

Studying Options for
**Raspberry Falls and
Selma Estates**
Community Systems



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LOUDOUN WATER COMMUNITY SYSTEMS

MISSION

We provide sustainable water services to protect health, the environment and quality of life.

Loudoun Water operates several Community Water and Wastewater Systems in Loudoun County, which provide the benefits of water and wastewater service to properties in a rural setting that are not served by Loudoun Water's central system. Community Systems provide a sustainable, cost effective water supply that meets all Safe Drinking Water Act requirements and treats wastewater in accordance with all applicable regulations.

Community Water Systems are part of the rural environment and, as such, do not have the capabilities of the Central Water System. Care must be taken during water-using activities to ensure a constant water supply.

Community System water and wastewater charges are based directly on the cost of service and are borne solely by the residents of homes served by these systems.

RASPBERRY FALLS COMMUNITY SYSTEMS

Loudoun Water assumed operation of the Raspberry Falls public water system in March 2002. It is permitted and regulated by the Virginia Department of Health (VDH). Groundwater is the source of your drinking water, supplied currently by two wells and treated with chlorine prior to storage. The water is then pumped and distributed to your home.

In compliance with VDH regulations, Loudoun Water has strict protocols in place which assure that all drinking water we supply to our customers meets all Safe Drinking Water Act requirements. The treated drinking water delivered to Raspberry Falls homes has always met these requirements. It is properly disinfected with appropriate levels of chlorine. Regular sampling of the treated water has never shown any bacteria.

The original public drinking water wells were drilled in limestone geology in 1991 and underwent testing in 1991 and 1997 to establish source water quality and determine required treatment levels. Low levels of total coliform bacteria were detected in the wells during testing. These levels were within acceptable limits established by EPA and the Virginia Department of Health (VDH) and VDH permitted the wells as acceptable water sources.

One of the original wells, PW-1, was found in November 2010 to be groundwater under the direct influence of surface water (GUDI). From that point forward, a level of treatment different than what is currently available to Loudoun Water was required in order for it to be used as a raw water source. As a result, the well was shut down and remains out of service. The well may be used again if the appropriate level of treatment is placed on the well.

PW-2, the other original well serving the community, remains in service as an acceptable water source.

A third well, Well F, was drilled in 2010 and underwent testing in 2011 prior to approval for use by VDH. The well experienced an event involving high turbidity in August 2011 and an investigation was conducted to determine the cause. The investigation determined that the event was caused by unforeseen hydraulic changes in water flow and pressure that can be addressed by the installation of a pump control valve.

Well F was confirmed as an acceptable water source that did not suffer damage during the event or the subsequent earthquake that followed later that month. Following the installation of the valve and approval of the work by VDH, Well F will be returned to service.

For more information about the Raspberry Falls Water System, please visit the Raspberry Falls page under Community Systems at www.loudounwater.org.

Water Quality Issues

In 2006, coliform bacteria was detected in Wells PW-1 and PW-2 during routine testing and triggered sampling regimens to determine the level of bacteria. Testing continued into the fall of 2006 and, in 2007, Loudoun Water worked with VDH to develop a testing program to determine if a correlation could be made with bacteria and rain events. The program generally established a correlation between significant rain events (>1") and the presence of coliform bacteria.

It is important to note that bacteria has never been found in the treated drinking water delivered to homes at any point in time during Loudoun Water's operation of the Raspberry Falls Water System.

In 2008, elevated levels of total coliform bacteria and low levels of E. coli found in the raw water prior to treatment led Loudoun Water to shut off PW-1 as a precaution. Subsequent testing and discussions with VDH led to the conclusion that the well remained a viable raw water source and it was placed back in operation.

Throughout its operation of the Raspberry Falls Community System, Loudoun Water has worked closely with VDH and its regulatory process. In response to data received during the regulatory process, Loudoun Water instituted a protocol that tested PW-1 and PW-2 four times more frequently than what is required by VDH with the goal of determining if the wells were GUDI.

Based on the analysis of the samples taken from May through October 2010, Loudoun Water was informed by VDH on November 23, 2010 that PW-1 was GUDI. PW-2 was not found to be GUDI and remains an acceptable water source.

In the letter detailing the GUDI determination, VDH directed Loudoun Water to consider several actions to address the situation, including the installation of filtration and disinfection treatment for the well and a connection to another waterworks such as the Town of Leesburg.

For more information about water quality issues and the November 2010 GUDI determination, please visit the Raspberry Falls page under Community Systems at www.loudounwater.org.

Response to VDH

In response to the GUDI determination, Loudoun Water's Board of Directors directed staff in a December 2010 resolution to consider installation of filtration and disinfection treatment at Raspberry Falls as an option and to evaluate the practicable options which were consistent with the Loudoun County Revised General Plan.

Following the resolution, the Loudoun County Board of Supervisors requested that Loudoun Water also study a pipeline extension of Town of Leesburg water to Raspberry Falls. Loudoun Water's board agreed to do so in January 2011.



Water Quality Issues

SELMA ESTATES COMMUNITY SYSTEM

Water is supplied to Selma Estates currently by two community wells, Well 9F and Well 1B. In compliance with VDH regulations, Loudoun Water has strict protocols in place which assure that all drinking water we supply to our customers meets all Safe Drinking Water Act requirements. The treated drinking water delivered to Selma Estates homes has always met these requirements. It is properly disinfected with appropriate levels of chlorine. Regular sampling of the treated water has never shown any bacteria.

Starting in January 2011, Loudoun Water proactively implemented a testing program for Selma Estates' untreated water wells that samples them at several times the frequency required by the Virginia Department of Health (VDH). Following the storms of April 28, 2011, Loudoun Water sampled the water from Selma Estates' untreated water wells and followed up with a second series of tests one week later.

The results of these two rounds of testing showed two positive test results at the lowest detectable level for E. Coli in Well 9F. E. Coli was not found at any level in Selma Estates' other production well, Well 1B. Based on these results, Loudoun Water worked with VDH and implemented the appropriate testing protocol to determine if Well 9F is groundwater under the direct influence of surface water (GUDI). The protocol required 20 rounds of samples be taken over a set period of time to make a determination. Loudoun Water will share these test results after the protocol is completed. It is important to note that no E. Coli was found in the treated drinking water served to Selma Estates' customers and that at no time was the public health at risk. Residents did not need to take any action.

THE STUDIES

For eight months, Loudoun Water worked with Hazen & Sawyer, a leading environmental engineering firm, and the Town of Leesburg to produce studies that would objectively evaluate and determine the technically viable options for the Raspberry Falls community.

(NOTE: These studies, and a comprehensive list of FAQs, can be found on both the Raspberry Falls and Selma Estates pages under Community Systems at www.loudounwater.org.)

A framework was developed so that the studies would objectively evaluate and determine – without emotional inputs or arguments – the technically viable options and inform the decision-making process that would follow to determine the appropriate solution or solutions.

The studies were not intended to provide an evaluation of need for additional treatment or for a pipeline. The Well PW-1 GUDI determination, however, highlighted the nature of wells in limestone geology; that some – but not all – wells in the limestone can become under the direct influence of surface water over time and require a different level of treatment.

This situation is not unique to Raspberry Falls; water wells that have become GUDI can be found throughout the Shenandoah Valley. The studies also considered potential changes in U.S. Environmental Protection Agency and VDH regulations.

The studies also do not make a decision on one overall option to be used to address the situation. Instead, the treatment study puts forward a preferred treatment option, while the pipeline study puts forward a preferred alignment.

Definitions

Before detailing the studies, it is important to review where our drinking water comes from and how it is defined by the EPA and VDH. This is important because how a water source is defined determines how we need to treat it.

Surface water is all water open to the atmosphere and subject to surface runoff like the Potomac River or Goose Creek Reservoir. This water requires surface water treatment like that provided by the Town of Leesburg.

Groundwater is essentially water from all sources not classified as surface water. This water is located beneath the surface and is filtered by the soil. This is the water filtering into wells PW-2 and Well F.



GUDI is groundwater under the direct influence of surface water. In the case of PW-1, GUDI water is defined as water beneath the surface experiencing significant and relatively rapid shifts that mirror climatological or surface water conditions. A GUDI determination for a well does NOT mean it is contaminated and cannot be used as a potable well. Wells throughout the Shenandoah Valley have been declared GUDI and are still in use today as potable wells with a different level of treatment.

It is important to note that GUDI determinations are specific to each well. This is why PW-2 and Well F are acceptable for use when PW-1 is not currently acceptable.



TREATMENT STUDY

Criteria

The treatment study evaluated the options based on the following criteria:

- Raw water quality
- Finished water quality
- Regulatory requirements
- Operational requirements
- Cost effectiveness
- Reliability
- VDH approval
- Ability to modify for future water quality challenges

Water Quality Considerations

Loudoun Water routinely tests and analyzes the untreated groundwater filtering into the wells in operation in Raspberry Falls and Selma Estates. There are minimal differences in the groundwater quality found in Raspberry Falls and the groundwater quality found in Selma Estates. Loudoun Water's treatment process currently produces finished drinking water of near identical quality in both communities that meets Safe Drinking Water Act requirements.

Treatment Options

Based on the criteria, several treatment options were initially considered. Three filtration processes were determined to be viable options moving forward: membrane filtration, adsorption clarification/media filtration and direct filtration.



Membrane filtration is a treatment system where the water is filtered through extremely tiny pores of membrane filters that provide an absolute barrier to particle passage, including bacteria and pathogenic organisms such as *Cryptosporidium*.

Adsorption clarification/media filtration consists of coagulation and flocculation (processes where small particles collide and clump together to form larger particles), adsorption clarification at elevated rates (which allows the particles to get captured and removed), and filtration.

Direct filtration consists of coagulation and filtration, with no clarification/sedimentation barrier.

The options also had to be adaptable to potential changes in EPA and VDH regulations. Over the years, several important regulations concerning the overall water industry have been made in addition to changes made in our permits to operate the Raspberry Falls and Selma Estates systems.

Preferred Treatment Option

After reviewing the three viable options, Hazen and Sawyer determined membrane treatment as the preferred option among the treatment options to address the Raspberry Falls situation.

Membrane filtration offered the following benefits:

- A proven technology for GUDI water supplies, allowing PW-1 to be put back into service;
- An absolute barrier to particle passage;
- An automated process with advanced controls, minimizing demands on staff;
- No usage of pretreatment chemicals;
- Less susceptibility to low turbidity issues that may affect other conventional technologies; and
- The lowest generation of residuals among the technologies evaluated.

Membrane filtration also is in compliance with VDH regulations. VDH recognizes membrane filtration as an acceptable option for treatment of GUDI water wells. At least 32 GUDI water wells found in the Shenandoah Valley have VDH-permitted membrane systems treating the water.

Cost Estimates

The estimated costs for the preferred membrane filtration option servicing Raspberry Falls only are as follows:

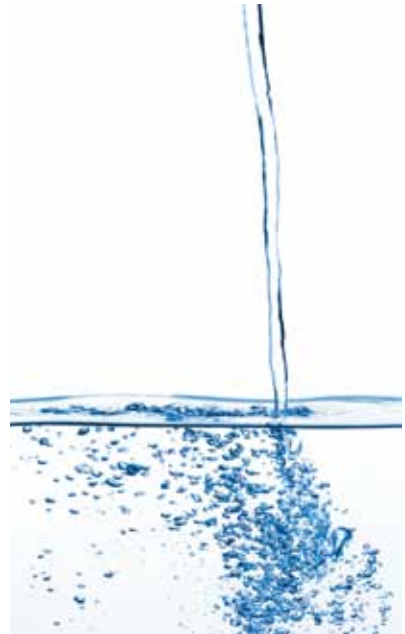
- Estimated capital costs of \$4 million, covering the construction of the water treatment plant.
- Estimated annual operating costs of \$118,000 to pay for pumping the water throughout the system, the use of chemicals in the treatment process, and staffing costs.
- Estimated life cycle costs of \$7.3 million to cover the overall costs plus the replacement of the system's key components at various stages in time and the need to upgrade the facility at the end of its expected 50-year life cycle.

The estimated costs for the preferred membrane filtration option servicing Selma Estates only are as follows:

- Estimated capital costs of \$3 million, covering the construction of the water treatment plant.
- Estimated annual operating costs of \$151,000 to pay for pumping the water throughout the system, the use of chemicals in the treatment process, and staffing costs.
- Estimated life cycle costs of \$7.3 million to cover the overall costs plus the replacement of the system's key components at various stages in time and the need to upgrade the facility at the end of its expected 50-year life cycle.

The estimated costs for the preferred membrane filtration option servicing both Raspberry Falls and Selma Estates with one system are as follows:

- Estimated capital costs of \$8 million, covering the construction of the water treatment plant.
- Estimated annual operating costs of \$219,000 to pay for pumping the water throughout the system, the use of chemicals in the treatment process, and staffing costs.
- Estimated life cycle costs of \$14.3 million to cover the overall costs plus the replacement of the system's key components at various stages in time and the need to upgrade the facility at the end of its expected 50-year life cycle.



Cost per Lot

In response to a question from the Loudoun County Board of Supervisors received before our formal presentation to the body, Hazen and Sawyer calculated the cost of the preferred treatment option per lot in Raspberry Falls spread out over a period of 20 years. The cost per lot for the preferred treatment option for Raspberry Falls only is estimated to be \$1,830 per year for 20 years. For Selma Estates only, the cost per lot is estimated to be \$1,310 per year for 20 years. For a combined system serving both Raspberry Falls and Selma Estates, the cost per lot is estimated to be \$1,570 per year for 20 years.

Implementation Timeline

Finally, the treatment study outlined a likely implementation timeline for the membrane filtration option. The construction and operation of a new water treatment plant would take an estimated two years from concept approval to system start-up.

This schedule takes into consideration:

- VDH regulatory review and approval;
- Preliminary engineering;
- Design and permitting;
- Bidding and award of the construction contract; and
- Actual construction.

NOTE: The membrane filtration option does not require legislative action by the Loudoun County Board of Supervisors or the Town of Leesburg for Loudoun Water to begin implementation.

(NOTE: The treatment study, and a comprehensive list of FAQs, can be found on both the Raspberry Falls and Selma Estates pages under Community Systems at www.loudounwater.org.)

Water Quality Considerations

PIPELINE STUDY

Criteria

The pipeline study evaluated the options based on the following criteria:

- Finished water quality (chlorine residual, DBPs)
- Constructability
- Property acquisition
- Environmental impacts
- Permitting
- Hydraulic capacity
- Operational requirements
- Cost effectiveness

Loudoun Water routinely tests and analyzes the untreated groundwater filtering into the wells in operation in Raspberry Falls and Selma Estates. The Town of Leesburg routinely tests the untreated surface water being pumped into their system from the Potomac River.

There are significant differences in the quality of the groundwater in the Raspberry Falls and Selma Estates areas and what is found in surface water coming from the Potomac River. Among the differences are the higher and more variable levels of turbidity, natural organic content and coliform (an indicator of bacteriologic quality) found in surface water from the Potomac.

The differences in quality between groundwater and surface water from the Potomac River are, for the most part, mitigated through the treatment processes with one important exception, the creation of disinfection byproducts during surface water treatment. These byproducts are formed when chlorine reacts with natural organic matter in the Potomac River water during treatment by the Town of Leesburg. Travel time and temperature are among the other factors behind the formation of these potential human carcinogens.

While the levels of disinfection byproducts found in the Town of Leesburg's system currently meet EPA and VDH regulations, the extension of town water to Raspberry Falls adds to the water's travel time and would increase the levels of disinfection byproducts. Stricter EPA regulations will become effective in the near future. There is a distinct possibility that these increased levels will fall out of acceptable ranges and require action by the utility.

Pipeline Options

Four pipeline options/alignments were considered. All alignment descriptions are simplified:

Alternative 1: A gravity feed from Leesburg's main zone that would not require pumping of the water to the community. It would run along Route 15 from Tuscarora High School to Raspberry Falls.

Alternative 2: A gravity feed from Leesburg's Western zone that would not require the pumping of water to the community. It would run from behind Ida Lee Park to Raspberry Falls.

Alternative 3: A feed that would require pumping from Leesburg's main zone to the community. It would run along Route 15 from Tuscarora High School to Raspberry Falls.

Alternative 4: A feed that would require pumping from Leesburg's Western Zone to the community. It would run behind Ida Lee Park to Raspberry Falls.

Preferred Pipeline Option

After reviewing the pipeline characteristics and alignments, Hazen and Sawyer detailed Alternative 3 as the preferred pipeline option to address the Raspberry Falls situation for the following reasons:

- The alignment is the shortest distance option, minimizing constructability issues;
- By following Route 15, easement acquisition is minimized. As a result, this option will have the shortest implementation time; and
- The capital and life cycle costs are the lowest among the options.

Cost Estimates

The pipeline study developed the following costs estimates by working with the Town of Leesburg, which is projected to be the operator of the system. The Town of Leesburg supplied the estimates for the annual operating and life cycle costs.

- Estimated capital costs of \$7.5 million, covering construction-related costs.
- Estimated annual operating costs of \$418,000 cover the costs of Town of Leesburg treatment, pumping of the water and labor.
- Estimated life cycle costs of \$18.9 million to cover the overall costs plus the replacement of the system's key components at various stages in time and the need to upgrade the facility at the end of its expected 50-year life cycle.

Cost per Lot

In response to a question from the Loudoun County Board of Supervisors received before our formal presentation to the body, Hazen and Sawyer calculated the cost of the preferred pipeline option per lot in Raspberry Falls spread out over a period of 20 years. The cost per lot is estimated at \$4,260 per year for 20 years.



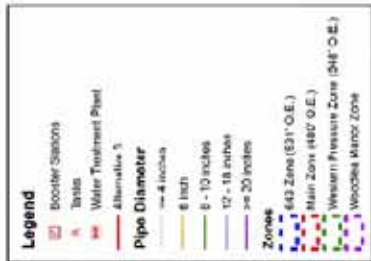
Implementation Timeline

It is projected it will take two to two-and-a-half years to implement the preferred pipeline option. This estimated timeframe covers easement acquisition, design and construction permitting, bidding and award, and the actual construction time.

NOTE: This implementation timeline does not include the time required for legislative action by the Board of Supervisors, which would have to revise the Loudoun County General Plan and issue a Commission Permit to allow the pipeline to Raspberry Falls because it is in the Rural Policy Area of the General Plan. The timeline also does not include the time required for legislative action by the Town of Leesburg.

(NOTE: The pipeline study, and a comprehensive list of FAQs, can be found on both the Raspberry Falls and Selma Estates pages under Community Systems at www.loudounwater.org.)

Town of Leesburg Main Pressure Zone Supply to Existing Raspberry Falls WTP



OPTION COMPARISON

OPTION	WATER QUALITY	CAPITAL COSTS	OPERATING COSTS (Annual)	LIFE-CYCLE COSTS (50 years)	COST PER LOT (20 years)	IMPLEMENTATION TIMELINE (Estimated)	LEGISLATIVE ACTION REQ'D
TREATMENT Membrane Filtration (Raspberry Falls Only)	Meets Safe Drinking Water Act requirements	\$4 million	\$118,000	\$7.3 million	\$1,830/year	Two years	No
TREATMENT Membrane Filtration (Selma Estates Only)	Meets Safe Drinking Water Act requirements	\$3 million	\$151,000	\$7.3 million	\$1,310/year	Two years	No
TREATMENT Membrane Filtration (Combined System)	Meets Safe Drinking Water Act requirements	\$8 million	\$219,000	\$14.3 million	\$1,570/year	Two years	No
PIPELINE (Alternative 3)	Meets Safe Drinking Water Act requirements (Potential disinfection byproduct issue)	\$7.5 million	\$418,000	\$18.9 million	\$4,260/year	Two to two-and-a-half years (Following legislative approval process)	Yes, by Loudoun County Board of Supervisors, Town of Leesburg

COMMUNITY INPUT

In addition to being sent to key stakeholders like the Loudoun County Board of Supervisors and the Town of Leesburg, the treatment and pipeline studies were transmitted on August 22, 2011, to the residents of Raspberry Falls and Selma Estates via email messages and through postings on the Raspberry Falls and Selma Estates pages of our website, loudounwater.org. The Raspberry Falls HOA was also informed of the release.

Loudoun Water also conducted a media briefing which secured coverage of the studies' release in the Washington Post, Leesburg Today and Loudoun Times-Mirror. A Guest Opinion by Loudoun Water Board Chairman Fred Jennings also ran in the Loudoun Times-Mirror the day of the release.

All of these efforts were designed to inform the public about the studies and included Loudoun Water's request for public comments and questions about the study results, especially from the residents of Raspberry Falls and Selma Estates, through the Loudoun Water website or a special email address, studies@loudounwater.org.

Following our presentation to the Loudoun County Board of

Supervisors and the Town of Leesburg, Loudoun Water agreed to hold a community meeting to make a similar presentation about the studies to any Raspberry Falls and Selma Estates resident who wishes to attend.

During the meeting, representatives from Loudoun Water, Hazen & Sawyer and other key stakeholders will present the findings of our studies in greater detail and provide answers to the questions/comments we have already received as part of the public comment process. Residents will have the opportunity to provide us with additional questions and comments following the meeting.

After presenting community input to the Board of Supervisors, the Town of Leesburg, and Loudoun Water's Board of Directors, it is anticipated that a decision will be made regarding the appropriate long-term option for the residents of the communities.

We stand ready to work collaboratively with all of the affected parties to select the appropriate long-term solution and to consider financing vehicles consistent with past actions taken by both the Board of Supervisors and the Leesburg Town Council to pay for the solution.

Contact Information

To ensure questions/comments are not missed or misinterpreted, Loudoun Water is only taking questions/comments in writing. To submit questions or comments, please visit our Website, www.loudounwater.org and click on Contact Us, or email Loudoun Water with your questions/comments at studies@loudounwater.org.

You can also write to us at:

Loudoun Water
44865 Loudoun Water Way
Ashburn, VA 20146

Please write Attn: Raspberry Falls on the envelope.



LOUDOUN  WATER

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www.loudounwater.org