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

INNOVATIVE WASTEWATER SYSTEM APPROVAL

Innovative Wastewater System Approval Number: IWWS 2015-02-R1

Issued To: Infiltrator Water Technologies
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For: Advanced Enviro-Septic (AES) Systems

Approval Date: April 24, 2015
December 31, 2024 Updated for 18E and renewed for 2025

In accordance with G.S. 130A-343 and 15A NCAC 18E Section .1700, an application by Infiltrator Water Technologies for a renewal of the approval for the Advanced Enviro-Septic (AES) has been reviewed, and found to meet the requirements of an Innovative system when the following conditions are met.

I. General

A. Scope of this Innovative Approval
   1. Design, installation, use, and operation and maintenance requirements for AES systems meeting NSF-40 and TS-I effluent standards pursuant to 15A NCAC 18E .1201(a), Table XXV.
   2. Operation, maintenance, and monitoring requirements for AES systems to ensure the treatment performance standards are met.

B. This Innovative System Approval is applicable to wastewater systems treating domestic strength effluent as defined in 15A NCAC 18E .0402(a), Table III, utilizing AES systems that have a design daily flow less than or equal to 1,500 gallons per day (gpd).

C. Use of AES systems for facilities with high strength effluent, as defined in 15A NCAC 18E .402(a), Table III or industrial process wastewater, shall be proposed by Infiltrator Water Technologies and a North Carolina Professional Engineer (PE) to the Department for review and approval on a case-by-case basis, prior to permitting by the local health department (LHD). The system design shall include the proposed untreated wastewater strength in BOD_5, COD, TN, TSS, and fats, oils, and grease, the expected organic loading rate in pounds of BOD or N, the hydraulic loading rate on the pretreatment system, and the calculations, references, and any other needed

information to support the proposed design.

D. Any site utilizing these systems shall have wastewater with sufficient alkalinity to facilitate biological treatment processes. The influent shall not have a pH or toxins that significantly inhibit microbial growth.

E. Use of AES systems that have a design daily flow greater than 1,500 gpd may be permitted after approval by the Department on a case-by-case basis in accordance with 15A NCAC 18E .0302(e) or G.S. 130A-336.1.

II. System Description

The AES system consists of the following components: a Department approved septic tank and a bed dispersal system utilizing two or more rows of AES pipe and surrounding system sand. A final dosing tank may be used between the septic tank and the AES bed dispersal system if required to meet site conditions.

The system sand surrounding the AES pipe is typically installed directly onto native soil at the bottom of the bed. The system may alternately be installed on a six-inch layer of washed gravel or rock placed uniformly along the excavated bed bottom.

III. Siting Criteria

A. The AES systems shall be sited and sized in accordance with 15A NCAC 18E .1206 for NSF-40 and TS-I bed systems.
   1. AES systems designed to meet NSF-40 standards where the soil is classified based on texture as Soil Group I, II, or III shall have a design flow less than or equal to 600 gpd. The site shall meet the requirements in 15A NCAC 18E .1206(b).
   2. AES systems designed to meet TS-I standards where the soil is classified based on texture as Soil Group I or II shall have a design flow less than or equal to 1,500 gpd. The system shall meet the siting requirements in 15A NCAC 18E .1206(c)(1) and (c)(4).
   3. Systems proposed to be installed in existing fill shall have a design flow less than or equal to 480 gpd and shall meet the siting requirements in 15A NCAC 18E .1206(e).
   4. Vertical separation requirements to a limiting condition are measured from the bottom of the system sand or gravel layer.

B. The site slope shall not exceed 15 percent for an AES system designed to meet NSF-40 standards and 10 percent for an AES system designed to meet TS-I standards. A hydraulic assessment completed pursuant to 15A NCAC 18E .1203(c)(3) is required for TS-I systems installed on sites with slopes greater than two percent.

C. The system shall be considered to be a fill system if the sand bed bottom is installed directly onto native soil and is less than 12 inches below the naturally occurring soil surface. When installed over a six-inch layer of washed gravel, the system is considered to be a fill system if the gravel bed bottom is less than six inches below the naturally occurring soil surface.

IV. System Sizing

A. The AES system shall be sized in accordance with 15A NCAC 18E .1206 for NSF-40 and TS-I bed systems.

B. AES systems designed to meet NSF-40 shall be sized in accordance with 15A NCAC 18E .1206(b)(2) for Soil Groups I and II. Sites with Group III soils shall have a bed bottom area 50% greater than the bottom area required for a trench system per 15A NCAC 18E .0903 (d).

C. AES systems designed to meet TS-I shall be sized in accordance with 15A NCAC 18E .1206(c)(2).

V. Special Site Evaluation

A special site evaluation may be required based on the proposed dispersal system. Refer to 15A NCAC 18E .0510 for when a special site evaluation is required.

VI. Design Criteria

A. The AES system shall be designed in accordance with the following criteria.
   1. A septic tank sized as required in 15A NCAC 18E .0801 shall be provided. The access riser provided over the effluent filter shall extend to finished grade at a minimum and be designed and maintained to prevent surface water inflow.
   2. A state-approved pump tank shall be provided, if needed. The pump tank shall be sized in accordance with 15A NCAC 18E .0802. Dosing shall be demand dosing for a system designed for less than or equal to 1,000 gpd, and timed dosing for a system designed for greater than 1,000 gpd. Dosing frequency shall range from four to eight doses per day. The system shall be designed to deliver a dosing volume no greater than one gallon per linear foot of AES pipe per dose.
   3. Components common to all AES systems:
      a. Septic tank;
      b. Distribution device;
      c. Two or more rows of AES units
      d. Sampling device;
      e. Vent; and
      f. System sand (see Attachment A).
   4. The minimum amount of AES pipe required for domestic strength effluent is specified in Table I.

Table I – AES Specifications

Number of Bedrooms	Maximal Hydraulic Capacity (gpd)	Minimum Amount of AES Pipe (ft)
2	240	120
3	360	150
4	480	200
5	600	250
> 5	Design Daily Flow (Q)	≥ Q/2.4

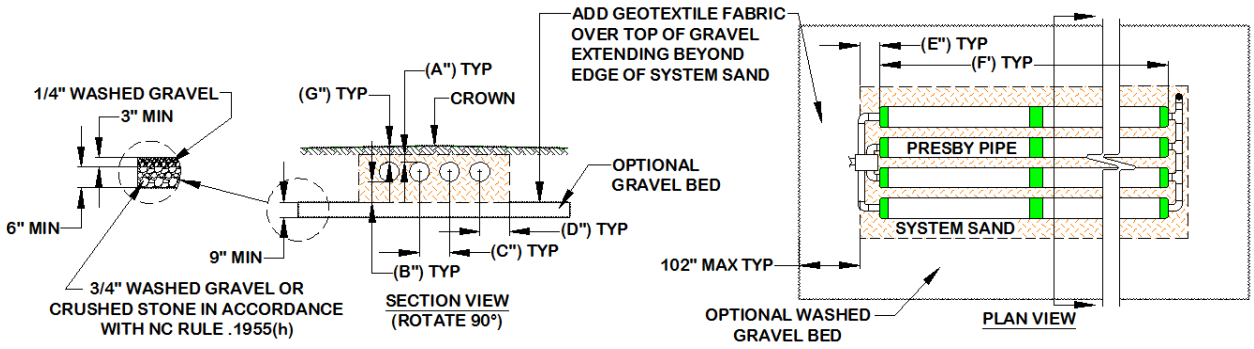
5. Distribution of the AES shall be evenly spaced across the system sand bed.
6. Minimum system sand depths and minimum and maximum spacing requirements are as follows:
   a. Minimum below AES – NSF-40: 12 inches; TS-I: 24 inches
   b. Minimum center to center spacing of AES – 18 inches
   c. Maximum center to center spacing of AES – 48 inches
   d. Lateral extension distance from center of last lateral row of pipes to the limit of the AES system – NSF-40: 24 - 48 inches; TS-I: 18 – 48 inches
   e. End extension distance from end of a row of pipes to the limit of AES System: 12 - 18 inches
   f. Minimum cover over system – 8 inches with a 4-inch minimum that must be system sand.
7. Minimum and maximum AES row lengths:
   a. Minimum length – 20 feet
   b. Maximum length – 60 feet
8. To meet bed sizing requirements in Section III, and the spacing requirements in Subsections 5, 6, and 7 of this Section, it may be necessary to either:
   a. Provide more AES pipe than the minimum required by Subsection 4; or
   b. Increase the spacing requirements in the following manner when the system is installed on a 6-inch layer of gravel or crushed stone. The gravel bed can extend a maximum of 102 inches from the boundaries of the system sand around the treatment area. Refer to Table II and accompanying illustration. The following modifications to the spacing requirements in Subsection 6 are applicable:
      (1) Maximum center-to-center spacing of AES – 102 inches
      (2) Lateral extension distance – 51 inches
      (3) End extension distance – 45 inches

Table II - System Sand Bed Dimensions and Row Length Requirements

System Sand Location	Illustration Item	NSF-40 Bed		TS-I Bed	
		System Sand Only	System Sand on 6 inches of Washed Gravel	System Sand Only	System Sand on 6 inches of Washed Gravel
Inches Above AES Pipe (minimum)	A	4 in	4 in	4 in	4 in
Inches Below AES Pipe (minimum)	B	12 in	12 in	24 in	24 in
Minimum Center-to-Center Row Spacing	C	18 in	18 in	18 in	18 in
Maximum Center-to-Center Row Spacing	C	48 in	102 in	48 in	102 in
Lateral Extension Distance from Center of Last Row to	D	24 in – 48 in	24 in – 51 in	18 in – 48 in	18 in – 51 in

Limit of System Sand (parallel to outermost rows)					
Inches of Extension Beyond Ends of AES Pipes	E	12 in – 18 in	12 in – 45 in	12 in – 18 in	12 in – 45 in
AES Pipe Row Length (feet)	F	20 ft – 60 ft	20 ft – 60 ft	20 ft – 60 ft	20 ft – 60 ft
Minimum Cover Over System (four in must be System Sand)	G	8 in	8 in	8 in	8 in

Illustration Showing Location of Table Dimensions



9. The system design shall incorporate provisions for complying with a means for determining the daily, 7-day, and 30-day flow monitoring requirements of 15A NCAC 18E .1702(a)(2)(l).
   a. If a pump is involved, a cycle counter shall be incorporated into the pump's control circuit. This cycle counter will be used to calculate the daily flow.
   b. If the system is gravity fed, the system design will either incorporate a siphon system with a dosing cycle counter, a tipping D-box with a cycle counter where the counter display would be used as a mechanical logger, or another mechanical approach which allows for accurate monitoring of daily flows as required in 15A NCAC 18E .1702(a)(2)(l). Any mechanism for monitoring flow not listed in this approval shall be proposed by the manufacturer and approved by the State.
   c. A data logging system will be incorporated with the cycle counter to allow review of flows over time.
   d. When none of the above options are feasible, a water meter can be placed on the incoming line to the house connected to a data logging system, with the understanding that not all the water entering the house will also enter the septic system due to personal consumption, landscaping purposes, etc.
10. The AES system shall be installed level on a sand bed or on a bed of gravel. When sited in accordance with the appropriate sections of this approval, the bottom of the sand bed or gravel bed for AES systems may be installed up to but no deeper than five feet below finished grade, provided that the vertical separation requirements in Section III of this approval are met.
11. For AES Systems, the bed shall be constructed as a rectangle, with the long axis as parallel to the ground elevation contours of the slope as possible. The bottom of the bed shall be excavated level (± 1/4 inches) in all directions. The sand bed shall be immediately installed without allowing machinery to traverse the excavated and exposed bed bottom. Infiltrator

Water Technologies approved track-machinery may be used on the bed after there is six inches of system sand under the tracks.

12. When the system is installed on a bed of gravel at least six inches thick, the gravel shall meet the requirements in 15A NCAC 18E .0902(b)(4). A layer of geotextile fabric shall be installed over the gravel and prior to installation of the AES system to prevent migration of system sand or backfill into the underlying gravel layer or onto the infiltrative surface. The AES pipes and system sand shall be centered on the gravel bed. All portions of the gravel bed shall be covered by a geotextile fabric prior to backfilling. The geotextile shall be capable of preventing the downward movement of silt-sized particles while allowing the movement of moisture and gases.
13. During final grading, soil cover shall be installed over the finished sand bed and/or gravel bed and around the perimeter of the system. Minimum backfill depth shall be eight inches above the AES pipe of which the first 4 inches shall be system sand. System sand shall be placed above the AES pipe, and shall extend laterally at this same elevation over the entire the sand bed. At least the final four inches of soil cover, after settling, shall have a finer texture (such as Soil Group II or III) for the establishment of a vegetative cover. Soil cover shall be installed with a side slope not to exceed a rise to run ratio of 1:3, unless a dry stacked interlocking block retaining wall is constructed adjacent to the AES pipe and surrounding sand, or adjacent to the gravel bed, where applicable. Any other type of retaining wall shall be designed by a PE and approved by the LHD. A retaining wall may be used to supersede the side slope requirements for fill systems. However, the five-foot setback from the edge of the system to the inside edge of the retaining wall must be maintained.
14. For systems designed with a design daily flow greater than 1,000 gpd which require two or more beds to be used, effluent shall be distributed to the beds and separate AES lines uniformly and evenly over a 24-hour period using a pump, pump control, and effluent dispersal system, in accordance with manufacturer requirements for pump systems.

B. AES systems shall be designed by a designer authorized in writing by Infiltrator Water Technologies (authorized designer) or a PE. Systems over 1,000 gpd shall be designed by a PE.

VII. Installation and Testing

A. A preconstruction conference shall be required to be attended by the following, as applicable: authorized designer, Authorized On-Site Wastewater Evaluator (AOWE), PE, installer authorized in writing by Infiltrator Water Technologies (authorized installer), Infiltrator Water Technologies licensed distributor, and LHD prior to beginning installation of the AES system.

B. AES systems shall be installed according to directions provided by Infiltrator Water Technologies.

C. All individuals or companies installing AES 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 IV installer and authorized in writing by Infiltrator Water Technologies.

D. Watertightness of the septic and pump tanks shall be documented by a leak test in accordance with 15A NCAC 18E .0805(b).

E. The authorized installer, PE, AOWE, or authorized designer, and the authorized operator shall conduct a final inspection and start-up of the AES system and all associated system components. The LHD will attend and observe the final inspection and start-up.

F. Site preparation steps and construction specifications for the AES system shall be strictly adhered to, including the depth of the bed in relation to site limiting conditions. All AES systems shall be installed according to directions provided by Infiltrator Water Technologies.

VIII. Operation, Maintenance, Monitoring, and Reporting

A. AES systems shall be classified, at a minimum, as a Type Va 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. All AES systems require an operation and maintenance agreement between the system owner and Infiltrator Water Technologies, its authorized representative, or with an authorized operator in accordance with 15A NCAC 18E .1302(c). The authorized operator must have proper equipment and training to access and program the control panels on site. The authorized operator shall be:
   1. a North Carolina certified subsurface operator (Operator in Responsible Charge); and
   2. either an employee of Infiltrator Water Technologies or authorized in writing by Infiltrator Water Technologies.

C. All AES systems shall be operated and maintained according to the latest version of Infiltrator Water Technologies' operation and maintenance manual.

D. At each AES system inspection the authorized operator shall follow service procedure steps identified in Infiltrator Water Technologies O&M Manual and, at a minimum, observe, monitor, and record the following:
   1. Wastewater level in the tanks;
   2. Sludge, scum, and grease levels in all the tanks;
   3. Clogging of effluent filter;
   4. Watertightness of tanks, risers and pipe penetrations at tanks;
   5. Operation of pumps, floats, valves, electrical controls and alarms, where applicable;
   6. Dispersal field pump delivery rate (drawdown test), determination of the average pump run time, and dispersal field dosing volume, where applicable;
   7. 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;
   8. Sample of AES system effluent collected from the sampling point to check for effluent clarity and odor;
   9. Readings from pump cycle counters, run time meters, and any water meter readings; and

10. System operating conditions, from the review of stored data for flow variances or other abnormal conditions.

E. The authorized operator shall also conduct other observations, measurements, monitoring, and maintenances activities as specified in the Operation Permit (OP) and as recommended by the manufacturer.

F. Sampling
   1. All sampling shall be done in accordance with 15A NCAC 18E .1302 and .1709. AES systems shall be sampled annually when the design daily flow is less than or equal to 1,500 gpd. Systems with a design daily flow greater than 1,500 gpd and less than or equal to 3,000 gpd shall be sampled twice a year.
   2. Effluent for all systems shall be analyzed for $CBOD_5$ and TSS. Systems specified to meet the TS-I standard shall also have the effluent analyzed for NH_4-N, and fecal coliforms. Field testing of effluent for pH and DO is highly recommended for all systems. Sampling is not required for fecal coliforms when the site is found to be compliant with all other constituents in Table XXV of 15A NCAC 18E .1201(a).
   3. Influent samples, if needed, shall be taken from a sampling port located between the septic tank and the AES system or from the influent dosing tank.
   4. Effluent samples shall be collected from the sampling device.

G. Notification and Performance of Maintenance and Repairs
   1. The authorized operator shall alert Infiltrator Water Technologies, 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, AES unit replacement, and/or adjustments to any other system component.
   2. The authorized operator shall notify the system owner, Infiltrator Water Technologies, and the LHD whenever the pump delivery rate efficiency or average pump run times are not within 25 percent of initial measurements collected 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 as needed upon recommendation of the authorized operator and in accordance with the AES system operation and maintenance instructions. At a minimum, 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 properly permitted septage management firm, and the septage handled in accordance with 15A NCAC 13B .0800.
   6. All maintenance activities shall be recorded in the authorized operator reports provided to the system owner, the LHD, and Infiltrator Water Technologies.

H. Reporting
   1. The authorized operator shall provide a written report to the system owner, Infiltrator Water Technologies, and the LHD within 30 days of each inspection. At a minimum this report shall specify:
      a. The date and time of inspection;

b. System operating conditions according to Section VII.D, VII.E, and VII.F;
c. Results from laboratory analysis of all influent and effluent samples;
d. Maintenance activities performed since the last inspection report;
e. A list of any improvements or maintenance needed;
f. A determination of whether the system is malfunctioning, and the specific nature of the malfunction;
g. Any changes made in system settings, based on recommendations of the manufacturer; and
h. A summary report of data retrieved from the control panel including flow variances and other operating conditions.

IX. Responsibilities and Permitting Procedures

A. Prior to the installation of an AES 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.

B. The IP, CA, and NOI shall contain all the conditions the site approval is based upon, including the proposed used 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 a Licensed Soil Scientist (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. AES systems shall be designed by either an authorized designer, AOWE, or a PE. Systems over 1,000 gpd, 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 an AES system, a design submittal prepared by an authorized designer, AOWE, or PE shall be submitted. The design submittal shall include the information required in 15A NCAC 18E .0305.

F. It is recommended that local authorized environmental health practitioners attend a design training session offered by the manufacturer or the authorized representative prior to permitting the system. Also, at the request of the LHD, a Regional Engineer will review the design.

G. 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.

H. The authorized operator shall be present during the final inspection of the system prior to the issuance of the OP or ATO.

I. The LHD shall issue the OP after the following:
   1. Field verification of installation completion;
   2. Receipt of written documentation from the authorized 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.

   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.

X. Repair of Systems

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

Approved By: _____ Date: _____

Attachment A: SYSTEM SAND SPECIFICATIONS

The system sand that surrounds the AES pipes is an essential component of the system. It is **critical** that the correct type and amount of system sand is used during construction. System sand must be coarse to very coarse, clean, granular sand, free of organic matter. A minimum of 12 to 24 inches of system sand is placed below (depending on type of system installation), 6 inches between and 4 inches over all the AES pipes. The system sand must extend 12 inches minimum around the perimeter of the AES pipes.

<table>
<tr><th>ORIGINAL
SYSTEM SAND</th><th>ASTM-C33 Modified for
SYSTEM SAND</th></tr>
<tr><td>0% larger than ¾ in.</td><td>100% passing 3/8 in.</td></tr>
<tr><td>0-35 % retained by #10</td><td>95-100% passing #4</td></tr>
<tr><td>40-90% retained by #35</td><td>80-100% passing #8</td></tr>
<tr><td>3% max. passing #200</td><td>50-85% passing #16</td></tr>
<tr><td rowspan="5">Comment: System sand is coarse to very coarse clean, granular sand, free of all organic matter. The correct sand provides pore space for gas transfer and encourages efficient dispersal into soil below.</td><td>25-60% passing #30</td></tr>
<tr><td>5-30% passing #50</td></tr>
<tr><td>0-10% passing #100</td></tr>
<tr><td>0-3% passing #200</td></tr>
<tr><td>Comment: This specification was derived in order to provide reference to a readily available, standardized sand product. The added restriction on fines content (3% max.) makes ASTM C-33 appropriate material for system sand.</td></tr>
</table>

Notes: (%) by weight shown; (#) Refers to Standard US Sieve Sizes; fines must be determined by washing sample