

**NORTH CAROLINA DEPARTMENT OF HEALTH AND HUMAN SERVICES
DIVISION OF PUBLIC HEALTH
ENVIRONMENTAL HEALTH SECTION
ON-SITE WATER PROTECTION BRANCH**

INNOVATIVE WASTEWATER SYSTEM APPROVAL
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Innovative Wastewater System Approval Number: IWWS 2004-01-R3

For:	Flow Equalization Systems	
Approval Date:	July 6, 2004	
	December 31, 2024	Updated for 18E and renewed for 2025
	December 31, 2025	Renewed for 2026

In accordance with G.S. 130A-343 and 15A NCAC 18E Section .1700, an approval for flow equalization systems has been renewed and found the to meet the requirements of an innovative system when the following conditions are met.

I. General

Flow equalization systems may be used for *non-residential* facilities that regularly and predictably operate at less than full capacity. Examples of applicable facilities include:

- Churches,
- Schools,
- Offices,
- Flea Markets, and
- Stadiums

Other facilities may be permitted for flow equalization when specifically approved by the State on a case-by-case basis.

This approval does not include flow equalization prior to pre-treatment devices.

The local health department (LHD) shall issue an Improvement Permit (IP) or Construction Authorization (CA) allowing for the use of the proposed Innovative system upon a finding that all provisions of this approval and all other applicable rules shall be met. The CA shall contain conditions regarding the design, installation, and use of the flow equalization system. The Operation Permit (OP) shall specify system components, requirements for operation and maintenance, and restrictions on operation of the facility.

Use of flow equalization in systems that have a design flow exceeding 3,000 gallons/day (gpd) or when the criteria of this Innovative approval are proposed not to be followed may be considered for review and approval by the Department on a case-by-case basis, prior to permitting by the LHD.

II. Definitions

- A. Equalized Daily Flow – The total volume of wastewater generated by flow events at the facility during the flow equalization cycle divided by the number of days in the cycle.
- B. Flow Equalization Cycle – The time period in which wastewater will be stored and dosed. For example, the cycle could be a seven day or 14 day cycle.
- C. Flow Event – An event in the flow equalization cycle in which wastewater will be generated. For example, a church service, sporting event, wedding, etc.
- D. Orifice Control Device – A calibrated flow restriction placed in the supply line prior to the dispersal field that allows the flow to be controlled.
- E. Flow Balance – A daily account of the amount of stored effluent in the equalization tank which is derived from the incoming flow, residual storage, and the outgoing flow. The flow balance shows the day of the week, the amount of wastewater generated, the amount of wastewater dosed, and the residual amount of effluent left in the dosing tank each day. At the end of the flow equalization cycle, the sum of the incoming flow should equal the sum of the amount dosed.

III. System Description

The system consists of a septic tank, grease tank if required, pump tank, pump, timed dose control panel with appurtenances, and a dispersal field.

IV. Siting Criteria

Flow equalization systems may be permitted on sites classified as Suitable and for any system that may be approved pursuant to 15A NCAC 18E.

V. System Sizing

The system sizing criteria shall be based upon the long-term acceptance rate specified in the appropriate portion of the rules or the Provisional, Innovative, or Accepted system approval for the type of dispersal system to be used.

VI. Special Site Evaluation

A special site evaluation may be required based on the proposed dispersal system. Refer to manufacturer specific drip approvals and 15A NCAC 18E .0510.

VII. Design Criteria

- A. The septic tank and effluent filter shall be sized based on the peak day, where Q is the largest projected 24-hour waste flow in the flow equalization cycle.
- B. The grease trap shall be sized in accordance with 15A NCAC 18E .0803.
- C. The pump tank shall be sized in accordance with 15A NCAC 18E .0802, with the following exceptions:
 1. Equalization Volume is based on the highest cumulative volume of effluent as indicated by the flow balance calculation;
 2. The high-water alarm shall be set to activate at or above the equalization volume; and
 3. Emergency Storage Volume is based on the effluent volume that equals Q as defined in VII.a.
- D. In addition to the requirements of 15A NCAC 18E .1102, the pump shall be sized to deliver the minimum required flow at the calculated total dynamic head. The pump shall also deliver a flow that meets or exceeds a scour velocity of two feet/second, using $Q = V \cdot 2.45d^2$, where V = scour velocity = two feet/second and d = inside pipe diameter in inches. The minimum delivery rate at a residual operating pressure of two feet shall be at least:
 1. 13 GPM for 1-½ inch Sch 40 pipe;
 2. 21 GPM for 2-inch Sch 40 pipe; and
 3. 46 GPM for 3-inch Sch 40 pipe.
- E. The control panel shall meet the requirements of 15A NCAC 18E .1103 and also include the following:
 1. High-water level alarm event counter
 2. Timer over-ride counter
 3. Control circuit fuse
 4. Alarm circuit fuse
 5. Float switch terminal block
 6. For each pump, either a programmable timer with variable controls for setting the on and off times from .05 seconds to 30 hours, or a repeat cycle timer that affords the amount of control needed for the pump run time and off time.
 11. Circuit breaker for the alarm /control circuit
 12. NEMA 4X Alarm strobe beacon
 13. NEMA 4X Alarm Horn (83 decibels at three feet minimum) with auto reset
 14. NEMA 4X Exterior Horn Test/Normal/Silence Switch
 15. Ground lug
 16. Two Lockable Hasps or one lockable hasp and two captive screws opposite the hinges of the NEMA 4X enclosure

The pump system shall be timed dosed as defined in 15A NCAC 18E .0105(112).

Approved flow equalization panel models shall be listed on the On-Site Wastewater Section web page.

- F. The following systems require multiple alternating or sequencing pumps:

1. Peak design daily flow is greater than 3,000 gpd;
2. The total line length exceeds 2,000 linear feet in a single trench system; or
3. The equalized design daily flow is greater than or equal to 1,500 gpd.

The control panel for multiple alternating or sequencing pumps shall be designed to sequence dosing events between pumps. The hand-off-automatic switches in duplex and multiplex panels shall enable the operator to shut off one or more dispersal fields with the dispersal fields remaining in service dosed automatically, sequentially, and uniformly.

- G. Remote alarms and telemetry may be required on a system-specific basis.
- H. The control panel shall be located in accordance with 15A NCAC 18E .1103(d).
- I. A pressure dosed manifold, low-pressure pipe distribution, or drip distribution shall be required for all flow equalization systems. Serial distribution may be used for retrofitting existing serial distribution systems if the effluent flows through an orifice control device before the flow becomes gravity. The orifice size shall be a minimum of 3/4-inch for a 1-1/2 inch supply line, and one inch for a two inch supply line in order to achieve minimum a minimum scour velocity of two feet/second. An accessible turn-up with a threaded cap and regulating valve shall be provided prior to the orifice control device to allow for regulation of the flow. Ensure when adjusting the flow that the minimum scour velocity is maintained.
- J. All dispersal trench types may be used with a flow equalization system. Manufacturer's installation procedures shall be followed when used, including provisions to dissipate the inflow rate to the trenches to minimize soil scouring and modifications that enable the presence and effectiveness of these provisions to be field verified.
- K. The following floats shall be provided and meet the requirements of 15A NCA 18E .1103(h).
1. A low level or redundant-off switch that prevents the pump from running in the event the liquid level in the pump tank is below the pump intake.
 2. A timer-enabling switch shall be set at or above the pump submergence level and shall not allow for partial doses.
 3. A high-water alarm switch shall activate after the equalization volume is exceeded. If there is a controlled delay before the alarm activation, the delay shall be no more than five minutes. After being silenced, the alarm horn shall automatically reset and shall be audible with each high-water event. The alarm event counter shall record each activation of the alarm.
 4. A timer override switch located at or above the high-water alarm shall dose no more than a designed dose event to the dispersal field. The alarm shall re-activate at each override event. The timer override float may be integral with the high-water alarm float.

Other sensor devices may be utilized if approved by the Department, but must meet all four float actions.

- L. The dosing volume shall be calculated based on the size of the dispersal fields and the number and frequency of the dosing events desired per day. The minimum and maximum pump run

times shall be in accordance with the pump manufacturer’s recommendations. The dosing volume shall be calculated based on 40 to 80 percent of the pipe volume for conventional systems and five to eight times the lateral volume for low-pressure pipe or drip systems.

- M. The equalized daily flow shall be calculated by adding the design daily flow for each event as determined in 15A NCAC 18E .0401 in the flow equalization cycle and then dividing by the number of days in the cycle. Under this approval, the maximum number of equalization days is 14 unless otherwise approved by the Department on a case-by-case basis. The dispersal field shall be sized by dividing the equalized daily flow by the LTAR determined in accordance with 15A NCAC 18E.

Example #1 – Church

An application has been submitted for a 200-seat church with a full kitchen. The daily design flow is 5 gallons/seat. The site has Group IV soils. The church has services on Sunday and Wednesday with extracurricular events, such as weddings, reunions, suppers, etc., on Saturdays. Sunday attendance is based on the 200 seats; Wednesday attendance is 100 members; and Saturday events can have a maximum of 200 people.

<u>Day</u>	<u>Attendance</u>	<u>Daily Flow</u>
Sunday	200 members	1,000 gallons
Wednesday	100 members	500 gallons
Saturday	200 members	<u>1,000 gallons</u>
Weekly Total:		2,500 gallons

Equalization cycle is seven days

The equalized daily flow is 2,500 gallons/7 days = 358 gpd. The dispersal field is sized for a daily flow of 358 gpd. The trench bottom area is 358 gpd/0.25 LTAR = 1,432 ft². The required linear footage is 1,432 ft²/3 feet wide trenches = 477 ft. The dose volume is 179 gallons, which is 58 percent of the four-inch corrugated pipe capacity.

Flow Balance:

<u>Day</u>	<u>In</u>	<u>Out</u>	<u>Residual</u>
Saturday	1,000 gal*	358 gal	642 gal
Sunday	1,000 gal	358 gal	1,284 gal**
Monday	0	358 gal	926 gal
Tuesday	0	358 gal	568 gal
Wednesday	500	358 gal	710 gal
Thursday	0	358 gal	352 gal
<u>Friday</u>	<u>0</u>	<u>358 gal</u>	<u>0</u>
Total:	2,500 gal	2,506 gal	0 gal

Pump Tank Sizing

Assuming a pump height of 18 inches and a tank with 30 gallons per inch

Pump submergence volume	= 540 gallons
Dose volume	= 179 gallons
Equalization volume	= 1,284 gallons **
<u>Emergency storage volume</u>	<u>= 1,000 gallons *(highest daily flow)</u>
Minimum dosing tank volume	= 3,003 gallons

The dispersal field is dosed 179 gallons every 12 hours. With a measured pump delivery rate of 40 gpm, the repeat cycle timer would be set at 4.5 minutes on and 12 hours (or 11.9 hours) off.

VIII. Installation and Testing

- A. A preconstruction conference shall be required to be attended by the following, as applicable: designer, North Carolina Professional Engineer (PE), licensed soil scientist (LSS), Authorized On-Site Wastewater Evaluator (AOWE), installer, and local health department (LHD), prior to beginning the installation of the flow equalization system.
- B. All individuals or companies installing flow equalization systems shall be in possession of all necessary permits and licenses before attempting any portion of a new or repair installation. The company or individual must be a Level III installer.
- C. The tanks shall be leak tested in accordance with 15A NCAC 18E .0805.
- D. Care shall be taken during system installation to prevent extraneous debris from entering the tanks, supply lines, or distribution network. Supply lines, manifolds, and orifice control devices shall be flushed out prior to system startup.
- E. The installer, PE, AOWE, or designer, and the operator, shall conduct a final inspection and start-up of the flow equalization system and all associated system components. The LHD will attend and observe the final inspection and start-up.
- F. Specified site preparation steps and construction specifications for the dispersal system shall be strictly adhered to, including specified depth of trenches in relation to site limiting conditions, cover material specifications if needed, trench installation method, etc.

IX. Operation, Maintenance, and Monitoring Requirements

- A. Flow equalization systems shall be classified, at a minimum, as a Type Ve system in accordance with 15A NCAC 18E .1301(b), Table XXXII. Management and inspection shall be in accordance with 15A NCAC 18E, Section .1300.
- B. The operator shall be a North Carolina certified subsurface operator (Operator in Responsible Charge).

- C. At each flow equalization system inspection, the operator shall, at a minimum, observe, monitor, and record the following:
1. Wastewater, sludge, and scum levels in all tanks;
 2. Watertightness of all tanks, risers, and pipe connections at the tanks;
 3. Operation of pumps, floats, valves, electrical controls, and alarms, including record of alarms since last visit and troubleshooting actions;
 4. Dispersal field pump delivery rate based on a drawdown test, determination of the average pump run time, and dispersal field dosing volume;
 5. Readings from pump cycle counters, high-water alarm event counters, and timer override counter; and
 6. Any structural damage, accessibility issues, adequate ventilation, excess odors, ponding of effluent, insect infestations, vegetative growth over the dispersal field, or surfacing of effluent on the dispersal field.
- D. The operator shall conduct other measurements, monitoring, maintenance activities, and observations as specified in the Operation Permit (OP).
- E. Notification and Performance of Maintenance and Repairs
1. The operator shall alert the LHD and the system owner within 48 hours of needed maintenance or repair activities including, but not limited to landscaping, tank sealing, tank pumping, pipe or control system repairs, and adjustments to any other system component.
 2. The operator shall notify the system owner and the LHD whenever the pump delivery rate efficiency or average pump run times are not within 25 percent of the initial measurements conducted prior to system start-up.
 3. System troubleshooting and needed maintenance shall be provided to maintain the pump delivery rate and average pump run time within 25 percent of initial measurements conducted during system start-up.
 4. The septic tank will be pumped whenever the depth of both the scum and sludge is found to be more than one-third of the liquid depth in any compartment.
 5. The tanks shall be pumped by a permitted septage management firm, and the septage handled in accordance with 15A NCAC 13B .0800.
 6. All maintenance activities shall be logged and recorded in the operator reports provided to the system owner and the LHD.
- F. Reporting
- The operator shall provide a written report to the system owner and the LHD within 30 days of each inspection. At a minimum, this report shall specify:
1. The date and time of inspection;
 2. System operating conditions measured and observed according to VIII.D and VIII.E;
 3. Maintenance activities performed since the last inspection report;
 4. An assessment of overall system performance;
 5. A list of any improvements or maintenance needed; and
 6. A determination of whether the system is malfunctioning, and the specific nature of the malfunction.

X. Responsibilities and Permitting Procedures

- A. Prior to the installation of a flow equalization system at a site, the owner shall submit an application or Notice of Intent (NOI) to the LHD for the proposed use of this system. Improvement Permits (IP) or Construction Authorizations (CA) issued by the LHD shall have a soil and site evaluation conducted either by the LHD, LSS, or Authorized On-Site Wastewater Evaluator (AOWE). The NOI shall include a soil and site evaluation conducted by an LSS. The application or NOI shall also include the following information:
1. A floor plan of the facility with a plumbing fixture schedule;
 2. Days of operation;
 3. Frequency of regular and special events;
 4. Number of employees;
 5. Number of people in attendance at events;
 6. Trips per day;
 7. Parking capacity;
 8. Building code occupancy limits for the structures; and
 9. Any other information required to calculate an accurate design flow.
- B. The IP, CA, and NOI shall contain all the conditions the site approval is based upon, including the proposed use of the Innovative system. The OP will include all conditions specified in the IP and CA. The Authorization to Operate (ATO) should include all the conditions specified in the NOI.
- C. When a special site evaluation is required pursuant to 15A NCA 18E .0510, an evaluation and written, sealed report from an LSS regarding the site shall be provided to the LHD. The report shall contain the information specified in 15A NCAC 18E .0510(d). The LHD may request the assistance of their Regional Soil Scientist in evaluating this report prior to permit issuance.
- D. Flow equalization systems shall be designed by either a designer, AOWE, or a PE. Systems with an equalized design daily flow greater than 1,500 gpd, the use of a septic tank or pump tank with a volume that exceeds 6,000 gallons, or as required in accordance with 15A NCAC 18E .0303(a) shall be designed by a PE.
- E. Prior to the LHD issuing a CA for a flow equalization system, a design submittal prepared by a designer, AOWE, or PE shall be submitted. The design submittal shall include the information required in 15A NCAC 18E .0305. Also, at the request of the LHD, a Regional Engineer will review designs.
- F. For sites required to be evaluated by an LSS or Licensed Geologist (LG), see Section V and IX.C, the LHD, AOWE, or PE may specify as a condition of the IP and CA that an LSS or LG oversee critical phases of the dispersal field installation and certify in writing that the installation was in accordance with their specified site and installation requirements prior to the OP or ATO issuance.
- G. The operator shall be present during the final inspection of the system prior to the issuance of the OP or ATO.

- H. The LHD shall issue the OP after the following:
1. Field verification of installation completion;
 2. Receipt of written documentation from the designer, AOWE, or PE that the system has been designed, installed, and is operating in accordance with the approved plans; and
 3. All necessary legal documents have been completed, including the contract between the system owner and the authorized operator.

In addition to the requirements of 15A NCAC 18E .0205, the OP shall contain the following information as conditions of the OP:

1. Equalized daily flow and flow equalization cycle;
2. Number of events per equalization cycle;
3. Limitations on attendance or usage of the facility; and
4. Hours of operation.

The LHD shall issue the OP for an (a2) and (a5) application after all necessary legal documents have been completed, including the contract between the system owner and the authorized operator.

The ATO shall be submitted to the LHD in accordance with G.S. 130A-336.1 and G.S. 130A-336.2.

XI. Repair of Systems

The provisions of 15A NCAC 18E .1306 shall govern the use of flow equalization systems for repairs to existing malfunctioning wastewater systems.

Approved by: _____ Date: _____