AN EVOLVING WASTEWATER ISLAND IN HENRICO COOUNTY, VIRGINIA

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INTRODUCTION

Amazingly, adopting the term "wastewater island" to describe an area where homeowners are experiencing problems with their onsite sewage systems and face challenges to find a wastewater solution has made a difference in the conversation about failing onsite sewage systems in Virginia. Onsite systems are regulated by the Virginia Department of Health (VDH), but sewer systems are regulated by the Virginia Department of Environmental Quality (DEQ).

In the recent session of the General Assembly, Senate Bill 1396 was enacted. SB 1396 adopted a mandate to consider the effects of climate change on onsite sewage systems and also included this language (Commonwealth of Virginia, 2021):

> ***§ 62.1-223.1. State policy as to community and onsite wastewater treatment.***
> *It is the policy of the Commonwealth to prioritize universal access to wastewater treatment that protects public health and the environment and supports local economic growth and stability. To further this policy, the Commonwealth endorses (i) public education about the importance of adequate wastewater treatment; (ii) collaboration among local, state, and federal government entities, including consistent collaboration and coordination of grant requirements and timelines; (iii) the prioritized focused, and innovative use of state and federal funding to address needs determined pursuant to § 62.1-223.3; (iv) a preference for community-based and regional projects as opposed to cumulative and repetitive site-by-site individual solutions; (v) the use of integrated solutions across sewer and onsite wastewater treatment systems; and (vi) the incorporation of the effects of climate change into wastewater treatment regulatory and funding programs.*

SB 1396 also established the Wastewater Infrastructure Policy Working Group with a membership of the Director of DEQ, the State Health Commissioner, the director of the Department of Housing and Community Development, and the Executive Director of the Virginia Resources Authority. These four members have voting power and several stakeholders, including VOWRA, were named to provide representatives to participate in meetings of the Working Group.

The initial emphasis for funding seems to be for people below 200% of the poverty level of $53,000 annual income for a four-person household in the contiguous 48 states for 2021 (US Health and Human Services, 2021). Limited funding for this category of homeowners has been available through programs from USDA throughout the years. Anecdotally, many of these cases fall through the cracks. Septic tank pumpouts are intended primarily to remove residual solids from the septic

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tank, but pumping out the tank also removes the water in the tank and any water that may back up from the drainfield into the tank. Some homeowners will call for a pumpout to provide immediate relief of a backup even though the relief does not last very long. When a system begins to fail seasonally during the period of the year that the seasonal water table is high, ie, the winter, pumping the tank monthly during the winter may allow a system to function tolerably for several years before it ultimately fails entirely. Pumpout records in one Virginia county in the 1990's showed that some homeowners called different pumpers each time they experienced a backup to avoid creating a record of septic system problems. Since low-income homeowners struggle to keep food on the table and the car on the road to get to work, they simply choose to live with septic problems rather than run the risk of uncovering another expensive problem. This group presents a special challenge for enforcement because applying for aid, if any is available, takes time, attention, and sometimes education that they do not have to carry the project through.

On the other end of the spectrum, wealthy homeowners can have work done whenever they find a problem. In wealthy neighborhoods, the onsite sewage maintenance professional is just another service person parked along the street with the lawncare professional, the pool maintenance professional, the plumber, and the rest.

In between rich and poor are the middle-income Americans with a mix of financial situations. In moderate income neighborhoods, there is often a mix of long-term homeowners with lots of equity in their homes, new homeowners who have not yet developed equity, and renters who sometimes rent by choice, but often do not have the financial stability to purchase a home. Incidentally, landlords are not eligible for financing options available to owner-occupied dwellings, thus must either pay out-of-pocket for repairs or qualify for commercial financing when faced with a problem like a failed drainfield.

The purpose of this inquiry is to explore an aging middle-income neighborhood of 169 homes in suburban/rural Henrico County, Virginia, to determine the challenges faced with their aging conventional onsite sewage systems. In Windsor Subdivision to date, approximately 25% of the homes have a repair permit on file with the Henrico County Health Department. The lots are approximately 0.5 acres and most of the homes have bored wells which require a 100' setback to a dispersal area. The average age of the homes is 39 years and the average current value of the homes is $198,055.03 based on data from the Henrico County Geographic Information System (GIS).

AN EVOLVING WASTEWATER ISLAND

We have dubbed Windsor subdivision an "evolving wastewater island". The definition of wastewater island (Revis & Gregory, 2015) includes the following:

- Environmental Factors:
    - No access to centralized sewerage.
    - Soils not suitable for COSS.
    - Sensitive receiving environment (local TMDL, ground water concerns, existing water quality issues).
    - Small lot size.
    - Older homes and communities.
    - Actively failing onsite sewage system with raw or partially treated wastewater backing up into the house, discharging to the ground surface, or discharging directly to groundwater.
- Financial Factors:
    - Low income.
    - Difficulty obtaining a loan.
    - Difficulty raising funds for initial installation.
    - Difficulty paying for ongoing maintenance cost.
- Social Factors:
    - Historical inequities.
    - Lower education regarding environmental/public health issues.

Obviously, these factors will weigh in at different levels of importance in each community evaluated. In the case of Windsor subdivision, the environmental factors predominate: no access to centralized sewerage, soils not suitable for COSS, small lot size. older homes and communities, actively failing onsite sewage system with raw or partially treated wastewater backing up into the house, discharging to the ground surface, or discharging directly to groundwater. The subdivision lies within the Chesapeake Bay watershed and the closest waterway is an unnamed tributary of the Chickahominy River, which is impaired for e. coli according to the Virginia DEQ Environmental Data Hub (Virginia DEQ, 2021). Therefore, Windsor subdivision qualifies for status within a sensitive receiving environment as well.

Since Windsor is a middle-income community, the financial factors of a wastewater island are not as applicable. However, 62 of the homes, or 37% have transferred within the past 5 years and thus these homeowners may have limited ability to secure a home equity loan or refinance should they require a home equity loan. We do not currently know the proportion of homes that are rental properties. As mentioned previously, landlords do not have the same financing options as owners who occupy the home. Theoretically, landlords are in a stable financial position, but sometimes they are not. Also, anecdotally, renters do not have the same sense of responsibility when living in a home served by an onsite sewage system and may let leaks persist and ignore warning signs such as wet spots in the yard.

Renters may also lack knowledge about septic systems and warning signs, as is true for some homeowners who occupy their homes. While we would expect education levels in a middle

income community to be high-school graduation level or above, homeowners with formal education are not always well-educated about onsite sewage systems. While 87% of the homes in this subdivision were built before the end of 1985, 88% have a property transfer later than 1985. From these numbers we can surmise that approximately 12% of the homes are occupied by their original owners. Some long-time owners of a septic system adapt to any limitations of the system that have developed over time and may not realize that their system is struggling.

REPAIRS TO DATE

A review of heath department records for Windsor subdivision reveals that at least 41 repair permits have been issued in Windsor subdivision. This number equates to approximately 24% of the 169 existing homes. A significant caveat is that in 2017, legislation was passed that redefined distribution box replacements as maintenance for conventional onsite sewage systems, meaning that a licensed onsite sewage installer or operator could replace a distribution box without a repair permit. Reporting on maintenance of conventional systems is voluntary, so some significant repairs may have been implemented since 2017 without knowledge of the health department. Tank replacements still require a permit, so these repairs would be included in the number of repairs given.

According to the NRCS Web Soil Survey (USDA NRCS Web Soil Survey, 2021), the predominant soil series within the subdivision are Kempsville fine sandy loam 0-2% slopes (19.2%), Kempsville very fine sandy loam, clayey substratum, 0-2% (31.8%) and Nevarc-Remlik complex, 15-50% slopes (25.2%). While the Kempsville series in general is well-drained and was considered suitable for conventional septic systems, we now recognize the light yellowish brown, 10YR 6/4, depletions in the upper portion of the B horizon to signify seasonally high-water table. In the 1982 Sewage Handling and Disposal Regulations, a sliding scale for standoff to SHWT was provided based on measured or estimated percolation rate, meaning that some existing systems in this subdivision may have been installed closer to the SHWT than we would design them today. Additionally, at that time the designation of the depth of SHWT was made primarily based on the occurrence of gray mottles with a chroma of 2 or less, exacerbating the problem. Installing too close to or into SHWT can cause seasonal failure and ultimately premature failure because the water mounding effect blocks both the dispersal of effluent in the soil and oxygen transfer in the dispersal area needed to properly treat the wastewater.

Another factor in the design of conventional onsite sewage systems in the 1980s and previously was to avoid pump systems whenever possible. At that time, some pump systems were not reliable, and designers would “buck grade” to avoid installing a pump system. Obviously, the piping in a conventional gravity onsite sewage system falls consistently through the septic tank, distribution box to the absorption trenches. The ground surface over the absorption trenches should be lower than the first floor or basement elevation of the house, also in a gravity-based installation, and the

absorption trenches should be installed on contour so that they are the same depth throughout with the pipe falling only 2-4 inches per 100 feet. "Bucking grade" means that the system runs into grade with so that the ground surface is higher than the floor elevation or that the absorption trenches are shallow at one end and deep at the other – the grade of the pipe runs contrary to the grade at the ground surface. When a system is installed into grade, any stress on the system caused by heavy rainfall, temporary over-use or leaky fixtures, will often cause sewage to back up into the house.

Both of these factors, SHWT and pump avoidance, may be partially responsible for early failures in this subdivision found in health department records. Approximately 46% of the 41 repairs found in health department records occurred before the system was 20 years old.

CONVENTIONAL SYSTEM PROGNOSIS

Provided that the 24% of systems that have already had a significant repair continue to function satisfactorily, the remaining 76% of existing conventional systems in this subdivision face failure in the future. Of the 169 homes, 49.1% were constructed between 1976 and 1980 and 47.9% were built between 1981 and 1990, meaning that 97% of the homes are older than 31 years.

All or nearly all the homes have bored wells, requiring a 100' setback to an onsite sewage system dispersal area, and the lot sizes are approximately 0.5 acres. We know that conventional systems last for decades, but they don't last forever, but it is difficult to predict exactly when failure will occur.

The cost of drainfield replacement for the 128 homes that have not yet had a significant repair will fall between $10,000 and $30,000 or $1,280,000 and $3,840,000. If these failures are found at the time of a real estate transfer, money usually becomes available to cover the cost of replacement out of the proceeds of the sale in a good economy.

If failures are found at other times, some homeowners will struggle to cover the cost of replacement, even in this middle-income community due to low equity, credit problems, or other lack of financial resources.

In the meantime, we hope to explore this evolving situation in greater detail. Some information, such as lot size, is not available in the GIS. There may be more information to glean from the health department files, because the original drainfield designs and soil evaluations were well documented.

We thought this project worth exploring because there are hundreds, if not thousands, of similar subdivisions in Virginia, and likely in other states as well. Because these are middle-income

homes, most homeowners have some financial resources available, and not all the systems have failed catastrophically at once, this subdivision probably does not qualify as a high priority for public funding. But as noted above, some homeowners will struggle to afford a suitable solution when their existing conventional onsite sewage system fails.

The total cost of replacement systems, even at $3.8 million, probably does not warrant the cost of extending public sewer into the area provided suitable onsite sewage solutions can be designed.

One aspect of the problem that we cannot explore without field work is the environmental impact of a failing subdivision. Fieldwork to explore the status of the existing drainfields would be very interesting as would water testing of the bored wells and surface water.

We hope to continue evaluating this neighborhood to uncover any underlying soil problems that contribute to premature failure of drainfields. We also hope that we can demonstrate that the "preference for community-based and regional projects" to assist homeowners should include a solution for moderate-income homeowners that may have some financial stability, but may not be in the position to fully fund a drainfield replacement. An aging subdivision such as Windsor may not qualify for a sewer extension, large decentralized system, or similar solution, but hopefully an assistance fund at the county or state level can be established to assist homeowners that require it.

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