

SOIL SYMBOLS

The map symbols used in this report to designate the types of soils are a modification of the system used in the engineering soil survey of New Jersey (Rogers, 1955). The first part of the symbol is a letter, or group of letters, which designates the soil group as defined and developed by Lueder (1950) (see table 1). The second part of the symbol is a number which identifies the soil group according to the classification system adopted by the Highway Research Board (AASHO) (1945) and is used in the same relations by the Delaware State Highway Department (see table 2).

A two-digit number indicates that two soil types occur within the same soil profile; for example, the symbol $1A2$ indicates that two soil types with some differences in soil profile, but usually in different horizons, are present.

Two different soil symbols may be combined by a diagonal bar (\diagup) to indicate that two soil types occur in the same soil profile. A diagonal bar indicates that two soil types occur in the same soil profile, but are not necessarily within the same profile. The two soils are interpreted that they cannot be mapped separately.

REFERENCES

Allen, Harold, and others. 1945, Report of committee on classification of materials for subgrades and granular roads: Highway Research Board, 25th Ann. Mtg., Oklahoma City, 1946, Highway Research Board Proc., v. 25, p. 3. Washington.

Feder, D. R., 1950, A system for designating map-unit engineering soil-maps in soil exploration and mapping: Highway Research Board Bull. 28, p. 17-35, Washington.

Higgers, F. C., 1955, Engineering soil survey of New Brunswick: Report No. 1: Rutgers Univ. Eng. Research Bull. 15. New Brunswick, N. J.

General classification	Granular materials 150 percent or less passing a No. 200 sieve						Silt-clay materials finer than 15 percent passing a No. 200 sieve					
Group classification	A-1		A-2				A-3		T			
	0	1	4	5	6	7	0	1	5	7	8	9
Base values												
Percent passing	60 min.	60 min.	40 min.	40 min.	40 min.	40 min.	40 min.	40 min.	40 min.	40 min.	40 min.	40 min.
No. 40 sieve	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.
No. 60 sieve	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.
No. 200 sieve	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.
Plasticity limits	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.
Characteristics of plastic passing No. 40 sieve	0 min.	0 min.	40 min.	41 min.	40 min.	41 min.	40 min.	41 min.	40 min.	41 min.	40 min.	40 min.
Plasticity index	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.
Grouping index	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.	0 min.
General subgrouping	Excellent		Good				Fair		Poor			
	Excellent		Good				Fair		Poor			
Material	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
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	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
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	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded silt and gravel		Silty sand			
	Silt-clay and gravel and sand		Clean sand and gravel				Poorly graded s					

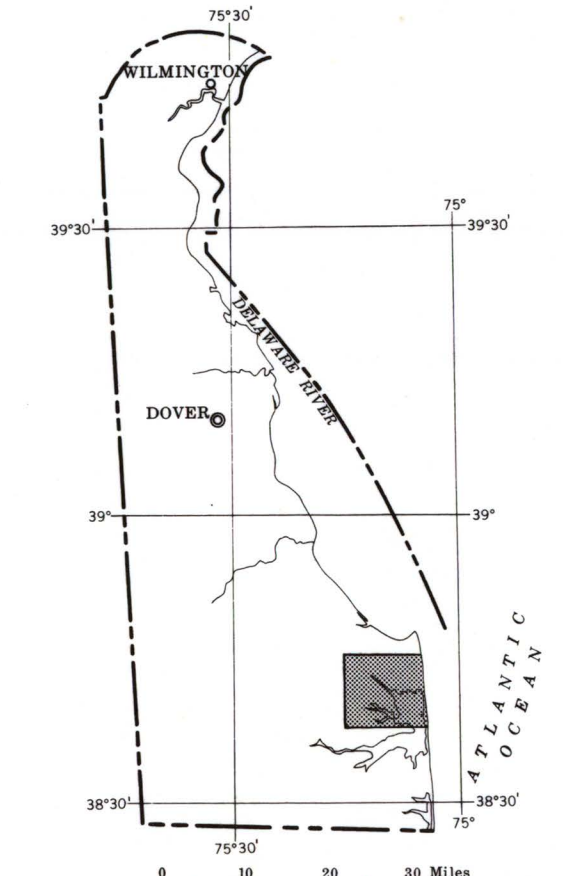


FIGURE 1.—Index map of Delaware showing location of the Deloath Beach Area.

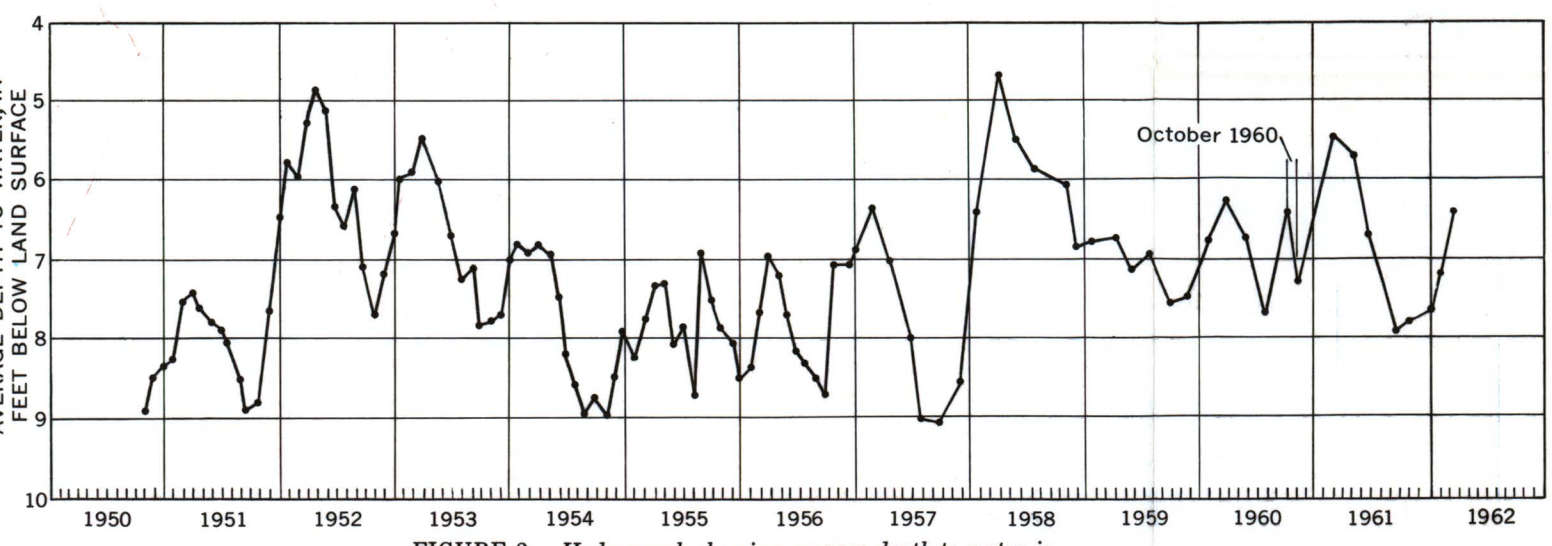


FIGURE 2.—*Hydrograph showing average depth to water in*

Liquid limit: ML, nonplastic										Plasticity index: NP, nonplastic			
Sample no.	Depth of sample (feet)	Mechanical analysis					Percent heave	Liquid limit, %	Plasticity index, %	Moisture-density (Maximum density in %)	Optimum moisture (Percent by weight)	Classification (AST ¹)	Map symbol
		Cumulative percent by weight passing (No. 4, 10, 20, 40, 60, 100 mesh)	Gravel, No. 4 to 10 mesh, %	Sand, No. 10 to 40 mesh, %	Fine sand, No. 40 to 60 mesh, %	Silt and clay, No. 60 to 100 mesh, %							
363	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
364	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
365	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
366	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
367	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
368	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
369	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
370	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
371	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
1B	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
1F	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
1A	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
2C	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3A	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3B	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3C	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3D	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3E	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3F	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3G	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3H	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3I	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3J	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3K	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3L	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0	100	0	0	0	0	100	100	A-1	A10	
	20-25	100	0	100	0	0	0	0	100	100	A-1	A10	
3M	3-5	100	0	100	0	0	0	0	100	100	A-1	A10	
	5-10	100	0	100	0	0	0	0	100	100	A-1	A10	
	10-15	100	0	100	0	0	0	0	100	100	A-1	A10	
	15-20	100	0</										

TABLE 4.—Characteristics of the engineering soil types in the Duluth District

[illegible]

² Two different soil types may be combined into a single map symbol (AM2/24), but the engineering characteristics of the individual soil types are described separately.