

**15A NCAC 18A .1957 CRITERIA FOR DESIGN OF ALTERNATIVE SEWAGE SYSTEMS**

(a) **LOW-PRESSURE PIPE SYSTEMS:** Low-pressure pipe (LPP) systems with a two to five-foot pressure head may be utilized on sites which are **SUITABLE** or **PROVISIONALLY SUITABLE** for conventional or modified systems or on sites where soil and site conditions prohibit the installation of a conventional or modified septic tank system if the requirements of this Paragraph are met.

- (1) The LPP system shall consist of the following basic components:
  - (A) a network of small-diameter (one to two inches) perforated PVC 160 pounds per square inch (psi) or stronger pressure-rated pipe placed in naturally occurring soil at shallow depths (generally 12 to 18 inches) in narrow trenches not less than eight inches in width and spaced not less than five feet on center. Trenches shall include at least five inches of washed stone or washed gravel below the pipe and two inches above the pipe; and four inches of soil cover.
  - (B) an approved, two-compartment septic tank or other approved pretreatment system, and a pumping or dosing tank;
  - (C) a watertight supply manifold pipe, of Schedule 40 PVC or stronger pressure-rated material or other pressure rated pipe specified in a system designed by a registered professional engineer, for conveying effluent from the dosing chamber to the low-pressure network.
- (2) The soil and site criteria for LPP systems shall meet the following requirements:
  - (A) LPP nitrification fields shall not be installed on slopes in excess of ten percent unless design procedures to assure proper distribution of effluent over the nitrification field are approved. Landscaping of the LPP distribution field shall be constructed to shed rainwater or runoff. All other requirements of Rule .1940 of this Section shall be met.
  - (B) Site suitability for an LPP system shall be based on the first 24 inches of soil beneath the naturally occurring soil surface. This 24 inches shall consist of **SUITABLE** or **PROVISIONALLY SUITABLE** soil as determined in accordance with Rules .1941 through .1944 and .1956 of this Section.
  - (C) Location of the septic tank, other approved pretreatment unit, pumping or dosing chamber, and nitrification field shall be in accordance with Rule .1950 of this Section. Horizontal distances from the nitrification field shall be measured from a margin two and one-half feet beyond the lateral and manifold pipes.
  - (D) There shall be no soil disturbance of the site or repair area for an LPP system except the minimum required for installation.
  - (E) The available space requirements of Rule .1945 of this Section shall apply.
- (3) Table IV shall be used in determining the long-term acceptance rate for LPP systems. The long-term acceptance rate shall be based on the most hydraulically limiting, naturally occurring soil horizon within two feet of the ground surface or to a depth of one foot below the trench bottom, whichever is deeper.

Table IV

SOIL GROUP	SOIL TEXTURAL CLASS	USDA CLASSIFICATION	LONG-TERM ACCEPTANCE RATE (gallons per day per square foot)
I	Sands (with suitable or provisionally suitable clay mineralogy)	Sand Loamy Sand	0.6 – 0.4
II	Coarse Loams (with suitable or provisionally suitable clay mineralogy)	Sandy Loam Loam	0.4 – 0.3

III	Fine Loams (with suitable or provisionally suitable clay mineralogy)	Sandy Clay Loam Silt Loam Clay Loam Silty Clay Loam Silt	0.3 – 0.15
IV	Clays (with suitable or provisionally suitable clay mineralogy)	Sandy Clay Silty Clay Clay	0.2 – 0.05

The long-term acceptance rate shall not exceed 0.5, 0.35, 0.225 or 0.125 gallons per day per square foot for Soil Groups I, II, III, or IV, respectively, for food service facilities, meat markets, and other places of business where accumulation of grease can cause premature failure of a soil absorption system unless data from comparable facilities indicates that the grease and oil content of the effluent will be less than 30 milligrams per liter (mg/l) and the chemical oxygen demand (COD) will be less than 500 mg/l or an approved pretreatment system is used which is designed to produce equal or better effluent quality.

- (4) In calculating the number of square feet for the nitrification field, the design sewage flow shall be divided by the long-term acceptance rate from Table IV. In calculating the minimum length of trenches in the LPP system, the total square footage of the nitrification field shall be divided by five feet.
- (5) Low-pressure systems shall be designed for uniform distribution of effluent. The trenches shall be level and parallel to the ground elevation contours. Laterals, manifolds and LPP drainfields shall comply with the following design criteria:
- (A) The maximum lateral length shall yield no more than a ten-percent difference in discharge rate between the first and last hole along the lateral.
  - (B) Minimum hole size shall be 5/32-inch for at least two-thirds of the field lateral lines. Smaller holes (no less than 1/8-inch) may be used in no more than one-third of the lateral lines where necessary to balance flow distribution on sloping sites. However, for systems serving restaurants, foodstands, meat markets and other establishments where effluent is expected to have a high clogging potential, the minimum hole size shall be 5/32-inch.
  - (C) Maximum hole spacing shall be as follows: Soil Group I, five feet; Soil Group II, six feet; Soil Group III, eight feet; and Soil Group IV, ten feet.
  - (D) The following design provisions are required for sloping sites:
    - (i) Separately valved manifolds are required for all subfield segments where the elevation difference between the highest and lowest laterals exceeds three feet.
    - (ii) The hole spacing, hole size or both shall be adjusted to compensate for relative head differences between laterals branching off a common supply manifold and to compensate for the bottom lines receiving more effluent at the beginning and end of a dosing cycle. The lateral network shall be designed to achieve a ten to 30 percent higher steady state (pipe full) flow rate into the upper lines, relative to the lower lines, depending on the amount of elevation difference.
    - (iii) Maximum elevation difference between the highest and lowest laterals in a field shall not exceed ten feet unless the flow is hydraulically split between subfield segments without requiring simultaneous adjustment of multiple valves.
  - (E) Turn-ups shall be provided at the ends of each lateral, constructed of Schedule 40 PVC pipe or stronger pressure-rated pipe, and protected with sleeves of larger diameter pipe (six inches or greater). Turn-ups and sleeves shall be cut off and capped at or above the ground surface, designed to be protected from damage, and easily accessible.
  - (F) The supply manifold shall be sized large enough relative to the size and number of laterals served so that friction losses and differential entry losses along the manifold do not result in more than a 15 percent variation in discharge rate between the first and last laterals. The supply manifold shall comply with the following design criteria:

- (i) The ratio of the supply manifold inside cross sectional area to the sum of the inside cross sectional areas of the laterals served shall exceed 0.7:1.
- (ii) The reduction between the manifold and connecting laterals shall be made directly off the manifold using reducing tees.
- (iii) Cleanouts to the ground surface shall be installed at the ends of the supply manifold.
- (G) Gate valves shall be provided for pressure adjustment at the fields whenever the supply line exceeds 100 feet in length. Valves shall be readily accessible from the ground surface and protected in valve boxes.
- (6) Septic tanks, pump tanks, pump dosing systems, siphons, and siphon dosing tanks shall be provided in accordance with Rule .1952 of this Section. The LPP dosing system shall comply with the following design criteria:
  - (A) Design flow rate shall be based upon delivering two feet to five feet of static pressure head at the distal end of all lateral lines.
  - (B) Dose volume shall be between five and ten times the liquid capacity of the lateral pipe dosed, plus the liquid capacity of the portions of manifold and supply lines which drain between doses.

(b) **FILL SYSTEM:** A fill system (including new and existing fill) is a system in which all or part of the nitrification trench(es) is installed in fill material. A fill system, including an existing fill site, shall be approved where soil and site conditions prohibit the installation of a conventional or modified septic tank system if the requirements of Subparagraphs (b)(1) or (b)(2) of this Rule are met.

- (1) Fill systems may be installed on sites where at least the first 18 inches below the naturally occurring soil surface consists of soil that is **SUITABLE** or **PROVISIONALLY SUITABLE** with respect to soil structure and clay mineralogy, and where organic soils, restrictive horizons, saprolite or rock are not encountered. Further, no soil wetness condition shall exist within the first 12 inches below the naturally occurring soil surface and a groundwater lowering system shall not be used to meet this requirement. Fill systems shall not be utilized on designated wetlands unless the proposed use is specifically approved in writing by the designating agency. The following requirements shall also be met:
  - (A) Nitrification trenches shall be installed with at least 24 inches separating the trench bottom and any soil horizon **UNSUITABLE** as to soil structure, clay mineralogy, organic soil, rock or saprolite. However, if a low pressure pipe system is used, the minimum separation distance shall be 18 inches.
  - (B) Nitrification trenches shall be installed with at least 18 inches separating the trench bottom and any soil wetness condition. This separation requirement for soil wetness conditions may be met with the use of a groundwater lowering system only in Soil Groups I and II, with **SUITABLE** structure and clay mineralogy. However, if a low pressure pipe system is used, the minimum separation distance shall be 12 inches.
  - (C) Systems shall be installed only on sites with uniform slopes less than 15 percent. Storm water diversions and subsurface interceptor drains or swales may be required upslope of the system to divert surface runoff or lateral flow from passing over or into the system.
  - (D) The long-term acceptance rate shall be based on the most hydraulically limiting soil horizon within 18 inches of the naturally occurring soil surface or to a depth one foot below the trench bottom, whichever is deeper. The lowest long-term acceptance rate for the applicable soil group shall be used for systems installed pursuant to this Rule. However, the long-term acceptance rate shall not exceed 1.0 gallons per day per square foot for gravity distribution or 0.5 gallons per day per square foot for low-pressure pipe systems installed on sites with at least 18 inches of Group I soils below the naturally occurring soil surface or to a depth of one foot below the trench bottom, whichever is deeper.
  - (E) If the fill system uses low-pressure pipe distribution, all the requirements of Paragraph (a) of this Rule, except Paragraph (a)(2)(B), shall apply. Systems with a design daily flow greater than 480 gallons per day shall use low-pressure pipe distribution.
  - (F) Fill material shall have such soil texture to be classified as sand or loamy sand (Soil Group I) up to the top of the nitrification trenches. The final six inches of fill used to cover the system shall have a finer texture (such as Group II, III) for the establishment of a vegetative cover. Existing fill material shall have no more than ten percent by volume of fibrous organics,

- building rubble, or other debris and shall not have discreet layers containing greater than 35 percent of shell fragments.
- (G) Where fill material is added, the fill material and the existing soil shall be mixed to a depth of six inches below the interface. Heavy vegetative cover or organic litter shall be removed before the additional fill material is incorporated.
  - (H) The fill system shall be constructed as an elongated berm with the long axis parallel to the ground elevation contours of the slope.
  - (I) The side slope of the fill shall not exceed a rise to run ratio of 1:4. However, if the first 18 inches below the naturally occurring soil surface is Group I soil, the side slope of the fill shall not exceed a rise to run ratio of 1:3.
  - (J) The outside edge of the nitrification trench shall be located at least five feet horizontally from the top of the side slope.
  - (K) The fill system shall be shaped to shed surface water and shall be stabilized with a vegetative cover against erosion.
  - (L) The setback requirements shall be measured from the projected toe of the slope. However, if this setback cannot be met, the setback requirements shall be measured from a point five feet from the nearest edge of the nitrification trench if the following conditions are met:
    - (i) Slope of the site shall not exceed two percent;
    - (ii) The first 18 inches of soil beneath the naturally occurring soil surface shall consist of Group I soils;
    - (iii) The lot or tract of land was recorded on or before December 31, 1989; and
    - (iv) A condition is placed upon the Improvement Permit to require connection to a public or community sewage system within 90 days after such system is available for connection and after it is determined that 300 feet or less of sewer line is required for connection.
  - (M) The available space requirements of Rule .1945 of this Section shall apply.
- (2) An existing fill site that does not meet the requirements of Paragraph (b)(1) of this Rule may be utilized for a sanitary sewage system if the following requirements are met:
- (A) Substantiating data are provided by the lot owner (if not readily available to the local health department) indicating that the fill material was placed on the site prior to July 1, 1977.
  - (B) The fill material placed on the site prior to July 1, 1977 shall have such soil texture to be classified as sand or loamy sand (Group I) for a depth of at least 24 inches below the existing ground surface. This fill material shall have no more than ten percent by volume of fibrous organics, building rubble, or other debris. This fill shall not have discreet layers containing greater than 35 percent of shell fragments. However, if at least 24 inches of Group I fill material was in place prior to July 1, 1977, additional fill with soil texture classified as Group I may be added to meet the separation requirements of Paragraph (b)(2)(D) of this Rule.
  - (C) Soil wetness conditions, as determined by Rule .1942(a) in this Section, are 18 inches or greater below the ground surface of the fill placed on the lot prior to July 1, 1977. This requirement shall be met without the use of a groundwater lowering system.
  - (D) Low-pressure pipe distribution shall be used and shall meet all the requirements of Paragraph (a) of this Rule, except (a)(2)(B). The long-term acceptance rate shall not exceed 0.5 gallons per day per square foot. However, for existing fill sites with 48 inches of Group I soils, conventional nitrification trenches utilizing a maximum long-term acceptance rate of 1.0 gallons per day per square foot may be installed in lieu of low-pressure pipe systems. The minimum separation distance between the trench bottom and any soil wetness condition or any soil horizon UNSUITABLE as to soil structure, clay mineralogy, organic soil, rock, or saprolite shall be 24 inches for low pressure pipe systems and 48 inches for conventional systems. This separation requirement may be met by adding additional Group I soil, but shall not be met with the use of a groundwater lowering system. Where fill is to be added, the requirements of Paragraphs (b)(1)(C), (F), (G), (H), (J), (K), of this Rule and the following requirements shall be met:
    - (i) The side slope of the fill shall not exceed a side slope ratio of 1:3, and;
    - (ii) The setback requirements shall be measured from the projected toe of the slope. However, if this setback cannot be met, the setback requirements shall be measured

from a point five feet from the nearest edge of the nitrification trench if the following conditions are met:

- (I) Slope of the site shall not exceed two percent;
  - (II) The lot or tract of land was recorded on or before December 31, 1989; and
  - (III) A condition is placed upon the Improvement Permit to require connection to a public or community sewage system within 90 days after such system is available for connection and after it is determined that 300 feet or less of sewer line is required for connection.
- (E) The available space requirements of Rule .1945 of this Section shall apply.
  - (F) The design flow shall not exceed 480 gallons per day.
- (3) Other fill systems may be approved by the local health department on a site-specific basis in accordance with Rule .1948(d) of this Section.

(c) Residential Wastewater Treatment Systems (RWTS) that comply with the National Sanitation Foundation (NSF) Standard 40 for Class I residential wastewater treatment systems shall be designed and constructed and installed in accordance with this Rule to serve a facility with a design daily flow rate of up to 1500 gallons per day, as determined in Rule .1949(a) or .1949(b) of this Section. RWTS shall not be used, however, where wastes contain high amounts of fats, grease and oil (30 mg/l or more), including restaurants and food service facilities, and the strength of the influent wastewater shall be similar to domestic wastewater with raw influent Biological Oxygen Demand (BOD) and suspended solids not to exceed 350 parts per million. RWTS performance, siting, sizing, installation, operation, monitoring, maintenance and reporting requirements shall comply with G.S. 130A-342 and 15A NCAC 18A .1970. NSF Standard 40 for Class I residential wastewater treatment systems is hereby incorporated by reference including any subsequent amendments and editions. Copies of the standards may be inspected at the On-Site Wastewater Section Central Office, located at 2728 Capital Blvd., Raleigh, NC in the Parker Lincoln Building, and copies may be obtained on-line at <http://www.techstreet.com/nsfgate.html> at a cost of ninety-five dollars (\$95.00), or by mail from Techstreet, 777 East Eisenhower Parkway, Ann Arbor, MI 48108 at a cost of ninety-five dollars (\$95.00) plus shipping and handling. RWTS shall bear the NSF mark and the NSF listed model number or shall bear the certification mark and listed model number of a third party certification program accredited by the American National Standards Institute (ANSI), pursuant to ANSI Policy and Procedures for Accreditation of Certification Programs to certify residential wastewater treatment systems in accordance with NSF Standard Number 40. The following conditions for approval, design, construction and installation of RWTS shall be met:

- (1) An application shall be submitted in writing to the State for an RWTS, which shall include the following, as applicable:
  - (A) manufacturer's name, address, phone number, plant location(s), and contact information for manufacturer's licensed distributors in North Carolina and their current service areas;
  - (B) verification of current approval and listing of a NSF Standard 40 Class I system by the National Sanitation Foundation or other ANSI-accredited third party certification program;
  - (C) manufacturer's identifying name or logo, listed model number(s) and treatment capacity (in gallons per day) to be imprinted on unit;
  - (D) three legible copies of plans and specifications, and information required to evaluate any tanks as required pursuant to 15A NCAC 18A .1953; and
  - (E) fee payment as required by G.S. 130A-343(k)(6), by corporate check, money order or cashier's check made payable to: North Carolina On-Site Wastewater System Account or NC OSWW System Account, and mailed to the On-Site Wastewater Section, 1642 Mail Service Center, Raleigh, NC 27699-1642 or hand delivered to Rm. 1A-245, Parker Lincoln Building, 2728 Capital Blvd., Raleigh, NC.
- (2) The rated capacity of RWTS listed as complying with NSF Standard 40 shall not be less than the design daily flow as determined by Rule .1949(a) or .1949(b) of this Section.
- (3) The following are minimum standards of design and construction of RWTS:
  - (A) No blockouts or openings shall be permitted below the liquid level of the RWTS.
  - (B) RWTS shall be resilient, watertight, corrosion resistant structures, with all components needing to be routinely maintained easily accessible to the system operator. Access openings shall be provided in the RWTS top. Access shall be provided for:
    - (i) cleaning or rodding out the inlet pipe,
    - (ii) cleaning or clearing the air or gas passage space above the partition,
    - (iii) pumping of each compartment required to be pumped,

- (iv) sampling the effluent, and
  - (v) repairing any system components or maintaining system component requiring repair or maintenance.
- (C) Tanks used in RWTS designed to hold sewage or effluent shall comply with the same design and construction requirements as septic tanks and pump tanks pursuant to 15A NCAC 18A .1954, as applicable.
- (D) Fiberglass reinforced plastic tanks used in RWTS designed to hold sewage or effluent shall be constructed with materials capable of resisting corrosion from sewage and sewage gases, and the active and passive loads on the unit walls. Except as required by the rules of this Section, fiberglass tanks shall comply with IAPMO PS 1-2004, Standard for Prefabrication Septic Tanks, and CSA International B66-05, Standard for Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks, as applicable. IAPMO PS 1-2004 and CSA International B66-05 are hereby incorporated by reference including any subsequent amendments and editions. Copies of these standards may be inspected at the On-Site Wastewater Section Central Office, located at 2728 Capital Blvd., Raleigh, NC in the Parker-Lincoln Building, and copies may be obtained from the ANSI On-Line Store at <http://webstore.ansi.org/ansidocstore> at a cost of forty-nine dollars and ninety-five cents (\$49.95), and from the Canadian Standards Association, at 5060 Spectrum Way, Suite 100, Mississauga, Ontario, L4W 5N6 Canada at a cost of one hundred dollars (\$100.00) plus shipping and handling, respectively. Documentation shall be provided that at least one of each size tank in each model meets specified physical properties set forth in IAPMO PS 1-2004 and CSA International B66-05, as applicable. At least one of each size of fiberglass reinforced plastic tank used in an RWTS shall be subjected to a vacuum test by an independent testing laboratory. Test unit must withstand negative pressure of 2.5 pounds per square inch (69.3 inches of water) without leakage or failure. Test results shall be included with the specifications that are provided to the state for approval.
- (E) Prefabricated tanks used in RWTS other than precast reinforced concrete or fiberglass reinforced plastic units shall be approved on an individual basis by the State based on information furnished by the designer which indicates the unit will provide effectiveness equivalent to reinforced concrete or fiberglass reinforced plastic units.
- (F) RWTS shall bear an imprint identifying the manufacturer, the RWTS serial number assigned to the manufacturer's model approved by the State, and the liquid or working capacity of the unit. The imprint shall be located to the right of the outlet opening pipe penetration point.
- (G) The design, construction, and operation of RWTS shall prevent bypass of wastewater.
- (H) Electrical circuits to the RWTS shall be provided with manual circuit disconnects within a watertight, corrosion-resistant, outside enclosure (NEMA 4X or equivalent) adjacent to the RWTS securely mounted at least 12 inches above the finished grade. Control panels provided by the manufacturer shall be installed in a watertight, corrosion-resistant enclosure (NEMA 4X or equivalent) mounted at least 12 inches above finished grade and located adjacent to the RWTS or in view of the RWTS on the side of the facility. The control panel shall not be located more than 50 feet from the RWTS components controlled by the panel. The control panel shall remain accessible at all times to the system operator (ORC). Conductors shall be conveyed to the disconnect enclosure and control panel through waterproof, gasproof, and corrosion-resistant conduits. Splices and wire junctions, if needed, shall be made outside the RWTS in a watertight, corrosion-resistant enclosure (NEMA 4X or equivalent) securely mounted adjacent to the unit at least 12 inches above the finished grade. Wire grips, duct seal, or other similar materials shall be used to seal around wire and wire conduit openings inside the RWTS and disconnect enclosure that shall prevent the transfer of liquid or gas into the RWTS or into the enclosure. The RWTS shall have an alarm device or devices to warn the user or operator of a unit malfunction or a high water condition. The alarm shall be audible and visible by system users and securely mounted adjacent to the RWTS, at least 12 inches above finished grade or in view of the RWTS on the side of the facility. The alarm shall not be located more than 50 feet from the RWTS component triggering the alarm condition. The alarm shall remain accessible at all times to the system operator (ORC). The alarm shall meet NEMA 4X standards or otherwise be equivalently

watertight and corrosion resistant. The alarm circuit or circuits shall be supplied ahead of any RWTS electrical control circuit overload and short circuit protective devices. Blower location shall be shown on plans and plans and specifications shall detail proposed corrosion-resistant blower enclosure, if applicable.

- (4) A settling tank shall be required prior to or as an integral part of the design of the RWTS. The liquid capacity of the settling tank shall be at least equal to half of the design daily flow of the RWTS, or as otherwise specified by the manufacturer, whichever is larger. The settling tank may either be an integral chamber of the RWTS tank, an approved prefabricated septic tank or another tank specially designed for a specific individual system and approved by the State as a part of the plans for the RWTS.
- (5) A manufacturer of an RWTS who desires consideration for approval as an Experimental, Controlled Demonstration, Innovative or Accepted system shall apply separately pursuant to Rule .1969 of this Section.

*History Note: Authority G.S. 130A-335(e),(f); 130A-342;  
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