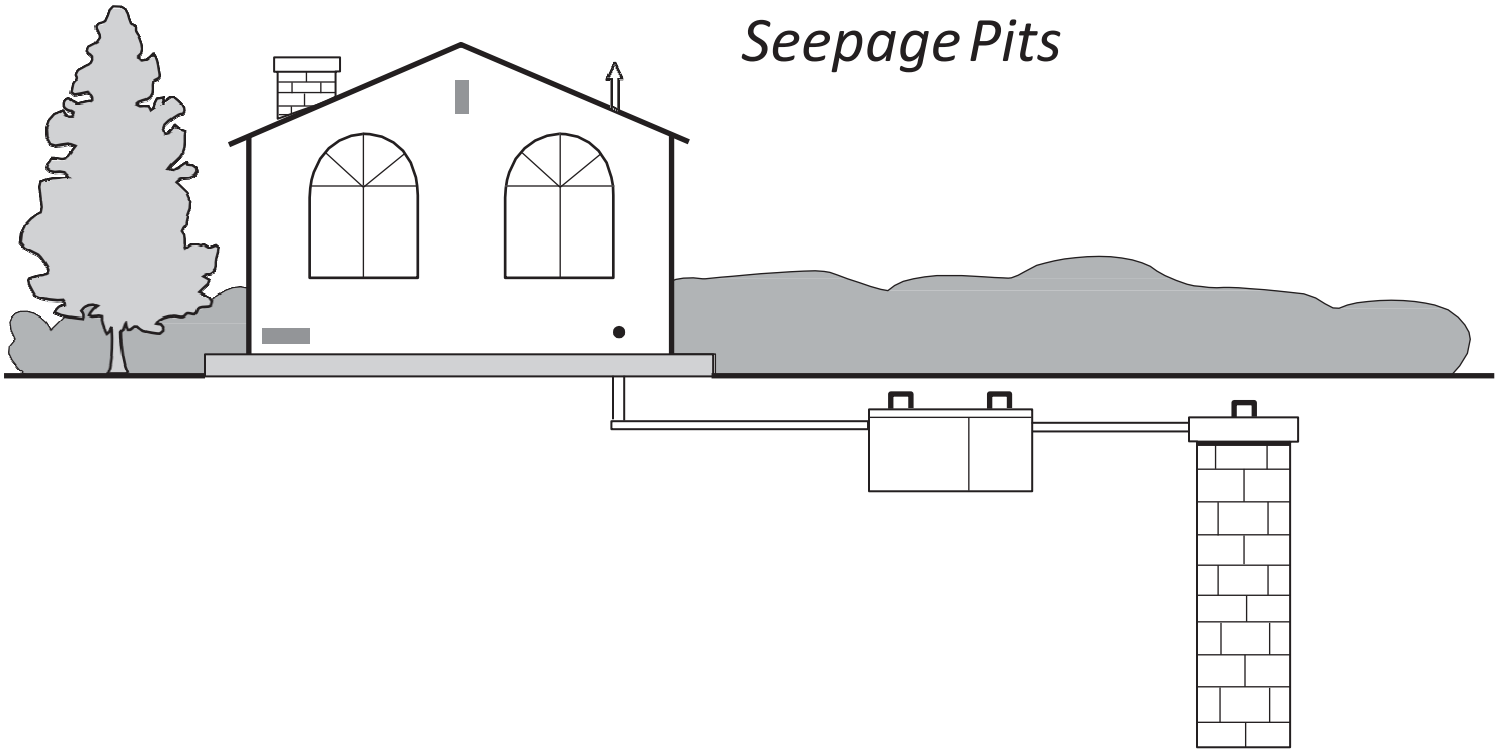
On-Site Waste Water Disposal System

Soil Percolation (PERC) Test Report Standards: *Suitability of Lots and Soils for Use of Leachlines or Seepage Pits*



City of Barstow

Building and Safety Division

January 2019

FOREWORD

A soil percolation report is a technical document which establishes whether on-site sewage disposal systems can be used for a specific parcel of land to serve a given type of development (such as single/multiple family dwellings, restaurant, campground, etc.).

The soil's percolation condition is determined by testing at the specific site and topographical, geologic, and hydrologic conditions are determined and described in the report. The on-site system is then designed in accordance with this information and the City of Barstow's Local Agency Management Plan (LAMP). A properly installed, operated and maintained system should not be subject to premature failure causing nuisances, odors or public health hazards.

Complete reports must be submitted, and all appropriate fees paid to the City of Barstow – Building and Safety Division (BSD), prior to the approval of the use of any on-site percolation system and the application of the design rate.

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CITY OF BARSTOW
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SOIL PERCOLATION (PERC) TEST REPORT STANDARDS

SUITABILITY OF LOTS AND SOILS FOR
USE OF LEACHLINES OR SEEPAGE PITS

NOTICE:

At least two working days before conducting routinely scheduled percolation tests, you must contact the Building and Safety Division (BSD). Please provide the following: assessor's parcel number, firm's name and person to contact, date(s) of testing, and telephone number. At the option of the inspector, a field inspection during testing or shortly thereafter may be conducted. The date that the inspector (or BSD) was contacted must be stated in the report.

I. A perc report is required by BSD:

a) For all subdivisions of land, except those for which a waiver has been granted.

b) For any parcel or land division where existing data will not allow the city Building and Safety Division to set a sewage disposal rate.

c) For any single lot where space or soil conditions for on-site sewage disposal are critical (i.e., very small or steep lots, very slow perc times, shallow groundwater with fast perc times, etc.)

d) For any commercial or sanitary wastes from industrial developments utilizing on-site percolation systems.

e) For a replacement system where existing data will not allow the city liquid waste specialist to set a design rate.

II. Those who prepare perc reports must have professional experience and be knowledgeable in assessing the site's on-site sewage disposal feasibility. They assume responsibility for the report's contents in accordance with the obligations of their professional registration and may be held liable if false or misleading information is presented. Preparers must possess one of the following professional registrations:

a) A State of California Registered Civil Engineer,

b) A State of California Certified Engineering Geologist,

c) A State of California Registered Environmental Health Specialist,

d) A State of California Registered Geologist,

e) A State of California Geotechnical Engineer

Reports must be properly documented with the original signature, stamp, professional registration number and license expiration date of the preparer. Photo copied signatures are not acceptable. Preparers shall be identified by name, field technicians by initial.

III. Format and other requirements:

1. DESCRIPTION OF SITE AND OF PROPOSAL

1) Date/individual that was notified of testing.

2) Prepared for: Name of client, address and phone number.

3) Location of land:

   a) Provide a sufficiently detailed vicinity map, township, range, section, assessor's parcel map or subdivision map, and/or legal description of property. Make sure you have the right parcel; state how the property is identified. (Owner's word alone is not acceptable.) Indicate landmarks and street addresses when possible. Specify those survey monuments found and if the property lines were surveyed, by whom.

4) Proposed Development/Project/Land use:

   a) State the type of project: i.e., condominium, subdivision tract, lot sale, parcel map, shopping center, etc.
   b) State the total acreage, the number of lots, and the average and range of the lot sizes.
   c) State the type of sewage disposal system: i.e., septic tank or package plant, leachline(s), or seepage pit(s), separate or common system, other.
   d) State if grading is proposed for the development, and how much.

5) Description of site and surroundings: (A photograph is often useful.)

   a) Topography: Include a topographic map prepared by a Registered Civil Engineer or Licensed Land Surveyor, unless the site and the surroundings are flat or have a uniform, constant slope (+ or - 1% variation) of less than 20%. For instance, "slope of 10% downward from north property line to south property line".

% Slope	Maximum Interval of Contours in Feet for Topo Map
0-2	2
>2-10	4
>10	10

   Describe the topography in the area of the proposed disposal site(s) and its location relative to the proposed development.

   b) Water courses: Indicate and show on the plot plan any floodway, floodplain, spring(s),

stream(s), and drainage course(s) which encroach within a distance of 1 ½ times the required minimum setback from the disposal area(s).

- Vegetation type and density (especially groundwater indicators such as willows, reed grasses, cattails, and smoke trees) as well as trees in general, area(s) of proposed system(s).
- Existing structures: (1) General description of proximity, density, probable kind and number of neighboring septic systems. (2) Indicate whether the proposed system could adversely impact any existing structure's disposal system(s) or replacement area on or in the vicinity of the parcel being tested where known. (3) Indicate location of nearest sewer, and any sewer manholes observed.
- Indicate the location of any active or inactive well(s) (and their construction details where known) located within 300 feet of the proposed disposal area. Indicate proposed source of domestic water. Identify future well sites, when appropriate.
- Rock outcroppings: Specify the type of rock (shale, slate, schist, granite).
- Indicate the depth to historic groundwater and how it was determined. Provide the date and source of information used (Flood Control Agency, local water companies, California Department of Water Resources Bulletin, USGS, etc.)
- Any other feature that may affect sewage disposal: fill material, spots of vegetation, obvious signs of slope instability, fractured bedrock, root channels, cracks in the soil profile, suspected infiltration galleries or old mine tunnels, proposed grading over the system, etc.

2. EQUIPMENT

Describe in detail equipment used to perform perc test - backhoe with 12" bucket, rig with 8" diameter, screw-type auger (identify type), 6" posthole digger, shovel, fork and spoon, measuring tape with 1/8" divisions, wire-onfloat sliding on 1/10" gradation scale, etc.

3. METHODOLOGY AND PROCEDURES

- **Location of borings and trenchings.** Under most circumstances, the random grid method should be utilized. In the event that other methods are used, explain the method and state the specific reason(s) it was used in lieu of the grid method. It is the report preparer's responsibility to ensure that tests were conducted where described in the report. Indicate locations on the plot plan. For easy identification leave three-foot laths marked with your initials, hole/trench number, and the date the test was conducted at each backfilled hole.
  Estimate theoretical cuts and fills and perform the tests and borings <u>at the depths</u> at which percolation will occur when the system is installed. When final grading is unknown, indicate that leachlines will be located in natural soil ± two (2) feet of cut or fill (± five (5) feet if pits) or at tested depths. If the final system design is not located within the stated range, additional testing will be required prior to final recordation or issuance of a building permit.

A. **Soil characteristics to determine number of borings or trenchings and tests.** Unless deviations are permitted in advance by the city inspector, the <u>minimum</u> number of explorations and tests in Tables 3.3, 3.4, and 3.5 is determined based on the following soil characteristics:

B. **Favorable** is defined by the following:

1. Ideal soil conditions are anticipated.
2. There is no visual evidence of shallow groundwater, bedrock, impervious materials, etc. Tests and borings performed agree with the visual evidence. Natural or finished slope of the disposal area is 20% or less.

C. **Moderate** is defined by the following:
1. Only isolated areas of the property are suspected to encounter problems due to groundwater, bedrock, impervious materials, etc.
2. No more than 10% of the tests and deep borings fail to meet standards.
3. The minimum number of tests and borings should be spaced in a random grid, the additional tests describe the limits of the problem area(s).
4. Natural or finished slope of the disposal area is less than 30%.

D. **Severe** is defined by the following:
1. Obvious surface features indicating site conditions that will hinder subsurface disposal are present.
2. Through random testing, more than 10% of the tests and borings do not meet standards.
3. Acceptable testing rates approach the upper limit of approval, or a nonuniform pattern of test rates develop.
4. Natural or finished slopes of the disposal area equal or exceed 30%.

2 Minimum number of exploratory borings

	Gross Lot Size	Soil Conditions	
		Favorable to Moderate	Severe
Subdivisions and individual lot sales	<1 acre	3 borings first 10 lots 1 boring every 10 thereafter	8 borings first 10 lots 5 borings every 10 thereafter
	1-5 acres	5 borings first 10 lots 3 borings every 10 thereafter	2 per lot*
	>5 acres	1 boring per lot*	2 per lot*
Residential lot		1 boring*	2 per lot*
Commercial lot, confluent systems under one ownership		1 boring per 4,000 gallons septic tank capacity*	1 boring per 2,000 gallons septic tank capacity*
Parcel Map	5 acres or less	1 boring in the center of the undivided parcel	2 borings evenly spaced in the undivided parcel

*** In the area of the disposal system, if known.**

3.3.1 Boring/Trenching Results - Number each hole or excavation. Graphically describe soil strata at each hole or excavation.

a) Soil profile descriptions shall be written under the supervision of the registrant for all of the excavations. The thickness (in inches or tenths of a foot) of the different soil horizons observed shall be indicated. Soil horizons shall be described on the basis of color, field texture analyses, soil mottles, bedrock, structure, roots, and pores. Depths shall be measured from the existing ground surface.

b) Where the soil lithology is stratified and low-permeability layers such as sandy silts and clays, or caliche could affect the on-site disposal system performance (leachlines and seepage pits bottomed less than 20 feet below grade), the soil profile shall be described by direct visual observation: i.e., in a backhoed trench, road cut, suitable large (> two (2) feet diameter) boring, or splitspoon sampling.

c) Textures - Use any of the classifications in Appendix pages Al-4. State the approximate percentage of cobbles, gravel, sand, silt, and clay.

d) Colors (dry/moist), reduction-oxidation mottling. (See Appendix.) The Munsell soil color chart shall be the descriptive tool utilized to determine the background soil color.

e) Presence and extent of small/large roots.

f) Ease of excavating/drilling, depth to bedrock and rock competency (soft, firm, hard, refusal).

g) Moisture - If soil at or near the point of saturation is encountered in the exploratory boring, observe the borehole after 24 hours to determine the presence of free water.

h) Free water - The depth to groundwater, if present, shall be reported. Observed groundwater shall be reported at the level groundwater reaches in the excavation, or at the highest level of sidewall seepage into the excavation after 24 hours. Measurements shall be made from the ground level. Soil above the water level in the excavation shall be checked for conditions associated with saturation (mottles).

i) Structural characteristics, stratigraphy, and geologic origin shall be described when determined necessary by the consultant for severe sites only.

j) Indicate method of boring abandonment.

3.4 Minimum Number of Tests for Leachlines:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note-Individual lot sales requires 100% lot testing)	<2.5 acres	6 tests first 10 lots, 1 test every 10 thereafter	9 first 10, 6 next 10	1/lot
	2.5 acres to 5 acres	8 tests first 10 lots, 3 tests every 10 thereafter	10 first 10, 7 next 10	1/lot
	>5 acres	1/lot	1/lot	1/lot
Residential lot		Minimum 4 tests*	4*	6*
Commercial lot, c o n f 1 u e n t systems under one ownership		4 tests/3,000 gallons septic tank capacity*, 1 test for each additional 2, 000 gallons septic tank capacity	5/3, 000* 2/2,000	6/3,000* 3/2,000
Parcel Map		Minimum one test for each lot in the area of the disposal system or City assigned rate per waiver criteria (minimum 4 tests)	2 tests per 1ot* (minimum 6 tests)	3/lot* (minimum 8 tests)

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.4.1 Standard Percolation Test Procedure for Leachlines

Excavation: Test holes shall be augured or excavated to within 13 inches of the actual test depth which corresponds to the anticipated depth of the leachline or the bed trench bottom. Vary depths to include testing of side wall if the disposal system will be more than three feet below the ground surface. In addition, perform one test in the least permeable soil stratum found during the deep excavation if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole: 1. A hole of diameter 5.5” - 8” (D) or square 5” - 7” (S) should normally be used.

2. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\frac{\text{mpi (test)} \times 6}{\text{actual “D” or “S” dimension}} = \text{mpi corrected}$$

Rates greater than 8 mpi do not need to be corrected.

3. Depth - The minimum test hole depth is 13". All sides to be vertical. (Below the test excavation bottom or at least 5 feet horizontal distance to daylight in a trench bench.)

4. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

5. Place two (2) inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated can may be placed over the gravel. (Note: if the can has a bottom, gravel may not be necessary.)

Pre-Soak: Fill the hole with 12" of clear water (10" above the gravel or the bottom of the perforated can.)

1. If ten (10) inches of clear water seeps away in two consecutive readings in less than ten (10) minutes each and the soil is of coarse texture, testing can be conducted immediately. Otherwise:

2. Pre-soak by:

   a. Maintain the water level in the test hole at ten (10) inches above the gravel, for at least four (4) hours, or;

   b. For augured test holes with a total depth over four (4) feet from the surface to the gravel, fill the entire hole to the surface. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing, or;

   c. For augured test holes of less than four (4) feet total depth, fill the test hole to the surface and invert a five (5) gallon bottle of water in the hole. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing.

NOTE: All of the above procedures are designed to allow a minimum of five (5) gallons of water to percolate and saturate the lower 12 inches of the test hole. Other pre-soak methods that also accomplish this may be used, but should be fully described in the final report.

Testing: 1. Begin testing 15-26 hours after the beginning of soaking (except for sandy soils as

noted), to allow time for swelling of clays but prevent soil from drying out.

2. Fill or refill the hole with clear water to eight (8) inches from the bottom of the hole, (6) six inches over the gravel.

Readings:

1. If more than five (5) inches of water is gone in 30 minutes, take readings every 10 minutes for one hour minimum. Refill after each reading. All final time intervals shall provide a minimum of a one (1) inch drop and not more than a three (3) inch drop.

2. If 1ess than one (1) inch is gone in 30 minutes, take 60 minute readings for three (3) hours minimum. Do not refill until at least a one (1) inch drop has occurred.

3. For all other cases, take 30 minute readings for three (3) hours minimum. Refill after each reading. All readings shall provide a minimum 1 inch drop, and a maximum 3 inch drop.

Accuracy: All measurements will be read to the closest 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.2 Continuous Pre-Soak Percolation Test Procedure-Leachlines

DESCRIPTION

This method requires the use of a water reservoir to provide a continuous volume of water in the hole during the pre-soak period. After a predetermined volume of water has seeped through the test hole, the measurement of the percolation rates may commence.

The method described in the following procedure utilizes a 5-gallon water bottle inverted in the test hole. This procedure can be modified to use a reservoir and a float device to control the water level as described:

PROCEDURE:

Excavation: The test excavation shall be constructed so as to facilitate the placement of the 5-gallon reservoir of water over the test hole. The excavation shall reach to within 13 inches of the actual test depth which corresponds to the approximate depth of the leachline or the bed trench bottom. Vary the depths in order to include testing of the sidewall if the disposal system is to be more than three feet below the ground surface. In addition, perform one test if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole:

1. Auger or hand excavation.
2. A hole of diameter 5.5" - 8" (D) or square 5" - 7" (S) shall normally be used.
3. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\text{mpi corrected} = \frac{\text{mpi (test)} \times 6}{\text{actual "D" or "S" dimension}}$$

Rates greater than 8 mpi do not need to be corrected.

4. The minimum test hole depth is 13 inches.

5. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

6. Place 2 inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated pipe is then placed in the hole to prevent caving and to support the water bottle. The pipe length shall be approximately the same as the test hole depth.

Pre-Soaking: To start, fill the test hole with water to 8 inches above the gravel. Invert a full 5-gallon bottle of clear water over the hole (in a bottle support) so that the hole is filled continuously to approximately 8 inches over the gravel.

When the 5 gallons of water has percolated through the test hole, or after 15 hours but before 26 hours from initiating pre-soak, testing may commence.

Testing:

A. Same day testing - When the 5 gallons has percolated while the tester is present, the test may proceed the same day as the pre-soak.

1. Remove the bottle and adjust the water level to 6 inches above the gravel:

2. Take a minimum of four (4) consecutive measurements at timed intervals that provide not less than a one (1) inch nor more than a 3 inch drop. Refill the water level to 6 inches above the gravel after each measurement.

B. Next day testing - (15-26 hours after starting pre-soak)

1. If water is still present in the test hole, the test shall not start less than 15 hours from initiating the pre-soak.
   a. Remove the bottle and adjust the water level to 6 inches above the gravel.
   b. Take a minimum of two (2) consecutive measurements at time intervals that provide not less than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.
2. If no water is left in the test hole, the test shall begin within 26 hours from starting the pre-soak. (Repeat the pre-soak procedure if more than 26 hours have passed.)
   a. Remove the bottle and adjust the water level to 6 inches above the gravel.

   b. Take a series of readings for a minimum of two hours, or four consecutive readings at time intervals that provide not 1ess than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.

Accuracy: All measurements shall be read to 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.3 Leachline Test Results

3.4.3.1 Tabulate all the results, including all tests that "failed" to meet the minimum acceptable standards.

3.4.3.2 Provide copies of all the field data and calculations using the following format:

Leachline Test:

1. Hole No:
2. Diameter in inches:
3. Hours presaturation; gallons used, time presoak initiated:
4. Depth (of bottom) below grade:
5. Types of strata tested:
6. Condition of hole: caving or siltation?
7. Any method used to prevent sidewall caving?
8. Name of tester:
9. Date tested:

Provide numerical values for each of these parameters

t_1 | $depth_1$ | t_2 | $depth_2$ | Δt | Δd | $\frac{\Delta t}{\Delta d}$ mpi (or mpc)

Where:

t_1 = initial time when filling or refilling is completed - minutes

d_1 = initial depth of water in hole

t_2 = final time in minutes

d_2 = final depth of water in hole

Δt = change in time - minutes

Δd = change in depth - inches

35 Minimum Number of Tests for Seepage Pits:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note: Individual lot sales r e q u ire 10 0 % testing)	<1 acre	3 tests first 10 lots; 2 tests for every 10 1ots thereafter	6 first 10 3 next 10	1/lot*
	1 acre to 2.5 acres	4 tests first 10 lots; 2 tests for every 10 lots thereafter	7 first 10 4 next 10	1/lot*
	>2.5 acres to 5 acres	5 tests first 10 lots; 3 tests for every 10 lots thereafter	8 first 10 5 next 10	1/lot*
	>5 acres	6 tests for first 10 lots; 4 tests for every 10 lots thereafter	1/lot*	2/lot*
Residential lot		2 tests*	3 tests*	
Commercial lot, c o n f 1 u e n t systems under one ownership		2 tests/4,000* gallons septic tank capacity in sewage disposal area 1 additional test per 2,000 gallons of septic tank capacity or fractional part thereof	2/3,000* 1/2,000	2/3,000* 2/2,000
Parcel Map		2 tests evenly spaced on the undivided parcel	3 tests evenly spaced on the undivided parcel	4 tests evenly spaced

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.5.1 Seepage Pit, Weighted Average Percolation Test Procedure

Test each stratum as for leachlines, in Section 3.4.1. Multiply the thickness of each stratum by its perc time; add the results. Divide the total by the sum of all the thicknesses. The result is the average mpi for the given total depth. Exclude all strata with pi > 30. This is not an easy procedure to perform without very accurate instruments.

3.5.2 Sewage Pit, Falling Head Percolation Test Procedure

Test Holes:

a) Holes are 6" to 8" in diameter. Exploratory borings (6"-8") may be backfilled at least 10 feet and used for testing. When backfilling, if soils are too coarse (less than 20% fines) mix top of backfill with driller's mud or other material approved by the Building and Safety Division; cover with one (1) foot of gravel.

b) Depth - Same as the depth estimated for the pit based on the soil log. If distinctly lower permeable stratum (strata) are found with higher permeable stratum within the test boring, the lower permeable stratum should be tested separately. Vary depths when unsure.

c) Because caving may invalidate the results in anticipated adverse areas of percolation, precautions, such as gravel packing, should be used.

Measurements

a) Carefully fill the hole with clear water until the water level is even with the surface of the ground. Refill to the surface for all but the last two (2) readings. The final refills shall be to the proposed depth of the inlet or a minimum of 4 feet below the ground surface.

b) In very sandy soils, where the water on two consecutive readings seeps faster than half the initial wetted depth in 30 minutes, the time intervals shall be 10 minutes or shorter and measurements shall be taken for at least one additional hour until three consecutive readings do not vary by more than 10%. Gravel packed holes must have four (4) consecutive readings where the water seeps faster than half the initial wetted depth in 30 minute intervals to compensate for the reduced water volume of each pre-soak.

c) In soils with fines, soak the hole and let it set overnight. The perc rate measurements shall be made on the day following the soaking, not more than 26 hours after the pre-soak. From the reference point, measure the drop in water level over thirty minute periods for at least six hours. For the final two readings, read every 30 minutes without refilling and check for possible nonuniform absorption; measure how fast the water level keeps on falling until it gets down to the bottom or slows down. The consultant must determine if the minimum six hour testing should be extended for another 30-60 minutes.

d) Remeasure the depth of the hole with each reading to see if caving has occurred. Caving in excess of 15% of total depth may invalidate the results of shallow test holes.

3.5.3 Seepage Pit Test Results

3.5.3.1 Tabulate all the final results, including all tests that "failed" to meet the standards.

3.5.3.2 Provide copies of all the field data and calculations using the following format:

a) Seepage Pit Test (Falling Head):

1. Boring number
2. Diameter of hole in feet:
3. Hours presaturation, time presoak initiated:
4. Depth (of bottom) below grade
5. Strata peculiarities:
6. Name of tester:
7. Date tested:
8. Method to prevent sidewall caving: Gravel Packed. See Appendix, page A-13.

Provide numerical values for each of these parameters

t_i | t_f | ^t | d_b | d_i | d_f | $F=d_f-d_i$ = ^d | Lave = | $Q = \frac{F\ D\ 9}{Lave\text{^}t}$ | pit mpi = $\frac{180}{Q}$

Where:

t_i = initial time when filling or refilling is completed, hour: minute

t_f = final, end-time of fall, hour: minute

^t = usually .5 or .166 hour

d_b = depth to water bottom, feet

d_i = depth to water surface at t_f, feet

d_f = depth to water surface at t_f, feet

Lave = average length of water column, feet $d_b - (d_i + d_f)/2$

D = diameter of hole in feet

Q = gallons of sewage (or septic tank capacity, whichever is greater) per square foot per day (g/sf/d).

Show your work!!

b) Seepage pit - weighted average method - use format per 3.4.3.2

4. Discussion of Results

- Discuss the uniformity of the soils in regards to the soil classification (favorable, moderate or severe) and percolation times obtained. (Uniform is defined as 4 test results falling within + 1/4 of their mean percolation time.) Based on boring/trenching data, discuss how the most restrictive layer below the disposal area was tested, or can be avoided by proper separation or design. For a given system, at least 3/4 of tests must show acceptable results. For example, if there is a failing test on a lot in a proposed tract/minor subdivision, three additional acceptable tests must be shown on that lot.
- Discuss possible sources of error or variability of results such as: measurement accuracy, cavings, one atypical location, etc. Siltation or caving of test holes may require special construction measures to prevent the soil absorption system from suffering the same fate. Discuss in #7 under Recommendations.
- Especially if seepage pit testing was done by procedure 3.5.2, interpret the results in light of

the soils profile and the final readings. Do not rely only on the formula results. The falling head test is not a suitable test procedure for markedly different strata, unless the strata are tested separately, or mounding analyses performed. (Check references) Discuss under 7.3.

5. Design

5.1 General Criteria

5.1.1 For uniform soil units, use a mpi between mean and most conservative mpi(s), i.e., average mpi = 7, most conservative mpi = 9, design mpi = 8. If there are no uniform soil units, use the most conservative mpi for the entire area. (See 4.1 - Note: Use pit mpi, not Q, for averaging.)

5.1.2 Unless an area has been determined to have degraded groundwater by a CRWQCB, there shall be a minimum of 5 feet (leachlines) or 10 feet (seepage pits) of original soil between the bottom of the soil absorption system and groundwater. If a soil has a perc time less than 5 mpi, then the soil for a total thickness of five (5) feet below the bottom of a leachline to groundwater shall contain at least 15% of material passing the #200 U.S. standard sieve (and less than one fourth (1/4) of the representative soil cross-section shall be occupied by stones larger than 6"). Where this requirement is not met, a 40-foot separation shall be maintained below the bottom of the leachline and the highest historic groundwater level based on recorded data or on observed mottling. Fairly uniform coarse-textured soils (SM or more coarse) shall not be used for seepage pits when a "pit mpi" is less than 10 and where a sieve analysis shows less than 15% fines passing the #200 U.S. standard sieve for a thickness of 10 feet and the separation to groundwater is less than 40 feet. Lahontan Region criteria are more stringent; Board clearance is required.

Basis for 100% passing - 3/8" sieve.

5.1.3 The design Q for seepage pits must be > 1.1 g/sf/day of sewage, but < 4 g/sf/day. Q's greater than 4 g/sf/d will not be credited. Caving seepage pit test holes in coarse textured soils shall not be credited with rates greater than 3 g/sf/day.

5.1.4 Gallons per day are calculated per the most current addition of the UPC Table 1-4/UBC Table 33A and either UPC Table I-2 or Table I-3. 5.2

5.2 Convert percolation times to leachline design rates

5.2.1 Leachline application rates for domestic sewage (Source: EPA's Design Manual, 1980) minimum square feet of absorption area per gallon of effluent per day

UTILIZE GRAPH FOR APPLICATION RATE

For single homes you may use:

Bedrooms	Gallons of Effluent Per Day	Gallons of Septic Tank Capacity
1-2	500	750
3	670	1,000
4	800	1,200
5-6	1,000	1,500

5.3 Convert Q to seepage pit design rates

5.3.1 Seepage Pit Design - Falling Head Method

Square feet/ gallons septic tank capacity (sf/gstc)

1/Q X 100 = sf/100 gstc

Design depth below inlet = $\frac{\text{septic tank capacity}}{Q \times D \text{ ä}}$

D = Diameter of pit in feet ä = 3.14

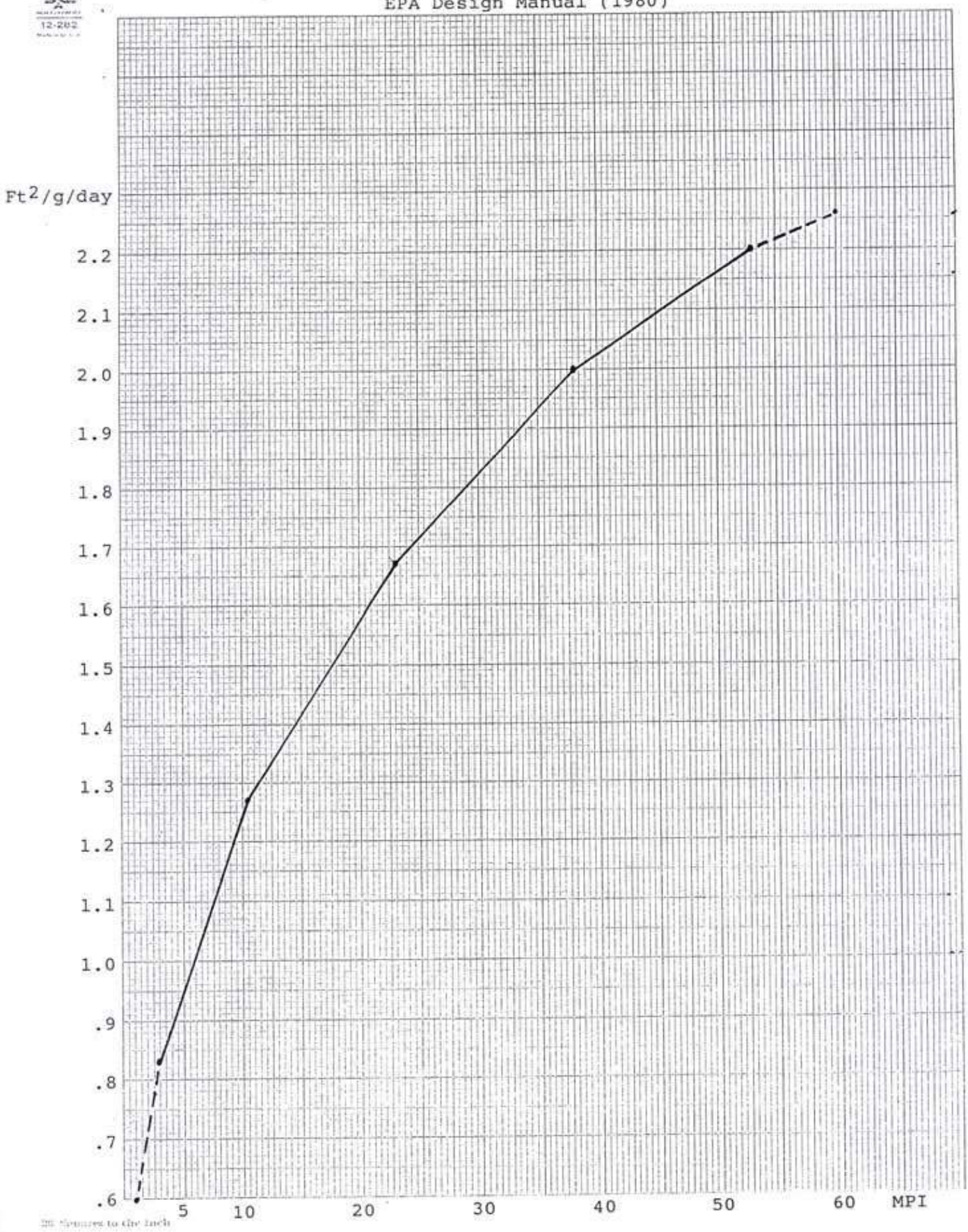
Depth below inlet shall be limited to tested depth or by groundwater.

5.3.2 Seepage Pit Design - Weighted Average Method.
Use EPA Design Graph for square feet of pit sidewall.

5.4 Special Criteria

5.4.1 If leachlines or pits serve a common system for two or more units, add 30% more square footage.

Midpoints of ranges for leachfield design, from the EPA Design Manual (1980)



5.4.2 For laundromats, restaurants, and confluent systems serving mobilehome parks or shopping centers (three or more retail shops), or if septic tank volume is calculated for flows > 2000 gpd with Vol = .75 flow +1125, multiply square footage by 2.5.

5.4.3 Credit for Alternating Fields:
A credit of 10% reduction in square footage may be given for installation of alternating leach fields or seepage pits (unless the consultant specifies otherwise).

Single houses on lots less than 10,000 square feet in area or with leach fields on ground naturally sloping >30% (with CRWQCB approval) may require alternating leach fields. The 100% expansion area can be used for one of the alternating leach fields. The report preparer must recommend that adequate future access to install the replacement system be maintained. Alternating systems, as well as standard systems, are not recommended in areas where mechanical obstruction of the system(s) may occur due to root intrusion.

Alternating systems may be considered when future access, or critical soils are limiting factors.

5.4.4 Special considerations: See Appendix page A-7, Section B.l.a.

6. Plot System Per Currently Adopted Uniform Plumbing Code

Draw tested property to scale:

Single Family Home, Small Commercial Minimum 1" = 30'
Parcel Map, Subdivision, Large Commercial Minimum 1" = 40'

61 Plot system and 100% expansion area, show existing and potential structures, wells, streams, etc. (Check Appendix for allowable separations.) Include contours, significant vegetation (including trees), rock outcropping, location of all borings and tests, and the proposed house pad.

62 For lot sales zoned for single family homes (lot sale subdivisions) show a hypothetical system for a five (5) bedroom home on each and every lot; if zoned for multi-unit development, show a hypothetical system sufficient for the effluent discharged by an average of three bedrooms per unit.

63 Where grading is expected, include original and finished elevations. If the grading plan was prepared by others, comment as it regards the recommendations set forth in the report. If grading is unknown, include qualifying statements in area(s) for the primary and expansion systems (see 3.1), or title the report "Preliminary". (Preliminary reports must still be adequate for purposes of recordation with recommendations to be followed for building permit purposes.)

64 The proposed dwelling/development shall be located so that the initial subsurface sewage disposal system and the required 100% expansion area shall function by gravity flow unless otherwise approved.

6 A pump system will be considered only under the following hardship conditions:

a To salvage an existing structure when an adequate disposal area cannot be reached by gravity flow.

b To allow new house construction on an existing lot when there is absolutely no other alternative to pumping. This hardship consideration will be based on reasonable site development.

c See Appendix, Page A-9.

6 All designed systems construction details are subject to review and approval by the Building and Safety Division. Minimum conventional construction details are to be found in the currently adopted Uniform Plumbing Code.

7. General Discussion and Conclusions or Recommendations

7 Specify any pertinent CRWQCB requirements and state whether they are being met. All systems must meet the CRWQCB requirements. See Appendix pages A-17-A-22.

7 State whether each lot has sufficient area to support an individual sewage disposal system that will meet BSD standards for the use intended. Include a qualifying statement if swimming pools, building expansions, etc. are or may be allowed; also if grading must be restricted, or if grading plans must be reviewed prior to grading, and installation inspected after grading by soils consultant, or if special construction techniques are required.

7 Discuss sewage mounding if lots are to be developed commercially or industrially with flows of 1500 g/d or greater and/or as determined necessary under 4.3. In addition, for commercial and industrial discharges, discuss the on-site system's ability to adequately treat harmful waste constituents prior to entering the groundwater if other than sanitary wastes may be discharged. Indicate if a special treatment process study should be done after the exact nature of the discharge(s) has been determined.

7 Recommend that a copy of the septic system handout *Taking Care of Your Septic System* be obtained by the owner/developer, or provide a copy in report Appendix.

** A P P E N D I X **

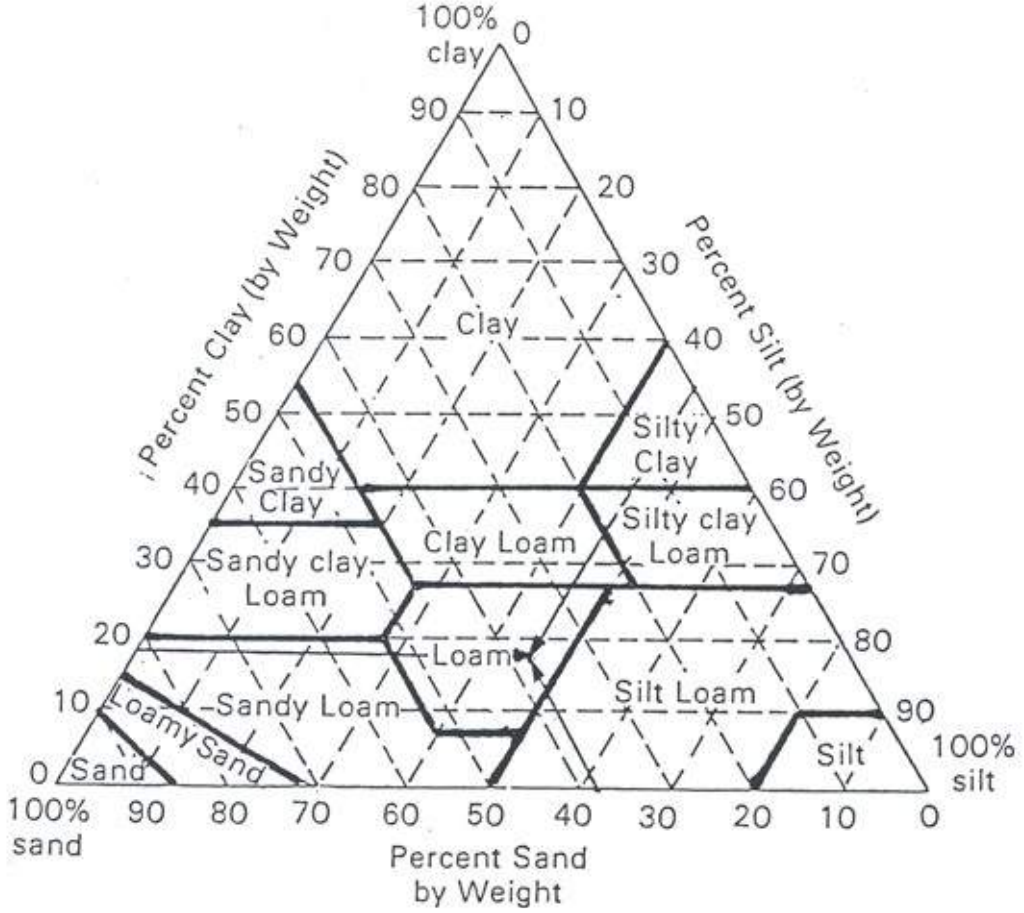
January 2019

Note: The Regional Water Quality Control Board criteria are current at time of publication, but may change. It is the consultant's responsibility to be aware of the minimum criteria. Changes will be made as necessary to the Appendix by the Department.

SOURCE: EPA DESIGN MANUAL FOR ON-SITE SYSTEMS
TEXTURAL PROPERTIES OF MINERAL SOILS

Soil Class	Characteristics & Appearance Dry Soil	Moist Soil
MINIMUM REQUIREMENTS FOR LOCATION OF		
Sand	Loose, single grains which feel gritty. Squeezed in the hand, the soil mass falls apart when the pressure is released.	Squeezed in the hand, it forms a cast which crumbles when touched. Does not form a ribbon between thumb and fore finger.
Sandy Loam	Aggregates easily crushed; very faint velvety feeling initially but with continued rubbing the gritty feeling of sand soon dominates.	Forms a cast which bears careful handling without breaking. Does not form a ribbon between thumb and fore finger.
Loam	Aggregates are crushed under moderate pressure; clods can be quite fi rm. When pulverized, loam has velvety feel that becomes gritty with continued rubbing. Casts bear careful handling.	Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and fore finger. Rubbed surface is rough.
Silt Loam	Aggregates are firm but may be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and fore finger. Rubbed surface has a broken or rippled appearance.
Clay Loam	Very firm aggregates and hard clods that strongly resist crushing by hand. When pulverized, the soil takes on a somewhat gritty feeling due to the harshness of the very small aggregates which persist.	Cast can bear much handling without breaking. Pinched between the thumb and fore finger, it forms a ribbon whose surface tends to feel slightly gritty when dampened and rubbed. Soil is plastic, sticky and puddles easily. (Thumbprints visible)
Clay	Aggregates are hard; clods are extremely hard and strongly resist crushing by hand. When pulverized, it has a grit-like texture due to the harshness of numerous very small aggregates which persist.	Casts can bear considerable handling with breaking. Forms a flexible ribbon between thumb and fore finger and retains its plasticity when elongated. Rubbed surface has a very smooth, satin feeling. Sticky when wet and easily puddled.

TEXTURAL TRIANGLE DEFIINING TWELVE TEXTURAL CLASSES OF THE USDA
(ILLUSTRATED FOR A SAMPLE CONTAINING 37% SAND, 45% SILT, AND 18% CLAY)



METHOD OF SOIL CLASSIFICATION
(ASTM D 2487)

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE:
Coarse-grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limit less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILTY-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

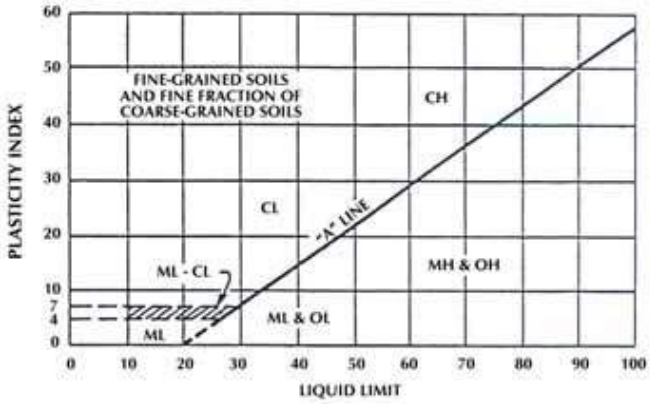
NOTE:
Fine-grained soils receive dual symbols if their limits plot in the hatched zone on the Plasticity Chart (ML-CL)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	¼ in. to 3 in.
Fine	No. 4 to ¼ in.
SAND	No. 200 to No. 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*Fines (Silt or Clay)	BELOW No. 200

NOTE:
Only sizes smaller than three inches are used to classify soils.

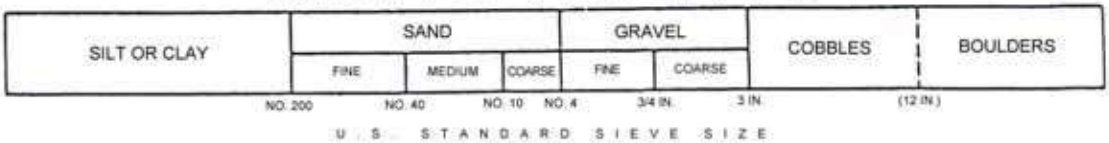
PLASTICITY CHART



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts, and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diotomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS



U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

Reference
The United Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3-357 Vol. 1, March, 1953 (Revised April, 1960)