



Private Water & Onsite Wastewater Professionals
CONNECTING | SUPPORTING | BUILDING CAPACITY

Onsite Wastewater Systems

A Field Reference to Identify Root Causes & Solutions for System Failures

Introduction

Onsite wastewater treatment systems (OWTS) — including conventional septic systems, aerobic treatment units, and alternative disposal systems — are a critical component of public health infrastructure across the United States. When these systems fail, untreated or partially treated sewage can surface on the ground, back up into buildings, or leach into groundwater and nearby waterways, creating significant risks to human health and the environment.

This resource was developed by the National Environmental Health Association's (NEHA) Private Water & Decentralized Wastewater (PWDW) Program Committee to support environmental public health practitioners in identifying the root causes of onsite sewage system failures and determining appropriate corrective actions. It is intended to complement site-specific assessments and local regulatory requirements, not replace them.

The U.S. Census Bureau has indicated that at least 10% of septic systems have stopped working. Some communities report failure rates as high as 70%.

*U.S. Census Bureau (via Growing Blue / EPA); EPA
1997 Response to Congress*

More than 1 in 5 U.S. households depend on individual septic or community cluster systems to treat their wastewater — approximately 25 million systems nationwide.

*U.S. EPA, About Septic Systems
([epa.gov/septic](https://www.epa.gov/septic))*

The content is organized by system component — Septic Tank, Aerobic Treatment Unit (ATU), Pump/Siphon Tank, and Disposal/Drainfield — and follows a root cause analysis framework to help practitioners move efficiently from failure observation to actionable solution.

How to Use This Resource

Each table below addresses a specific system component and lists:

Failure Type: The observable or reported condition indicating a malfunction

Root Cause: The underlying factor(s) driving the failure

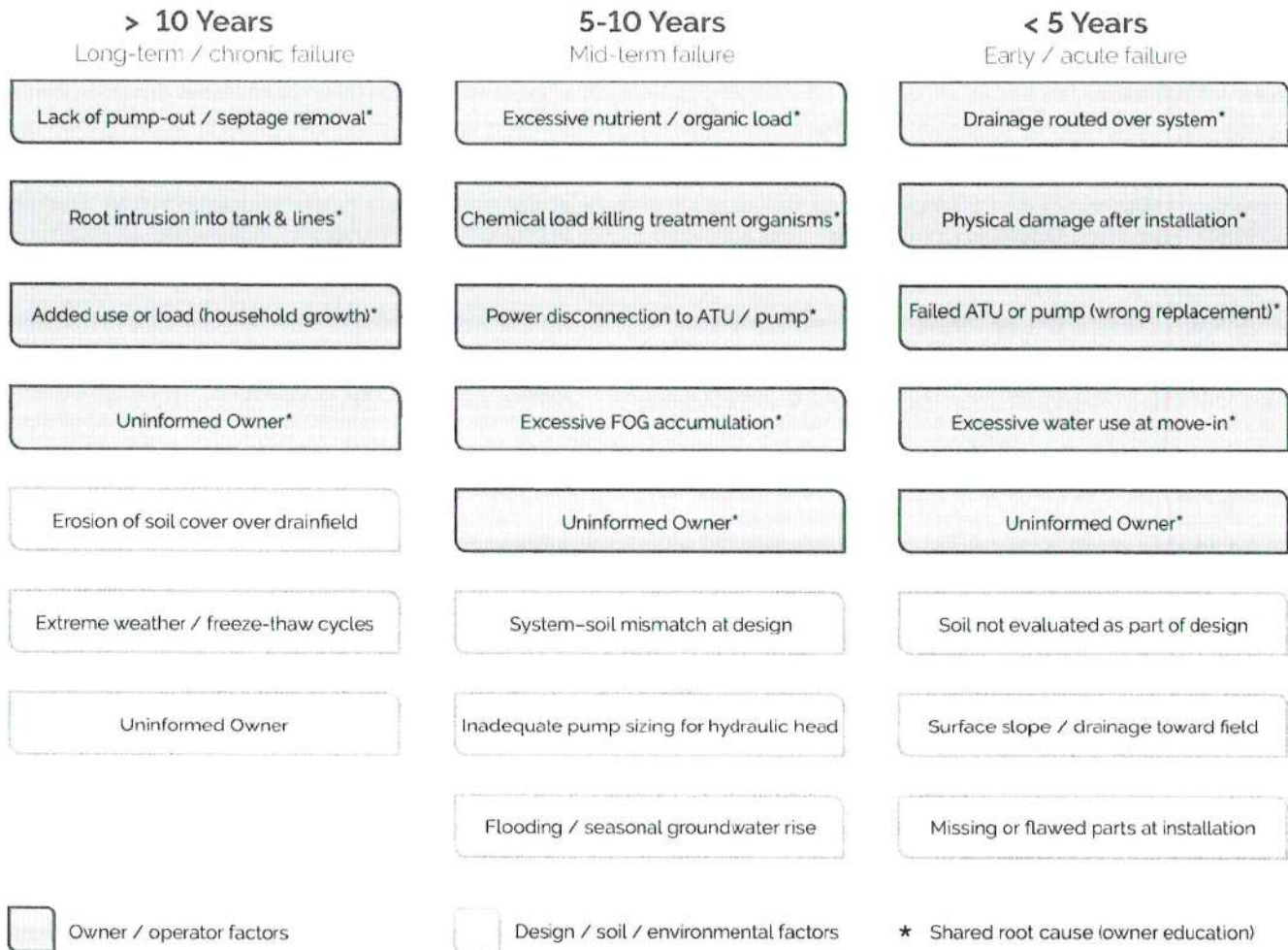
Preventive Action / Solution: Recommended corrective or preventive measures

Note: Many failures involve multiple contributing factors. Use the tables in combination with site observations, system records, and applicable state or local regulations. When in doubt, consult a licensed onsite wastewater professional.

System Failure Root Cause Analysis — Cause & Effect Diagram

The fishbone (Ishikawa) diagram below illustrates the major contributing factors to onsite sewage system failure. Use it as a visual reference alongside the detailed tables that follow.

Figure 1. Root Cause Analysis Onsite Sewage System Failure Fishbone Diagram



1. Septic Tank Failure

Septic tank failure occurs when there is damage to the tank, sewage is emerging from the tank area, or flow out of the tank is restricted, causing backup into plumbing.

System	Failure Type	Root Cause	Preventive Action / Solution
Septic Tank	Excessive solids buildup	Failure to routinely pump septage	Pump tank on a regular schedule (every 3–5 years minimum). Contact a licensed pumper.
	Hydraulic overload	Groundwater or surface water intrusion through	Inspect and seal lids, inlet, and outlet connections. Ensure no water is permitted to accumulate or flow over the tank.

System	Failure Type	Root Cause	Preventive Action / Solution
		unsealed lids, inlets, or outlets	
	Hydraulic overload	Excessive household water use (e.g., multiple laundry loads in one day, high guest volume)	Spread laundry over multiple days. Be mindful of water use during periods of high household occupancy.
	Hydraulic overload	Leaking faucets or toilets; drip-prevention practices in winter	Repair leaks promptly. If dripping faucets are used to prevent freezing, divert the flow to a bucket or outdoors when possible; allow the system to dry out when feasible.
	Hydraulic overload	Surface water pooling over tank, saturating soil or entering risers	Grade soil and install drainage to prevent surface water accumulation above the tank.
	Inappropriate materials flushed	Chemical products killing beneficial organisms needed for solids digestion	Avoid flushing household chemicals, medications, antibacterial soaps, or solvents. Use septic-safe products.
	Physical obstruction	Tree root intrusion into tank piping creating clogs	Maintain appropriate setbacks from trees at installation. Remove roots and consider root barriers if needed.
	Physical obstruction	Solids, paints, fats, oils, and grease causing blockages	Dispose of grease and solids in solid waste, not the drain. Avoid flushing non-biodegradable materials.
	Structural movement / flow disruption	Expansive clay soils shifting tank; uncompacted soil under pipes causing settling or breakage	Place a bed of sand under tanks at installation to stabilize. Compact backfill around pipes properly during installation.

2. Aerobic Treatment Unit (ATU) Failure

ATU failure is characterized by foul-smelling conditions or an excessive nutrient load being released from the system, indicating inadequate treatment.

System	Failure Type	Root Cause	Preventive Action / Solution
Aerobic Treatment Unit (ATU)	System foul-smelling / excess nutrient load	Air pump not functioning or undersized for incoming BOD load	Verify pump size is appropriate for system specifications. Ensure any replacement

System	Failure Type	Root Cause	Preventive Action / Solution
		(common when homeowners self-replace pumps)	pump meets original design requirements — consult a licensed professional
	System foul-smelling / excess nutrient load	Power supply failure or disconnection	Inspect electrical connections and circuit breakers regularly. Install alarms to alert of power loss.
	System foul-smelling / excess nutrient load	Inappropriate materials flushed, causing chemical kill-off of treatment organisms	Educate household members on what should not be flushed. Avoid antibacterial products and household chemicals.
	Physical obstruction	Tree root intrusion into tank piping	Maintain appropriate setbacks from trees. Inspect piping regularly and address root intrusion promptly.
	Physical obstruction	Solids, paints, fats, oils, and grease causing blockages	Dispose of grease in solid waste. Avoid flushing non-biodegradable or hazardous materials.
	Structural movement / flow disruption	Expansive clay soils causing tank movement or pipe separation	Install on stable, compacted base material (e.g., sand bed). Ensure proper compaction of backfill around piping.

3. Pump or Siphon Tank Failure

Pump or siphon tank failure occurs when flow exceeds system capacity or when effluent does not reach the intended treatment or disposal components.

System	Failure Type	Root Cause	Preventive Action / Solution
Pump / Siphon Tank	Flow exceeds capacity or does not reach treatment/disposal	Power supply failure or disconnection	Inspect electrical connections and circuit breakers regularly. Install alarms to alert of power loss or pump failure.
	Pump overload / failure	Pump inadequately sized for hydraulic head or pressure requirements	Verify pump specifications match system design at installation. Consult a licensed professional for replacement.
	Pump overload / failure	Excessive solids accumulation overloading pump or siphon	Assess solids levels every four months. Pump tank when solids are excessive to prevent pump strain.

System	Failure Type	Root Cause	Preventive Action / Solution
	Pump overload/ failure	Float switches improperly placed, improperly attached, or non-functional causing excessive pump cycling	Inspect float switches regularly. Ensure floats are correctly positioned and functioning per system specifications.
	Siphon failure	Siphon damaged or shifted, preventing proper cycling	Inspect siphon components during routine maintenance. Replace damaged siphons promptly.
	Hydraulic overload	Groundwater or surface water intrusion through unsealed lids, inlets, or outlets	Seal all tank penetrations. Prevent water from ponding over or around the tank.
	Physical obstruction	Tree root intrusion into piping	Maintain setbacks from trees. Inspect and clear roots as needed.
	Structural movement / flow disruption	Expansive clay soils or uncompacted fill causing tank movement or pipe damage	Place sand bed under tanks. Properly compact backfill around all piping.

4. Disposal System / Drainfield Failure

Disposal system failure is indicated when effluent or sewage pools on the surface or flows from the area intended for final treatment and dispersal.

System	Failure Type	Root Cause	Preventive Action / Solution
Disposal / Drainfield	Effluent pooling or surfacing from disposal area	Excessive water use or flow from household pushing too much volume into the field	Conserve water and spread use over time. Identify and repair household leaks.
	Hydraulic overload	Field not appropriately sized for household demand at the time of design or installation	Consult a licensed engineer for field capacity assessment. Consider expansion or alternative system if undersized.
	Hydraulic overload	Soil absorption capacity not properly evaluated during design; system not appropriate for soil class	Require accurate soil evaluation (e.g., percolation or soil morphology assessment) prior to installation. Ensure design matches site-specific soil capacity.



System	Failure Type	Root Cause	Preventive Action / Solution
	Hydraulic overload	Pump or siphon dose exceeds field capacity	Verify dose timing and volume match field design specifications. Adjust controls if needed.
	Hydraulic overload	Field placed in path of significant surface drainage	Evaluate drainage patterns before installation. Redirect or intercept surface runoff away from disposal area.
	Hydraulic overload	Buried debris or fill areas creating conduit for water movement near the system	Identify buried debris and fill zones prior to installation. Avoid siting fields near fill areas.
	Hydraulic overload	Swimming pool backwash routed into the system	Route pool backwash to an appropriate discharge point, not the onsite system.
	Hydraulic overload	Surface or groundwater intrusion into disposal field	Evaluate and address groundwater table depth and surface drainage at the site. Install diversion drains if needed.
	Soil issues	Erosion removing protective soil cover over the system	Maintain vegetative cover over disposal area. Address erosion with grading or erosion control measures.
	Soil issues	Shrink-swell soils causing pipe separation, bellies, or flat spots	Select appropriate pipe materials and bedding for site soil conditions. Inspect piping after extended dry or wet periods.
	Soil issues	Excessive slope over absorption area, allowing drainage pooling	Account for slope in system design. Use pressure distribution or other designs appropriate for sloped sites.
	Root intrusion	Tree or shrub roots clogging disposal lines	Maintain setbacks from trees and large shrubs. Inspect lines periodically and clear roots as needed. Remove encroaching vegetation.
	Solids accumulation	Wastewater moving too quickly through tanks, or excessive solids buildup clogging field lines, emitter holes, and soil	Follow routine pumping schedule. Do not allow solids to accumulate beyond recommended levels. Ensure proper baffle installation in tank to slow effluent flow.
	Biomat overgrowth	Excessive biomat development slowing or stopping percolation	Allow field to rest when possible (alternating field distribution helps). Avoid overloading the system. A healthy, not excessive, biomat is normal and functional.



System	Failure Type	Root Cause	Preventive Action / Solution
	Heavy equipment damage	Soil compaction from vehicle or equipment traffic over the system	Mark field boundaries clearly. Restrict all vehicle and equipment access over the disposal area.
	Heavy equipment damage	Physical damage to pipes, chambers, or other components from heavy equipment	Educate property owners on the location and vulnerability of system components. Post warning signs or install physical barriers as needed.

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