APPENDIX B

DETAILED PROCEDURE FOR DETERMINING AN ERODIBILITY VALUE, K_e

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PROCEDURAL GUIDE

Values of K_e can be obtained from soil series descriptions in SCS surveys or, when values have not been published, determined from the soil erodibility nomograph developed by Wischmeier, et al., (1971) (Figure B.1). The percent sand ranging from 0.1 - 2 mm and the percent silt plus very fine sand (0.05 - 0.1 mm) (left section of nomograph) can be readily obtained from the particle size distribution method (Appendix A).

Relative permeability classes (lower right section of Figure B.1) refer to the entire soil profile and are coded from 1 (rapid) to 6 (very slow). These classes correspond to permeability rates given in a soil survey or, if not available, the rates can be deduced from routine soil profile descriptions. Field or laboratory measurements of permeability are usually not necessary. The permeability rates which correspond to the six classes and general guidelines for assessing these classes in the field are given in Table B.1. The relationships and correlation between the permeability classes and the four soil-hydrologic groups, A-D, as defined in the SCS curve number method (section 3.1) are given in Table B.2.

The structural classes (upper right section of Figure B.1) refer to the aggregation of soil particles into clusters which are separated from other aggregates by planes or surfaces of weakness. The structural classifications, e.g. granular or platey, are given in SCS survey descriptions and can be used to place a soil into its appropriate nomograph code, 1-4, as defined in Table B.3. Detailed field descriptions of structure which are necessary at a disturbed or topsoiled site are also given in Table B.3. These guides are a useful supplement to soil series descriptions because site specific conditions are then taken into account.

The final parameter needed to estimate K_e from the nomograph is organic matter content. It is recommended that 4 percent organic mater content be used for those soils having greater than 4 percent content unless additional available data suggest otherwise. If information on organic matter is not available in a soil series description, it can be determined by laboratory analysis using the dry combustion method or Walkley-Black wet combustion method given in Black (1965).

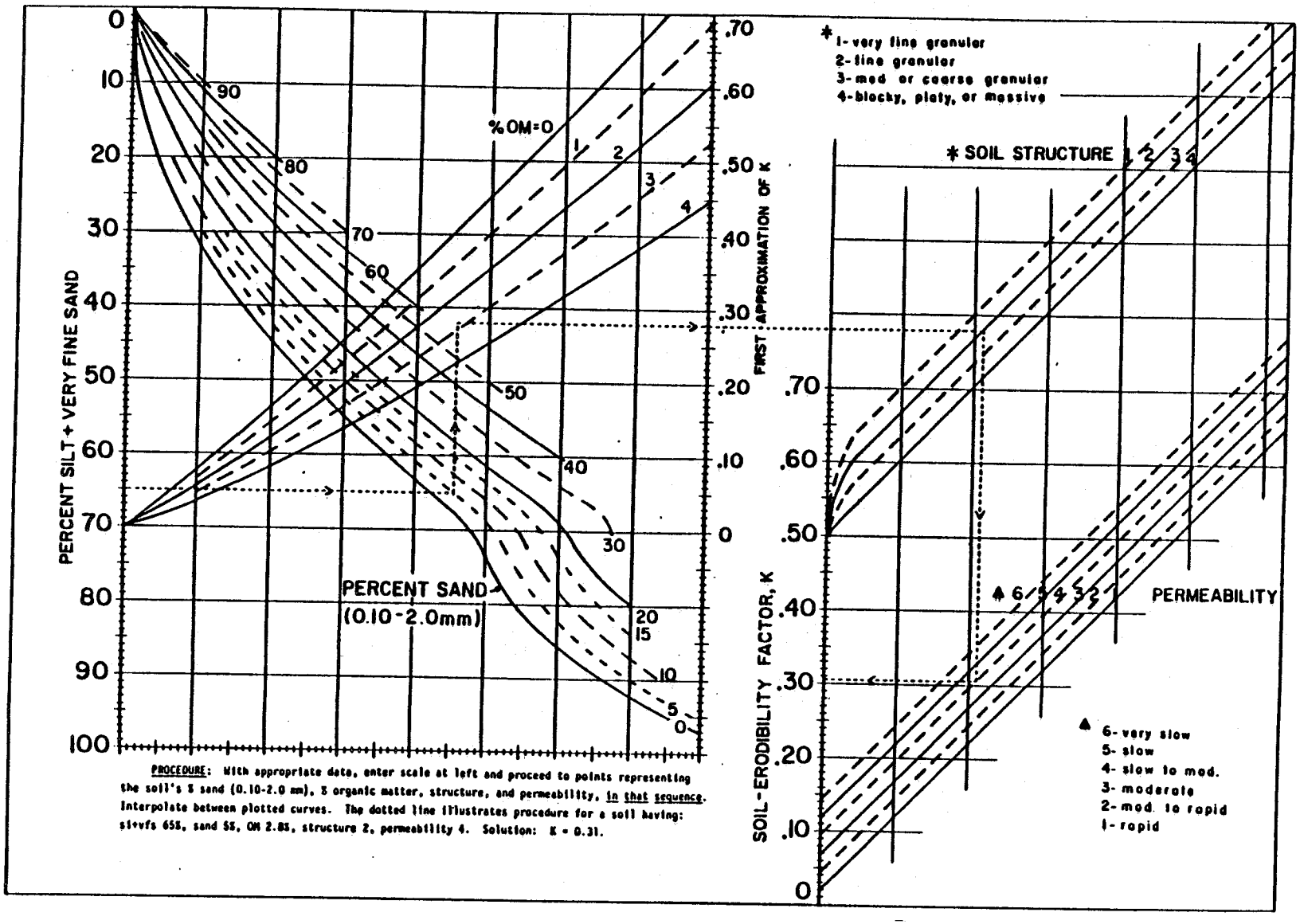

Figure B.1. Soil erodibility nomograph (from Wischmeier, et al., 1971).

Table B.1. Assessment of Permeability Classes.

Permeability Class	Permeability rates in/hr*	Nomograph Code
very slow	<0.06	6
slow	0.06-0.2	5
slow to moderate	0.2-0.6	4
moderate	0.6-2.0	3
moderate to rapid	2.0-6.0	2
rapid	6.0-20.0	1

*Based on saturated flow through saturated undisturbed core under 1/2-inch head

(In the absence of measurements or classes, soils and minesoils can be placed into classes by evaluating structure, particle sizes, porosity, cracking and other characteristics which appear to control the soil's permeability. Generally, it is necessary to assess the soil horizons (layers) and determine which layer is least permeable (controlling layer.)

Table B.2. Approximate Relationships Between Permeability Codes and Soil-Hydrologic Group.

Permeability Class Code	Guideline	Corresponding Soil-Hydrologic Group (CN Method)
1-2	Gravelly, sandy soils; very well drained; deep; well developed; includes soils which remain open and do not form surface seal; intake is not restricted.	A (High)
3	Moderately coarse to moderately fine texture; moderate or strong subsoil structure with textures coarser than silty clay loam.	B (Moderate)
4	Moderately coarse to moderately fine texture; includes silty clays and silty clay loams; weak angular or subangular blocky structure with moderate permeabilities.	
5	Moderately fine grained soils; soils underlain by massive clays or silty clays.	C (Low)
6	Soils underlain by fragipans; high-swelling clay soils; shallow soils over nearly impermeable layers; may include soils within a permanently high water table.	D (Very Low)

Table B.3. Assessment of Structure Classes.

Soil Structure Class	Nomograph Code
very fine granular	1
fine granular	2
medium or coarse granular	3
blocky, platey, or massive	4

Field Structure Guidelines

Very fine granular: refers to particles subspherical in shape which are generally nonporous. "Very fine" includes aggregates <1 mm in size.

Fine granular: refers to 1-2 mm sized aggregates

Medium-coarse granular: refers to 2-10 mm sized aggregates

Platy: refers to particles arranged along a plane - roughly horizontal

Blocky: refers to particles arranged in a polygon shape bounded by flat or slightly rounded surfaces or planes

Massive: refers to coherent soils which have no observable aggregation pattern or distinct arrangement of natural lines of weakness.

To improve the estimated K value for clay pans and expanding shales, which commonly occur in mining areas, two separate erodibility factors for "dry" and "wet" seasons may be desirable. The permeability ratings should be reduced during the wet season but not during thunderstorms occurring in the dry season. The U.S. Forest Service (1980) recommends the following computation for weighted annual mean K values for wet and dry seasons:

$$K' = \frac{(K_w M_w + K_d M_d)}{M_w + M_d}$$

where

K' = weighted mean erodibility,

K_w = soil erodibility during wet season,

M_w = number of wet months with erosive rainfall and/or snowmelt runoff,

K_d = soil erodibility during dry season,

M_d = number of dry months with erosive rainfall and/or snowmelt runoff.

An example procedure for determining K_e from the nomograph is given in Figure B.1. A methodology for determining or estimating all soils data (Appendix A - Particle Size Distribution and Appendix B - Soil Erodibility) is illustrated in a step-by-step flow chart in Figure B.2.

References Cited

Black, C.A. (ed). 1965. Methods of Soil Analysis, Agron. Mono. Ser. 9, Amer. Soc. Agron., Madison, Wisconsin, 1572 p.

U.S. Department of the Army. 1970. Laboratory Soils Testing, Department of the Army, Office of Chief Engineers, EM 1110-2-1906.

U.S. Forest Service. 1980. An Approach to Water Resources Evaluation of Non-Point Silva Cultural Sources, Envir. Protection Agency, Athens, Georgia, EPA-IAG-D6-0660.

Wischmeier, W.H., C.B. Johnson, B.V. Cross. 1971. A Soil Erodibility Nomograph for Farmland and Construction Sites, J. Soil & Water Conservation, pp 189-192.

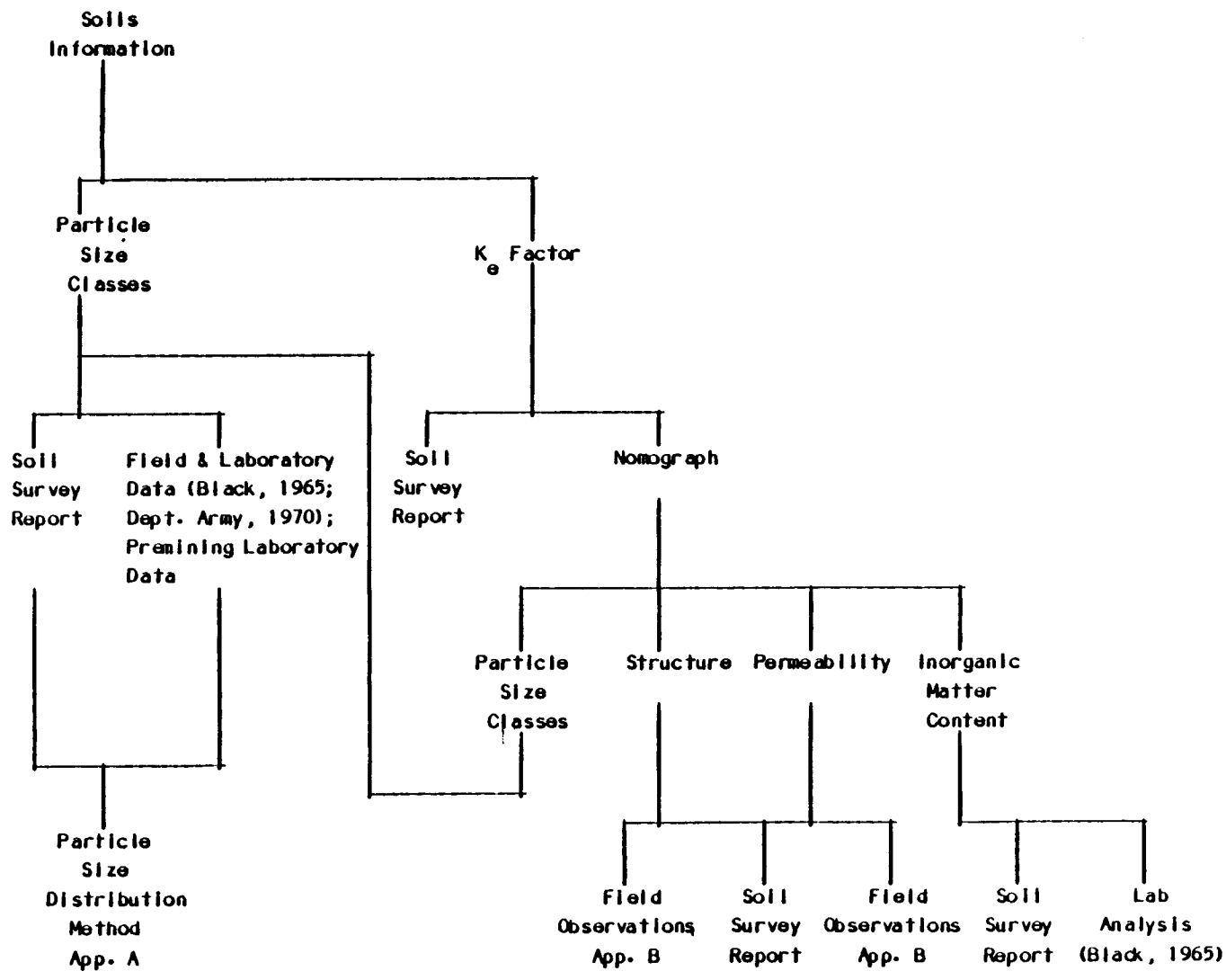

Figure B.2. Flow chart for acquiring data for soils and surficial material.

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