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Ask Tom! Column

Cluster Systems - Advanced Treatment and Community Character

Guest article by Dennis F. Hallahan, P.E., Technical Director, Infiltrator Systems Inc

Introduction

Cluster systems have gained much recognition as a viable solution as small cities, towns and counties face complex wastewater management issues. Interest in these systems continues to grow due because they provide communities with high quality, cost efficient wastewater treatment, while protecting community character and reducing the urban sprawl.

(Photo: Snake River in Jackson Hole required an onsite wastewater treatment system which would preserve the natural habitat. Infiltrator Systems' chambers were installed to minimize required leach field dimensions.)

The Cluster Systems of Today

There are many definitions of a cluster system. The most used is that cluster systems serve a number of structures with more than one and as many as hundreds of connections. Also known as community systems, cluster systems are a treatment option when traditional onsite systems (a single system for each structure) or the extending of sewers are not viable alternatives.

The decision regarding which type of system to use remains based on a site's soils, groundwater and bedrock elevation, topography, and regulatory requirements. Similar to individual onsite systems, cluster systems typically treat and dispose of effluent within the development limits. Subsurface, non-point discharges are the norm; however surface discharge is also an option. One of the benefits with cluster systems is that they offer a wide range of methods available to collect, treat, and dispose of the effluent. This allows the designer to choose the most cost-effective technology that is appropriate for the community.

Community Opportunities

The opportunities and benefits presented to communities by the cluster system approach are significant. Many communities have master plans that detail the growth patterns within the community with the primary goal of maintaining community character. In many cases, these plans become idealistic goals once a conventional sewer system is installed. Historically, growth has followed sewering resulting in urban sprawl. Cluster systems allow controlled and sustainable development. The community can have the best of both worlds by maintaining its character and increasing its tax base. This sustainable development model is gaining attention with community designers, developers and regulators nationwide.

Environmentally sensitive sites are especially well suited for cluster systems. The treatment component of the cluster system can be designed to treat to a higher standard than a conventional onsite wastewater system. It is extremely valuable in the removal of constituents of concern such as nitrogen in saltwater bodies or phosphorous in freshwater ecosystems. In addition, the treatment and dispersal components can be located in a more environmentally protective location. This might mean installing the cluster system up and out of the flood plain, in a location of deeper/better soils, or a greater distance away from a body of water.

If a cluster system has a subsurface disposal component then that can be an environmental improvement over a surface, point discharge approach. With water scarcity a major concern even in the eastern United States, cluster systems represent a method for better management of groundwater resources. Water is a valuable resource and cluster systems allow the replacement (recycling) of the water within the same watershed. This can sustain the water balance within the watershed and avoid inter-basin transfers of water.

Management – The Most Vital Component

There are many components critical to the success of any wastewater management system including siting, design, installation, and management. Management is just as vital as all of the others, but traditionally it has been the Achilles Heel for cluster systems. Public perception may be the biggest barrier prior to installation, but once the system is installed, management becomes the vital component.

As is the case with large municipal wastewater treatment plants, operations and maintenance (O&M) is critical to the success of a cluster or community system. Due to size efficiencies and differing regulatory requirements, cluster systems may offer less intensive O&M than traditional sewers and are therefore more economical to operate. Also, cluster systems served by small treatment plants typically do not require a full-time operator.

These small treatment plants (up to 500,000 gpd) only require visits by an operator 2-3 times per week for 2-3 hours. As a result, one trained operator can manage several facilities. Advances in technology via web-based remote monitoring or telemetry have raised system management to a new level of efficiency and automation. The system can be monitored around the clock. If there are problems, the provider is notified immediately.

As part of the local approval process, the developer can contract for system management for the initial startup period (1-2 years). This allows the system to get up and running well. Then, the system can be turned over to the municipality or district. At that time, the municipality (or existing utility) has a new system paid for by the developer as source of income to fund the necessary O&M.

O&M considerations should play a large role up front in the design of the system. For example, the design of a cluster system could include features such as:

- Easy access to system components that require inspection, maintenance, and repair/replacement.
- Reliable products and materials with a long design life and manufacturers' warranties.
- Watertight components such as tanks, pump chambers, manholes, piping, fittings and lids to prevent surface or ground water infiltration.
- Watertight riser lids secured with a specialized tool to help prevent unauthorized entry. The lids may vary in color such as green to blend well with surrounding vegetation.
- Risers flush with the grade to allow for easy access without yard excavation. This prevents further damage or maintenance from to soil, rocks or other material entering the system.
- Pumps labeled for identification and labels coinciding with the labeling on the control panel.
- Metal detection tape (locator tape) to assist in locating buried system components such as pressure lines that do not have riser lids.
- Vegetative cover that is maintained if the system disposes of effluent onsite via a subsurface disposal field. The vegetation (typically grass) can serve many purposes such as evapotranspiration, nutrient uptake, and soil erosion prevention.

Cluster System Barriers

There are barriers to the acceptance, approval, and installation of cluster system designs. Among these are the uninformed public, regulatory officials, and the design community. The Onsite Wastewater Treatment Manual (EPA 2002) lists several barriers including:

- Public misperceptions that centralized sewage treatment plants perform better, protect property values, and are more acceptable than decentralized systems.
- Prescriptive requirements outlined in state onsite regulations that discourage local jurisdictions from utilizing a decentralized approach.
- Liability laws that may discourage the use of innovative systems.
- Funding difficulties brought about by various grant guidelines and loan priorities that prevent communities from accessing resources to fund construction of alternative wastewater treatment systems.
- Lack of a suitable O&M provider.
- A subsurface discharge component that may require a sizeable parcel of land.

Cluster Systems – The "new" option

Cluster systems are not a new concept, but they have become more viable given the availability of advanced wastewater technology. The biggest developments have been chambers, which can save critical space and be installed much easier and quicker resulting in lower costs. Also, drip systems are particularly effective on sites with limitations such as high groundwater or high bedrock.

(Photo: A drainfield utilizing Infilltrator Systems' chambers serves over 200 individual and clustered residential homes along the Columbia River in Quincy, WA.)

The drip system does require pretreated effluent, a larger footprint, and specialized installation, whereas chamber systems can be sized to accept any level of treated effluent. And, as previously discussed, the tide is turning in favor of viable management entities. The private and public sector have recognized that due to technological advances, this can be a source of income.

Conclusion

Cluster systems represent an additional option for a community, but barrier that remains is the resistance to change. Economic conditions however, have made resistors more receptive to new approaches. As loss of funding continues to be an issue, engineers and communities will be forced to be more resourceful with their financial resources and innovative with their wastewater management solutions. In this scenario, cluster treatment will move to the forefront of the options that will provide excellent treatment at a reasonable cost for sustainable development.

About our author

Mr. Dennis Hallahan received his MS in civil engineering from the University of Connecticut and his BS in civil engineering from the University of Vermont. Dennis is a registered professional engineer in Colorado and Connecticut. He also holds patents for several onsite wastewater products.

Dennis has over sixteen years of experience in the design and construction of onsite wastewater treatment systems. He has authored several articles for onsite industry magazines and has given numerous presentations nationally on the science and fundamentals of onsite wastewater treatment systems. Dennis joined Infiltrator Systems Inc. of Old Saybrook, Connecticut in 1999 and is currently their Technical Director.

For more information contact

Dennis F. Hallahan, P.E.
Technical Director
Infiltrator Systems Inc.
6 Business Park Road
P.O. Box 768
Old Saybrook, CT, 06475
Telephone: (860) 577-7100
Email: dhallahan@infiltratorsystems.net
Web site: http://www.infiltratorsystems.com/

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Welcome to Ask Tom!, a monthly column by our resident water treatment guru, Tom Keenan of National Environmental Services Agency (NESA). Tom addresses the issues that bug you the most. And Tom knows!! With 35 years experience in providing environmental support services to public and private sector clients on a wide range of environmental issues.

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