Water Quality Management

RISE is looking for innovative approaches to the treatment and use of potable, grey, and black water on rural properties. Of greatest importance is to reduce the impact of the occupants on the environment and to limit the effects of the changing climate and sea levels on the ability to occupy and enjoy rural coastal locations.

Below are two areas of interest related to Water Quality Management, and specific problems in need of solutions:

1) Septic System Design

The Problem(s)

Due to the lack of main sewer systems, many properties in rural areas manage (grey/black water) waste using septic systems. The occurrence of septic system failures is an increasing concern among residents of Virginia's rural coastal communities and their local government leaders. The prevalence of sea level rise, land subsidence, and recurrent flooding in coastal Virginia make the region particularly susceptible to septic system failures as compared to other parts of the Commonwealth.[1] The Virginia Department of Health has estimated that there are over 104,000 onsite sewage systems in Virginia's Middle Peninsula, Northern Neck and Eastern Shore.[2]

The failure of conventional septic systems in rural coastal Virginia threatens public health and water quality. This Challenge is seeking innovative, cost-effective solutions that can withstand the environmental conditions of rural coastal Virginia and produce clean water that passes all public health standards.
The Pain Points in Current Solutions

Some parts of the Middle Peninsula are already less than three feet in elevation above mean sea level ("MSL"), and in the next 30 years, the entire area will be less than three feet above MSL. A conventional septic system needs at least 18 inches from the bottom of the trench to a water table. The total depth of the trench (18 inches) plus the vertical separation provides three feet of unsaturated soil above the water table, which is required for a conventional septic system to function properly.

When a conventional septic system is impractical or impossible, homeowners can utilize alternative systems, many of which are already permitted and available in Virginia.

Even with the plethora of alternative systems available in Virginia, long-term, viable options are lacking for some sites in rural coastal Virginia. Many sites are subject to recurrent flooding, so the upkeep and maintenance of alternative systems become inefficient and cost prohibitive. Even for sites that do not experience recurrent flooding, existing alternative systems may be impractical for homeowners due to the higher cost as compared to a conventional septic system.

[1] Septic Reference Guide for VCPC_82695136_3.pdf
[2] "HB 2322: Plan to Transition Septic Pump Out Oversight and Enforcement in Rural Coastal Virginia", November 2020, Virginia Department of Health, Office of Environmental Health Services

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One potential solution to the problem of failing septic systems in rural coastal Virginia is to elevate the treatment tank above ground to protect it from the damaging effects of recurrent flooding, sea level rise and inclement weather. An elevated treatment tank would likely also require an elevated drainfield. Elevated drainfields are currently permitted in Virginia, but an elevated treatment tank has not yet been implemented or permitted. Elevating the treatment tank is a novel approach without any current regulatory requirements that would preclude this design.

One issue with an elevated system is that it may require pumps which in turn rely on electrical power. When the power is interrupted the system may not function as it should. Many property owners address this (and other issues from power outages) by purchasing a gas generator (typical cost approximately $800).

RISE is seeking both in-ground and elevated systems solutions.

If the proposed system is an in-ground (conventional or alternative system) it must:

- Be either retrofitted or a new installation
- Function in a high-water table environment
- Be able to secure permittable under current regulations

If the proposed solution has an elevated treatment tank it must:

- Function for up to 72 hours after main power is interrupted
- Be protected against severe environmental/meteorological conditions

Also, optional but preferred attributes for an elevated system:

- Can provide up to 6500W continuous power for up to 72 hours at 120 VAC for household use
- Can recycle some or all of the discharge water for home reuse in accordance with regulatory guidelines (see **Buildings' Water System Redesign** below).

Solutions that consider single or multiple connected homes may be considered.

Additional Information Available Upon Request

- "Septic Reference Guide for the Virginia Coastal Policy Center", Jessica Kirkland, Nov 30, 2020. Available upon request.
- Virginia Pollutant Discharge Elimination System (VPDES)
- Virginia Department of Environmental Quality
- HB 2322: Plan to Transition Septic Pump Out Oversight and Enforcement in Rural Coastal Virginia, November 2020. Available upon request.

2) Buildings' Water System Redesign

The Problem(s)

Wells that provide properties with potable water are experiencing saltwater intrusion. Often a property will need a second well to provide sufficient drinking water. There is a need for more holistic, closed or partially closed systems that more efficiently and cost effectively utilize fresh water, grey water, and saltier water for all the purposes water is needed in a home.

This Challenge will demonstrate new approaches to reassessing buildings' water needs providing solutions that reduce the use of potable well water, while maximizing the uses of other sources of water.

Solutions to this Challenge may incorporate solutions from **Septic System Design** above.

The Pain Points in Current Solutions

Often reduced or degraded flows from wells struggle to provide proper potable water levels for a building's daily consumption. The correction to this is to drill another well head, which can be expensive, and another possible pathway to well contamination from bacteria or saltwater. There is no acceptable way of including the potential reuse of grey water to reduce the burden on potable water. A holistic water solution for a house is required instead of relying solely on well water.

RISE is seeking new systems (replumbed house) that:

Provide habitants with sufficient fresh potable water for daily consumption and use, and reuse grey water to limit discharge to (already wet) property, and potentially find uses for saltier water to save potable water.
Some solutions may be:

- Integrated and permittable system of fresh, grey, and other water sources for use in a building's operations.
- Development of localized water processing capabilities: desalinization, purification, recycling, etc.

Solutions must be sustainable, affordable, and permittable under current regulations. Solutions that consider single or multiple homes may be considered.

Additional Information Available Upon Request

- "Septic Reference Guide for the Virginia Coastal Policy Center", Jessica Kirkland, Nov 30, 2020 (available upon request).
- Virginia Pollutant Discharge Elimination System (VPDES)
- Virginia Department of Environmental Quality
- HB 2322: Plan to Transition Septic Pump Out Oversight and Enforcement in Rural Coastal Virginia, November 2020 (available upon request).