Regulation 43 Tables:

Table 3-1 Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
C.R.S.	Colorado Revised Statutes
CBOD	Carbonaceous Biochemical Oxygen Demand
CPOW	Colorado Professionals in Onsite Wastewater
CSA	Canadian Standards Association
ETL	Electrical Testing Laboratories
gpd	Gallons per day
IAPMO	International Association of Plumbing and Mechanical Officials
ISDS	Individual Sewage Disposal System
LTAR	Long-term Acceptance Rate

mg/L	Milligrams per Liter
MPI	Minutes Per Inch
NAWT	National Association of Wastewater Technicians
NDDS	Non-pressurized Drip Dispersal System
NPCA	National Precast Concrete Association
NRTL	Nationally Recognized Laboratory
NSF	National Science Foundation International
OWTS	On-site Wastewater Treatment System(s)
STA	Soil Treatment Area
TL	Treatment Level
TN	Total Nitrogen
TSS	Total Suspended Solids
UL	Underwriters' Laboratories

Table 5-1: Rupture Resistance: Blocks, Peds, Clods – Estimate the class by the force required to rupture (break) a soil unit.

Dry Cementation Class	Specimen Falls Under
Loose	Intact specimen not obtainable
Non-cemented	Very slight force between fingers
Extremely weakly cemented	Slight force between fingers
Very weakly cemented	Moderate force between fingers
Weakly cemented	Strong force between fingers
Moderately cemented	Moderate force between hands
Strongly Cemented	Foot pressure by full body weight
Very Strongly Cemented	Blow of > 4.5 lbs., but not body weight
Indurated	Blow of ≥ 4.5 lbs. weight dropped at 6 inches

Source: NRCS Field Book for Describing and Sampling Soils, Version 3.0; 2021 Reprint; Consistence section, pg. 2-63.

Dry Rupture Resistance applies to soils that are moderately dry

Table 6-1 Single-Family Residential Design Flows

# Bedrooms	Occupancy (# of Persons)	Wastewater Flow Per Person (gallons/day)	Design Flow (gallons/day)
2	4	75	300
3	6	75	450
4	7	75	525
5	8	75	600
6	9	75	675

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD_5 Load is "Per Person" Unless Otherwise Noted[5]

RESIDENTIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Single-family dwellings, Accessory dwelling units	75	0.20
RESIDENTIAL WASTEWATER Auxiliary buildings, by fixture	**GPD**	**BOD_5 IN POUNDS PER DAY**
Bath/Shower	14.7	0.014
Dishwasher	1.8	0.002
Kitchen sink with garbage grinder	5.8	0.052
Laundry washer	19.5	0.037
Lavatory	8.4	0.021
Water closet (toilet)	24.8	0.029

RESIDENTIAL WASTEWATER Residential, Other	GPD	BOD_5 IN POUNDS PER DAY
Boarding and rooming houses (users absent during working hours)	50	0.15
Hotels and motels per room	75	0.15
Mobile home	75	0.20
Multiple-family dwellings or apartments	75	0.20
Mobile home park per space	300	0.80
Tiny Homes[3], per unit	150	0.40
Vacation home rental; per additional bed space provided; in addition to the 150 gal./bedroom[4]	50	0.20

3. For a "tiny home" the OWTS may be sized as a one-bedroom home.
4. As stated in section 43.6.A.2.i, the local public health agency may increase the "per bedroom" design flows for vacation home rentals relative to the expected maximum occupancy of the home. These flows are in addition to the 150 gal./bedroom requirement.
5. Note that discharges from non-domestic sources such as process waste, industrial waste, microbreweries, dog kennels, veterinary clinics, horse barns, etc. are not addressed in this regulation. Such discharges must obtain permitting as a Class V Injection Well through the EPA, as appropriate.

COMMERCIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Day-use, or Transient Facilities		
Examples: Airports or bus stations per passenger; fairgrounds per person attending; ball parks, race tracks, stadiums, theaters or auditoriums per seat	5	0.02
Airport per employee	10	0.06
Banquet halls per seat with food preparation, per event	7.5	0.06
Banquet halls per seat, no food preparation, per event	5	0.02
Barber and beauty shops per chair	100	0.70 [1]
Bowling alleys per lane - toilet wastes only	5	0.03
Convenience Stores with self-serve beverages	Footnote 7	Footnote 7
Country club per member	30	0.02
County club per employee	20	0.06

COMMERCIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Day-use, or Transient Facilities		
Dentist offices per non-wet chair	50	0.14
Doctor offices per doctor	250	0.80 [1]
Farm workers, factories and plants, exclusive of industrial wastewater, per employee per eight-hour shift – no showers	20	0.05
Farm workers, factories and plants exclusive of industrial wastewater per employee per eight-hour shift - showers provided	35	0.08
Laundries, self-service per commercial washer	400	0.75
Office buildings per employee per eight-hour shift	15	0.06
Service stations per toilet fixture	250	0.50 [1]
Stores and shopping centers per square foot of retail space	0.1	0.01 [1]
Work or construction camps semi-permanent with flush toilets	50	0.17
Work or construction camps semi-permanent without flush toilets	35	0.02

1. BOD levels may require further verification depending on the specific use of the facility.
7. Wastewater from convenience stores will likely meet the requirements of high strength waste. Studies indicate that BOD^5 effluent levels will range between 500 – 1500 mg/l. The exact levels will depend on products available (i.e.: coffee, soda, etc.), number of patrons, and how often the excess from each product is disposed. Flows from each facility can also vary substantially depending on location and the size of the store. Locations adjacent to freeways could have significantly more flow than a site located in a residential area. Subsequently, the design engineer must provide data from similar facilities in order to afford an estimation of projected peak daily flows.

COMMERCIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Food Service Establishments		
Coffee shop per customer	3.5	0.50 [1, 8]
Restaurant open 1 or 2 meals per seat	50	0.06/meal
24-hour restaurant per seat	75	0.07/meal served
Restaurant with paper service only per seat	25	0.01/meal served
Additional for bars and cocktail lounges per seat	30	0.02
Drive-in restaurant per car space	50	0.02

COMMERCIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Institutional Wastewater Without Kitchens Unless Otherwise Noted		
Churches per seat; without any food service, or other uses	3.5	0.01
Churches, per seat; warming kitchen only, no major food service	5	0.01
Churches, per seat; with food service, per meal served	7.5	0.02
Hospitals per bed space	250	0.20
Nursing homes; Group homes for developmentally disabled, per bed space	125	0.20
Schools, Boarding per person	100	0.17
Schools, Day without cafeteria, gym or showers	15	0.04
Schools, Day with cafeterias, no gym or showers	20	0.08
Schools, Day with cafeterias, gym and showers	25	0.10
Schools, Day additional for school workers	15	0.06

1. BOD levels may require further verification depending on the specific use of the facility.
5. Note that discharges from non-domestic sources such as process waste, industrial waste, microbreweries, dog kennels, veterinary clinics, horse barns, etc. are not addressed in this regulation. Such discharges must obtain permitting as a Class V Injection Well through the EPA, as appropriate.
8. Wastewater from coffee shops will likely meet the requirements of high strength waste. Studies indicate that BOD^5 effluent levels may exceed 500 mg/l. The exact levels will depend on the drink options (i.e.: latte, espresso, etc.), number of patrons, and how often the excess from each product is disposed. Flows from each facility can also vary substantially depending on location and the size of the store. Subsequently, the design engineer must provide data from similar facilities in order to afford an estimation of projected peak daily flows.

RECREATIONAL AND SEASONAL WASTEWATER USE	GPD	BOD_5 IN POUNDS PER DAY
Camps, day, no meals served	15	0.12
Children's camp, overnight with meals and showers	50	0.12
Luxury resort [6]	125	0.17
Resort night and day	50	0.12
Campground per campsite [2]	50	0.12

RECREATIONAL AND SEASONAL WASTEWATER USE	GPD	BOD_5 IN POUNDS PER DAY
Public park flush toilet per fixture per hour when park is open	36	0.04 lbs./ fixture
Public park urinal per fixture per hour when park is open	10	0.01 lbs./ fixture
Public park shower per fixture per hour when park is open	100	0.10 lbs./ fixture
Public park faucet per fixture per hour when park is open	15	0.04 lbs./ fixture
Swimming pools and bathhouses	10	0.06
Travel trailer parks with individual water and sewage hookup per unit [2]	100	0.24
Travel trailer park without individual water and sewage hookup per unit [2]	50	0.12

2. Laundry facilities are to be calculated on a per commercial washer basis in accordance with other elements of this table.
5. Note that discharges from non-domestic sources such as process waste, industrial waste, microbreweries, dog kennels, veterinary clinics, horse barns, etc. are not addressed in this regulation. Such discharges must obtain permitting as a Class V Injection Well through the EPA, as appropriate.
6. A "Luxury Resort" will typically include a spa, restaurant/bar, pool, etc.

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD $_5$ Load is "Per Person" Unless Otherwise Noted[5] (Footnotes Compiled)

1. BOD levels may require further verification depending on the specific use of the facility.
2. Laundry facilities are to be calculated on a per commercial washer basis in accordance with other elements of this table.
3. For a "tiny home" the OWTS may be sized as a one-bedroom home..
4. As stated in section 43.6.A.2.i, the local public health agency may increase the "per bedroom" design flows for vacation home rentals relative to the expected maximum occupancy of the home. These flows are in addition to the 150 gal./bedroom requirement.5. Note that discharges from non-domestic sources such as process waste, industrial waste, microbreweries, dog kennels, veterinary clinics, horse barns, etc. are not addressed in this regulation. Such discharges must obtain permitting as a Class V Injection Well through the EPA, as appropriate.
6. A "Luxury Resort" will typically include a spa, restaurant/bar, pool, etc.
7. Wastewater from convenience stores will likely meet the requirements of high strength waste. Studies indicate that BOD^5 effluent levels will range between 500 – 1500 mg/l. The exact levels will depend on products available (i.e.: coffee, soda, etc.), number of patrons, and how often the excess from each product is disposed. Flows from each facility can also vary substantially depending on location and the size of the store. Locations adjacent to freeways could have significantly more flow than a site located in a residential area. Subsequently, the design engineer must provide data from similar facilities in order to afford an estimation of projected peak daily flows.
8. Wastewater from coffee shops will likely meet the requirements of high strength waste. Studies indicate that BOD^5 effluent levels may exceed 500 mg/l. The exact levels will depend on the drink options (i.e.: latte, espresso, etc.), number of patrons, and how often the excess from each product is disposed. Flows from each facility can also vary substantially depending on location and the size of the store. Subsequently, the design engineer must provide data from similar facilities in order to afford an estimation of projected peak daily flows.

Table 6-3 Treatment Levels[6]

Treatment Level	BOD_5 (mg/L)	$CBOD_5$[1] (mg/L)	TSS (mg/L)	Total Nitrogen (mg/L)	Fecal Coliform[5]
TL1[2]	180	-	80	60-80	
TL2	-	25	30	N/A [3]	
TL2N	-	25	30	>50% reduction [4]	
TL3	-	10	10	N/A [3]	
TL3N	-	10	10	20	
TL3ND	-	10	10	20	≤200 per 100 mL

Shading indicates higher treatment levels.

1. Requirements for $CBOD_5$ are only related to effluent samples from a higher level treatment system.
2. Domestic septic tank effluent prior to soil treatment or higher level treatment has a wide range of concentrations. These values are typical, but values used for design must account for site-specific information.
3. Total Nitrogen does not apply to Treatment Levels TL2 and TL3. Processes intended to reduce total nitrogen are addressed in Treatment Levels TL2N and TL3N. Any total nitrogen reductions that may be observed for TL2 and TL3 are as a result of the treatment process for BOD_5 and TSS reductions.
4. NSF/ANSI Standard 245 – Wastewater Treatment Systems – Nitrogen Reduction requires reduction of 50 percent rather than an absolute value.
5. TL3ND requires effluent to be treated to TL3N standards prior to disinfection. The disinfection must meet the requirements of section 43.12.H.
6. With the exception of fecal coliform, treatment level requirements are based on values obtained from composite sampling.

Table 6-4 High Strength Wastewater*

	BOD_5 (mg/L)	**TSS (mg/L)**	**Fats, Oils, Grease (FOG) (mg/L)**
Septic Tank Influent	>300	>200	>50
Septic Tank Effluent	>180	>80	>25

* High strength wastewater prior to a septic tank has a wide range of concentrations. These values are typical, but values used for design purposes must account for site-specific information.

Table 7-1 Minimum Horizontal Distances in Feet between Components of an On-Site Wastewater Treatment System and Water, Physical and Health Impact Features[7, 10]

	-Spring, Well[1, 9] -Suction Line -Underground Potable Water Supply Cistern[4]	Potable Water Supply Line[2]	Structure **with** basement, crawl space, or footing drains	Structure **without** basement, crawl space, or footing drains	-Property Lines[11] -Upslope curtain drain	-Subsurface Drain -Intermittent Agricultural Irrigation Lateral[7] -Lined Pond or Irrigation Channel -Drywell -Storm sewer -Stormwater Structure	-Surface Water -Lake -Water Course -Open Irrigation Channel[7] -Stream -Wetland	-Dry Gulch -Cut Bank -Fill Area (from crest) -In ground pools	-Septic Tank -HLT Unit -Dosing Tank -Vault or Privy
Septic Tank, Higher Level Treatment Unit, Dosing Tank, Effluent pipe [2], Vault or Vault Privy	50 [2]	10 [2]	5	5	10	10	50	10	--
Building Sewer	50 [2]	5 [6]	0	0	10 [2]	10 [2]	50 [2]	10 [2]	--
STA Trench, STA Bed, Unlined Sand Filter, Sub-surface Dispersal System, Seepage Pit	100 [3]	25 [2]	20	10	10	25	50 [3]	25	5
Lined Sand Filter	60	10 [2]	15	10	10	10	25	10	5
Lined Evapo-transpiration Field or Outside of Berm of Lined Wastewater Pond	60	10 [2]	15	15	10	10	25	10	5
Open Unlined Sand Filter in Soil With a Percolation Rate Slower than 60 Minutes per Inch, Unlined Evapotranspiration System, Outside of Berm of Unlined Wastewater Pond, or System Not Relying on STA for Treatment Other than Aerosol	100	25 [2]	20	10	10	25	25	15	10
Slit Trench Latrine, Pit Privy	100	50 [2]	25	25	25	25	100	25	N/A
System Not Relying on STA for Dispersal	100 [3]	10 [2]	125	125 [5]	10	0	25 [3]	10	10

NOTE: The minimum distances shown above must be maintained between the OWTS components and the features described. Where soil, geological or other conditions warrant, greater distances may be required by the local board of health or by the Water Quality Control Commission pursuant to section 25-8-206, C.R.S. and applicable regulations. For repair or upgrading of existing OWTS where the size of lot precludes adherence to these distances, a repaired OWTS must not be closer to setback features than the existing OWTS, as reviewed and approved by the local public health agency.

1. Includes potable wells, irrigation wells and monitoring wells set within a potable aquifer and infiltration galleries permitted as wells by the Division of Water Resources. All horizontal setbacks to a potable water supply must be met unless a variance by the Board of Examiners of Water Well Construction and Pump Installation Contractors is granted per section 18.2 of the Water Well Construction Rules, 2 CCR 402-2, (Division of Water Resources). Setback requirements which may necessitate a variance are found within section.10.2 or 11.4 of the Water Well Construction Rules, as applicable. The minimum horizontal setback that may be granted for new construction through a variance is to 75 feet; and must meet the requirements of Table 7-2 of this regulation. Setbacks for existing wells must comply with requirements of section 43.10.I.2.

2. Crossings or encroachments may be permitted at the points as noted above provided that the potable water or wastewater conveyance pipe is encased for the minimum setback distance on each side of the crossing. A length of pipe with a minimum Schedule 40 rating [ASTM Standard D3034-24 (2024 version)] of sufficient diameter to easily slide over and completely encase the conveyance must be used. Rigid end caps of at least Schedule 40 rating [ASTM Standard D3034-24 (2024 version)] must be glued or secured in a watertight fashion to the ends of the encasement pipe. A hole of sufficient size to accommodate the pipe must be drilled in the lowest section of the rigid cap so that the conveyance pipe rests on the bottom of the encasement pipe. The area in which the pipe passes through the end caps must be sealed with an approved underground sealant compatible with the piping used. Piping of equal or higher strength may also be used. Other methods of separation between the potable water pipe and a component of the OWTS that provide equal protection are allowed. These may include, but are not limited to, concrete or controlled flowable fill encasement extending no less than 10 feet each side of the crossing, or an impermeable geo-membrane curtain extending at least two feet below the potable water pipe and no less than 10 feet each side of the crossing. These methods must be reviewed and approved by the local public health agency.

3. Add eight feet additional distance for each 100 gallons per day of design flows between 1,000 and 2,000 gallons per day, unless it can be demonstrated by a professional engineer or geologist by a hydrologic analysis or the use of a barrier, consisting of a minimum 30 mil PVC liner or equivalent, that contamination will be minimized. If effluent meets Treatment Level 3N and the local public health agency has a maintenance oversight program in accordance with section 14.D. of this regulation, the distance addition is not required. Flows greater than 2,000 gallons per day must be hydrologically analyzed for flow, velocity, hydraulic head, and other pertinent characteristics as means of estimating distances required to minimize contamination as part of the Division site application and permitting process.

4. All horizontal setbacks to an underground potable water supply cistern must be met unless a variance by the Board of Examiners of Water Well Construction and Pump Installation Contractors is granted per section 18.2 of the Water Well

Construction Rules, 2 CCR 402-2. Setback requirements which may necessitate a variance are found within section.10.2 or 11.4 of the Water Well Construction Rules, as applicable. The minimum horizontal setback that may be granted through a variance is to 25 feet. Noted setbacks are not required to above ground cisterns.

5. If the structure is not used as a habitable unit, the isolation may be reduced by the local board of health to no less than 50 feet.

6. Building sewer installations shall meet the design requirements of the Colorado Plumbing Code.

7. Where ditch companies have a specific right of easement for “reasonable and necessary use to access, operate, and maintain ditches”, all OWTS components must maintain a minimum of 25’ setback from the crest of the ditch/channel.

8. Sites with multiple OWTS on a single property where the total flows are > 2,000 gpd must meet the increased required setbacks as provided in WQSA-6 (Policy 6).

9. Per 2 CCR 402-10 (6.4.2) Geothermal wells shall be located at least 100 feet to the nearest source or potential source of contamination, unless a variance has been obtained from the state engineer.

10. Setback from a utility easement: While a specific setback for components of an OWTS to a utility easement is not specifically identified, the intent of the regulation is provided herein. The setback from utility easements is dependent on whether the utility is above or below ground. For above ground utilities, components of an OWTS must not be installed in areas where construction or maintenance vehicles may be required to travel in order to gain access to the utility. For utilities installed below grade, the objective is to setback the utility far enough away from the soil treatment area so that sewage will not seep into a utility trench excavation. The setback is also necessary to prevent construction or maintenance vehicles from driving on any component of an OWTS. Where remote properties have a blanket utility easement, the owner/operator of the OWTS will be responsible for providing signage or physical barriers as needed to reduce the risk of vehicular traffic or other disturbance to the OWTS. In all instances, a five foot setback will typically address most concerns.

11. In specific circumstances, the local public health agency may allow for a reduced setback from a property line to the OWTS; per the requirements of section 43.7.D.1.

Table 7-2 Minimum Separation Distance Requirements in Feet from Soil Treatment Area, Relative to Treatment Level Provided [3]

ITEM	OWTS DESIGN CONSIDERATION	Treatment Levels 1 and 2	Treatment Level 2N [4]	Treatment Level 3 [4]	Treatment Level 3N [4]	Treatment Level 3ND [4]
Horizontal Separation Distances						
1	Distance from soil treatment area to wells[5]	100	100	100	100 [1]	100 [1]
2	Distance from effluent pipes & soil treatment area to pond, creek, lake, or other surface water feature	50	25	25	25	25
3	Distance from soil treatment area to dry gulch or cut bank	25	10	10	10	10
Vertical Separation Distances						
4A	Treatment depth in feet from infiltrative surface to a limiting layer, or groundwater condition	4 feet [2] (3 feet with pressure dosing)	2.5	2.5	2	1
4B	Treatment depth in feet from infiltrative surface to a limiting layer, or groundwater condition with the inclusion of an unlined sand filter	3 (TL1) 2.5 (TL2)	2.5	2	2	1

NOTE: Treatment levels are defined in Table 6-3. Reductions in separation distances with higher level treatment may be granted only if the local public health agency regulations have included provisions for operation and maintenance.

1. All setback distance reductions to the 100 foot requirement for wells and soil treatment areas must be in full compliance with the minimum standards and variance requirements of the State of Colorado Division of Water Resources: Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction. For TL 3N and TL3ND effluent, a reduction to 75 feet is allowed if a variance from the Water Well Construction Regulations is obtained. Note that the Division of Water Resources does not address inquiries for existing wells. Local agencies must follow the same review principles, as provided within division's guidance document; "Variances for water wells"; March 2019.
2. Reductions in the vertical separation requirements for the use of higher level treatment systems with seepage pits are not allowed. The bottom of the excavation of a seepage pit must be a minimum of four feet above a limiting layer.
3. Refers to the quality of effluent applied to the distribution media
4. Pressure dosing is required for all TL2N, TL3, TL3N, and TL3ND systems
5. Includes potable wells, irrigation wells and monitoring wells set within a potable aquifer and infiltration galleries permitted as wells by the Division of Water Resources.

Table 9-1 Minimum Septic Tank Size Based on Number of Bedrooms

Number of Bedrooms	Tank Capacity (gallons)
2 or 3	1,000
4	1,250
Each Additional	250

Table 10-1 Soil Treatment Area Long-term Acceptance Rates by Soil Texture, Soil Structure, Percolation Rate and Treatment Level

Soil Type, Texture, Structure and Percolation Rate Range					Long-term Acceptance Rate (LTAR); Gallons per day per square foot [2]		
Soil Type	**USDA Soil Texture**	**USDA Soil Structure-Type**	**USDA Soil Structure-Grade**	**Percolation Rate (MPI)**	**Treatment Level 1 [1]**	**Treatment Level 2 and 2N [1]**	**Treatment Level 3, 3N and 3ND [1,*]**
R	>35% Rock (>2mm), or Fractured or Deteriorated Bedrock: See Table 10-1A					>35% Rock (>2mm), or Fractured or Deteriorated Bedrock: See Table 10-1A	
1	Sand, Loamy Sand	Single Grain	0 (Structureless)	5-15	0.80	1.40	1.55
2	Sandy Loam, Loam, Silt Loam	PR (Prismatic) BK (Blocky) GR (Granular)	2 (Moderate) 3 (Strong)	16-25	0.60	1.0	1.1
2A	Sandy Loam, Loam, Silt Loam	PR, BK, GR Massive	1 (Weak) 0 (Structureless)	26-40	0.50	0.80	0.90
3	Sandy Clay Loam, Clay Loam, Silty Clay Loam	PR, BK, GR	2, 3	41-60	0.35	0.55	0.65
3A	Sandy Clay Loam, Clay Loam, Silty Clay Loam	PR, BK, GR Massive	1 0 (Structureless)	61-75	0.30	0.45	0.55
4	Sandy Clay, Clay, Silty Clay	PR, BK, GR	2, 3	76-90	0.20	0.30	0.30
4A [3]	Sandy Clay, Clay, Silty Clay	PR, BK, GR Massive	1 0 (Structureless)	91-120	0.15	0.20	0.20
5 [3]	Soil Types 2-4A	Platy	1, 2, 3	121+	0.10	0.15	0.15

NOTE: Shaded areas require system design by a professional engineer.

1. Treatment levels are defined in Table 6-3.
2. The determination of long-term acceptance rates must also include an evaluation of soil consistence (identification of "cementation class"). Refer to the Rupture Resistance chart, Table 5-1, in section 43.5.D. Moderately to Very strongly cemented soils will typically have characteristics of Type 3A or 4A soils. Long term acceptance rates should be reduced to coincide with the expected permeabilities.
3. Soil types 4A and 5 will require the effluent to be dispersed via pressure distribution, with a minimum of two alternately dosed zones.

* Higher long-term acceptance rates for Treatment Level 3N may be allowed for OWTS required to have a discharge permit, if the capability of the design to achieve a higher long-term acceptance rate can be substantiated.

Table 10-1A [1] Design Criteria for Soils with High Rock Content (Type "R" Soils) [2,5,6]

Soil Matrix Type, Percent of Rock, Size of Rock, Excavation Difficulty, and Soil Permeability [3]				Required sand depth relative to the quality of effluent applied to the distribution cell [7]			
Soil Type [1]	**Soil Matrix Type, Percent of Rock, and Size of Rock [3,4]**	**Excavation Difficulty [1]**	**Soil Permeability; Minutes Per Inch (MPI) [1, 2]**	**Treatment Level 1 [7, 8]**	**Treatment Level 2 and 2N [7]**	**Treatment Level 3 and 3N [7]**	**Treatment Level 3ND [7]**
FBR	In-situ Fractured Bedrock (FBR)	Low Moderate High Very High Extremely High	0 – >90 Usually rapid in highly fractured bedrock.	Minimum 3-foot deep Unlined Sand Filter	Minimum 2.5-foot deep Unlined Sand Filter	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter
DBR	In-situ Deteriorated Bedrock (DBR)	Low Moderate High	41 – >90 Typically slower than the material textures	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter	Sand media not required	Sand media not required
R-0	Soil Type [3] 1 (Sand and Loamy Sand) where more than 35% rock is greater than 2 mm in size.	Low- Tile spade with arm pressure.	0 to 15	Minimum 3-foot deep Unlined Sand Filter	Minimum 2.5-foot deep Unlined Sand Filter	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter
R-1	Soil Type [3] 2 – 4, with 35 - 65% rock (>2mm); where 50% or more of the rock is less than 20 mm (3/4 inch) in size	Low - Tile spade with arm pressure, To, Moderate - Tile spade with foot pressure.	16 to 90 Varies relative to soil type and cementation class.	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter	Sand media not required	Sand media not required
R-2	Soil Type [3] 2 – 4, with more than 65 Rock (>2mm); **OR** contains 35 - 65% rock (>2mm), where 50% or more of rock is more than 20 mm (3/4 inch)	Low - Tile spade with arm pressure, To, Moderate - Tile spade with foot pressure.	16 to 90 Varies relative to soil type and cementation class.	Minimum 3-foot deep Unlined Sand Filter	Minimum 2.5-foot deep Unlined Sand Filter	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter

R-3	Soil Type [3] 2 – 4 (Loam, Clay Loam, Clay) with 65% or more of the rock is greater than >2mm **OR**, Soil Type [3] 4A and 5 (Structureless Clay, or other Platy Structured Soil) with more than 35% rock	High – Tile spade is difficult, pick using over-the-head swing is easy. Very High – Pick with over-the-head swing is moderate to markedly difficult. Extremely High – Pick with over-the-head swing is nearly impossible.	Greater than 90 Soil Type [3] 2 – 4 (Loam, Clay Loam, Clay) More than 65% of the Rock is greater than 2mm in size. **OR,** 50% or more of Rock is greater than 20 mm (3/4 inch) in size.	Minimum 3-foot deep Unlined Sand Filter	Minimum 2.5-foot deep Unlined Sand Filter	Minimum 2-foot deep Unlined Sand Filter	Minimum 1-foot deep Unlined Sand Filter

1) General guidance for Table 10-1A:
   a) FBR: Fractured Bedrock – As this category encompasses a variety of site conditions where the percentage of rock, excavation difficulty, and permeability may vary substantially, all information must be used by the design engineer to determine the proper long term acceptance rate. Table 10-1B provides guidance for this determination.
   b) DBR: Deteriorated Bedrock – As this category encompasses a variety of site conditions where the percentage of rock, excavation difficulty, and permeability may vary substantially, all information must be used by the design engineer to determine the proper long term acceptance rate. Table 10-1C provides criteria for this determination.
   c) Soil Type R-0 is a limiting layer due to rapid permeability and a high rock content that provides limited surface area for adequate treatment.
   d) Soil Type R-2 and R-3 are restrictive layers due to reduced permeability and/or a high rock content, each providing a limited surface area for adequate treatment. In many cases, the only difference between an R-2 and R-3 soil type will be the "excavation difficulty" and/or soil permeability.
   e) An OWTS installed in "Type R Soils" must disperse effluent through an unlined sand filter, unless one of the following conditions are met:
      i) Treatment Level 3ND is attained and the requirements of 43.12.F are met.
      ii) Site conditions are determined to be a soil Type DBR, or R-1, and Treatment Level 3 or 3N effluent is attained prior to dispersal to the soil treatment area.
   f) "Excavation Difficulty" is provided in Table 10-1C
2) Provisions for determining the long-term acceptance rates for soils referenced in this chart are provided in section 43.11.C.3. The design of systems in type "R" soils must conform to the requirements of sections 43.11.C.2 and 3.
3) The "Soil Matrix Type, Percentage and Size of Rock" column references the soil types described in Table 10-1.
4) The percentage of rock may be determined by a gradation conducted per ASTM standard D6913-17 (2017. version), or a visual determination as per pgs. 7-1 through 7-9 of the NRCS Field Book, Version 3, 2021 reprint.
5) All systems installed in a type "R" soil must be designed by a professional engineer.
6) Pressure distribution is required for all "R" Soil Types and shall comply with the requirements of sections 43.10.E.3.
7) Minimum imported sand depths are provided in this table. NOTE HOWEVER THAT AN ADDITIONAL VERTICAL SEPARATION ABOVE A LIMITING LAYER OR GROUNDWATER CONDITION MAY BE NECESSARY TO MEET THE REQUIREMENTS OF TABLE 7-2.
8) Type "R" soil treatment systems that are designed per the criteria noted in the Treatment Level 1 column of this table do not require operation and maintenance oversight by the local public health agency.

Table 10-1B: Fractured Bedrock (FBR), LTAR Guidance

FBR: Distance between fractures*	Code	LTAR
<4 inches	1	Soil Type 1
4 to < 18 inches	2	Soil Type 1
18 to < 40 inches	3	Soil Type 2
40 to < 80 inches	4	Soil Type 3
≥ 80 inches	5	Soil Type 4

Table 10-1B is intended to provide guidance to the design engineer in determining the appropriate LTAR for the soil treatment area. Fractured bedrock formations typically consist of many variables, resulting in a wide range of permeabilities. The design engineer should take all factors into consideration before identifying a specific LTAR for each site. In certain instances, percolation tests may be necessary to more accurately identify the appropriate LTAR.

*Describes the dominant (average) horizontal spacing between vertical joints (geogenic cracks or seams) in the bedrock layer.

Reference: NRCS Field Book for Describing and Sampling Soils, Version 3.0; 2021 Reprint; Geology section, pg. 1-24. Note: The LTAR identified in this table is not included in the NRCS Field Book.

Table 10-1C: LTAR Determination for Deteriorated Bedrock (DBR)

Excavation Difficulty: The relative force or energy required to excavate the soil/rock.

Class	Criteria
Low	Excavation by tile spade requires arm pressure only; impact energy or foot pressure is not needed
Moderate	Excavation by tile spade requires impact energy or foot pressure; arm pressure is insufficient
High	Excavation by tile spade is difficult but easily done by pick using over-the-head swing
Very High	Excavation by pick with overhead swing is moderately to markedly difficult. Backhoe excavation by 50 – 80 hp tractor CAN be made in moderate time.
Extremely High	Excavation by pick is nearly impossible. Backhoe excavation by 50 – 80 hp tractor CANNOT be made in a reasonable time.

Note: Depending on the "Excavation Difficulty" in a DBR soil, the proposed LTAR must increase by the following: one soil type for "moderate", two soil types for "high", and three soil types for "very high" or "extremely high" excavation difficulty from the soil type of the observed soil texture; with a maximum soil type 5 LTAR. Soil types provided in Table 10-1.

Source: NRCS Field Book for Describing and Sampling Soils, Version 3.0; 2021 Reprint; Consistence section, pg. 2-69.

Table 10-2 Size Adjustment Factors for Methods of Application in Soil Treatment Areas Receiving Treatment Levels 1, 2, 2N, 3, 3N and 3ND Effluent

Type of Soil Treatment Area	Method of Effluent Application from Treatment Unit Preceding Soil Treatment Area		
	Gravity	Dosed (Siphon or Pump)	Pressure Dosed
Trench	1.0	0.9	0.8
Bed	1.2	1.1	1.0

Table 10-3 Size Adjustment Factors for Types of Distribution Media in Soil Treatment Areas for Receiving Treatment Level 1 Effluent

Type of Soil Treatment Area	Type of Distribution Media Used in Soil Treatment Area[1]		
	Category 1	Category 2	Category 3
	Rock or Tire Chips	Other Manufactured Media	Chambers or Enhanced Manufactured Media
Trench or Bed; Soil Types 1 - 4	1.0	0.9	0.7
Trench or Bed; Soil Types 4A - 5	1.2	1.1	1.0

1. All proprietary distribution products must receive acceptance and the applicable size adjustments through Division review per the applicable requirements of section 43.13.

Table 12-1 Gradation of Wicking Sand for Evapotranspiration Beds (Fine Sand)

Sieve Size	Percent Passing
4	100
40	50-70
200	<15