

Rethinking Recreation

Wastewater treatment best practices for campgrounds and recreational vehicle parks

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The novel coronavirus, SARS-CoV-2 (COVID-19), has changed much about modern life in America. One interesting change is in how people spend free time. Vacations have shifted away from plane trips and hotel-based stays in favor of motor homes and recreational vehicles (RVs). This is good news for RV manufacturers experiencing record demand for their products and for campgrounds and RV parks. Furthermore, campgrounds have evolved to include more types of accommodations and amenities such as full showers, laundries, kitchens or restaurants, convenience stores, recreational water features, and outdoor attractions. This creates new wastewater treatment challenges for the RV/campground owner. Assuming many of these park or campground sites are located well outside the boundaries of centralized sewer systems, this places them in need of distributed wastewater treatment for any new systems or upgrades to existing ones.

Wasteloads, Treatment, and Discharge

Wastewater system designers and engineers should refer to local and state codes for flow and load design standards when developing a new site. However, they should keep in mind that the chemical oxygen demand (COD), biochemical oxygen demand, and oil and grease constituents are generally higher than residential-strength wastewater and can vary greatly from site to site. This is partly because site unit flows are often lower than residential or municipal flows, which contribute to higher influent concentrations. In addition, most campers use enzymatic or biological accelerants to assist the breakdown of solids in the waste stream. While this is encouraged to avoid clogs in the blackwater holding tanks and helps with odors inside the campers, these additives increase organic loads and can be deadly to treatment system biology. Additives that have



Yogi Bear's Jellystone Park in Texas features a Delta Packaged Treatment Plant, a self-contained unit.
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warnings like “danger” or “poison” can harm treatment even if described as “biodegradable.”

The use of inhibitory cleaning agents can also be an issue. These include quaternary ammonium compounds (also known as quats), which can have lasting effects on biological treatment systems. These compounds sometimes enter the collection system from individual

campers but are often found in commercial kitchens and bathroom/shower houses that can be found at trending, full-featured sites. Quats can completely stall biological activity in treatment systems, even in small concentrations.

The preferred treatment technologies are often dictated by the discharge methods available at the site. Design engineers should

Best Practices in Action

Yogi Bear's Jellystone Park, Texas

This popular, full-service RV campground features cabins, tent sites, shower houses, laundry facilities, swimming pools, and two food service venues. The park's existing wastewater treatment system had been expanded many times and was again at capacity, restricting park service expansion and requiring costly and time-consuming maintenance. The design engineer was tasked with designing a new system that could handle the wastewater flow of 113,562 L/d (30,000 gal/d) and meet all Texas Commission of Environmental Quality standards. The selected treatment system features the extended aeration process. The facility features dual aeration basins, sludge holding tanks, blowers, pumps, and a single, 10-foot-diameter mechanical clarifier.

Henly RV Park, Dripping Springs, Texas

This RV park has experienced high growth in recent years. To accommodate this growth, a 5,678 L/d (1,500 gal/d) wastewater treatment system was added in 2019 utilizing submerged attached growth media with subsurface discharge technology. Due to site-specific constraints, it was preferable to install new treatment at the existing site rather than moth ball the old and construct new. A future phase is planned for 2021 to accommodate further expansion.



The self-contained wastewater treatment unit, called a Delta Packaged Treatment Plant, (seen here at Yogi Bear's Jellystone Park in Texas) can be accessed from the top. Infiltrator Water Technologies

carefully consider which discharge strategy is best for the project based on site location, owner preference, operator availability, cost, and state and local regulations. Surface water discharges generally require a higher treatment level than subsurface discharges, and they always require a National Pollutant Discharge Elimination System permit along with operations, monitoring, and reporting requirements. Subsurface discharges are often permitted through a different state agency than surface discharges. These permits are generally less stringent regarding effluent water quality, although these systems will require additional property to site subsurface dispersal fields.

Best Practices

Most distributed systems are small, aerated biological treatment units with some combination of mechanical treatment components. However, considering that the quantity of visitors can vary greatly from season to season and even week to week, the likelihood of finding a one-size-fits-all solution is quite low. The following strategies can be used to overcome these anticipated flow and load variations.

1. Understand that wastewater produced from an RV is emulsified, and, therefore, the design will need to include solids management. If the system chosen utilizes primary settling, this

unit operation will need to be large to allow time for solids settling.

2. Utilize time dosing to spread flows throughout the day and week. RVs have holding tanks for both black and gray water that are periodically drained and flushed. This often takes place on Sunday as visitors pack up to leave after a weekend camping trip. This draining and flushing leads to surge flows and loads to the treatment system.
3. Evaluate system loading based on mass-balance instead of hydraulic loading to ensure proper reactor sizing.
4. Perform a sampling program to establish key influent wasteload parameters. Published values are fine if the estimates are conservative, but nothing is better than real-world data.
5. Size systems with two or more parallel biological treatment trains to allow the operator (if the permit allows) to shut down one or more trains as flows and loads change. Size pumping and air delivery systems accordingly to accommodate lower flow conditions.
6. Evaluate the choices available for treatment, and use technology proven to work on high-strength wastewater that can handle seasonal shifts in flow and load. Systems utilizing attached growth microorganisms are known for their resilience in starvation conditions.



Some sites may have experienced many phases of growth over the years, and they may already have a plethora of various treatment technologies in play. Eliminating these varying and complicated operational headaches in favor of a single treatment solution can free up valuable operations and maintenance resources.
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This will help the system accommodate seasonal fluctuations and bring the system back to life in the spring when flows and loads increase.

Additional Considerations

Other improvements to consider include quality-of-life considerations, such as locating the treatment system away from camper slips, designing blower systems with sound-attenuating enclosures, and hiding treatment systems behind landscaping to avoid a potential eyesore.

Many existing sites will have existing treatment systems, and sometimes these

systems are simple to modify for increased capacity. However, system replacement may be a better choice when existing infrastructure is in poor condition. Each project is unique and reviewing engineers should perform a thorough capacity analysis and equipment review before recommending to salvage or scrap existing unit operations.

Challenges and Lessons Learned

The most difficult challenge to overcome when designing and specifying treatment systems is often owner expectations. Wastewater treatment is generally the lowest-priority expense for a



Campers typically discharge wastewater on Sundays after a weekend of camping. Infiltrator Water Technologies

