PURDUE UNIVERSITY

CAPSTONE/SENIOR DESIGN EXPERIENCE 2019

RS-1 Residential Drainage Design

Agricultural & Biological ENGINEERING

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1. Problem Statement

Create an outlet to divert water away from the residence to allow the septic system to work and reduce standing water in the south half of the backyard, in all but extreme conditions, which include:

- Excessive rain greater than a 10-year, 24-hour storm
- Rainstorm with soil conditions of antecedent two or three

2. Background

- High clay content (0.3 gpd/ft^2 loading rate)
- Seasonal high water table (8” from surface)
- No nearby regulated drains
- No obvious outlet from property

3. Criteria

- Cost
- Transformation of Landscape
- Final Septic System Performance
- Water diverted from around home

4. Constraints

- Cannot move barn
- No obvious outlet
- Health Department Regulations

5. Environmental, Social, and Safety Factors

- Proper distance is kept from existing septic system to mitigate risk of contamination
- Minimal long-term change to property
- Vent for septic system will be clearly marked and will be kept on edge of property

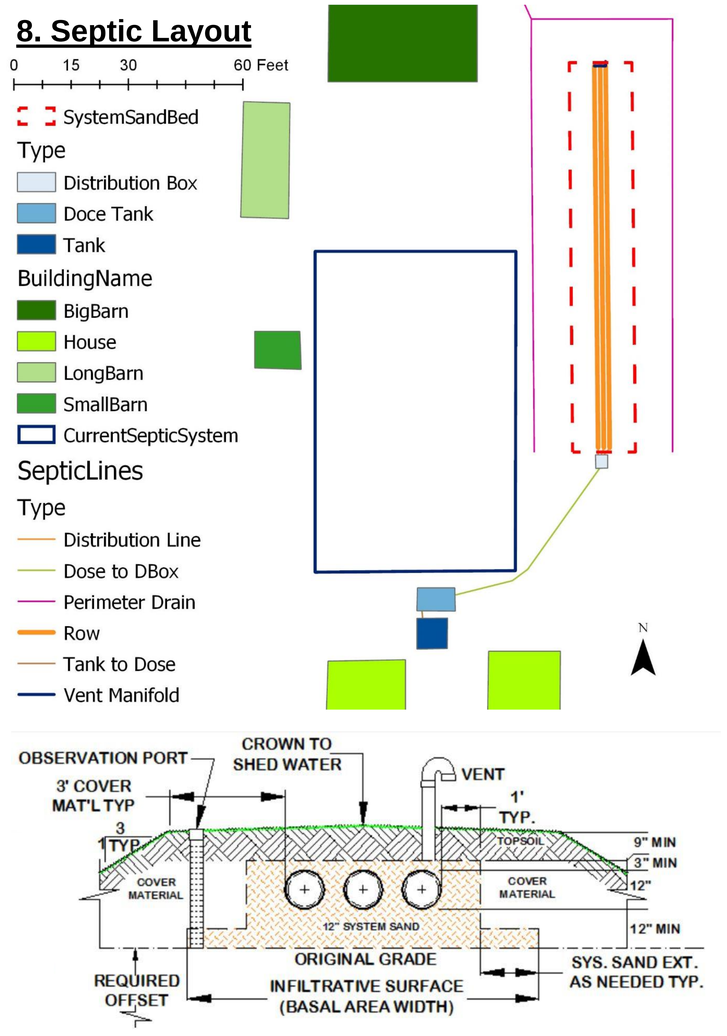
6. Alternative Solutions

- Concrete wet well installation
  - Temporary storage for curtain drain and perimeter tile
  - Pumped to neighbor’s pond as final outlet
- Use of regulated drain as perimeter tile outlet
- Make the low area in yard into pond

7. Final Solution

- New Presby septic system
  - Small footprint
- Curtain drain around home
  - Drain gutters
  - Remove moisture from crawlspace
- Regrading of the backyard
  - Reduce standing water

8. Septic Layout



9. Impact and Sustainability

- Protects health and wellbeing of Riedel family
- Protects water quality of retention area
- New septic system will function indefinitely
- Regrading relied on gravity to improve drainage

10. Economic Analysis

Presby System	$5,720.25
Sand	$2,260
Perimeter Tile	$200
Grass Seed	$399.76
Electric Install	$450
Gutter Drains	$542.21
Labor	$5,600
Total Cost	$15,172.22

11. Design Validation

- Verification of septic system design through contractor
- Use of SCS Curve Number Method to calculate runoff from 10-year, 24-hour storm
  - $Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$
  - Total runoff volume: 55,500 ft^3
  - Total Holding Capacity 58,000 ft^3
- Watershed delineation using NRCS toolbox in ArcGIS

Sponsor:
The Riedel Family

Technical Advisor:
Dr. Jane Frankenberger

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John Hack – Hack Excavating

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Dr. Margaret Gitau
Dr. John Lumkes

Standards & Best Practices:
RULE 410 IAC 6-8.3
ASAE EP 260.3
Presby Indiana Design Manual

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