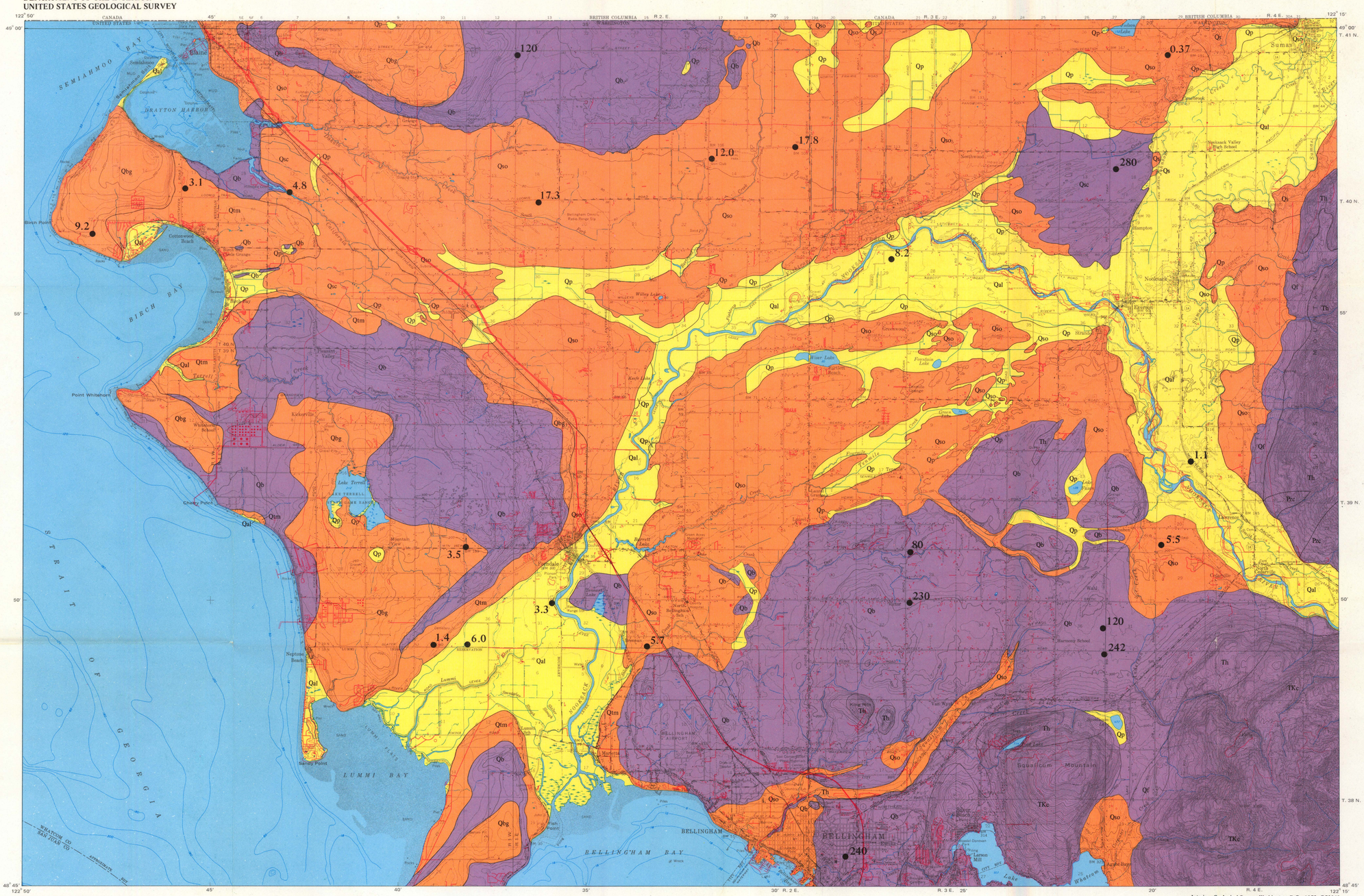
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FOLIO OF WHATCOM COUNTY, WASHINGTON
I-854-A



Base from U.S. Geological Survey
Blaine, 1952 and Lynden, 1954
Photorevisions as of 1973, shown in red; from aerial photographs taken in 1972

Interior—Geological Survey, Washington, D.C.—1973—R73363

PERCOLATION RATES

Slower than 45 minutes per inch
Septic tanks will not function properly

Faster than 45 minutes per inch
Adequate for septic tanks

Areas subject to periodic flooding or high water table

17.3
Percolation rate in minutes per inch

EARTH MATERIALS

Qal — Modern alluvium
Deposits of flood plains, deltas, beaches, and spits

Qp — Peat

Qtm — Marine terrace deposits, mostly sand

Qso — Sumas outwash
Sand and gravel deposited by glacial streams

Qsc — Sumas silt and clay

Qs — Sumas till and ice-contact sand and gravel

Qbg — Sand and gravel veneer over Bellingham Drift

Qb — Pebbly silty clay of Bellingham Drift

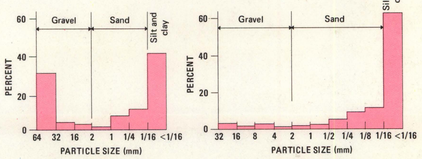
Qf — Undifferentiated drift of Fraser Glaciation

Th — Huntingdon Formation of Daly (1912)
Continental sandstone, shale, coal and conglomerate

TKc — Chuckanut Formation
Continental sandstone, shale, conglomerate and coal

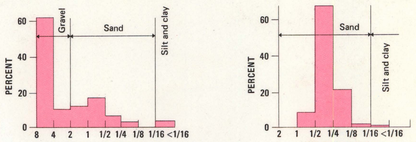
Pzc — Chilliwack Formation of Daly (1912)
Volcanic rocks, limestone

FIGURE 1.—Particle size distribution of representative geologic units



A. Fish Point
B. Tenmile Creek

Bellingham drift (Qb). High silt-clay percentages result in low permeability, and slow percolation rates (100 to 240 minutes-per-inch)



C. Outwash gravel north of Lynden
D. Outwash sand near Laurel

Sumas outwash (Qso). Low silt-clay percentages result in high permeability, and adequate percolation rates (4 to 18 minutes per inch)

INTRODUCTION

Nearly all of western Whatcom County lying outside municipal limits depends on septic-tank systems for sewage disposal. To function satisfactorily these systems require adequate filtration through soil and rock materials that underlie drainfields. The nature of these ground materials, therefore, is critical to operation of the system.

FACTORS AFFECTING PERCOLATION RATES

The rate at which fluids percolate through earth materials depends largely on the amount of silt and clay present and the amount of water in them. In general, clean sand and gravel are permeable and allow easy migration of fluids through the pore spaces between grains. In very coarse and uniform material, fluids may pass too quickly for good filtering action. In silty or clayey deposits, spaces between grains are small; permeability is low and percolation is slow. Such materials are of limited value for drainfields.

When the water table (top of the ground water) rises to the bottom of a filter trench, effluent enters the ground water directly and can leave the trench only as fast as the ground water moves. Even though the ground-water movement, in some cases, may be faster than waste fluids can percolate through unsaturated materials, the direct flow of effluent into the ground water is undesirable.

HOW PERCOLATION RATES ARE MEASURED

In Whatcom County, the Health Department has adopted the following procedure to measure percolation rates: a test hole is dug to the depth of the proposed filtration trench. After all loose material is removed, 2 inches of fine gravel is placed at the bottom. The soil is then presoaked by filling the hole with clear water which is kept 12 inches deep or more over the gravel for at least 4 hours. The water level is then lowered to 6 inches above the gravel. The percolation rate is determined by measuring the distance the water level drops during a 30-minute period, and the rate is expressed in minutes-per-inch of drop in water level. The minimum lot areas required for adequate filtration at suitable sites may be determined from table 1.

GEOLOGIC CONTROLS ON FILTER FIELDS

The permeability and percolation rates in western Whatcom County are closely related to geology. This relationship is apparent from the results of percolation tests performed in accordance with county prescribed procedures at 22 localities in 6 geologic units (see map and table 2).

Differences in particle size and particle distribution (relative proportions of gravel, sand, silt, and clay) between geologic units (fig. 1) affect percolation rates. Modern alluvium (Qal), terrace deposits (Qtm), and glacial outwash (Qso) are more permeable than most other surficial deposits in Whatcom County because they are well sorted and lack much silt and clay. Some outwash grades into finer grained sediments (Qsc). In one area north of Everson, these Qsc deposits are very clayey and have slow percolation rates but elsewhere they are sandier with consequently faster percolation rates. Alluvial, terrace, and outwash deposits underlie most of the lower areas of Whatcom County.

Bellingham Drift (Qb) consists of pebbly silty clay of low permeability and underlies much of the higher ground of western Whatcom County. Buried glacial till deposits, consisting of a highly compacted mixture of pebbles, sand, silt, and clay, are even less permeable and occur beneath younger deposits throughout most of the county. Bedrock in western Whatcom County, mostly well-cemented sandstone, is least permeable, except along localized fracture planes.

Other conditions that hamper the proper functioning of filter fields include:

(1) Water table too shallow. Filter fields function poorly when submerged by high ground-water levels; unfiltered effluent directly contaminates the ground water. In severe cases, ground water backing up in the septic tank stops the normal digestion process and waste products pass more or less unchanged through the system. Ground water is often within a few feet of the land surface during the fall and winter near the Nooksack River flood plain and in peat bogs (Qp).

(2) Relatively impermeable till or bedrock at shallow depth. The effluent concentrates above the impermeable layer and moves laterally along it with little downward movement.

(3) Steep slopes. Effluent may move laterally and seep to the surface in concentrated form.

Septic-tank filter fields will most satisfactorily meet county requirements under the following conditions:

(1) Permeability should be moderate (not high), as in terrace and glacial outwash deposits. Percolation rates should be faster than 45 minutes per inch.

(2) Ground-water table during the wet season should be more than 4 feet below the surface.

(3) Bedrock or other impermeable material should be more than 4 feet below the bottom of filtration trenches.

(4) Slope of the ground should be less than 10 percent, especially if impermeable material occurs at shallow depth.

THE PERCOLATION MAP

The accompanying map, showing areas with different percolation rates, was prepared from geologic maps on the basis of the relationship between the physical characteristics of geologic units and the results of the percolation tests. Units that have percolation rates slower than permissible limits established by Whatcom County are separated from those with more rapid rates. Those units with rates slower than 45 minutes per inch have soil conditions that could cause failure or serious problems for septic-tank filter fields. However, because of the scale of geologic mapping, there may be small local areas within these units where conditions adequate for septic-tank fields can be identified by the testing procedures. Areas where seasonally shallow ground water or flooding may cause periodic septic-system failures are also shown.

This map is one of a series being prepared by the U.S. Department of the Interior in cooperation with several agencies to present basic environmental information and interpretations to assist land-use planning in the Puget Sound ara area

TABLE 1.—Minimum requirements for septic-tank filter fields in Whatcom County

[from "Sewage control rules and regulations" Department of Public Health, June 20, 1972]

Percolation rate (percolation time): minutes required for water to fall 1 inch	Lot size (1-3 bedroom houses) sq ft	Additional area (sq ft) per bedroom in excess of 3
5 or less	9,600	1,400
6 to 10	11,400	1,800
11 to 15	11,700	2,100
16 to 30	13,500	2,700
31 to 45	15,000	3,200
greater than 45	not adequate	

TABLE 2.—Percolation rates measured for six geologic units in western Whatcom County

Symbol	Geologic unit	Percolation rate (min./in.)
Qal	Modern flood-plain alluvium	1.1 (sand, gravel) 3.3 (silt) 6.0 (silt) 8.2 (sand)
Qtm	Sand terraces above present flood plains	1.4 3.1
Qso	Sumas outwash sand and gravel	0.37 5.5 5.7 12.0 17.3 17.8
Qsc	Sandy silt-clay	4.8 280.
Qbg	Sand and gravel on top of Bellingham Drift	3.5 9.2
Qb	Bellingham Drift	80 120 120 230 240 242

MAP SHOWING PERCOLATION RATES OF EARTH MATERIALS IN WESTERN WHATCOM COUNTY, WASHINGTON

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1973

For sale by U.S. Geological Survey, price 75 cents