Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N155E—Brodale flaggy fine sandy loam, 20 to 30 percent slopes														
Brodale	0-7	45-54-70	15-33-50	5-13-18	1.09-1.25-1.41	4.23-9.17-14.10	0.07-0.10-0.15	0.0-0.8-1.9	5.0-10.0-12.0	.17	.32	2	5	56
	7-12	30-45-70	15-42-60	5-13-18	1.01-1.25-1.49	4.23-9.17-14.10	0.07-0.10-0.15	0.0-0.7-1.9	5.0-9.0-11.0	.15	.32			
	12-20	30-50-70	15-38-60	5-12-18	1.47-1.48-1.50	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.6-1.9	2.0-3.0-6.0	.10	.37			
	20-31	30-52-70	15-37-60	5-11-18	1.46-1.56-1.65	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.3-1.6	0.5-0.8-2.0	.10	.43			
	31-79	30-52-70	15-37-60	5-11-18	1.47-1.54-1.62	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.2-1.4	0.3-0.5-1.0	.10	.43			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N508E—Seaton silt loam, driftless ridge, 12 to 20 percent slopes, moderately eroded														
Seaton, driftless ridge	0-9	4- 6- 15	67-77- 80	10-17- 22	1.10-1.28 -1.45	4.00-9.00-14.00	0.22-0.23-0. 24	1.0- 1.8- 2.8	1.0- 2.0- 3.0	.49	.49	5	5	56
	9-15	4- 6- 16	67-77- 80	10-17- 22	1.25-1.35 -1.40	4.23-9.17-14.11	0.20-0.21-0. 22	1.0- 1.8- 2.8	0.5- 0.8- 1.0	.55	.55			
	15-21	3- 6- 13	65-72- 75	15-22- 27	1.40-1.50 -1.55	4.23-9.17-14.11	0.20-0.21-0. 22	1.4- 2.6- 3.6	0.0- 0.3- 0.5	.49	.49			
	21-27	3- 6- 12	65-69- 75	18-25- 29	1.40-1.50 -1.55	4.23-9.17-14.11	0.20-0.21-0. 22	1.7- 3.1- 3.9	0.0- 0.3- 0.5	.49	.49			
	27-34	2- 6- 12	65-69- 75	18-25- 29	1.40-1.50 -1.55	4.23-9.17-14.11	0.20-0.21-0. 22	1.7- 3.1- 3.9	0.0- 0.3- 0.5	.49	.49			
	34-44	2- 7- 15	64-69- 75	18-24- 27	1.40-1.50 -1.55	4.23-9.17-14.11	0.20-0.21-0. 22	1.7- 3.0- 3.6	0.0- 0.3- 0.5	.49	.49			
	44-70	8-11- 25	61-68- 78	8-21- 23	1.45-1.55 -1.60	4.23-9.17-14.11	0.20-0.21-0. 22	0.7- 2.5- 2.9	0.0- 0.3- 0.5	.49	.49			
	70-79	8-12- 25	61-70- 80	6-18- 23	1.45-1.55 -1.60	4.23-9.17-14.11	0.20-0.21-0. 22	0.5- 1.8- 2.9	0.0- 0.3- 0.5	.55	.55			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N521B—Mt. Carroll silt loam, 2 to 6 percent slopes, moderately eroded														
Mt. carroll, moderately eroded	0-8	0-10- 19	61-71- 80	10-19- 20	1.36-1.40 -1.45	4.23-9.17-14.11	0.22-0.23-0. 24	1.0- 2.1- 2.5	2.5- 3.0- 3.5	.43	.43	5	5	56
	8-38	0- 9- 19	54-70- 73	12-21- 27	1.38-1.40 -1.43	4.23-9.17-14.11	0.20-0.21-0. 22	1.1- 2.5- 3.6	0.0- 0.5- 1.0	.49	.49			
	38-79	20-30- 40	50-64- 77	3- 6- 10	1.43-1.50 -1.56	4.23-9.17-14.11	0.20-0.21-0. 22	0.2- 0.5- 1.0	0.0- 0.3- 0.5	.64	.64			
N521C2—Mt. Carroll silt loam, 6 to 12 percent slopes, moderately eroded														
Mt. carroll, moderately eroded	0-8	0-10- 19	61-71- 80	10-19- 20	1.36-1.40 -1.45	4.23-9.17-14.11	0.22-0.23-0. 24	1.0- 1.6- 2.5	2.5- 3.0- 3.5	.43	.43	5	5	56
	8-38	0- 9- 19	54-70- 73	12-21- 27	1.38-1.40 -1.43	4.23-9.17-14.11	0.20-0.21-0. 22	1.1- 2.5- 3.6	0.0- 0.5- 1.0	.49	.49			
	38-79	20-30- 40	50-64- 77	3- 6- 10	1.42-1.49 -1.56	4.23-9.17-14.11	0.20-0.21-0. 22	0.2- 0.5- 1.1	0.0- 0.3- 0.5	.64	.64			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N521D2—Mt. Carroll silt loam, 12 to 20 percent slopes, moderately eroded														
Mt. carroll, moderately eroded	0-8	0-10- 19	61-71- 80	10-19- 20	1.36-1.40 -1.45	4.23-9.17-14.11	0.22-0.23-0. 24	1.0- 1.6- 2.5	2.5- 3.0- 3.5	.43	.43	5	5	56
	8-38	0- 9- 19	54-70- 73	12-21- 27	1.38-1.40 -1.43	4.23-9.17-14.11	0.20-0.21-0. 22	1.1- 2.5- 3.6	0.0- 0.5- 1.0	.49	.49			
	38-79	20-30- 40	50-64- 77	3- 6- 10	1.42-1.49 -1.56	4.23-9.17-14.11	0.20-0.21-0. 22	0.2- 0.5- 1.1	0.0- 0.3- 0.5	.64	.64			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N582B—Newhouse-Valton complex, 2 to 6 percent slopes														
Newhouse	0-9	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	2.5- 3.5- 4.5	.43	.43	5	5	56
	9-13	-12-	-71-	12-17- 21	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.0- 0.1- 1.3	1.0- 1.5- 2.0	.49	.49			
	13-25	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.49	.49			
	25-60	30-55- 60	-27-	10-18- 30	1.35-1.50 -1.65	1.40-7.70-42.34	0.11-0.14-0. 16	0.0- 0.4- 4.2	0.0- 0.3- 0.5	.55	.55			
Valton	0-9	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	2.5- 3.5- 4.5	.43	.43	4	5	56
	9-22	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.55	.55			
	22-60	-17-	-41-	35-42- 75	1.25-1.40 -1.55	0.42-0.74-1.41	0.06-0.11-0. 16	5.8- 8.0-18.3	0.0- 0.3- 0.5	.32	.32			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N582D2—Newhouse-Valton complex, 12 to 18 percent slopes, moderately eroded														
Newhouse, moderately eroded	0-9	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	1.5- 2.5- 3.5	.43	.43	5	5	56
	9-13	-12-	-71-	12-17- 21	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.0- 0.1- 1.3	1.0- 1.5- 2.0	.49	.49			
	13-25	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.49	.49			
	25-60	30-55- 60	-27-	10-18- 30	1.35-1.50 -1.65	1.40-7.70-42.34	0.11-0.14-0. 16	0.0- 0.4- 4.2	0.0- 0.3- 0.5	.55	.55			
Valton, moderately eroded	0-9	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	1.5- 2.5- 3.5	.43	.43	4	5	56
	9-22	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.55	.55			
	22-60	-17-	-41-	35-42- 75	1.25-1.40 -1.55	0.42-0.74-1.41	0.06-0.11-0. 16	5.8- 8.0-18.3	0.0- 0.3- 0.5	.32	.32			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N590D2—Tama silt loam, valleys, driftless, 12 to 18 percent slopes, moderately eroded														
Tama, valleys, moderately eroded	0-6	0- 7- 10	63-68- 80	18-26- 27	1.31-1.36 -1.41	1.00-9.00-10.00	0.22-0.23-0. 24	2.0- 3.5- 3.8	3.0- 3.5- 4.0	.37	.37	5	6	48
	6-9	0- 4- 10	60-69- 76	24-27- 32	1.24-1.30 -1.36	1.00-3.00-10.00	0.22-0.23-0. 24	3.2- 3.8- 4.8	1.5- 2.0- 2.5	.43	.43			
	9-35	0- 4- 10	60-69- 73	24-27- 32	1.34-1.38 -1.41	1.00-3.00-10.00	0.18-0.19-0. 20	3.1- 3.7- 4.7	0.5- 0.8- 1.0	.49	.49			
	35-79	0- 4- 10	60-71- 80	20-26- 30	1.28-1.38 -1.47	1.00-3.00-10.00	0.18-0.19-0. 20	2.1- 3.2- 4.1	0.0- 0.3- 0.5	.49	.49			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N619A—Kennebec-Lawson, channeled, complex, 0 to 3 percent slopes, flooded														
Kennebec, occasionally flooded	0-41	- 9-	-68-	18-23- 27	1.25-1.30 -1.35	4.23-9.17-14.11	0.22-0.23-0. 24	0.4- 1.6- 3.2	3.5- 4.5- 5.5	.32	.32	5	6	48
	41-54	- 9-	-68-	18-23- 28	1.25-1.30 -1.35	4.23-9.17-14.11	0.18-0.20-0. 22	0.4- 1.6- 3.5	1.0- 2.0- 3.0	.43	.43			
	54-80	- 9-	-67-	18-24- 28	1.35-1.38 -1.40	4.23-9.17-14.11	0.18-0.20-0. 22	0.4- 2.3- 3.5	0.5- 1.0- 2.0	.49	.49			
Lawson, channeled, frequently flooded	0-30	-10-	-68-	18-23- 27	1.25-1.27 -1.30	4.23-9.17-14.11	0.22-0.23-0. 24	0.4- 1.6- 3.2	3.5- 4.5- 5.5	.37	.37	5	6	48
	30-60	-20-	-60-	15-20- 28	1.45-1.50 -1.55	9.17-15.00-42.3 4	0.15-0.20-0. 22	0.0- 1.0- 3.5	0.5- 1.0- 2.0	.49	.49			
N620B—Chaseburg silt loam, 2 to 12 percent slopes, frequently flooded														
Chaseburg, frequently flooded	0-4	-14-	-72-	12-14- 16	1.35-1.45 -1.55	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.0- 0.0	1.0- 2.5- 3.0	.49	.49	5	5	56
	4-60	-14-	-72-	10-14- 18	1.55-1.60 -1.65	4.00-9.00-14.00	0.20-0.21-0. 22	0.0- 0.0- 0.4	0.3- 1.0- 2.0	.55	.55			

Physical Soil Properties--Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N621B—Volney channery silt loam, 2 to 12 percent slopes, occasionally flooded														
Volney	0-7	15-24-35	50-58-70	10-18-27	1.22-1.27-1.32	1.00-9.00-10.00	0.13-0.15-0.16	0.7-1.5-3.4	3.0-4.0-5.0	.17	.32	3	6	48
	7-30	15-29-45	30-52-70	10-19-27	1.33-1.42-1.50	1.00-9.00-10.00	0.13-0.15-0.16	0.2-1.2-3.2	1.0-2.0-3.0	.15	.37			
	30-79	15-36-50	30-48-70	10-16-27	1.42-1.47-1.52	14.10-28.20-42.30	0.02-0.05-0.08	0.1-0.2-2.3	0.5-0.8-1.5	.05	.43			

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N639F—Frontenac-Lacrescent complex, 20 to 45 percent slopes, rocky														
Frontenac	0-12	-25-	-53-	18-23- 27	1.35-1.40 -1.45	4.00-9.00-14.00	0.22-0.23-0. 24	0.4- 1.8- 3.2	2.0- 3.0- 4.0	.28	.28	4	6	48
	12-30	-22-	-55-	18-23- 27	1.40-1.45 -1.50	4.00-9.00-14.00	0.17-0.20-0. 22	0.4- 1.8- 3.2	0.3- 0.5- 1.0	.43	.43			
	30-79	-47-	-45-	5- 8- 10	1.45-1.58 -1.70	4.00-14.11-42.0 0	0.06-0.12-0. 16	0.0- 0.0- 0.0	0.0- 0.3- 0.5	.15	.49			
Lacrescent	0-10	-25-	-53-	18-23- 27	1.25-1.30 -1.35	4.00-9.00-14.00	0.22-0.23-0. 24	0.4- 1.8- 3.2	2.0- 3.0- 4.0	.37	.37	3	6	48
	10-17	-25-	-53-	18-23- 27	1.25-1.33 -1.40	4.00-9.00-14.00	0.17-0.18-0. 19	0.4- 1.8- 3.2	1.5- 2.5- 3.5	.20	.37			
	17-28	-30-	-55-	8-16- 23	1.30-1.40 -1.50	4.00-14.11-42.0 0	0.07-0.13-0. 16	0.0- 0.0- 2.0	0.3- 0.5- 1.0	.15	.49			
	28-60	-30-	-56-	8-14- 20	1.30-1.40 -1.50	4.00-14.11-42.0 0	0.07-0.13-0. 16	0.0- 0.0- 1.0	0.0- 0.3- 0.5	.17	.55			

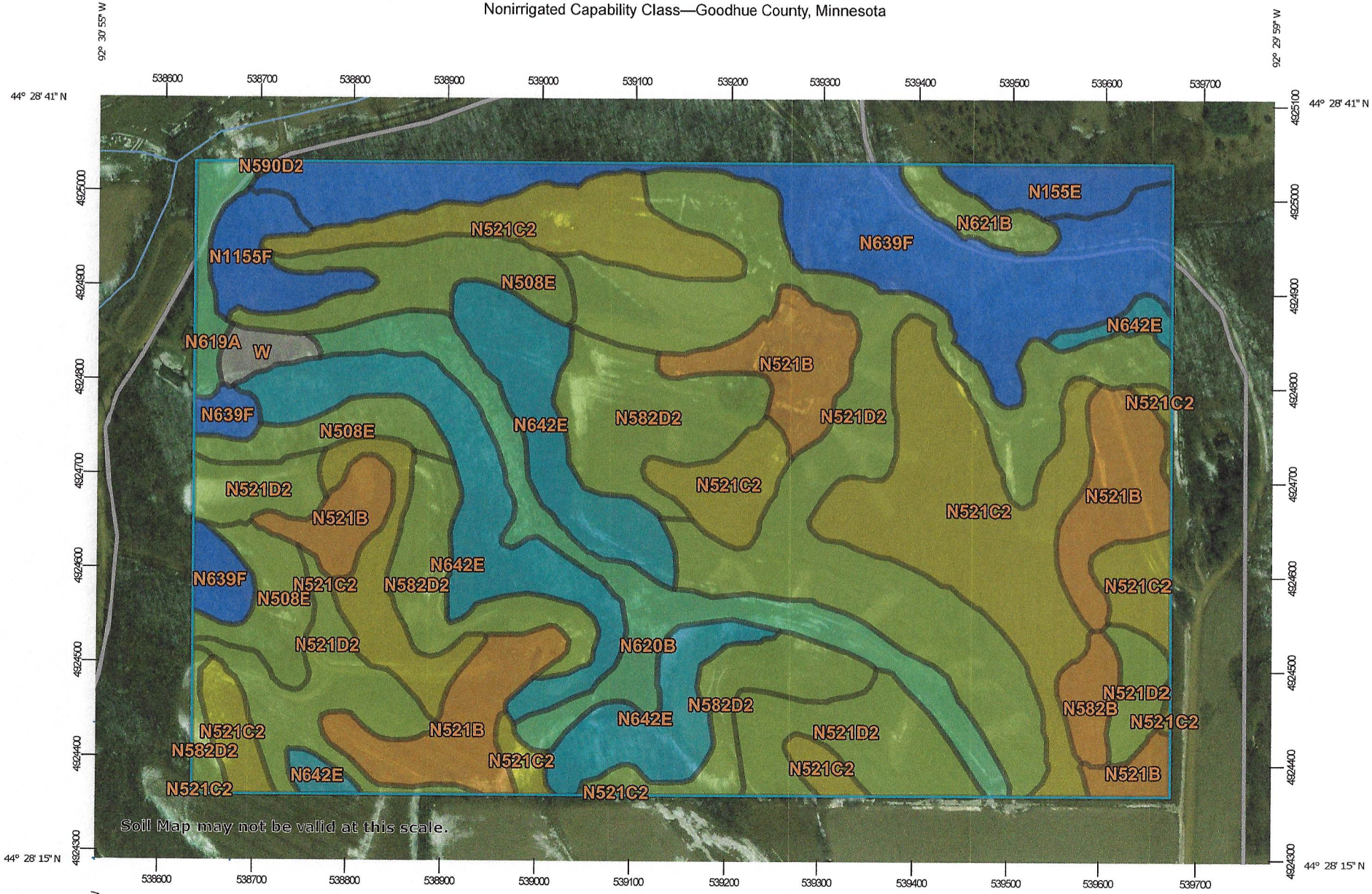
Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N642E—Frankville-Nasset complex, Oneota formation, 18 to 35 percent slopes														
Frankville	0-6	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	2.0- 3.0- 4.0	.32	.32	2	5	56
	6-14	-12-	-71-	12-17- 21	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.0- 0.1- 1.3	1.0- 1.5- 2.0	.55	.55			
	14-23	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.55	.55			
	23-28	0-18- 30	-35-	40-48- 55	1.50-1.55 -1.60	0.42-1.00-1.41	0.08-0.09-0. 12	7.3- 9.7-12.1	0.0- 0.3- 0.5	.28	.28			
	28-80	—	—	—	—	0.42-2.10-4.20	—	—	—					
Nasset	0-6	-12-	-71-	14-17- 20	1.10-1.15 -1.20	4.00-9.00-14.00	0.22-0.23-0. 24	0.0- 0.1- 1.0	2.0- 3.0- 4.0	.32	.32	3	5	56
	6-12	-12-	-71-	12-17- 21	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.0- 0.1- 1.3	1.0- 1.5- 2.0	.49	.49			
	12-37	-10-	-68-	18-22- 24	1.15-1.23 -1.30	4.00-9.00-14.00	0.20-0.21-0. 22	0.4- 1.6- 2.3	0.0- 0.5- 1.0	.49	.49			
	37-44	-23-	-29-	40-48- 55	1.50-1.55 -1.60	0.42-1.00-1.41	0.08-0.09-0. 12	7.3- 9.7-12.1	0.0- 0.3- 0.5	.24	.24			
	44-80	—	—	—	—	0.42-2.10-4.20	—	—	—					

Physical Soil Properties–Goodhue County, Minnesota														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
N1155F—Brodale-Bellechester complex, 30 to 60 percent slopes, rocky														
Brodale	0-7	45-54-70	15-33-50	5-13-18	1.09-1.25-1.41	4.23-9.17-14.10	0.07-0.10-0.15	0.0-0.8-1.9	5.0-10.0-12.0	.17	.32	2	5	56
	7-12	30-45-70	15-42-60	5-13-18	1.01-1.25-1.49	4.23-9.17-14.10	0.07-0.10-0.15	0.0-0.7-1.9	5.0-9.0-11.0	.15	.32			
	12-20	30-50-70	15-38-60	5-12-18	1.47-1.48-1.50	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.6-1.9	2.0-3.0-6.0	.10	.37			
	20-31	30-52-70	15-37-60	5-11-18	1.46-1.56-1.65	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.3-1.6	0.5-0.8-2.0	.10	.43			
	31-79	30-52-70	15-37-60	5-11-18	1.47-1.54-1.62	4.23-14.11-42.00	0.04-0.09-0.15	0.0-0.2-1.4	0.3-0.5-1.0	.10	.43			
Bellechester	0-7	85-92-99	0-7-15	0-1-5	1.58-1.62-1.67	42.10-92.10-141.00	0.05-0.07-0.08	0.0-0.0-0.5	2.0-2.3-3.0	.02	.02	4	1	220
	7-16	85-93-99	0-6-15	0-1-5	1.59-1.63-1.67	42.10-92.10-141.00	0.05-0.07-0.08	0.0-0.0-0.4	1.5-1.8-2.5	.02	.02			
	16-23	85-94-99	0-5-15	0-1-5	1.59-1.66-1.72	42.10-92.10-141.00	0.03-0.05-0.10	0.0-0.0-0.4	1.0-1.5-2.0	.02	.02			
	23-28	85-97-99	0-2-15	0-1-5	1.71-1.72-1.74	42.10-92.10-141.00	0.03-0.05-0.10	0.0-0.0-0.4	0.3-0.8-1.0	.02	.02			
	28-42	85-99-99	0-1-15	0-0-5	1.72-1.73-1.74	42.10-92.10-141.00	0.03-0.05-0.10	0.0-0.0-0.3	0.0-0.5-0.8	.02	.02			
	42-79	—	—	—	—	1.00-42.10-92.10	—	—	—					
W—Water														
Water	—	—	—	—	—	—	—	—	—					

Data Source Information

Soil Survey Area: Goodhue County, Minnesota
Survey Area Data: Version 16, Jun 5, 2020

Nonirrigated Capability Class—Goodhue County, Minnesota



Map Scale: 1:5,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Soil Rating Lines
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Soil Rating Points
- Capability Class - I
- Capability Class - II
- Capability Class - III
- Capability Class - IV
- Capability Class - V
- Capability Class - VI
- Capability Class - VII
- Capability Class - VIII
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Goodhue County, Minnesota
Survey Area Data: Version 16, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 4, 2010—Nov 20, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Nonirrigated Capability Class

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
N155E	Brodale flaggy fine sandy loam, 20 to 30 percent slopes	7	2.5	1.5%
N508E	Seaton silt loam, driftless ridge, 12 to 20 percent slopes, moderately eroded	4	10.3	5.9%
N521B	Mt. Carroll silt loam, 2 to 6 percent slopes, moderately eroded	2	16.1	9.3%
N521C2	Mt. Carroll silt loam, 6 to 12 percent slopes, moderately eroded	3	31.2	18.1%
N521D2	Mt. Carroll silt loam, 12 to 20 percent slopes, moderately eroded	4	39.1	22.7%
N582B	Newhouse-Valton complex, 2 to 6 percent slopes	2	1.6	0.9%
N582D2	Newhouse-Valton complex, 12 to 18 percent slopes, moderately eroded	4	15.4	8.9%
N590D2	Tama silt loam, valleys, driftless, 12 to 18 percent slopes, moderately eroded	4	0.1	0.0%
N619A	Kennebec-Lawson, channeled, complex, 0 to 3 percent slopes, flooded	5	1.8	1.1%
N620B	Chaseburg silt loam, 2 to 12 percent slopes, frequently flooded	5	9.8	5.7%
N621B	Volney channery silt loam, 2 to 12 percent slopes, occasionally flooded	4	1.7	1.0%
N639F	Frontenac-Lacrescent complex, 20 to 45 percent slopes, rocky	7	18.7	10.9%
N642E	Frankville-Nasset complex, Oneota formation, 18 to 35 percent slopes	6	20.2	11.7%
N1155F	Brodale-Bellechester complex, 30 to 60 percent slopes, rocky	7	3.1	1.8%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
W	Water		1.1	0.6%
Totals for Area of Interest			**172.8**	**100.0%**

Description

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

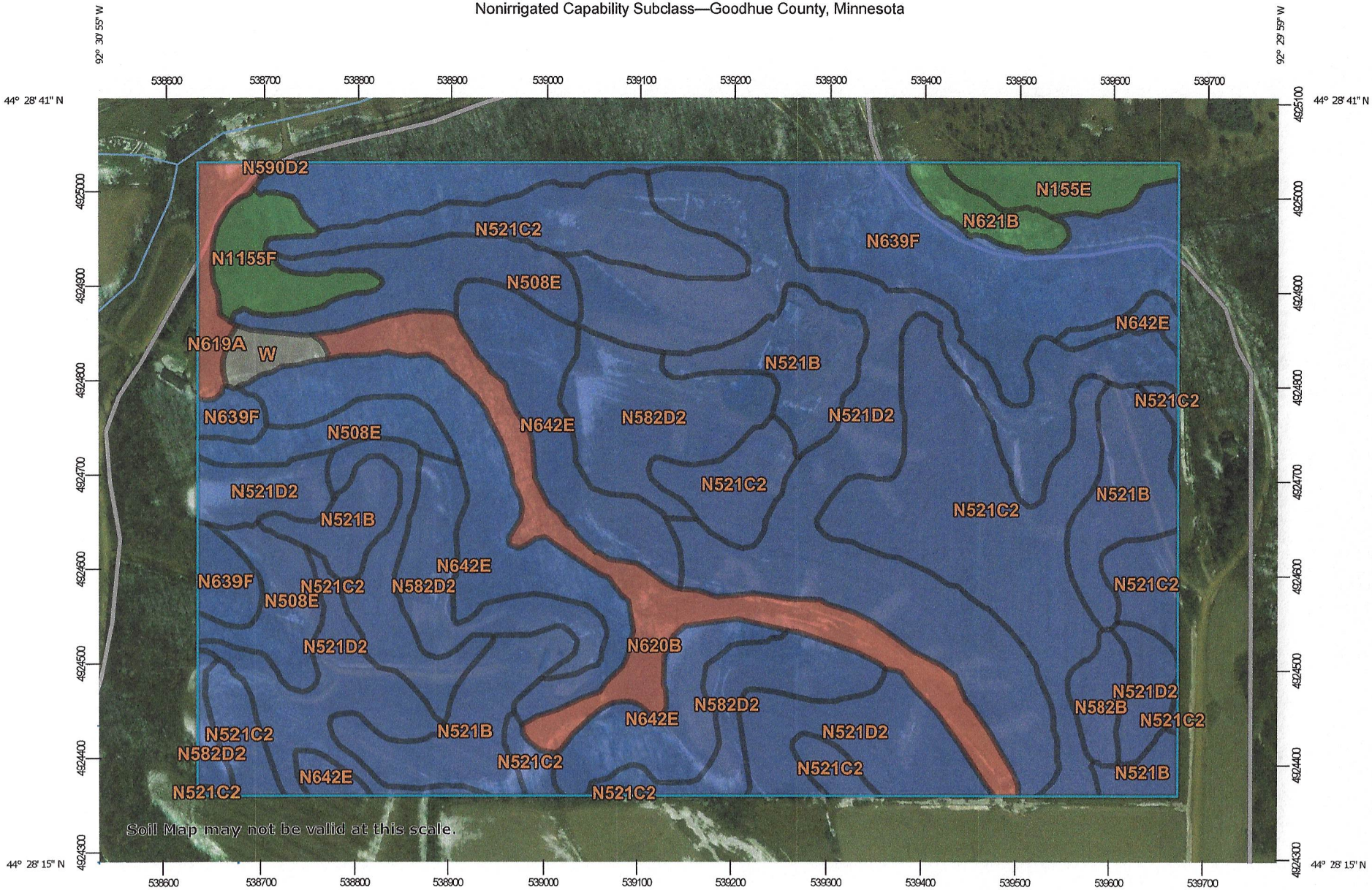
Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Map Scale: 1:5,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Erosion
- Soil limitation within the rooting zone
- Excess water
- Climate condition
- Not rated or not available

Soil Rating Lines
- Erosion
- Soil limitation within the rooting zone
- Excess water
- Climate condition
- Not rated or not available

Soil Rating Points
- Erosion
- Soil limitation within the rooting zone
- Excess water
- Climate condition
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Goodhue County, Minnesota
Survey Area Data: Version 16, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 4, 2010—Nov 20, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Nonirrigated Capability Subclass

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
N155E	Brodale flaggy fine sandy loam, 20 to 30 percent slopes	s	2.5	1.5%
N508E	Seaton silt loam, driftless ridge, 12 to 20 percent slopes, moderately eroded	e	10.3	5.9%
N521B	Mt. Carroll silt loam, 2 to 6 percent slopes, moderately eroded	e	16.1	9.3%
N521C2	Mt. Carroll silt loam, 6 to 12 percent slopes, moderately eroded	e	31.2	18.1%
N521D2	Mt. Carroll silt loam, 12 to 20 percent slopes, moderately eroded	e	39.1	22.7%
N582B	Newhouse-Valton complex, 2 to 6 percent slopes	e	1.6	0.9%
N582D2	Newhouse-Valton complex, 12 to 18 percent slopes, moderately eroded	e	15.4	8.9%
N590D2	Tama silt loam, valleys, driftless, 12 to 18 percent slopes, moderately eroded	e	0.1	0.0%
N619A	Kennebec-Lawson, channeled, complex, 0 to 3 percent slopes, flooded	w	1.8	1.1%
N620B	Chaseburg silt loam, 2 to 12 percent slopes, frequently flooded	w	9.8	5.7%
N621B	Volney channery silt loam, 2 to 12 percent slopes, occasionally flooded	s	1.7	1.0%
N639F	Frontenac-Lacrescent complex, 20 to 45 percent slopes, rocky	e	18.7	10.9%
N642E	Frankville-Nasset complex, Oneota formation, 18 to 35 percent slopes	e	20.2	11.7%
N1155F	Brodale-Bellechester complex, 30 to 60 percent slopes, rocky	s	3.1	1.8%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
W	Water		1.1	0.6%
Totals for Area of Interest			**172.8**	**100.0%**

Description

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability subclasses are soil groups within one capability class. They are designated by adding a small letter, "e," "w," "s," or "c," to the class numeral, for example, 2e. The letter "e" shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; "w" shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); "s" shows that the soil is limited mainly because it is shallow, droughty, or stony; and "c," used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by "w," "s," or "c" because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, or wildlife habitat.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower