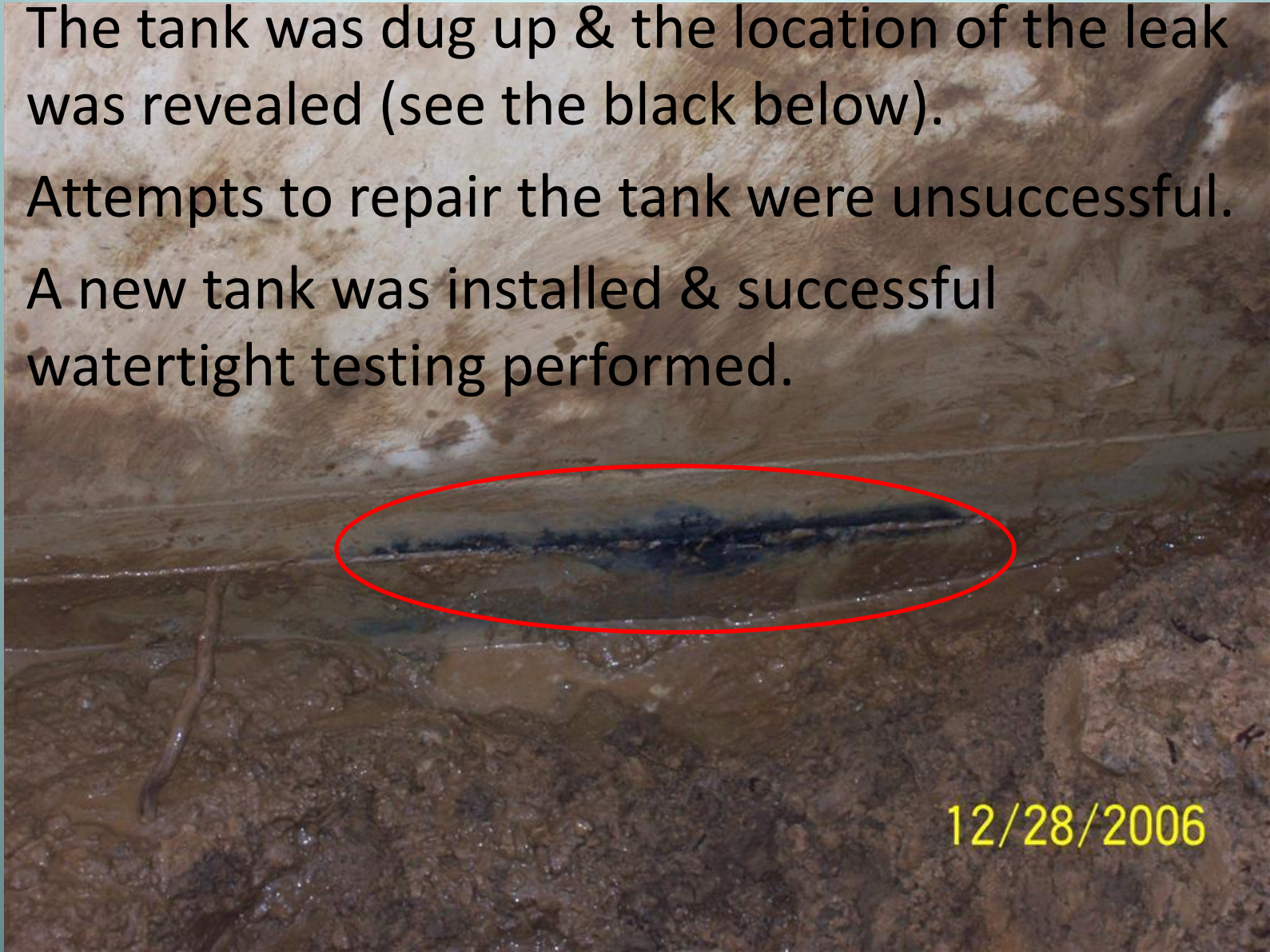
(Pictures are showing a septic tank riser with the lid off.)



No water was used in the home during the leak test, which confirmed the tank was leaking.

# Infiltration & Exfiltration

- The tank was dug up & the location of the leak was revealed (see the black below).
- Attempts to repair the tank were unsuccessful.
- A new tank was installed & successful watertight testing performed.





# Let's Think-TANK

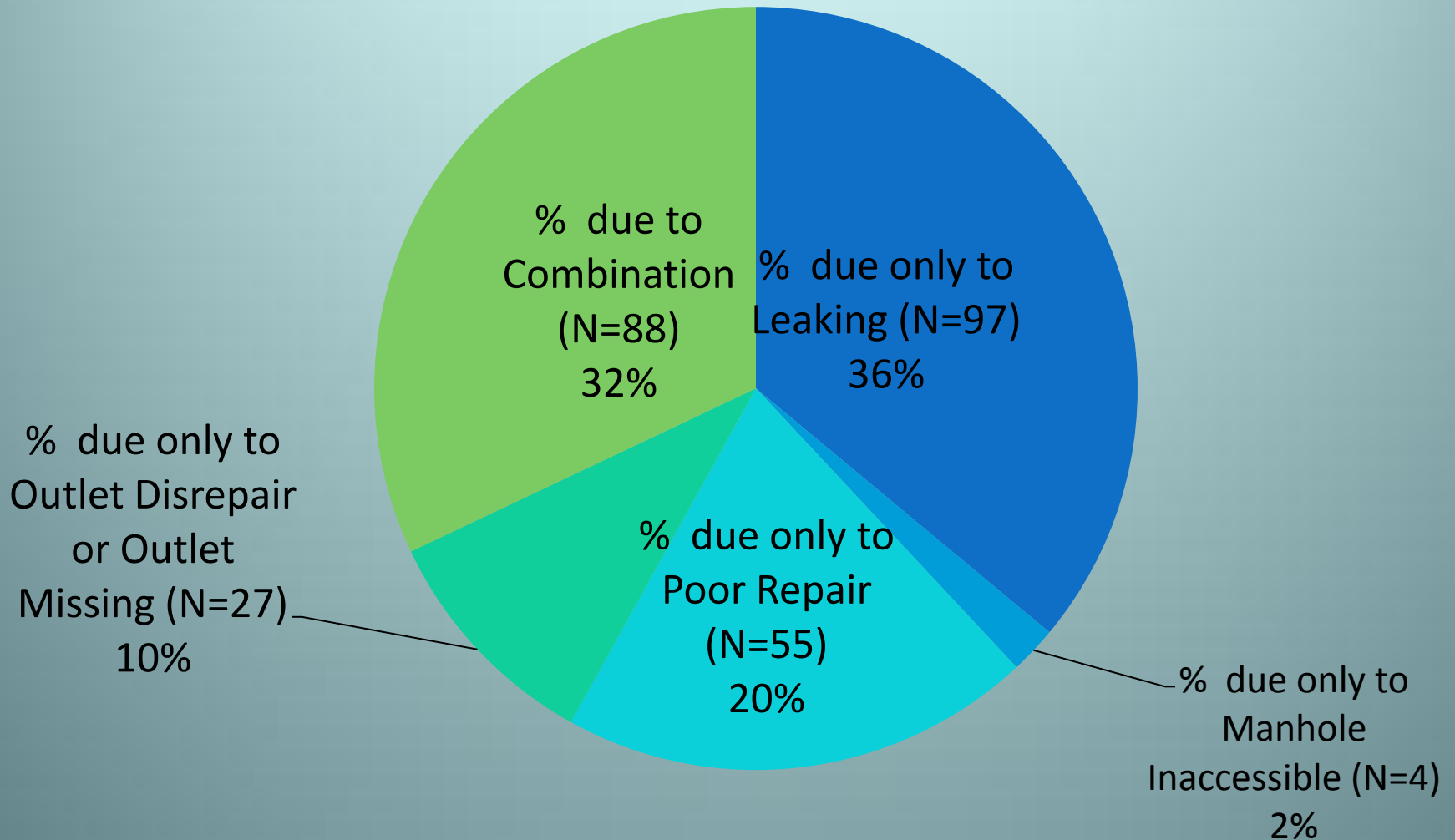
2297 Sewage (Time of Sale or Transfer) Evaluations in 3 Years

2644 septic tanks were evaluated for:

- **structural condition & safety,**
- **location,**
- **watertightness,**
- **necessary maintenance:**
  - Pumping (solids + scum  $\geq$  1/3 liquid depth)
  - Repair or replacement of outlet baffles/tees

**251 sites with a septic tank related failure**  
**-total of 271 tank failures**

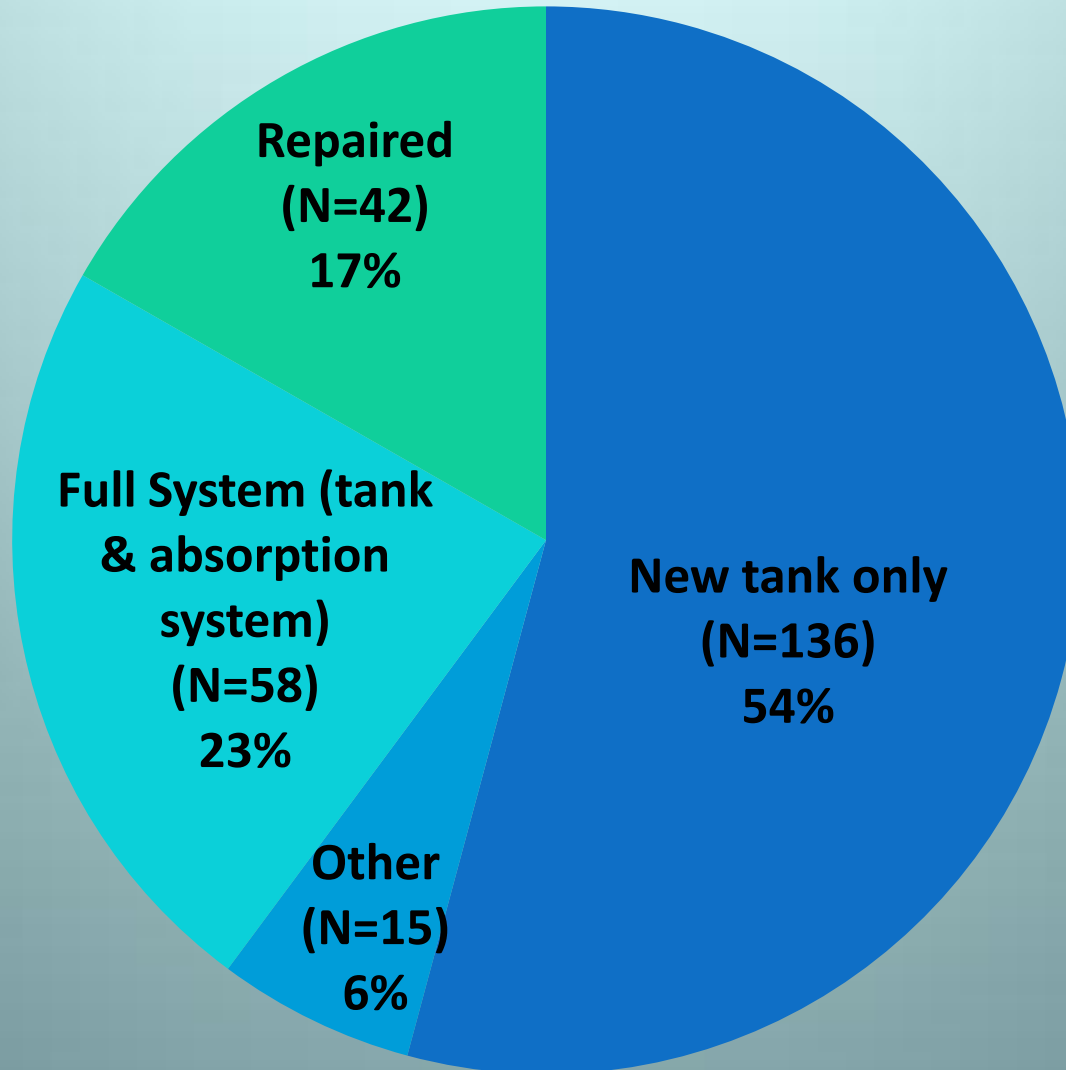
# Reason for Septic Tank Failure TOST 2007 - 2010





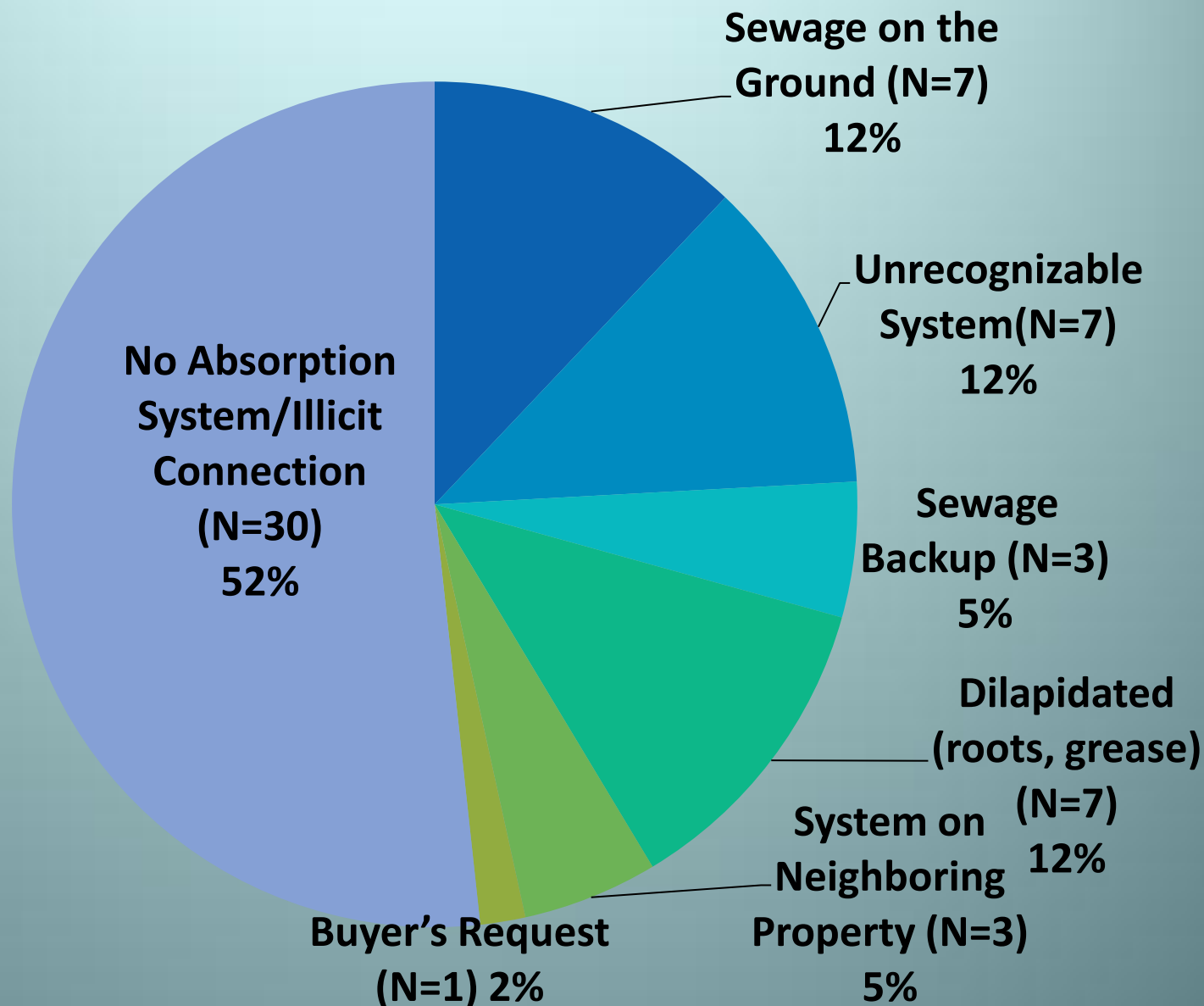
# The Fix for Failed Septic Tanks

## TOST 2007-2010



Other includes connection to available sewer, bypass leaking tank where multiple tanks exist

# Reason for Full System Replacement on Septic Tank Failure Sites





Structurally sound, properly located, watertight septic tanks are necessary for septic tank operation, groundwater protection, digestion, treatment, and to prevent costly repairs and/or drainfield replacement.

# TOST Results

For more information on the  
Barry-Eaton District Health Department  
TOST findings go to [www.barryeatonhealth.org](http://www.barryeatonhealth.org)  
and visit Environmental Health to read the full  
report to the community –

*TOST - The First Three Years*

and to view the picture appendix  
a must see...

# References & Additional Resources

- **EPA Design Manual: Onsite Wastewater Treatment & Disposal Systems, 1980**
- **EPA Onsite Wastewater Treatment Systems Manual, 2002**
- ***Planning and Installing Sustainable Onsite Wastewater Systems*, S.M. Parten, P.E., McGraw Hill, 2010**
- **“Design and Performance of Septic Tanks,”** Site Characterization and Design of Onsite Septic Systems, ASTM STP 901, M.S. Bedinger, A.I. Johnson, and J.S. Fleming, Eds., American Society for Testing Materials, Philadelphia, 1997.
- **“Watertight Tanks,”** Mark A. Gross, Ph.D., P.E. *Small Flows Quarterly, Summer 2004, 12-15*
- **“WATERTIGHT SEPTIC TANKS: NO MORE EXCUSES”** , Eric S. Ball, Harold L. Ball, Jeffrey L. Ball, and Terry R. Bounds