

**Appendix 7D-2 Recommended Maximum Water Velocities and Manning's n as a Function of Soil Type and Flow Depth**

ASSHTO Classification	ASSHTO Soil Description	Fortier and Scobey Soil Description	Maximum Water Velocity (ft/s)	Manning's n -Flow Depth 0.5-2.0 ft
	<b>BROKEN ROCK and COBBLES</b>	Cobbles and Shingles	5.5	0.030
A-1-a	Stone fragments or <b>GRAVEL</b> , with or without well-graded <sup>1</sup> binder <sup>2</sup>	Coarse gravel, non-colloidal	4.5	0.025
same	same	Fine gravel	3.5	0.020
A-1-b	Coarse <b>SAND</b> , with or without well-graded <sup>1</sup> binder <sup>2</sup>	Graded loam to cobbles when non-colloidal	4.0	0.030
A-2 (A-2-4, A-2-5, A-2-6, A-2-7)	Mixture of <b>GRAVEL</b> and <b>SAND</b> , with silty or clay fines <sup>3</sup> , or nonplastic silt fines	Graded silts to cobbles when colloidal	4.5	0.030
same	same	Sandy loam, non-colloidal	2.0	0.020
A-3	Fine <b>SAND</b> , without silty clay fines; e.g. beach sand or stream-deposited fine sand	Fine Sand, non-colloidal	1.5	0.020
same	same	Silt loam, non-colloidal	2.3	0.020
A-4	Non- to moderately plastic <sup>4</sup> <b>SILT</b> ; mixtures of silt, sand, and/or gravel, with a minimum silt content of 36%	Alluvial silts, non-colloidal	2.3	0.020
A-5	Moderately to highly plastic <sup>4</sup> <b>SILT</b> . Soil; mixtures of silt, sand, and/or gravel, with a minimum fines <sup>3</sup> content of 36%	Ordinary firm loam	2.5	0.020
A-6	Plastic <sup>4</sup> <b>CLAY</b> soil; mixtures of clay, sand, and/or gravel, with a minimum fines <sup>3</sup> content of 36%	Alluvial silts, colloidal	3.5	0.025
A-7	Moderately to highly plastic, <b>CLAY</b> ; mixtures of clay, sand, and/or gravel, with a minimum clay content of 36%	Stiff clay, very colloidal	4.0	0.025

- 1) Well-graded-containing a broad range of particle sizes with no intermediate sizes missing.
- 1) Binder - soil particles consisting of fine sand, silt, and clay.
- 2) Fines - particle sizes finer than 0.074 mm (e.g., silt and clay particles).
- 3) Plasticity - ability of a soil mass to deform at constant volume without cracking or crumbling.
- + Relationship between AASHTO classification and Fortier and Scobey description is loosely correlated.

**Chapter 7 – Ditches and Channels**

<b>USCS Classification</b>	<b>USCS Soil Description</b>	<b>Fortier and Scobey Soil Description</b>	<b>Maximum Water Velocity (ft/s)</b>	<b>Manning's n -Flow Depth 0.5-2.0 ft</b>
	<b>BROKEN ROCK and COBBLES</b>	Cobbles and Shingles	5.5	0.030
GP, GW, SW, SP	Poorly graded gravel, well graded gravel, well graded sand, poorly graded sand	Coarse gravel, non-colloidal	4.5	0.025
		Fine gravel	3.5	0.020
SW	Well graded sand	Graded loam to cobbles when non-colloidal	4.0	0.030
GC, SC	Clayey gravel, clayey sand	Graded silts to cobbles when colloidal	4.5	0.030
SM	Silty sand	Sandy loam, non-colloidal	2.0	0.020
SP, SW	Poorly graded sand, well graded sand	Fine Sand, non-colloidal	1.5	0.020
ML	Silt	Silt loam, non-colloidal	2.3	0.020
CL	Lean clay	Alluvial silts, non-colloidal	2.3	0.020
ML, CL	Silt, lean clay	Ordinary firm loam	2.5	0.020
CL	Lean clay	Alluvial silts, colloidal	3.5	0.025
CH	Fat clay	Stiff clay, very colloidal	4.0	0.025

Note: Relationship between Unified Soil Classification System (USCS) classification and Fortier and Scobey description is loosely correlated.