Improving Water Quality in the Lick Creek Watershed by Improving the Performance of Septic Systems

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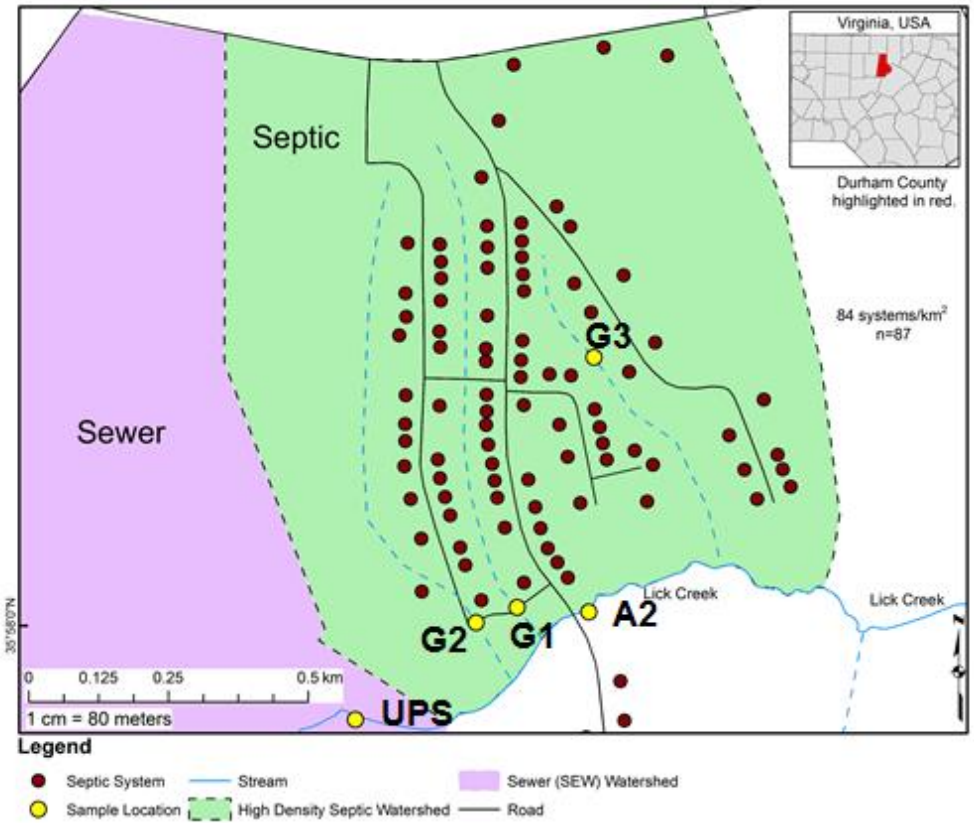
Researchers from the Coastal Resources Management Program and Environmental Health Sciences Program at East Carolina University (ECU) partnered with Durham County Public Health, the NC Department of Health and Human Services, NC A&T State University, septic contractors, and property owners to improve water quality in the Lick Creek Watershed by improving the performance of septic systems. Lick Creek drains to Falls Lake, a major water supply reservoir for the Raleigh area. Most residents in the Lick Creek Watershed use groundwater wells for their water supply. Suspicious discharges from septic systems were identified in the watershed restoration plan for Lick Creek as a potentially significant source of nutrients and fecal bacteria. Therefore, improving septic system function could improve groundwater and surface waters used as water supply sources. ECU was awarded grant funding from the NC DEQ 319 Program to improve water quality by enhancing septic system performance via installation of replacement septic system components, pumping septic tanks, and modifying drainageways to enhance pollutant removal. Contact was made with watershed residents via mail and phone regarding the project. Water sampling was conducted to identify streams with relatively high pollutant concentrations and for determining locations for best management practice implementations. Monitoring data revealed elevated concentrations of nutrients and fecal indicator bacteria in three streams (G1, G2, G3) draining neighborhoods with high densities of septic systems. Durham County Public Health Department provided to researchers the septic system permits that were on file for the homes in the watersheds. Walking surveys using protocols provided by NC DHHS collaborators were conducted on the three watersheds (G1-G3) to identify properties where septic system improvements may be needed and to solicit project volunteers. Researchers talked with homeowners concerning the basic principles of how septic systems function, maintenance needs of the systems and principles of water quality. Certified septic contractors (4) were met at residences in the watersheds and 37 septic tanks were pumped. Prior to pumping, wastewater samples were collected from the tanks and analyzed for nitrogen and phosphorus concentrations. The volume of wastewater pumped and nutrient concentrations in septage were used to estimate the mass of nutrients removed from the watershed as a result of the tank pumping. Repair permits were issued by Durham County Public Health for malfunctioning septic systems and three malfunctioning septic systems were repaired/replaced. An eroding drainageway along one of the drainageway (G2) was enhanced by widening the banks, increasing the storage capacity, and installing woodchips and expanded media in the bed for enhanced pollutant removal. Over 200 linear feet of drainageway was improved and preliminary results suggest nutrient transport has been reduced by more than 30% as a result of the modifications. An estimated 49 lbs of nitrogen and 1.5 lbs of phosphorus were removed via pumping. Septic system repairs should reduce nitrogen and phosphorus transport to surface waters by 22 lbs, and 3 lbs, respectively each year. Efforts to engage residents in the watershed, implement best management practices and quantify reductions in pollutant transport (related to BMP implementation) continue.

Supporting Materials

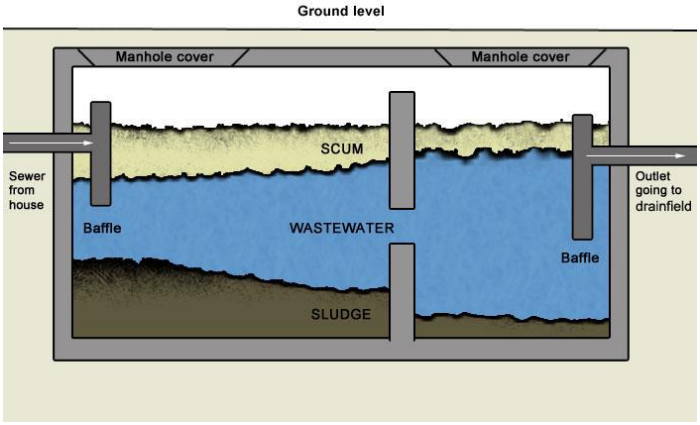
Water quality parameters including flow, dissolved nitrogen and phosphorus, *E. coli*, enterococci, pH, temperature, specific conductance, turbidity, and dissolved oxygen were measured/analyzed for 9 stream segments within the Lick Creek Watershed.



Initial Lick Creek Surface Water Quality (means and geometric means)							
Site	DIN (mg/L)	PO4-P (mg/L)	DOC (mg/L)	TDN (mg/L)	SC (uS/cm)	E. coli (MPN/100 mL)	Enterococci (MPN/100 mL)
A1	0.04	< 0.01	12.9	1.03	76	106	20
A2	0.10	0.01	19.5	1.02	152	76	23
A3	0.10	0.01	15.9	1.01	125	105	16
A4	0.07	0.01	8.3	0.96	70	16	28
A5	0.04	0.01	7.6	0.93	68	17	8
G1	2.66	0.09	19.4	2.79	237	1539	287
G2	0.38	0.01	38.4	1.18	353	954	440
G3	1.84	0.06	13.8	2.18	153	3444	200
UPS	0.07	0.01	18.7	1.01	146	62	39

Nutrient and bacteria concentrations were elevated at stream sampling locations G1, G2, and G3 relative to the other sites. These watersheds have a relatively high density of septic systems.

Walking surveys were conducted in the watersheds with relatively poor water quality and a high density of septic systems. Information from the septic system permits was used to help locate system components. Soil and site conditions were evaluated to assess potential options for septic system repairs.



Septic contractors were met at properties where the septic tanks needed pumping. The layer (scum, liquid, sludge) thickness was measured for each tank and samples of the layers were collected for nutrient analyses. The volume and concentrations were used to determine masses of nutrients pumped from the tanks.

Malfunctioning septic systems were located and repair options considered. One property with a pump system, had a cracked supply line that was discharging effluent to the surface, and the runoff was reaching a nearby creek. The supply line was repaired.

A new drainfield and septic tank were installed on properties with malfunctioning systems after repair permits were issued for the two sites.

Severely eroded sections of a drainageway (left side images) were stabilized by widening and reshaping the banks. Woodchips and expanded media were placed in the bed of the drainageway, and covered with stone. These modifications have reduced pollutant transport by more than 30%.