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PRELIMINARY GUIDANCE FOR ESTIMATING EROSION ON AREAS DISTURBED BY SURFACE MINING ACTIVITIES IN THE INTERIOR WESTERN UNITED STATES

INTERIM FINAL REPORT

U.S. Department of Agriculture
Soil Conservation Service

SOIL CONSERVATION SERVICE

U.S. Environmental Protection Agency
Region VIII

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

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Prepared for:

U.S. Environmental Protection Agency
Region VIII
Office of Energy Activities
Denver, Colorado

By:

U.S. Department of Agriculture
Soil Conservation Service

REVIEW NOTICE

This report was prepared for the U. S. Environmental Protection Agency by the U. S. Department of Agriculture, Soil Conservation Service, Denver, Colorado, under Interagency Agreement EPA-IAG-D6-F154. This report has been reviewed by the Region VIII Office of Energy Activities, EPA, and approved for publication in interim final form. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

A field investigative phase by the Soil Conservation Service will follow this preliminary guidance effort.

FOREWORD

This publication describes the appliction of the Universal Soil Loss Equation (USLE) to the task of estimating sheet and rill erosion from lands of the Interior Western United States that have been or may be disturbed by surface mining.

This work has been accomplished under an interagency agreement, EPA-IAG-D6-F071, between the Soil Conservation Service and the Environmental Protection Agency, Region VIII, Office of Energy Activities. Mr. Arnold D. King, State Conservation Agronomist, and Mr. Tommie J. Holder, State Soil Scientist, both members of the Soil Conservation Service staff, directed and performed the work in preparation of this document. Mr. Dan Kimball and Mr. Gary Parker of the EPA were project officers for this study.

Acknowledgment is given to the personnel of the respective State Soil Conservation Service offices who provided valuable assistance during the data development phase of this project and to Ms. Shirley Lindsay of the EPA, Office of Energy Activities for her critical review and recommended changes.

ABSTRACT

Increasing demands are being placed on the coal resources of the Interior Western United States. This publication provides guidance on use of the Universal Soil Loss Equation (USLE) to predict water-related erosion on areas distributed by surface mining activities. The information should prove to be useful in developing and evaluating mining plans, as well as in evaluating the environmental impacts of various surface mining projects.

The USLE is a method of estimating soil loss from sheet and rill erosion as a function of rainfall intensity, soil erodibility, length/percent slope, vegetative protection and erosion control practices (contour tillage and stripcripping).

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Section 1.0

INTRODUCTION

Surface mining activity in the Interior Western U.S. is increasing due to the energy demands of the Nation. As disruption of surface lands increase, a tool is needed to evaluate alternative mitigating measures needed in reclamation of disturbed areas. This publication is directed toward application of the Universal Soil Loss Equation (USLE) on surface mined lands and is an effort to provide guidance to those responsible for evaluating erosion control practices included in mine reclamation plans. Erosion and sedimentation are environmental impacts that can be mitigated through proper planning and implementation of conservation practices on disturbed areas.

The USLE is a tool developed initially for use in evaluating conservation practices on the Nation's croplands. Recent developments in the soil loss equation have made it a potentially valuable tool for planning conservation practices on disturbed areas resulting from construction and surface mining activities. It is an empirical formula based on many years of experience and research. The information gained by application of the USLE can be used as a basis for comparing alternative conservation practices used in reclamation planning.

Section 2.0

HISTORY OF THE SOIL LOSS EQUATION

An equation that related soil loss to length and percent of slope was published in 1940. This equation utilized all available rainfall data and was based upon the erosion data then available in the United States. It is usually considered the pioneering effort to put soil conservation practices for cropland on a firm, quantitative basis.

Factors were developed to express the influences of cropping and conservation practices on certain soils of the Midwest during 1941. This became known as the Corn Belt equation. Between 1941 and 1946, further improvements were made in the equation for use throughout Iowa by adding factors to express the influence of soil type and quality of management of soil loss. Continuing research and operational conservationists of the Soil Conservation Service, in eight northcentral states, led to the development of the system referred to as ''slope practice for use in farm planning'' (ARS, 1966).

In 1946, a nationwide committee on soil loss prediction met in Ohio for the purpose of adapting the Corn Belt equation to other cropland areas with erosion problems. This committee reappraised the Corn Belt factor values and added a rainfall factor. The resulting formula, generally known as the Musgrave equation, has been widely used for estimating gross erosion from watersheds in flood abatement programs. A graphical solution of the equation was published in 1952 and was used by the Soil Conservation Service in the northeastern states (Lloyd, et al. 1952).

An improved soil loss equation, developed in the late 1950's, overcame many of the limitations of the earlier equations. The improved equation was developed at the Runoff and Soil Loss Data Center of the Agricultural Research Service, Purdue University. Most of the basic runoff and soil loss data obtained in studies in the United States since 1930 were assembled at this location for summarization and further analyses. These analyses resulting in several major improvements that were incorporated in the new soil loss equation (Wischmeier, et al. 1971).

Wischmeier's work in developing simplified relationships of soil characteristics for estimating the soil erodibility factor (or ''K'' value) was a major breakthrough and allowed widespread use of the Universal Soil Loss Equation (USLE). These relationships, addressed in Section 3.2 and on Figure 3 of this publication, have lifted many of the previous restrictions of the USLE.

The USLE has generally been limited until recently to use on croplands of the eastern United States. It is now potentially useful as a technique for estimating soil loss from lands of the Interior Western U.S. disturbed by mining and construction activities.

Section 3.0

THE UNIVERSAL SOIL LOSS EQUATION

The Universal Soil Loss Equation (USLE) is an empirically developed formula historically used to estimate soil loss on agricultural lands.

The soil loss equation is A = R K L S C P, where:

A is the computed soil loss expressed in tons/acre/year.

R, the rainfall factor, is the number of erosion index units in a normal year's rain. The erosion index is a measure of the erosive force of specific rainfall.

K, the soil erodibility factor, is the erosion rate per unit of erosion index for a specific soil in cultivated continuous fallow, on a nine percent slope, 72.6 feet long. The reasons for specifying these conditions as unit values are presented in Section 3.2, the detailed discussion of this factor.

L, the slope length factor, is the ratio of soil loss from the field slope length to that from a 72.6 foot length on the same soil type and gradient.

S, the slope gradient factor, is the ratio of soil loss from the field gradient to that from a nine percent slope.

C, the cover or cropping management factor, is the ratio of soil loss from a field with specified cropping and management to that from the fallow condition on which the factor K is evaluated.

P, the erosion control practice factor, is the ratio of soil loss under specified soil management practices, to that with straight rows, up and down the slope.

Numerical values for each of the six factors have been determined from field experience and research data. These values differ from one field or locality to another. The approximate numerical values of the erosion factors can be obtained from the tables and figures presented in this report.

Ongoing and future investigations will establish and verify numerical values for the above factors with respect to lands disturbed by surface mining in the Interior Western U.S.

Section 6.0, "Application of the USLE," illustrates how to select applicable values from the tables and charts, and how to predict soil loss before, during and after reclamation. Assistance in the application of the USLE can be obtained at the SCS offices listed in Appendix B.

3.1 THE RAINFALL FACTOR "R"

The energy of moving water detaches soil and causes erosion. The rainfall factor "R" is a measurement of the kinetic energy of the expected rainstorms of a specific geographical area. Locational values of the rainfall factor "R" can be taken directly from the map titled "Average Annual Values of the Rainfall Factor 'R' ", Figure 1. The information presented in this figure was developed using rainfall data furnished by the National Weather Bureau and a conversion chart from Soil Conservation Service Technical Note No. 32 (Brooks, et al. 1974).

The values of the factor "R" were computed from rainfall data expressed in tenths of inches received from a two-year frequency, six-hour duration rainstorm. The data was converted to factor "R" by use of a modification curve to better conform to specific climatic characteristics occurring in various area(s). The iso-erodents, or "R" factors, in the mountainous states west of the 104th meridian are not as accurate as data developed in the eastern states because of the highly localized rainfall patterns in the mountain regions (Wischmeier, 1974). There simply are not enough weather monitoring stations in the mountainous regions to record adequate rainfall information. However, most of the western coal resources are located in areas where the iso-erodent information is relatively accurate for the long term average.

Other parameters of factor "R" include rainfall probabilities expressed in terms of percentage and soil loss from individual storms. However, this information has been developed for only a few locations, most of which are in the eastern states (Wischmeier, et al. 1965). Additional efforts are needed in developing this climatic data for the Interior Western states. If and when this rainfall information becomes available, it can be used in the Universal Soil Loss Equation.

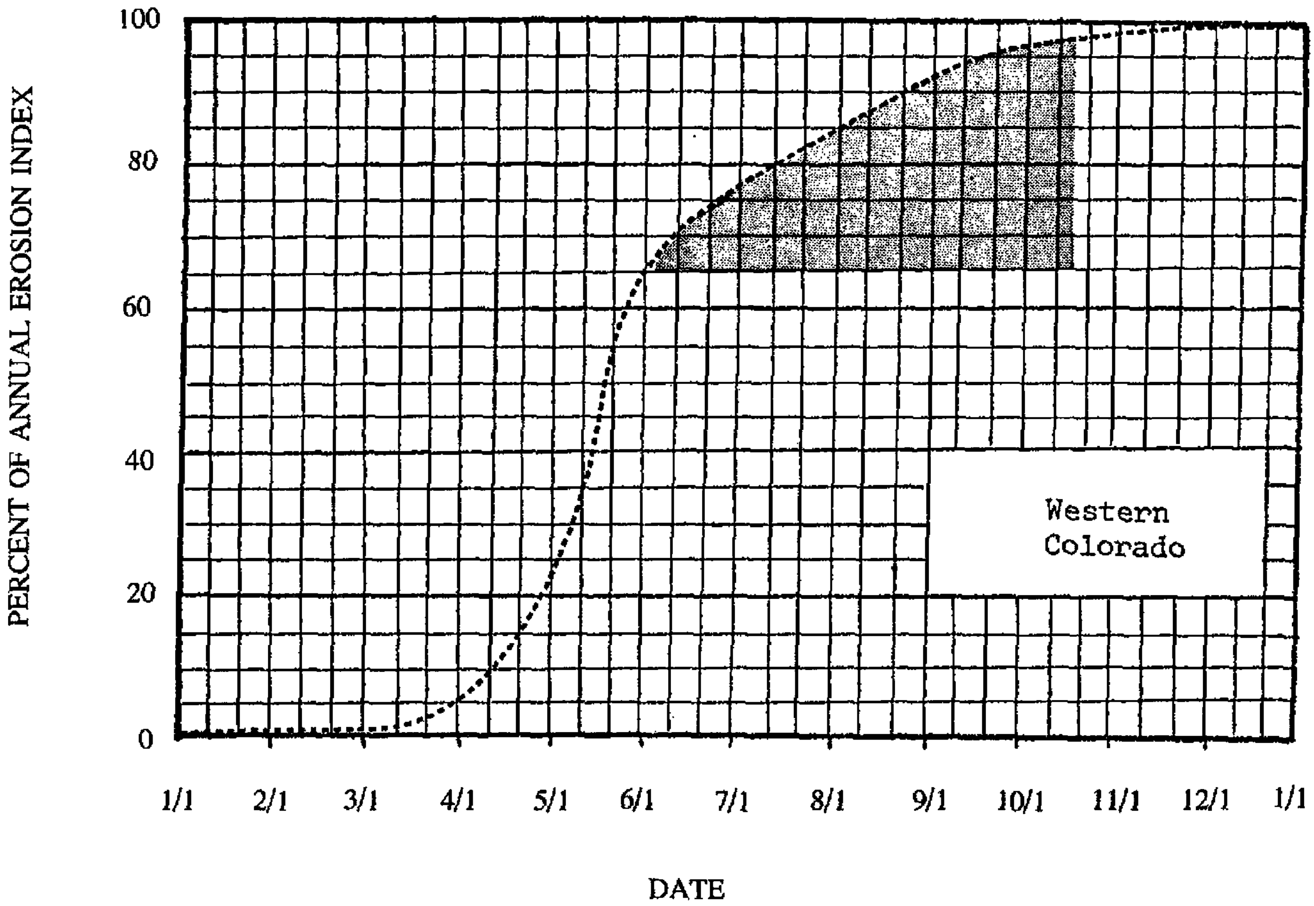
It should be understood that "R" factors presented in Figure 1 are based on long term average precipitation records. Therefore, the accuracy of soil loss predictions depends upon how close the actual precipitation events match the yearly averages.

The use of an erosion index distribution curve that represents a given area permits factor "R" to be modified to indicate the number of erosion units for any period of time within a year. This concept makes it possible to estimate erosion for periods of less than twelve months during the year. Figure 2 illustrates how this concept can be used.

The precedure for developing erosion index distribution curves is thoroughly discussed in SCS Technical Note 32 (Brooks, et al. 1974). Erosion index distribution curves that represent specific areas of a state are available through the Soil Conservation Service state offices listed in Appendix B.

FIGURE 2

Erosion Index Distribution Curve
for Computing Factor "R" for Less than 12 Months



Example

Earth work will be completed on a project area on or about June 1st. It is estimated that mulching and seeding will be accomplished by October 15th. What will be the adjusted "R" factor during this stage of reclamation given R=30?

Factor "R" will be adjusted to indicate only the Erosion Index (EI) units that occur during the period from June 1 to October 15th. This is accomplished as follows:

Determine the percent of annual EI at each date. June 1 %EI=65
October %EI=98

The difference, (98−65=) 33, indicates 33% of the annual "R" factor occurs during the specified time period.

Determine the adjusted "R" factor: R(Adjusted)=.33R=.33(30)=9.9

3.2 THE SOIL ERODIBILITY FACTOR "K"

The rate of soil erosion on any area is usually influenced more by land slope, rainstorms characteristics, cover, and management than by properties of the soil itself. Some soils, however, erode more readily than others even when slope, rainfall, cover and management are the same. This difference is due to properties of the soil itself and is referred to as the soil erodibility.

Soil properties that influence erodibility by water are those that affect the infiltration rate, permeability, and total water holding capacity, and those that resist the dispersion, splashing, abrasion, and transporting forces of the rainfall and runoff. A number of attempts have been made to determine criteria for scientific classification of soils according to erodibility. Generally, however, soil classification used for erosion prediction have been largely subjective and have only relative rankings.

The relative erodibility of different soils is difficult to judge from field observations. Even a soil with a relative low erodibility factor may slow signs of serious erosion when the soil occurs on long or steep slopes or in localities having numerous high-intensity rainstorms. On the other hand, a soil with a high natural erodibility factor may show little evidence of actual erosion under gentle rainfall when it occurs on short and gentle slopes or when the best possible management is practiced (Wischmeier, et al. 1965).

Until recently, the lack of a simplified method to determine the erodibility of any given soil without actual soil loss measurements has created problems in determining "K" values. Although soil loss on different sites may vary more than tenfold just because of basic soil differences, the erodibility factor has been directly measured for only a few soils. A new method was developed under the leadership of W. H. Wischmeier, of the Agricultural Research Service, U.S. Department of Agriculture. The use of a relatively simple nomograph (Figure 3) is of great value in determining "K" values, and thus, in planning conservation practices on severely disturbed areas (Wischmeier, et al. 1971).

As shown in the nomograph, five soil parameters are necessary to predict soil erodibility. These consist of percent silt plus very fine sand, percent sand greater than 0.10 millimeter, organic matter content, soil structure and permeability.

Soil erodibility generally tends to increase with greater silt content and decrease with greater sand, clay, and organic matter content. Early studies concluded that within a range from 0 to 4 percent organic matter, soil erodibility tends to decrease appreciably as organic matter increase and magnitude of change is related to soil texture (Wischmeier, et al. 1969). The effects of organic matter is excess of 4.0 percent has not yet been determined.

The soil structure parameter reflects average relationships between structure type and size. There are indications that the magnitude of these relationships may be influenced by structure strength and soil pH, but these affects are apparently too small to be concerned with in-field application (Wischmeier, et al. 1971).

The relative permeability classes coded on the nomograph refer to the soil profile as a whole. Usually these can be determined from routine profile descriptions. The controlling soil layer most often is below the surface layer. Including the permeability parameter should not necessitate laboratory determinations because general permeability classification guides are given in the USDA Soil Survey Manual (USDA Soil Survey Staff, 1951).

The procedure for using the soil erodibility nomograph is shown on Figure 3. For many agricultural soils having a fine granular structure and moderate permeability, the value of "K" can be read directly from the first approximation of "K" scale on the right hand edge of the first section of the nomograph, and the procedure can terminate there (Wischmeier, et al. 1971). However, for purposes of determining "K" factors on lands disturbed by surface mining, it will ordinarily be necessary to continue the procedure through the structure and permeability curves.

Soil scientists with the Soil Conservation Service have determined "K" factors for all established soil series in the states included in this publication. Refer to Appendix A to determine factor "K" for a given soil.

Soil profiles that have been moved, mixed, or otherwise distributed are expected to experience a change in erodibility (i.e., "K" value). However, the magnitude of a change in "K" and varying relationships with time have not been quantified. Even in cases where topsoil is preserved and replaced, there may be changes in "K" values, due primarily to structural changes. Future research efforts will be directed toward studying the parameters of disturbed soils as they relate to soil erodibility.

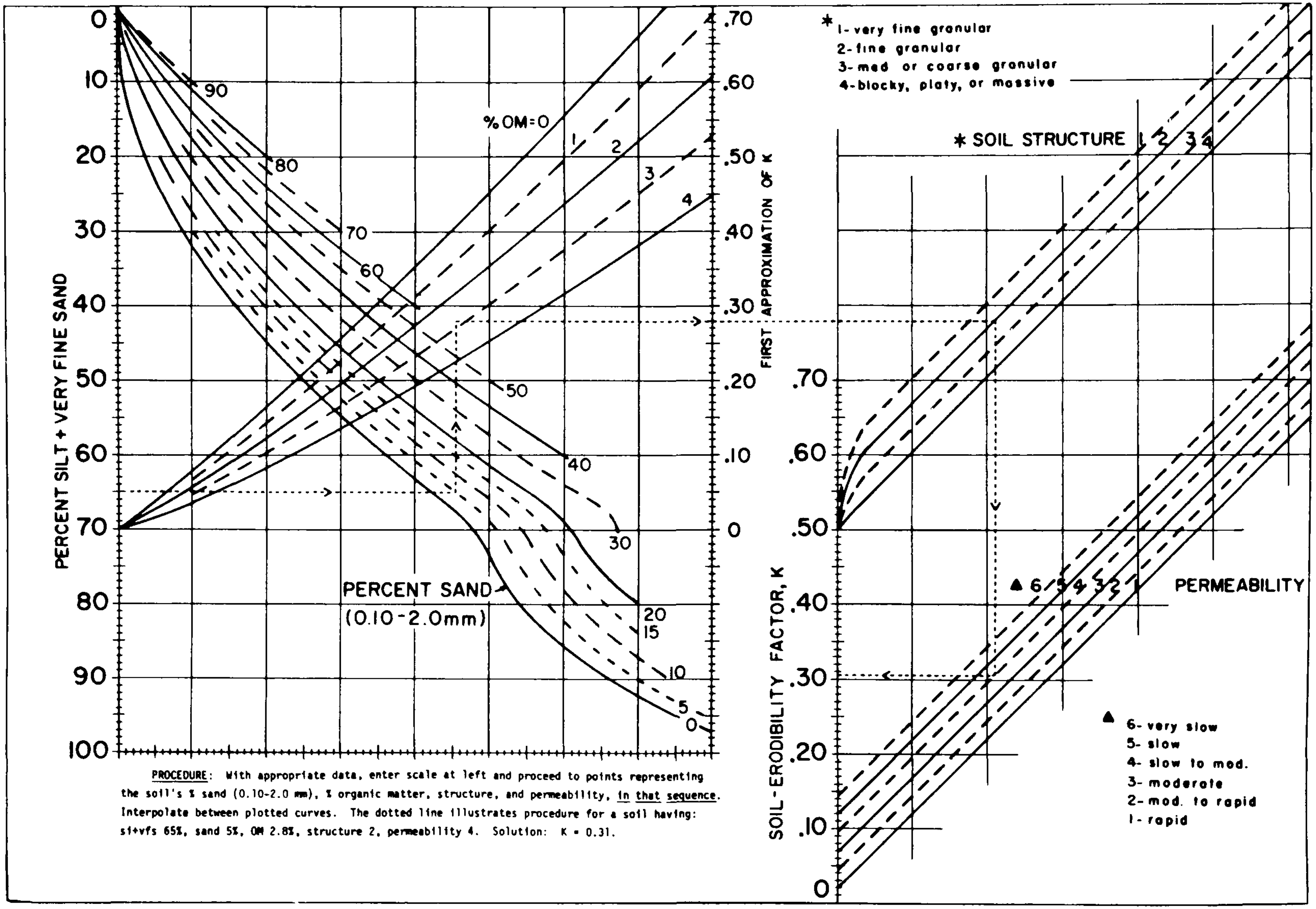


Figure 3. Nomograph for Determining Soil Erodibility—Factor "K"

Wischmeier, et al, 1971

3.3 FACTORS FOR SLOPE LENGTH "L" AND GRADIENT "S"

Soil erosion by overland flow of water is significantly affected by both slope length and percent slope. For convenience and use in the field, the factors have been combined into a single factor expressed as "LS" (Wischmeier, 1974).

The factor "LS" is the expected ratio of soil loss per unit area on a field slope to corresponding loss from the basic nine percent slope, 72.6 feet long. Notice in Table 1 that by interpolation a nine percent slope 72.6 feet long has an "LS" factor of 1.0.

The "LS" factor for gradients up to 60% and slope lengths up to 2000 feet can be obtained from the slope effect chart (Table 1). Research supports values up to 20% slope and about 400 feet lengths. Values of "LS" beyond these limits are extrapolations beyond the range of field research. Slopes occurring on areas disturbed by mining activities will rarely exceed 400 foot lengths, but will commonly exceed 20% gradient. Further efforts should be directed toward research to substantiate "LS" values beyond the range of 400 foot lengths and 20% slopes.

In order to use this guide effectively, it is necessary to have a good understanding of what constitutes slope length. It is defined as the distance in feet from the point of origin of overland flow to either of the following, whichever applies to the major part of the area:

1. The point where the slope decreases to the extent that visible deposition begins. The presence of alluvial fans is a good indication of a significant slope change.
2. The point where runoff enters an area of concentration that may be part of a drainage network or a constructed channel such as a waterway, terrace, or diversion (Wischmeier, et al. 1965).

Refer to the slope effects, Table 1, to arrive at the factor "LS". For example, a 30% slope, 90 feet long, would have an "LS" value of 7.5 by interpolation.

Figure 4: Approximate original topography or contour can be restored on most surface mined lands. Efforts should be made to establish acceptable slope lengths and gradients on restored lands.

Table 1. Values of the Topographic Factor "LS"

Length of Slope (L) Ft.	Percent Slope (S) 0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	40.0	50.0	60.0
20	.05	.05	.06	.06	.08	.12	.18	.21	.24	.30	.44	.61	.81	1.0	1.3	1.6	1.8	2.6	4	6	8	10
40	.06	.07	.07	.08	.10	.15	.22	.28	.34	.43	.63	.87	1.2	1.4	1.8	2.2	2.6	3.5	5	8	11	15
60	.07	.08	.08	.08	.11	.17	.25	.33	.41	.52	.77	1.0	1.4	1.8	2.2	2.6	3.0	4.5	6	10	14	18
80	.08	.08	.09	.09	.12	.19	.27	.37	.48	.60	.89	1.2	1.6	2.1	2.6	3.0	3.6	5.5	7	11	16	21
100	.08	.09	.09	.10	.13	.20	.29	.40	.54	.67	.99	1.4	1.8	2.4	2.9	3.5	4.2	6.0	8	13	18	23
110	.08	.09	.10	.10	.13	.21	.30	.42	.56	.71	1.0	1.5	2.0	2.5	3.0	3.7	4.5	6	9	14	19	25
120	.09	.09	.10	.10	.14	.21	.30	.43	.59	.74	1.0	1.6	2.1	2.6	3.3	4.0	4.6	7	9	14	20	26
130	.09	.09	.10	.11	.14	.22	.31	.44	.61	.77	1.2	1.6	2.2	2.8	3.4	4.1	4.9	7	9	15	20	27
140	.09	.10	.10	.11	.14	.22	.32	.46	.63	.80	1.2	1.7	2.3	2.9	3.6	4.3	5.1	7	10	15	21	29
150	.09	.10	.11	.11	.15	.23	.32	.47	.66	.82	1.2	1.8	2.4	3.0	3.7	4.5	5.3	8	10	16	23	30
160	.09	.10	.11	.11	.15	.23	.33	.48	.68	.85	1.2	1.9	2.5	3.1	3.9	4.7	5.5	8	10	17	24	31
180	.10	.10	.11	.12	.15	.24	.34	.51	.72	.90	1.4	1.9	2.6	3.3	4.1	5.0	6.0	9	12	18	26	33
200	.10	.11	.11	.12	.16	.25	.35	.53	.76	.95	1.4	2.1	2.8	3.6	4.4	5.3	6.3	9	12	18	27	35
300	.11	.12	.13	.14	.18	.28	.40	.62	.93	1.2	1.8	2.7	3.6	4.5	5.6	6.8	8	12	16	25	35	45
400	.12	.13	.14	.15	.20	.31	.44	.70	1.0	1.4	2.0	3.2	4.2	5.4	6.7	8.0	10	14	19	30	42	54
500	.13	.14	.15	.16	.21	.33	.47	.76	1.2	1.6	2.2	3.7	4.9	6.2	7.6	9.2	11	16	21	34	47	61
600	.14	.15	.16	.17	.22	.34	.49	.82	1.4	1.6	2.4	4.1	5.4	6.9	8.5	10.3	12	16	24	38	53	68
700	.15	.16	.17	.18	.23	.36	.52	.87	1.4	1.8	2.6	4.5	6.0	7.5	9.3	11.3	13	18	26	41	58	75
800	.15	.16	.17	.18	.24	.38	.54	.92	1.6	2.0	2.8	4.9	6.4	8.2	10.1	12.2	14	20	28	45	58	81
900	.16	.17	.18	.19	.25	.39	.56	.96	1.6	2.0	3.0	5.2	6.9	8.8	10.8	13.1	16	22	30	48	67	87
1000	.16	.18	.19	.20	.26	.40	.57	1.0	1.6	2.2	3.0	5.6	7.4	9.3	11.6	14.0	17	24	32	51	72	93
1100	.17	.18	.19	.20	.27	.41	.59	1.0	1.8	2.2	3.5	5.9	7.8	9.9	12.2	14.8	18	25	34	54	76	98
1200	.17	.18	.20	.21	.27	.42	.81	.10	.18	2.4	3.5	6.2	8.2	10.4	13.0	15.6	18	27	36	57	80	104
1300	.18	.19	.20	.21	.28	.43	.82	1.2	2.0	2.4	3.5	6.5	8.6	11.0	13.5	16.4	19	28	38	60	84	109
1400	.18	.19	.21	.22	.29	.44	.63	1.2	2.0	2.6	3.5	6.8	9.0	11.4	14.1	17.1	20	30	40	63	88	114
1500	.19	.20	.21	.22	.29	.45	.65	1.2	2.0	2.6	4.0	7.1	9.4	12.0	14.7	17.8	21	31	41	65	92	119
1600	.19	.20	.21	.23	.30	.46	.66	1.2	2.2	2.6	4.0	7.4	9.8	12.4	14.8	18.5	22	32	43	68	95	123
1700	.19	.21	.22	.23	.30	.47	.67	1.2	2.2	2.8	4.0	7.6	10.1	12.9	15.9	19.2	23	33	44	70	97	128
2000	.20	.22	.23	.24	.32	.49	.71	1.4	2.4	3.0	4.5	8.4	11.1	14.1	17.5	21	25	36	49	77	108	141

Contour limits - 2 percent 400 feet, 8 percent 200 feet, 10 percent 100 feet, 14 - 24 percent 60 feet. The effectiveness of contouring beyond these limits is speculative.

When the length of slope exceeds 400 feet and (or) percent of slope exceeds 24 percent, soil loss estimates are speculative **as these values** are beyond the range of research data.

3.4 COVER OR CROP MANAGEMENT FACTOR "C"

The factor "C" values relate to the effects various ground covers have on erosion. The basic soil loss is the rate at which the soil would erode if the field were continuously clean tilled. The "C" factor in the USLE indicates the percentage of this potential soil loss that would occur if the surface were partially protected by some particular combination of cover and management (Holeman, et al. 1975).

In order to apply the factor "C" to land uses other than cropland, three zones of influence are considered. These three influence zones are shown in Tables 3 and 4 and can be grouped into general categories of canopy cover, weeds or undecayed organic residue, and sod or decaying organic matter. Canopy cover, as the name implies, is an overhanging protective cover standing sufficiently above other vegetative growth as to be readily distinguishable and to provide shielding from direct rainfall inpingement. Weeds or undecayed organic residue is the vegetative growth, either viable or dead but undecayed, that provides some protection from rainfall impact, but does not serve to significantly retard runoff by holding the water that reaches the surface. Sod or decaying organic matter is that material directly on the soil surface and serves to retard rainfall runoff by holding the water.

Vegetative residue in contact with the soil surface is extremely effective against erosion (Mannering, 1967). A thick layer of organic litter is often present under woodland situations. Therefore, very little erosion occurs unless the soil has been disturbed or exposed. Croplands often erode severely because of the soil disturbance necessary for weed control, seedbed preparation, and planting operations. Likewise, surface mined areas are generally bare for a period of time from pre-winter (i.e., before surface freezing) removal of topsoil until mining and from final grading to the mulching and seeding of regraded and topsoiled areas.

Reclamation plans are ordinarily directed toward rehabilitating affected lands to a designated land use. Tables 2, 3, and 4 provide guidance for determining "C" factors for cropland, pastureland, rangeland, and woodland.

Refer to Table 5 to determine factor "C" for various rates of mulch. It should be noted that two tons of straw mulch per acre provides approximately the same "C" factor as 44% ground cover of grass with no appreciable canopy cover. The mulch material, however, is only temporary and begins to lose its effectiveness soon after application. The durability of the mulch depends on the amount of material applied, quality of material, and method of application. Various kinds of organic mulch decay at different rates. Also, the method of application is important due to the high wind velocities occurring in parts of the Interior Western United States. Ordinarily, the higher the quantity of mulch applied, the longer it lasts and the more protection the mulch provides against erosion; however, if too much is applied, it has a smothering effect on grass seedlings.

If the post mining land use is recreation or wildlife habitat, the "C" factor will be selected from the chart that best describes the vegetative condition of the area.

Table 2. Crop Management Factor "C"

Cropland

Crop Rotations	Residue at Planting lbs/Ac	"C" Values/State							
		AZ	CO	MT	NM	ND	SD	WY	UT
Winter wheat-fallow	0	.55	.47	.43	.56	.43	.41	.39	.41
or	0-500	.36	.36	.31	.37	.36	.37	.31	.33
Spring wheat-fallow	500-1000	.21	.21	.21	.27	.23	.27	.21	.22
	1000-1500	.14	.15	.13	.15	.14	.17	.13	.16
Continuous spring	0	.33	.34	.30	.35	.34	.34	.33	.33
or	0-500	.30	.31	.24	.24	.27	.27	.31	.30
Winter wheat-	500-100	.17	.18	.15	.18	.20	.20	.18	.17
occasional fallow	1000-1500	.12	.13	.11	.13	.15	.15	.14	.13

For cropping systems not included in this chart, additional information can be obtained through the local Soil Conservation Service office (see Appendix B).

Table 3. "C" Factors for Woodland

1/ Tree Canopy % of Area	2/ Forest Litter % of Area	3/ Undergrowth	"C" Factor
100-75	100-90	Managed 4/	.001
		Unmanaged 4/	.003-.011
70-40	85-75	Managed	.022-.004
		Unmanaged	.01-.04
35-20	70-40	Managed	.003-.009
		Unmanaged	5/

1) When tree canopy is less than 20%, the area will be considered as grassland for estimating soil loss. See Table 4.

2) Forest litter is assumed to be at least two inches deep over the percent ground surface area covered.

3) Undergrowth is defined as shrubs, weeds, grasses, vines, etc., on the surface area not protected by forest litter. Usually found within canopy openings.

4) Managed—grazing and fires are controlled.
Unmanaged—stands that are overgrazed or subjected to fires from natural causes.

5) For unmanaged woodland with litter cover of less than 75%, C values should be derived by taking 0.7 of the appropriate values in Table 4. The factor of 0.7 adjusts for the much higher soil organic matter on permanent woodland.

Figure 5: Methodologies for restoring vegetative cover on severely disturbed land are presently being developed and evaluated. The Interior Western U.S. climate is often the limiting factor.

Table 4. "C" Factors for Permanent Pasture and Rangeland

Vegetative Canopy			Cover That Contacts the Surface 1/						
Type and Height of Raised Canopy 2/	Canopy Cover 3/	Type 4/	Percent Ground Cover						
			0	10	20	40	60	80	95-100
No appreciable canopy		G	1.0	.45	.20	.10	.042	.013	.003
		W	1.0	.45	.24	.15	.090	.043	.011
Canopy of tall forbs or short brush (0.5 m fall ht.)	25	G	1.0	.36	.17	.09	.038	.012	.003
		W	1.0	.36	.20	.13	.082	.041	.011
	50	G	1.0	.26	.13	.07	.035	.012	.003
		W	1.0	.26	.16	.11	.075	.039	.011
	75	G	1.0	.17	.10	.06	.031	.011	.003
		W	1.0	.17	.12	.07	.067	.038	.011
Appreciable brush or brushes (2 m fall ht.)	25	G	1.0	.40	.18	.09	.040	.013	.003
		W	1.0	.40	.22	.14	.085	.042	.011
	50	G	1.0	.34	.16	.085	.038	.012	.003
		W	1.0	.34	.19	.13	.081	.041	.011
	75	G	1.0	.28	.14	.08	.036	.012	.003
		W	1.0	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	1.0	.42	.19	.10	.041	.013	.003
		W	1.0	.42	.23	.14	.087	.042	.011
	50	G	1.0	.39	.18	.09	.040	.013	.003
		W	1.0	.39	.21	.14	.085	.042	.011
	75	G	1.0	.36	.17	.09	.039	.012	.003

1/ All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists.

2/ Average fall height of waterdrops from canopy to soil surface: m=meters.

3/ Portion of total-area surface that would be hidden from view by canopy in a vertical projection, (a bird's-eye view).

4/ G: Cover at surface is grass, grasslike plants, decaying compacted duff, or litter.

W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface, and/or undecayed residue.)

Table 5. Factor "C" for Various Quantities of Mulch

Mulch—adequately crimped into soil	"C" Factor
bare areas	1.0
¼ ton straw mulch per acre	.52
½ " " " " "	.35
¾ " " " " "	.24
1 " " " " "	.18
1½ " " " " "	.10
2 " " " " "	.06
3 " " " " "	.03
4 " " " " "	.02

3.5 THE EROSION CONTROL PRACTICE FACTOR "P"

In conventional application of the USLE, the erosion control practice factor "P" relates to erosion control on cropland fields. This would include contour tillage, and contour stripcropping. Typically, if erosion is being calculated on land uses other than cropland, the factor "P" will be 1.0. The exception is where physical manipulation of the land is used such as contour pitting, gouging, or furrowing during a reclamation process.

When sloping soil is disturbed and exposed to erosive rains, the protection offered by mulch, sparse grass stands, or close-growing crops can be supported by practices that will slow the runoff water and thus reduce the amount of soil it can carry. The supporting practices include contour tillage and stripcropping on the contour. The factor "P" in the erosion equation is the ratio of soil loss with the supporting practice to the soil loss up-and-downhill culture. Improved tillage practices, fertility treatments, and greater quantities of residues left on the area contribute materially to erosion control and frequently provide the major control in a field. However, these are considered conservation cropping and management practices, and the benefits derived from them are included in the factor "C" (Wischmeier, et al. 1965).

Tillage and planting operations performed on the contour are very effective in reducing erosion from storms of low to moderate intensity. Storms of high intensity however are common to many areas of the Interior Western United States, and contouring provides little protection against such high intensity rainstorms.

Terracing in combination with contouring is more effective as an erosion control practice than just contouring and stripcropping. The beneficial effects of terracing is reflected in the factor "LS" since the length of slope is directly affected by terracing. Off-field sediment load is affected by terracing from both the shorter slope lengths and sediment storage in the terrace channels. Sediment yield is further discussed in Section 5.

Contour furrowing and pitting is being evaluated for use in reclamation plans. These practices demonstrate benefits from moisture conservation, as well as erosion control (Dollhopf, et al. 1976). Table 6 gives relative guidance on factor "P" for erosion control practices related to contouring.

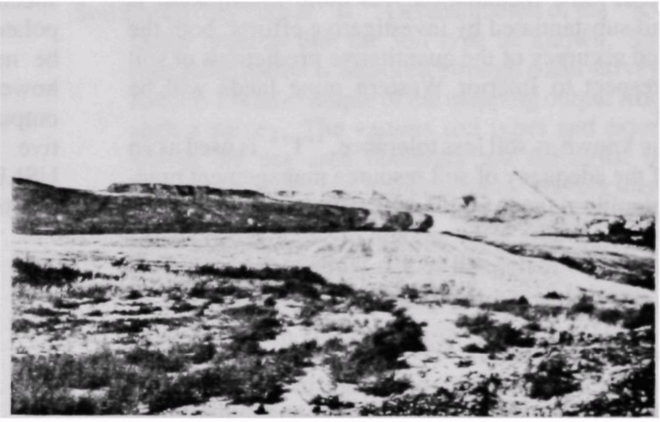


Figure 6: Reclaimed surface mined land can sometimes be utilized for croplands. Climate often restricts the post-mining land use to grassland.

Table 6. Determining Factor "P"

Land Slope %	Contouring 1/	Contour 2/ Furrows or Pits	Contour 3/ ditches (wide spacing)
2.0 to 7	0.50	0.25	3/
8.0-12	0.60	0.30	3/
13.0-18	0.80	0.40	3/
19.0-24	0.90	0.45	3/
25.0-30	1.0	0.65	3

1/ Topsoil spreading, tillage, and seeding on the contour. Contour Limits—2 percent 400 feet, 8 percent 200 feet, 10 percent 100 feet, 14-30 percent 60 feet. The effectiveness of contouring beyond these limits is speculative.

2/ Estimating values for surface manipulation of reclaimed land disturbed by surface mining. Furrows or pits installed on the contour. Spacing between furrows 40-60 inches with a minimum 6 inch depth. Pits equal or exceed 12 inch width 36 inch length and 6 inch depth. Pit spacing is dependent on pit size, but generally the pits should occupy 50% of the surface area.

3/ Factor values for this practice are not established.

Section 4.0

LIMITATIONS AND USES OF THE UNIVERSAL SOIL LOSS EQUATION

The USLE was developed to predict soil loss from agricultural lands due to sheet and rill erosion. It does not account for gully erosion, which cannot be predicted by any known formula. Neither does it predict sediment yield or stream loading (see Section 5.0).

The USLE has not found wide use to date as a tool for evaluating the potential and adequacy of proposed surface mining reclamation activities, but consideration of such application is receiving wider acceptance. The USLE can provide a basis for comparison of the impacts and long-term productivity of pre-minded land conditions with those proposed for post-mine reclamation. As more information is acquired and substantiated by investigative efforts, both the precision and accuracy of the quantitative predictions of soil loss with respect to Interior Western mine lands will be established.

A value known as soil loss tolerance, "T", is used as an indicator of the adequacy of soil resource management practices on agricultural lands under continuing production conditions. The "T" value is the amount of soil that can be lost in a year from a particular soil series, while at the same time supporting sustained long-term agricultural productivity of that land.

Soil loss tolerances, or "T" factors, are included in Appendix A for all soil series occurring in the eight-state area included in this publication. It is thought that "T" factors *may* provide some comparative value for estimated soil loss for a particular soil series on reclaimed mined lands. However, it must be recognized that "T" factors shown in Appendix A were developed for use in planning and evaluating conservation plans on cropland. Most of the areas of land where this guide applies in the Western United States will be reclaimed following mining for grazing or wildlife usage. In addition, such areas will be severely disturbed where mining takes place, and in many cases, high rates of erosion will occur on these disturbed areas until permanent cover is established. Additional efforts need to be directed toward quantifying "T" factors for both overburden material and topsoiled areas in conjunction with mined land reclamation. Until additional guidance is available, the applicability of the "T" factors shown in Appendix A may be of limited utility.

A potential source of significant error in the accuracy of soil loss prediction by the USLE is in selecting and assigning the factor values. The conditions to be evaluated must be clearly defined.

The accuracy of the USLE when applied to land disturbed by surface mining is dependent upon the relationship between the assumed factor values and the actual conditions that determine the factor. The accuracy of the "K" value is of particular concern. In many instances and for purposes of sample calculations in this report, the "K" value has been assumed constant for pre-mining and post-mining conditions. The actual characteristics and the potential changes in the "K" value with respect to field application are presently unknowns. Due to severe disturbance of the soil between pre- and post-mining, some change in the "K" value between pre- and post-mining conditions may be variable with time and continuously change until stable conditions are established.

Soil, cover, and management conditions may not match specific guidelines shown in the tables and charts, and interpolated values guided by judgment and experience may often be necessary. Interpolation and assumptions should not however diminish the usefulness of this publication if the outputs and conclusions reached are put into proper perspective. It should be kept in mind that the primary value of the USLE lies in its ability to compare alternative reclamation practices quantitatively.

Section 5.0

SOIL LOSS vs. SEDIMENT YIELD

Sediment yield is equivalent to the gross erosion minus what is deposited en route to a given point. Sediment yield estimates are needed to evaluate sediment loading to streams and to determine sediment design requirements for sediment control structures. The yield of a given area varies with the changing patterns of precipitation, soil, cover, drainage patterns, topography, and size of the drainage area.

A method of determining sediment yield has been used for many years by the Soil Conservation Service. The estimate of sediment yield is made by use of the following equation:

$$Y=E(DR)$$

where

Y=sediment yield (tons/unit area/year)

E=gross erosion (tons/unit area/year)

DR=sediment delivery ration (always less than 1)

Gross erosion can be estimated by use of the Universal Soil Loss Equation. The sediment delivery ratio should be determined by a sedimentation geologist or engineer. Many interrelationships of watershed characteristics must be considered in order to determine accurate sediment delivery ratios (SCS Engineering Handbook, 1971).

Section 6.0

APPLICATION OF THE USLE

The information presented in previous sections of this publication was developed to provide background information on the USLE and provide pertinent data needed to apply the equation.

This section is devoted to giving an illustrative example of an erosion study for lands disturbed by surface mining. It should be noted that the methodology and exhibits shown in this section of the publication provide general guidance and examples for illustrative purposes. The guidance is not meant to imply a specific method or procedure for conducting an erosion study.

It must be noted that the sample soil loss calculations presented in this publication are only examples. The pre- and post-mining land uses specified herein present a hypothetical situation and do not suggest that specific land productivity nor reclaimed land use or configuration are attainable and recommended. A site-specific, demonstration study will follow the effort represented by this publication. This study will attempt to assess the influences of physical manipulation on soil loss and investigate the potential change in "K" values for pre- and post-mining conditions.

6.1 DEVELOPING AN EROSION STUDY

An erosion evaluation project should be carried out with specific objectives in mind. Soil loss or erosion information can be of value for a number of purposes. In many cases the primary purpose may be the evaluation of various alternative plans or components to plans. For example, it may be of concern to determine quantitatively the effects diversions or terraces may have on erosion. If the objective is to determine off-site sediment yield, additional surveys will be necessary to arrive at a sediment delivery ratio(s) representative of the drainage area(s).

Erosion is an environmental impact that should be addressed in plans involving land disturbance resulting from surface mining activities. It is possible, by using information in this publication to predict soil loss for pre-mining conditions and to predict what the soil loss will be at completion of the reclamation plan, or at any stage during reclamation. Again, it should be emphasized that the USLE utilizes long-term average rainfall intensities, and deviation from average intensity, amount, or distribution will affect the answers arrived at by use of the USLE. In spite of this restriction, the USLE is recognized by most conservationists as the best method available to calculate soil loss from sheet and rill erosion.

Certain-site specific resource information will be necessary for an erosion study, including soil survey information, topographic information, vegetative analysis, and climatic data. Other material may include aerial photography, forms and procedure for recording erosion factors, and as much information as possible concerning the planned mining activities and reclamation work.

6.2 DETERMINING EROSION FACTORS

To predict the soil loss from a given land area, a value must be assigned to each of the five factors in the USLE. The correlation between the chosen factor values and actual site conditions will determine the accuracy of the soul loss prediction. Values for some of the factors may be taken directly from the tables, figures, and Appendix A presented in this report, while values for other factors will require a site survey and measurement.

<u>Determination of Erosion Factors</u>

Rainfall Factor "R": The "R" factor value can be taken directly from Figure 1 by selecting the value assigned to the location of the project area.

Soil Erodibility Factor "K": Determination of the "K" factor requires that the soil type be known. Soil type information is acquired through a soil survey. Exhibit 1 is an example of the mapping output from such a survey. The various soil types and extent within the use area boundary are identified by three-letter codes and mapping units. Having identified the soil series, the "K" value for each can be determined from Appendix A. Appendix A lists all known soil series for the eight Interior Western states of Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming.

The question of whether the "K" value remains the same for disturbed and reclaimed lands as for pre-mining lands remains specifically unanswered. Follow-up investigations to this publication hope to address this question, but until such time and for simplification of this example, the same pre- and post-mining "K" values will be used.

Length-Slope Factor "LS": The user of this publication should be thoroughly familiar with the section discussing factors "L", "S", and "LS" In most cases, field investigation and reference to the reclamation plan will be necessary to determine the length and degree of slope. After determining the "L" and "S", refer to Table 1 for the "LS" factor used in the USLE.

Crop Management Factor "C": This factor relates to vegetative soil protection. Refer to Tables 2, 3, 4, or 5, depending on the land use, to determine the appropriate erosion factor based on information from field investigation or information contained in the reclamation plan. Additional information on cropland "C" factors is available at local SCS offices (Appendix B) if the planned cropping system does not fit one list in Tables 2 through 5.

The line intercept methods should be used to determine percent ground cover and canopy cover for use in Tables 4 and 5. A 100-foot tape that measures in tenths of feet will permit easy conversion to percent ground cover and canopy cover. (Canfield, 1941.)

Control Practice Factor "P": The "P" factor is ordinarily applicable to cropland management systems, however, research is underway to determine the effects of contour pitting and furrowing on rangeland and pastureland. A follow-up investigation to this report will consider the effects of pitting and furrowing on mine reclaimed lands on the USLE. Refer to Table 6 to select the appropriate "P" factor.

6.3 PREDICTING SOIL LOSS

The following represent examples of how the USLE may be used to predict soil loss on lands which have been or may be disturbed by surface mining activities. The primary area of application of the USLE is anticipated to be with regard to predicting any change in soil loss between the pre- and post-mining land use conditions. Thus, step-by-step procedures applicable to the situation are presented below.

It is also conceivable however that soil loss predictions during active reclamation, i.e., between pre- and post-mining, may be useful with respect to timing of reclamation procedures such as mulching, seeding, sedimentation basin design (assuming a soil loss-sediment yield relationship has been established), etc., and thus, step-by-step procedures applicable during this period are also presented.

Pre- and Post-Mining Land Use

Step 1: Develop an erosion factor map of the pre-mining project area (Exhibit 2). Because topography probably will change, land use may change, and substrate characteristics may change, a post-mining erosion factor map is necessary (Exhibit 3). Various erosion sub-areas may occur within a single land use area due to a change in one or more of the erosion factors. Erosion areas can be delineated by drainage patterns, land use, or various physical differences. Field investigation will be necessary to determine erosion factors for each designated area or sub-area. A soils map of the area will be necessary in all cases (Exhibit 1).

Step 2: Develop a chart to record the pre-mining condition erosion factors for each erosion area (Exhibit 4).

Each sub-area/area delineated on the pre-mining erosion factor map (Exhibit 2) is listed in Exhibit 4, as are the USLE factors as determined from the soil survey mapping effort (Exhibit 1) and information from Tables, Figures and Appendix A presented in this report. The information in Exhibit 4 is then tabulated to give the average tons per acre per year soil loss for each sub-area. Sub-area 1A for example:

$$A = R \quad K \quad LS \quad C \quad P$$

$$A=(30)\ (0.37)\ (0.25)\ (0.10)\ (1);$$

where the topographic LS factor is determined from Table 1 by interpolation:

A=0.28 tons per acre per year.

Knowing the number of acres involved, 1,290 for sub-area 1A, the predicted tons per year soil loss from sub-area 1A is calculated to be 361.2. The soil loss from the individual sub-areas/areas can be calculated and summed to yield the total estimated annual average soil loss from the mine area under pre-mining conditions. Exhibit 4 shows a total predicted soil loss of 2,895.8 tons per year from the mine area under pre-mining conditions. This should not be mistaken for sediment yield.

Step 3: Using the post-mining erosion factor map (Exhibit 3) a chart (Exhibit 5) similar to Exhibit 4 can be developed. In the development of this chart, it is reasonable to assume that some of the USLE factors will remain constant for both pre- and post-mining land use conditions. "R" will always remain constant. "K" may remain relatively constant if the surface soil is redistributed in the approximate vicinity where it was removed, but this constancy cannot be confirmed nor denied with presently available information. For calculation purposes in this example a constant pre- and post-mining "K" value will be assumed. Future investigations will address this issue. The remaining factors L, S, C, and P may change depending upon any change in the post-mining land use and topography variables that influence those factors. In this example, and as shown in the factor values in Exhibit 5, several changes have been assumed between pre- and post-mining land use. A summary of changes is presented below:

Post-Mining Sub-Areas	Assumed Changes
1A, 1B, 1C, 1E	Change in "C" factor—assumes 50% post-mining ground cover density.
1D	Same as above; plus includes pre-mining area 3A, Cropland, assuming it is changed to pastureland increasing area by 300 acres.
2A, 2B	Change in the "L" factor to 160 as the result of terracing which is reflected in a change in the topographic "LS" factor. The practice of contouring is also initiated for post-mining land use resulting in a "P" factor of 0.50 (Table 6).
3A	Post-mining land use change to pastureland having the same factors as area 1D and thus is included in 1D for calculation purposes.

Step 4: Having established the USLE factors for the post-mining land use conditions, the predicted soil loss can be calculated on a tons-per-acre-per-year basis. Using acreage values, the annual tons per year from the mine area can then be tabulated (Exhibit 5).

Having calculated the predicted soil loss from the mine area under the pre- and post-mining conditions, a comparison of the soil loss between the two land use conditions can be made. The tabulated information in Exhibits 4 and 5 shows:

Pre-Mining Condition

Land Area	Predicted Annual Soil Loss from Area	Area
Pastureland	1,239.4 T/Yr	4,190 Ac
Cropland	1,656.4 T/Yr	940 Ac
TOTAL SOIL LOSS	2,895.8 T/Yr	

Post-Mining Condition

Land Area	Predicted Annual Soil Loss from Area	Area
Pastureland	1,415.5 T/Yr	4,490 Ac
Cropland	302.4 T/Yr	640 Ac
TOTAL SOIL LOSS	1,717.9 T/Yr	

Under the assumptions and constraints of this example, a reduction in predicted average soil loss of 1,177.9 T/Yr would be realized.

It must be recognized that this projected reduction in soil loss between pre- and post-mining land use is the result of multiple changes in the USLE factors that are assumed to be variable, i.e., LS, C, and P. To ideally and fully utilize the USLE, the influence of a change of any one factor would have on the predicted soil loss and its relationship to changes in the other factors should be examined, i.e., a change in X units of "C" is comparable to Y units of any other variable. Thus; by knowing the factor-to-factor relationships and having cost information relating to the manipulation necessary to affect a unit parameter change, a post-mining land use scheme could be optimized in terms of economics within the constraints of applicable reclamation laws, standards, and physical constraints.

The establishment of the factor-to-factor relationships is beyond the scope of this publication, but it is felt that a brief example showing the influence of changing one variable factor versus changing another variable factor is important.

In the previous pre- and post-mining land use example, it has been noted that in some instances several variables changed for each sub-area. In order to see the influence a change in variable factors can have on the predicted soil loss, sub-area 2A will be examined.

The pre-mining land use condition for sub-area 2A in Exhibit 4 are shown in Exhibit 6, Item I. The post-mining land use conditions for the same sub-area from Exhibit 6, Item II.

A comparison of this information shows that the predicted annual soil loss from cropland sub-area 2A changes from 598.4 T/Yr under pre-mining conditions, or a reduction in soil loss of 396 T/Yr. This change is influenced by a change in both the "L" factor and the "P" factor. To examine the relative impact the changes of these two factors have on the predicted soil loss, each factor shall be considered separately. First looking at only a change in the "L" factor, while maintaining the same "P" factor (Item III), the predicted soil loss becomes 404.4 T/Yr, indicating a 194.0 T/Yr reduction in predicting soil loss.

Secondly, looking at a change only in the "P" factor while holding the "L" factor constant (Exhibit 6, Item IV) shows the predicted soil loss would be 298.9 T/Yr or a 299.5 T/Yr reduction. It is readily seen that in this particular example, the assumed change in "P" has a much more significant affect on reducing the predicted soil loss than the assumed changes in "L". It is also seen that the calculated changes, as dictated by the individual factors, are not additive. The predicted annual average soil loss reduction from sub-area 2A when both factors are changes, 396 T/Yr reduction, does not equal the sum of the individual change, 194.0 + 299.5 T/Yr or 493.5 T/Yr reduction. 1 T/Yr reduction in predicted soil loss obtained by a change in one variable, say "L", and a 1 T/Yr reduction obtained by a change in another variable, say "P", does not equal a 2 T/Yr change obtained if both factors are changed. Being aware of the above and the applicable laws, standards, and physical constraints, the land manager can utilize the available information to maximize those variables which lend themselves to manipulation most economically and/or conveniently, putting lesser emphasis on the more "difficult" factors in order to bring "A" to the desired level.

Active Reclamation

As previously stated, the USLE can be utilized to predict the average soil loss from a given area over a time period less than one year. The major influence in predicting soil loss over short time periods, as compared to predicting the annual average soil loss, is the adjustment of the "R" factor and the short-term changes in land conditions. As illustrated in Figure 2, the "R" factor can be modified for periods less than 12 months. Step-by-step procedures applicable to soil loss evaluation during this period are presented below.

Step 1: Identify the area of study and select the time periods such that the USLE factors can be assumed constant for that period. In this example, the area shall be the area identified in Exhibit 2 as the Phase I post-mining area. This area, 480 acres, is the first area disturbed and subsequently reclaimed as the mining activity progresses. The time periods (Exhibit 7) are (1) from May 15 (5/15) to October 1 (10/1) during which it is assumed that the area will remain essentially bare, and (2) from 10/1 to 5/15 during which mulching and seeding are assumed.

Step 2: Prepare a chart, Exhibit 7, showing the area of study and assign numeric values to the USLE factors. The land condition for period 1 is assumed to be bare for approximately five months, 5/15 to 10/1, while protected by mulch for the remaining seven months, 10/1 to 5/15, period 2. The "K" and "P" factors for both periods are assumed to remain the same as in pre-mining. The length and slope factors, "L" and "S", are assumed to be restored after mining has occurred and thus also remain the same. The "C" factor will change with respect to the stages of cover and the "R" factor will change as determined from the EI distribution curve, Figure 2, for the appropriate time period.

The "C" factor values (Table 5) are 1.0 for bare soil (5/15 to 10/1, period 1), and 0.06 for assumed mulching and seeding at two tons of mulch per acre (10/1 to 5/15, period 2). The adjusted "R" factor values, Figure 2, are determined as follows. (Note that the EI curve, Figure 2, is assumed to be the appropriate curve for this mining site.)

1. Percent of annual EI at each date: 5/15 % EI=45
10/1 % EI=97
2. The difference, (97-45)=52, indicates 52% of the annual "R" factor occurs from 5/15 to 10/1.
3. The adjusted "R" factor is then:
"R" (adjusted=.52(R)=.52(30)
=15.6

The EI curve is assumed to repeat each year, over the short term, thus the adjusted "R" factor for the period from 10/1 and 5/15 is the remaining percentage, or 48%. The adjusted "R" factor from 10/1 to 5/15 is then:

R (adjusted)=.48R=.48(30)=14.4

Step 3: Having assigned values to all factors, the average soil loss can be predicted. Exhibit 7 shows that during period 1 when the land is bare and 52% of the erosion due to rainfall is anticipated, the predicted soil loss is 1.44 tons/acre/period, indicating a total loss of 691.2 tons from 5/15 to 10/1. During period 2, the predicted average loss is 0.08 tons/acre/period, or 38.4 tons from the 480 acres over the period 10/1 to 5/15. The total predicted soil loss from 5/15 to 5/15 the following year, is thus 729.6 tons/year.

Exhibit 7 also shows the predicted soil loss during the second year assuming that the seeding was successful and that a 20 percent ground cover density with no appreciable canopy is representative of the conditions over the second year. During this period, total predicted soil loss is 264.0 tons/year as compared to 729.6 tons/year the first year.

EXHIBIT 1

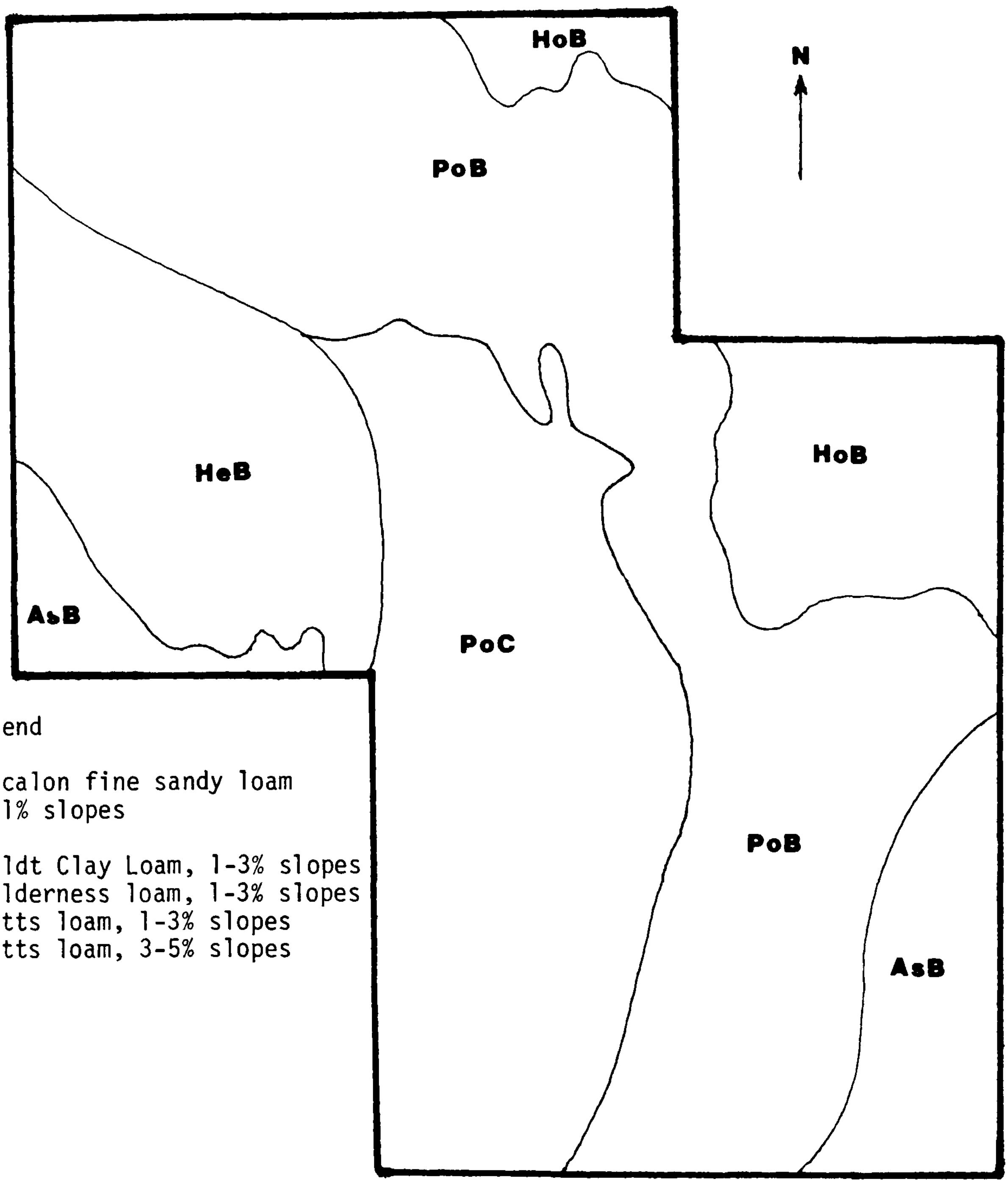
SOIL MAP

Owner Coal Field Inc. Operator Same

County Diablo State Colorado

Soil survey sheet (s) or code nos. page 29 Approximate scale 2" - 1 mile

Prepared by U. S. Department of Agriculture, Soil Conservation Service cooperating with ____________________ Conservation District



Soil Legend

AsB - Ascalon fine sandy loam 0-1% slopes

HeB - Heldt Clay Loam, 1-3% slopes
HoB - Holderness loam, 1-3% slopes
PoB - Potts loam, 1-3% slopes
PoC - Potts loam, 3-5% slopes

EXHIBIT 2

Erosion Factor Map
Coal Field Inc.
Present Conditions
(Pre-Mining)

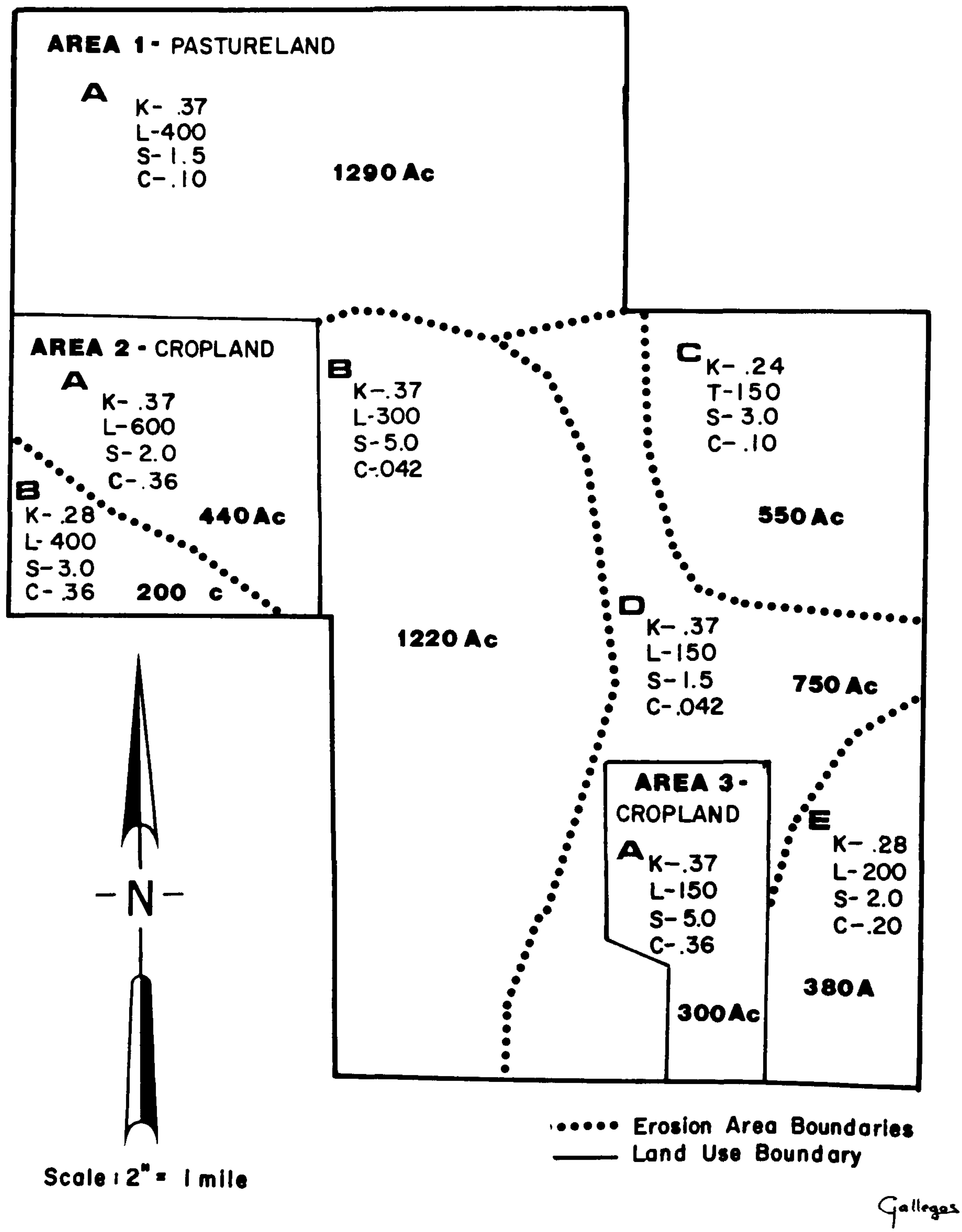


EXHIBIT 3
Erosion Factor Map
Coal Field Inc.
Post-Mining Conditions

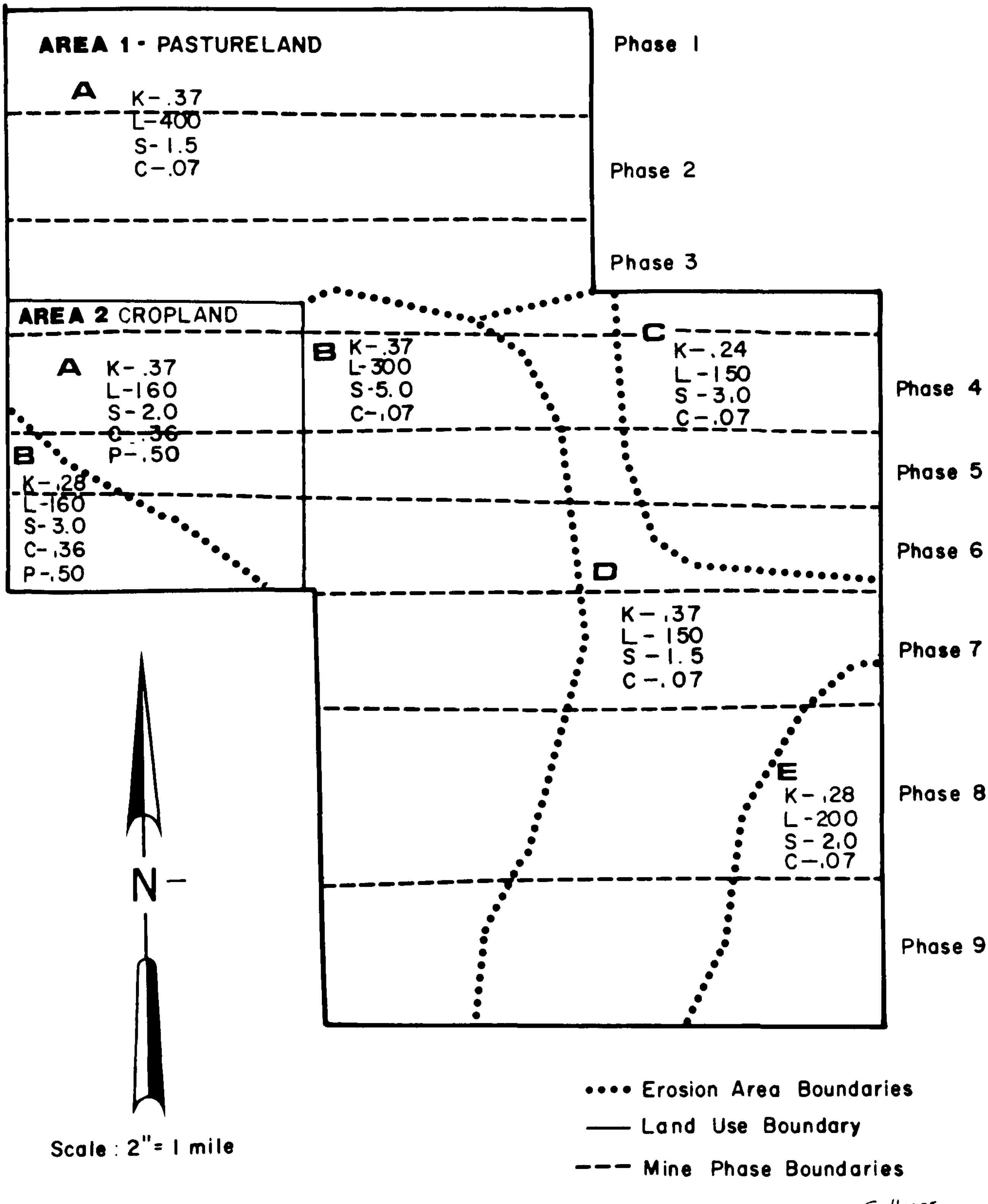


EXHIBIT 4

EROSION CALCULATIONS

Project: Coal Field Inc. Land Condition: Pre-mining Date

Areas of the Project	Land use or Cond.	Universal Soil-Loss Equation Factors							Est. Soil Loss T/Ac/Yr	Acres in Area	Est. Soil Loss from Area Tons/Yr
		R	K	L	S	LS	C	P			
1A	Past.	30	.37	400	1.5	.25	.10	1.0	.28	1290	361.2
1B	Past.	30	.37	300	5.0	.93	.042	1.0	.43	1220	524.6
1C	Past.	30	.24	150	3.0	.32	.10	1.0	.23	550	126.5
1D	Past.	30	.37	150	1.5	.19	.042	1.0	.09	750	67.5
1E	Past.	30	.28	200	2.0	.25	.20	1.0	.42	380	159.6
SUB-TOTAL (Pastureland)										4190	1239.4
2A	Crop.	30	.37	600	2.0	.34	.36*	1.0	1.36	440	598.4
2B	Crop.	30	.28	400	3.0	.44	.36*	1.0	1.33	200	266.0
3A	Crop.	30	.37	150	5.0	.66	.36*	1.0	2.64	300	792.0
SUB-TOTAL (Cropland)										940	1656.4
TOTALS										5130	2895.8

Remarks:

* Present farming program is wheat-fallow with approximately 200 lbs. of residue at planting time (see table 2).

EXHIBIT 5

EROSION CALCULATIONS

Project: Coal Field Inc. Land Condition: Post mining Date__________

Areas of the Project	Land use or Cond.	Universal Soil-Loss Equation Factors							Est. Soil Loss T/Ac/Yr	Acres in Area	Est. Soil Loss from Area Tons/Yr
		R	K	L	S	LS	C	P			
1A	Past.	30	.37	400	1.5	.25	.07	1.0	.19	1290	245.1
1B	Past.	30	.37	300	5.0	.93	.07	1.0	.72	1220	878.4
1C	Past.	30	.24	150	3.0	.32	.07	1.0	.16	550	88.0
1D	Past.	30	.37	150	1.5	.19	.07	1.0	.15	1050	157.5
1E	Past.	30	.28	200	2.0	.25	.07	1.0	.15	380	57.0
						SUB-TOTAL (Pastureland)				4490	1426.0
2A	Crop	30	.37	160*	2.0	.23	.36	.50*	.46	440	202.4
2B	Crop	30	.28	160*	3.0	.33	.36	.50*	.50	200	100.0
3A	Included in area 1D										
* The cropland will be terraced to reduce slope length and farmed on the contour (See table 6).											
						SUB-TOTAL (Cropland)				640	302.4
									TOTALS	5130	1728.4

Remarks: The following assumptions were necessary.

1. Mined areas will be restored to approximately original topography.
2. Introduced plant species plus improved management will result in approximately 50% ground cover.
3. Topsoil will be redistributed over approximately the same area where it was removed. If this is accomplished, "K" factors will remain relatively constant.

EXHIBIT 6

EROSION CALCULATIONS

Project: Coal Field Inc. Land Condition: "Factor Influence Chart" Date________

Areas of the Project	Land use or Cond.	Universal Soil-Loss Equation Factors R	K	L	S	LS	C	P	Est. Soil Loss T/Ac/Yr	Acres in Area	Est. Soil Loss from Area Tons/Yr
ITEM I Pre-Mining											
2A	Crop	30	.37	600	2.0	.34	.36	1.0	1.36	440	598.4
ITEM II Post-Mining											
2A	Crop	30	.37	160	2.0	.23	.36	.50	.46	440	202.4
									SUB-TOTAL		
ITEM III "L" factor change											
2A	Crop	30	.37	160	2.0	.23	.36	1.0	.92	440	404.8
ITEM IV "P" factor change											
2A	Crop	30	.37	600	2.0	.34	.36	.50*	.68	440	298.9
									SUB-TOTAL		
									TOTALS		

Remarks:

* Table 6 indicated contouring is not an acceptable alternative for this area due to the excessive slope length (see 1/). However, if the area is terrace to reduce slope length, contouring will be applicable.

EXHIBIT 7

EROSION CALCULATIONS

Project: Coal Field Inc. Land Condition: Active Reclamation Date____________

Areas of the Project	Land use or Cond.	Universal Soil-Loss Equation Factors R	K	L	S	LS	C	P	Est. Soil Loss T/Ac	Acres in Area	Est. Soil Loss from Area Tons/Period
(Time Period 1)											
1st year 5/15-10/1 Phase I	bare	15.6*	.37	400	1.5	.25	1.0	1.0	1.44	480	691.2
(Time Period 2)											
1st year 10/1-5/15 Phase I	Mulch and Seed	14.4	.37	400	1.5	.25	.06	1.0	.08	480	38.4
						SUB-TOTAL (1st year)				480	729.6
2nd year 5/15-5/15 Phase I	estab.	30	.37	400	1.5	.25	.20	1.0	.55	480	264.0
						SUB-TOTAL (2nd year)				480	264.0
									TOTALS	480	993.6

Remarks:

* Factor "R" has been adjusted to reflect total erosion index units from May 15 to Oct. 1 (See figure 2). Target date for mulching and seeding is October 1st. From October 1st to May 15th the 2 tons of mulch (See table 5) should remain effective. The second year should be the establishment year with a "C" of approximately .20 (See table 4).

Section 7.0

GLOSSARY

Arid: Regions or climates that lack sufficient moisture for crop production without irrigation. The limits of precipitation vary considerably according to temperature conditions, with an upper annual limit for cool regions of ten inches or less and for tropical regions as much as fifteen to twenty inches.

Brush: A growth of shrubs or small trees.

Bunchgrass: A grass that does not have rhizomes or stolons and forms a bunch of tuft.

Canopy: The cover of leaves and branches formed by the tops or crowns of plants as viewed from above the cover.

Clean Tillage: Cultivation of a field so as to cover all plant residues and to prevent the growth of all vegetation except the particular crop desired.

Contour: 1. An imaginary line on the surface of the earth connecting points of the same elevation; 2. A line drawn on a map connecting points of the same elevation.

Contour Farming: Conducting field operations, such as plowing, planting, cultivating, and harvesting, on the contour.

Contour Furrows: Furrows plowed approximately on the contour on pasture and rangeland to prevent runoff and increase infiltration. Also, furrows laid out approximately on the contour for irrigation purposes.

Contour Stripcropping: Layout of crops in comparatively narrow strips in which the farming operations are performed approximately on the contour. Usually strips of grass, close-growing crops, or fallow are alternated with those in cultivated crops.

Contour Stripping: The removal of overburden and mining from a coal seam that outcrops or approaches the surface at approximately the same elevation. In steep or mountainous areas.

Cover (Ground Cover): Vegetation or other material providing protection to the soil.

Cover Crop: A close-growing crop grown primarily for the purpose of protecting and improving soil between periods of regular crop production or between trees and vines in orchards and vineyards.

Cropland: Land used primarily for the production of adapted, cultivated, close-growing fruit or nut crops for harvest, alone or in association with sod crops.

Crop Residue: The portion of a plant or crop left in the field after harvest.

Crop Residue Management: Use of that portion of the plant or crop left in the field after harvest for protection or improvement of the soil.

Deposition: The accumulation of material dropped because of a slackening movement of the transporting agent (water or wind).

Diversion Terrace: Diversions, which differ from terraces in that they consist of individually designed channels across a hillside; may be used to protect bottomland from hillside runoff or may be needed above a terrace system for protection against runoff from an unterraced area; may also divert water out of active gullies, protect farm buildings from runoff, reduce the number of waterways, and sometimes used in connection with stripcropping to shorten the length of slope so that the strips can effectively control erosion. See terrace.

Duff: The more or less firm organic layer on top of mineral soil, consisting of fallen vegetative matter in the process of decomposition, including everything from pure humus below to the litter on the surface; a general, non-specific term.

Erosion: 1. The wearing away of the land surface by running water, wind, ice, or other geologic agents, including such processes as gravitational creep; 2. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of water erosion.

Gross Erosion: The total amount of water erosion occurring on a site. Includes sheet and rill and gulley erosion.

Permeability Soil: The quality of a soil horizon that enables water or air to move through it. The permeability of a soil may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Pitting: Making shallow pits of suitable capacity and distribution to retain water from rainfall or snowmelt on rangeland or pasture.

Plant Residue: See crop residue, mulch, soil organic matter.

Reclamation: The process of reconverting disturbed lands to their former uses or other productive uses.

Runoff (Hydraulics): That portion of the precipitation on a drainage area that is discharged from the area in stream channels.

Sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site or origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Slope: The degree of deviation of a surface from horizontal, measured in a numerical ratio, percent, or degrees. Expressed as a ratio or percentage, the first number is the vertical distance (rise) and the second is the horizontal distance (run), as 2:1 or 200 percent. Expressed in degrees, it is the angle of the slope from the horizontal plane with a 90% slope being vertical (maximum) and 45% being a 1:1 slope.

Slope Characteristics: Slopes may be characterized as concave (decrease in steepness in lower portion), uniform, or convex (increase in steepness at base). Erosion is strongly affected by shape, ranked in order of increasing erodibility from concave to uniform to convex.

Soil Erosion: The detachment and movement of soil from the land surface by wind or water.

Soil Map: A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical and cultural features of the earth's surface. The following kinds of soil maps are recognized in the U.S.: detailed, detailed reconnaissance, reconnaissance, generalized, and schematic.

Soil Organic Matter: The organic fraction of the soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil population. Commonly determined as the amount of organic material contained in a soil sample passed through a two-millimeter sieve.

Soil Profile: A vertical cross-section of the soil from the surface into the underlying unweathered material.

Soil Series: The soil series is a group of soil having horizons similar to differentiating characteristics and arrangement in the soil profile, except for texture of the surface portion, or if genetic horizons are thin or absent, a group of soils that, within defined depth limits, is uniform in all soil characteristics diagnostic for series.

Soil Survey: A general term for the systematic examination of soils in the field and in laboratories; their description and classification; the mapping of kinds of soil, the interpretation of soils according to their adaptability for various crops, grasses, and trees; their behavior under use or treatment for plant production of for other purposes; and their productivity under different management systems.

Stripcropping: Growing crops in a systematic arrangement of strips or bands which serve as barriers to wind and water erosion.

Stubble: The basal portion of the plants remaining after the top portion has been harvested; also, the portion of the plants, principally grasses, remaining after grazing is completed.

Subsoil: The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when "soil" was conceived only as the plowed soil and that under it as the "subsoil"

Surface Mining: A process in which rock and topsoil strata overlying ore or fuel deposits are scrapped away by mechanical shovels. Also known as strip mining.

Terrace: An embankment or combination of an embankment and channel constructed across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.

Tillage: The operation of implements through the soil to prepare seedbeds and root beds.

Topsoil: The original or present dark-colored upper soil that ranges from a mere fraction of an inch to two or three feet thick on different kinds of soil.

Section 8.0

BIBLIOGRAPHY

(1) Brooks, Frank L. and Turelle, Joseph W., 1974. Universal Soil Loss Equation. Technical Note No. 32. West Technical Service Center, Portland, Oregon.

(2) Canfield, R. H., 1941. Application of the Line Interception Method in Sampling Range Vegetation. Journal Forestry 39:388-394.

(3) Dendy, F. E. and G. C. Bolton, 1976. Sediment Yield-Runoff-Drainage Area Relationships in the United States, Journal of Soil and Water Conservation. Volume 31, No. 6.

(4) Dollhopf, D. J., J. B. Jensen, and R. C. Hodder. Effects of Surface Configuration in Water Pollution Control on Semiarid Mined Lands. U.S. Environmental Protection Agency, Demonstration Grant No. R-803079-01-0.

(5) Holeman, John; Turelle, Joseph W.; and Barnes, R. C., 1975. Procedure for Computing Sheet and Rill Erosion on Project Area. Technical Release No. 51, Washington, D.C.

(6) Lloyd, C. H., and Eley, G. W., 1952. Graphical Solution of Probable Soil Loss Formula for Northeastern Region. Journal of Soil and Water Conservation 7:189-191.

(7) Mannering, J. V., 1967. The Relationship of Some Physical and Chemical Properties of Soils to Surface Sealing. Ph.D. thesis, Purdue University, Lafayette, Indiana.

(8) SCS National Engineering Handbook; Section 3, Sedimentation; Chapter 6, Sediment Sources, Yields, and Delivery Ratios; Washington, D.C., 1971.

(9) Soil Taxonomy, December 1975. A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Agricultural Handbook 436. USDA—Soil Conservation Service.

(10) Soil and Water Research Division, Agriculture Research Service, 1966. A Universal Equation for Predicting Rainfall-Erosion Losses. ARS Special Report.

(11) USDA Soil Survey Staff, Soil Survey Manual, USDA Handbook No. 18, August 1951.

(12) Wischmeier, W. H., and D. D. Smith, 1965. Predicting Rainfall-Erosion Losses from Cropland East of the Rocky Mountains. Agriculture Handbook No. 282. U.S. Government Printing Office, Washington, D.C.

(13) and J. V. Mannering, 1969. Relation of Soil Properties to Its Erodibility. Soil Science Society AM. Proc. 33(1): 131-137.

(14) C. B. Johnson and B. V. Cross, 1971. A Soil Nomograph for Farmland and Construction Sites. Journal of Soil and Water Conservation. September-October 1971. Volume 26, No. 5.

(15) 1974. New Developments in Estimating Water Erosion, Proceedings of the 29th Annual Meeting of the Soil Conservation Society of America, August 11-14, 1974, Syracuse, New York.

(16) 1976. Use and Misuse of the Universal Soil Loss Equation. Journal of Soil and Water Conservation. January-February 1976. Volume 31, No. 1.

APPENDIX A

Factors "K" and "T"

SOIL SERIES	DEPTH INCHES	K	T
AABERG	0-4	.15	3
	4-30	.25	
AASTAD	0-19	.24	5
	16-19	.32	
ABAC	0-19	.37	1
ABAJO	0-10	.49	1
	10-20	.32	
	20-50	.28	
ABARCA	0-4	.24	3
	4-30	.28	
	30-60	.10	
ABBOTT	0-6	.28	5
ABCAL	0-60	.28	5
ABCLA	0-28	.28	3
	28-60	.20	
ABERDEEN	0-26	.32	3
	26-60	.43	
ABES	0-15	.24	2
	15-21	.32	
ABOR	0-30	.43	2
ABRA GR-L, L	0-3	.49	4
GR-SL, SL	0-3	.17	4
	3-60	.49	-
ABRAHAM	0-60	.49	5
ABREU	0-3	.24	3
	3-15	.32	
	15-43	.24	
ABSAROKEE	0-8	.32	2
	8-26	.37	
ABSHER	0-60	.32	3
ABSTED	0-3	.32	4
	3-8	.49	
	8-60	.55	
ABSTON	0-3	.24	2
	3-10	.49	
	10-34	.28	
ACACIO	0-4	.24	5
	4-13	.24	
	13-60	.24	
ACASCO	0-14	.20	3
	14-24	.20	
	24-60	.10	
ACEL	0-6	.64	5
	6-28	.43	
	28-66	.49	
ACKMAN	0-7	.32	5
	7-71	.37	
ACREE	0-14	.32	5
	14-60	.28	
ADEL	0-48	.28	5
	48-60	.43	-
ADELINO	0-4	.28	5
	4-38	.37	
	38-60	.37	
ADENA	0-3	.37	5
	3-12	.24	
	12-60	.32	
ADGER	0-1	.49	5
	1-60	.55	
ADILIS GR-SL, GR-L	0-4	.15	3
L, SL	0-4	.20	3
	4-20	.10	
	20-60	.10	-
ADIV	0-3	.32	5
	3-60	.37	-
AGAR		.32	5
AGASSIZ	0-7	.15	1
	7-18	.15	
AGNER	0-7	.17	4
	7-33	.17	
	33-60	.10	
AGNESTON	0-6	.17	2
	6-25	.20	
AGUA	0-27	.49	3
	27-60	.10	
AGUA FRIA	0-21	.32	2
	21-30	.32	
	30-60	.17	
AGUALT FSL	0-12	.24	3
L	0-12	.49	3
	12-27	.49	
	27-60	.10	
AGUSTIN	0-60	.17	3
AHLSTROM	0-7	.32	2
	7-40	.37	
AIRPORT	0-19	.28	2
	19-60	.43	
AJO	0-2	.28	3
	2-24	.24	
AKASKA		.28	5
AKELA	0-18	.17	1
ALADDIN	0-60	.24	5
ALAMA	0-3	.43	5
	3-28	.43	
	28-60	.43	
ALAMOSA	0-12	.28	5
	12-40	.28	
	40-60	.28	
ALBATON		.28	5
ALBINAS	0-3	.32	5
	3-25	.28	
	25-60	.43	
ALCESTER		.28	5
ALCOVA	0-7	.24	5
	7-25	.24	
	25-60	.24	
ALDER	0-6	.32	2
	6-11	.37	
	11-30	.43	
ALEMEDA	0-9	.24	2
	9-13	.24	
	13-26	.17	
ALGERITA	0-5	.24	3
	5-37	.28	
	37-66	.32	
ALICE	0-60	.20	5
ALICIA	0-60	.49	5
ALLENS PARK	0-10	.20	2
	10-26	.20	
ALLENTINE	0-3	.43	4
	3-42	.49	
	42-60	.64	
ALLESSIO	0-8	.24	5
	8-25	.17	
	25-60	.10	
ALMONT	0-8	.28	
	8-60		
ALMY	0-6	.28	5
	6-25	.37	
	25-60	.37	
ALOVAR	0-60	.37	5
ALPINE LOOP	0-18	.32	5
	18-33	.43	
	33-64	.37	
ALTA	0-12	.28	3
	12-36	.43	
	36-54	.37	
ALTVAN		.32	3
AMARILLO	0-11(FSL)	.24	5
	0-11(LFS)	.20	5
	11-80	.32	
AMBRANT	0-39	.17	2
AMESHA	0-28	.32	5
	28-74	.37	
AMHERST	0-2	.32	1
	2-10	.28	
AMOR	0-31	.28	4-3
AMOS	0-3	.37	3
	3-41	.24	
AMSDEN	0-12	.32	5
	12-60	.49	
AMSTERDAM	0-8	.37	5
	8-28	.43	
	28-60	.28	
AMTOFT	0-20	.28	1
ANAMITE	0-3	.49	5
	3-56	.55	
ANAPRA	0-26	.43	5
	26-60	.17	
ANASAZI	0-24	.49	1
ANCHO	0-60	.37	5
ANCO	0-60	.37	5
ANDREEN	0-9	.15	2
	9-20	.15	
	20-60	.10	
ANDREESON L	0-6	.20	5
ST-L,ST-CL	0-6	.15	5
	6-35	.32	
	35-60	.15	
ANDREWS	0-14	.28	2
	14-24	.17	
ANETH	0-60	.49	5
ANGOSTURA	0-7	.15	5
	7-22	.10	
	22-60	.15	
ANIMAS	0-12	.24	2
	12-38	.24	
ANNABELLA SL	0-10	.20	5
CB-SL,GR-SL	0-10	.17	5
	10-60	.17	
ANSEL	0-12	.28	5
	12-36	.32	
	36-60	.15	
ANSELMO		.20	5
ANT FLAT L,CL	0-11	.24	3
ST-L	0-11	.20	3
	11-32	.32	
	32-60	.43	
ANTELOPE SPRINGS	0-3	.55	1
	3-13	.43	
	13-48	.24	
ANTEPO	0-7	.32	5
	7-60	.32	
ANTHO	0-60	.20	5
ANTHONY SL,GR-SL	0-10	.20	5
L	0-10	.49	5
	10-60	.20	
	0-16	.20	5
	16-60	.17	
ANTLER	0-15	.28	5
	15-60	.37	
ANTROBUS	0-8	.15	5
	8-40	.15	
ANTY	0-26	.32	3
	26-62	.24	
ANWAY SL	0-3	.17	5
L	0-3	.49	5
SICL	0-3	.32	5
	3-18	.32	
	18-60	.37	
ANVIK	0-18	.28	5
	18-42	.32	
	42-60	.17	
ANZIANO	0-12	.32	3
	12-30	.32	
	30-60	.10	
APACHE	0-16	.28	1
APISHAPA	0-8	.17	5
	8-60	.17	
APRON	0-6	.32	5
	6-60	.24	
ARAPIEN	0-13	.37	2
	13-38	.32	
	38-60	.43	
ARAVE	0-8	.49	1
	8-60	.49	
ARCH	0-17	.32	2
	17-60	.37	
ARCHERSON	0-6	.32	3
	6-24	.28	
	24-60	.10	
ARCHIN	0-10	.20	3
	10-60	.43	
ARENA	0-8	.24	2
	8-24	.24	
ARIZO	0-8	.10	5
	8-60	.10	
ARLE	0-30	.10	2
ARMIJO	0-60	.37	5
ARMINGTON	0-4	.49	2
	4-33	.43	
ARNEGARD	0-60	.28	5
ARNHART	0-6	.37	5
	6-20	.49	
	20-60	.49	
ARNO	0-60	.32	5

SOIL SERIES	DEPTH INCHES	K	T
ARNY	0-9	.28	5
	9-22	.32	
	22-60	.37	
AROSA	0-10	.37	5
	10-39	.32	
	39-62	.37	
ARP	0-2	.32	1
	2-18	.24	
ARROW	0-6	.10	2
	6-22	.24	
	22-32	.17	
ARTESIA	0-3	.17	2
	3-25	.24	
ARVADA	0-4	.49	5
	4-60	.55	
ARVANA	0-8	.24	2
	8-24	.32	
ARVESON	0-34	.28	5
	34-60	.15	
ARVILLA	0-16	.20	3-2
	16-60	.10	
ASCALON LS	0-7	.24	5
SL, FSL	0-7	.28	5
	7-18	.32	
	18-25	.32	
	25-60	.24	
ASHBON	0-4	.17	1
	4-13	.15	
ASHCROFT	0-6	.10	3
	6-26	.10	
	26-60	.10	
ASHLEY FSL, L	0-9	.24	1
ST-L	0-9	.20	1
	9-15	.24	
	15-72	.10	
ASHUELOT	0-8	.32	1
	8-15	.43	
	15-30	.64	
	30-60	.49	
ASO FSL	0-2	.24	5
CL	0-2	.37	
	2-14	.37	
	14-39	.24	
ASPERSON	0-2	.32	2
	2-24	.37	
ASSINNIBOINE	0-7	.24	5
	7-20	.32	
	20-60	.24	
ATASCOSA	0-9	.28	1
ATENCIO	0-10	.24	3
	10-20	.17	
	20-30	.10	
	30-60	.10	
ATEPIC	0-17	.28	1
ATHELWOLD		.28	4
ATHERLY	0-6	.24	5
	6-60	.24	
ATHMAR	0-11	.37	5
	11-36	.28	
	36-60	.10	
ATOKA	0-6	.37	2
	6-19	.37	
	19-30	.37	
ATON	0-10	.37	2
	10-29	.24	
	29-72	.17	
ATTEWAN	0-7	.37	3
	7-18	.32	
	18-26	.37	
	26-60	.10	
AUT	0-12	.49	2
	12-26	.43	
AUZQUI	0-12	.32	5
	12-60	.43	
AVALANCHE	0-60	.32	5
AVALON L	0-11	.43	3
SCL	0-11	.24	3
	11-42	.37	
AVAMAN	-		
AVON	0-9	.24	3
	9-27	.28	
	27-60	.32	
AVONDA	0-13	.32	5
	13-27	.49	
	27-60	.10	
AVONDALE	0-12	.32	5
	12-60	.49	
AYLMER	0-60	.15	5
AYON	0-12	.24	5
	12-19	.24	
	19-60	.24	
AZAAR	0-13	.24	2
	13-22	.43	
	22-32	.37	
AZELTINE	0-16	.15	2
	16-60	.10	
AZFIELD	0-6	.28	5
	6-61	.32	
BABB	0-7	.28	5
	7-60	.32	
BACA	0-8	.24	5
	8-24	.24	
	24-60	.24	
BACHUS	0-31	.32	2
BADUS		.28	5
BAGARD	0-7	.24	2
	7-38	.17	
	38-60	.24	
BAGGOTT	0-16	.28	1
BAGLEY	0-9	.37	5
	0-9	.32	5
	39-60	.37	
BAINVILLE	0-24	.37	2
BAIRD HOLLOW CB-L	0-22	.17	8
L	0-22	.20	6
	22-60	.20	
BAKER PASS	0-12	.20	5
	12-71	.28	
BALDY	0-18	.17	5
	18-42	.10	
BALLER	0-15	.10	1
BALMORHEA	0-60	.15	5
BALON GR-SCL,GR-CL	0-3	.32	5
GR-SL, SL	0-3	.15	5
	3-23	.32	
	23-60	.15	
BALTIC		.28	5
BAMFORTH	0-60	.10	5
BANDERA	0-16	.20	2
	16-60	.10	
BANGSTON SL	0-9	.15	5
LS, FS	0-9	.10	5
	9-60	.10	
BANKARD	0-5(LFS)	.10	5
	0-5(SL)	.10	
	5-60	.10	
BANKS	0-4	.24	5
	4-60	.17	
BARCUS	0-10	.15	5
	10-37	.20	
	37-60	.24	
BARELA	0-4	.37	3
	4-8	.37	
	8-31	.37	
	31-41	.37	
BARFUSS	0-19	.28	4
	19-27	.32	
	27-40	.37	
BARISHMAN	0-12	.32	5
	12-60	.28	
BARKERVILLE	0-10	.15	2
	10-26	.10	
BARNES	0-20	.28	5-4
	20-60	.37	
BARNUM	0-4	.37	5
	4-60	.49	
BARRETT	0-16	.10	1
BARTON	0-19	.24	3
	19-31	.24	
BARVON	0-14	.37	3
	14-34	.32	
	34-42	.20	
BASCOM	0-16	.32	2
	16-36	.20	
	36-72	.37	
BASS	0-15	.17	3
	15-26	.15	
	26-40	.10	
BASSEL	0-7	.15	5
	7-15	.15	
	15-60	.15	
BATA	0-7	.32	
	7-25	.17	
	25-60	.24	
BATTERSON	0-4	.24	1
	4-15	.24	
BATTLE CREEK	0-10	.32	2
	10-37	.28	
	37-64	.28	
BAYERTON	0-7	.28	2
	7-24	.28	
	0-3	.32	2
BEAD	0-6	.24	4
	6-18	.24	
	18-40	.24	
	40-60	.17	
BEADLE		.28	5
BEAMTON	0-3	.32	2
	3-24	.43	
BEAR BASIN	0-13	.17	2
	13-65	.20	
BEARDALL	0-15	.32	2
	15-34	.24	
BEARDEN	0-28	.28	5
	28-60	.43	
BEARDSLEY	0-10	.37	2
	10-36	.28	
BEARMOUTH	0-10	.28	2
	10-60	.10	
BEARPAW	0-6	.37	5-4
	6-50	.43	
	50-86	.49	
BEARSKIN	0-10	.15	1
BEAUVOIS	0-30	.37	5
	30-60	.43	
BEAVERELL	0-3	.32	5
	3-17	.28	
	17-60	.10	
BEAVERTON	0-9	.28	2
	9-14	.24	
	14-60	.10	
BECKS	0-15	.15	2
	15-19	.15	
	19-37	.10	
BECKTON	0-6	.49	5
	6-34	.37	
	34-60	.37	
BEEBE	0-60	.49	5
BEEK	0-60	.32	3
BEENON	0-7	.37	1
	7-18	.32	
BEGAY	0-50	.49	3
BEHANIN	0-17	.20	2
	17-44	.28	
	44-52	.15	
BELEN	0-31	.37	5
	31-54	.43	
BELFIELD	0-12	.37	5-4
	12-60	.43	
BELLAMY	0-26	.28	2
BELMEAR	0-8	.24	2
	8-30	.32	
BELTON	0-9	.43	3
	9-27	.37	
	27-40	.43	
BENCLARE		.28	5
BENJAMIN	0-60	.28	4
BENOIT	0-18	.28	2
	18-60	.10	
BENTEEN	0-4	.37	2
	4-17	.32	
	17-29	.37	
BENZ	0-60	.37	5
BEOTIA	0-20	.28	5
	20-60	.43	
BERCAIL	0-5	.32	5
	5-60	.37	
BERENT	0-60	.37	5
BERINO	0-8	.17	5
	8-60	.32	
BERMESA	0-14	.28	2
	14-26	.32	
BERNAL	0-12	.28	1
BERNARDINO	0-9	.28	5
	9-15	.24	
	15-60	.15	
BERTAG SIL	0-24	.28	5
GR-L	0-24	.24	5
	24-60	.32	
BERTELSON	0-60	.24	4
BERTHOUD	0-56	.37	5
BERYL	0-20	.37	2
	20-34	.24	
BESSEMER	0-7	.32	5
	7-22	.37	
	22-60	.24	
BETTS		.28	5
BEW	0-6	.32	5
	6-22	.37	
	22-60	.43	
BEZZANT	0-60	.20	1
BICKMORE	0-16	.24	2
	16-24	.24	
	24-37	.20	
BIDMAN	0-5	.28	5
	5-18	.32	
	18-60	.43	
BIG BLUE	0-10	.18	5
	10-18	.24	
	18-50	.24	
BIGETTY	0-3	.37	5
	3-60	.43	
	60-71	.28	

SOIL SERIES	DEPTH INCHES	K	T
BIG HORN	0-4	.49	5
	4-26	.37	
	26-60	.37	
BIG TIMBER	0-6	.32	1
	6-18	.28	
BIJOU	0-15	.10	5
	0-15	.10	5
	15-33	.10	
	33-60	.10	
BIGNELL	0-11	.32	5
	11-15	.28	
	15-60	.20	
BILLINGS	0-60	.43	5
BINCO	0-7	.28	5
	7-60	.28	
BINFORD	0-18	.20	3
	16-60	.10	
BINGHAM L	0-10	.28	2
GR-L	0-10	.24	2
CB-L	0-10	.24	
	10-18	.24	
	18-60	.10	
BINNA	0-24	.37	3
	24-28	.17	
	28-60	.10	
BINTON	0-6	.37	5
	6-60	.43	
	0-14	.43	
BIPPUS	0-28(L)	.28	5
	0-28(FSL)	.24	5
	28-60	.28	
BIRCH	0-14	.20	2
	14-22	.15	
	22-38	.10	
BIRDOW	0-60	.28	5
BIRDSLEY	0-14	.43	2
BITTERROOT	0-11	.32	2
	11-36	.37	
BITTON	0-21	.32	5
	21-46	.24	
	46-64	.28	
BLACKBURN	0-11	.37	5
	11-42	.28	
	42-60	.49	
BLACKHALL	0-12	.32	1
BLACKETT	0-60	.24	2
BLACKLEED	0-14	.17	5
	14-40	.15	
BLACKMAN	0-30	.37	5
	30-60	.37	
BLACKPIPE		.32	4
BLACK RIDGE	0-16	.20	1
BLACKROCK	0-8	.17	5
	8-39	.24	
	39-52	.28	
BLACKSTON	0-14	.10	3
	14-28	.10	
	28-60	.10	
BLACKWATER	0-22	.28	2
BLAINE	0-16	.28	2
	16-35	.32	
BLAKE			
BLAKELAND	0-12	.10	5
	12-60	.10	
BLAMER	0-30	.17	2
BLANCA	0-16	.28	4
	16-40	.17	
	40-54	.10	
BLANCHARD	0-60	.15	5
BLANDING	0-60	.49	5
BLANYON	0-10	.37	5
	10-25	.43	
	25-60	.43	
BLAZON	0-14	.43	1
BLENCOE			
BLENDON		.20	5
BLEVINTON	0-30	.20	5
	30-60	.24	
BLODGETT	0-16	.17	5
	16-44	.15	
BLOOM	0-4	.37	5
	4-60	.37	
BLUEPOINT	0-9	.17	5
	9-41	.17	
	41-80	.17	
BLUERIM	0-3	.15	2
	3-18	.24	
	18-29	.20	
BLUE STAR	0-19	.15	2
	19-60	.10	
BLUFFDALE	0-16	.32	3
	16-60	.32	
BLYBURG		.32	5
BLYTHE	0-11	.37	2
	11-36	.32	
BOBTAIL	0-2	.10	2
	2-26	.10	
BODORUMPE	0-36	.28	2
BOEL		.20	5
BOHNLY			
BOHNSACK	0-60	.28	5
BOETTCHER	0-4	.32	2
	4-29	.22	
BOGAN	0-12	.32	3
	12-24	.37	
BOLTUS	0-3	.32	2
	3-12	.28	
BON		.24	5
BOND	0-4	.28	1
	4-17	.37	
BONDURANT	0-12	.24	5
	12-60	.28	
BONEEK		.32	5
BONILLA		.24	5
BONITA	0-31	.28	5
	31-60	.28	
BORACHO	0-10	.17	1
BORDEAUX	0-18	.32	5
	18-60	.37	
BORKY	0-4	.32	2
	4-32	.28	
BORO		.28	5
BORREGO	0-6	.32	1
	13-18	.29	
	6-13	.32	
BORUP	0-60	.32	5
BORVANT	0-19	.17	1
BOSLER	0-7	.32	3
	7-19	.32	
	19-30	.37	
	30-60	.10	
BOSTWICK L,GR-L,FSL, ST-L	0-6 CL	.25	5
	0-6	.10	5
	6-30	.20	
	30-60	.25	
BOTTINEAU	0-25	.28	5-4
	25-60	.37	
BOULDER	0-6	.15	3
	6-20	.20	
	20-60	.10	
BOTTLE	0-14	.15	2
	14-26	.20	
BOWBAC	0-5	.37	2
	5-23	.32	
BOWBELLS	0-23	.28	5-4
	23-60	.37	
BOWDISH	0-10	.20	2
	10-30	.37	
BOWDLE	0-25	.28	4-3
	25-60	.10	
BOWEN	0-10	.15	2
	10-28	.15	
BOX ELDER L	0-7	.37	2
CL	0-7	.20	2
	7-26	.37	
	26-72	.55	
BOXWELL	0-14	.32	2
	14-28	.37	
BOYD	-	.28	4
BOYSAG FSL	0-3	.28	1
GR-L,VFSL	0-3	.43	1
SL	0-3	.20	1
	3-13	.28	
BOYLE	0-5	.15	1
	5-13	.10	
BOYSEN	0-4	.37	5
	4-60	.43	
BOZEMAN	0-4	.28	5
	4-8	.24	
	8-28	.32	
	28-64	.37	
BRAD	0-10	.15	1
BRADSHAW	0-60	.20	1
BRAMER	0-10	.10	5
	10-60	.10	
BRANDENBURG	0-4	.28	1
	4-10	.24	
BRANTFORD	0-15	.28	3-2
BRAZITO	0-9	.24	2
	9-60	.15	
BREECE	0-36	.10	5
	36-60	.10	
BRENDA	0-24	.28	3
	24-40	.17	
BRESSER SL	0-10	.10	5
LS	0-10	.10	5
	10-18	.15	
	18-29	.10	
	29-60	.10	
BRIBUTTE	0-3	.37	2
	3-12	.43	
BRIDGE	0-6	.43	1
	6-17	.28	
	17-24	.15	
BRIDGER	0-9	.28	5
	9-24	.37	
	24-60	.28	
BRIDGEPORT		.32	5
BRIDGET		.32	5
BRIDGEWATER		.28	5
BRIGGSDALE SL,FSL	0-5	.24	2
L, CL	0-5	.28	2
	5-20	.32	
	20-32	.37	
BRINKERT	0-5	.28	5
	5-25	.28	
	25-40	.24	
BRIOS SL,LS	0-14	.17	5
L	0-14	.49	
	14-60	.10	
BROAD	0-9	.28	2
	9-22	.20	
	22-36	.15	
BROAD CANYON GR-L,CB-L	0-15	.17	2
ST-L,GRV-L	0-15	.15	1
	15-60	.15	
BROADHEAD L	0-12	.20	2
CB-L	0-12	.17	2
	12-44	.20	
	44-60	.49	
BROADHURST		.28	5
BROADMOOR	0-15	.10	2
	15-25	.10	
BROCKO	0-7	.32	5
	7-75	.37	
BROCKWAY	0-11	.32	5
	11-39	.28	
	39-60	.24	
BROLLIAR	0-5	.43	2
	5-34	.28	
BROOKINGS		.28	5
BROOMFIELD	0-6	.37	3
	6-30	.37	
BROSS	0-8	.10	5
	8-60	.10	
BROWNFIELD	0-26	.17	5
	26-80	.24	
BROWNLEE	0-20	.20	3
	20-42	.32	
	42-45	.28	
BROWNRIGG	0-3	.20	1
	3-8	.24	
	8-15	.28	
BROWNSTO	0-10	.17	5
	10-60	.10	
BRUSSETT	0-7	.37	5
	7-18	.32	
	18-66	.37	
BRYANT		.32	5
BRYCAN	0-12	.43	5
	12-37	.20	
	37-62		
BUCHHOUSE	0-23	.32	5
	23-72	.28	
BUCKLON	0-18	.32	1
BUCKLEBAR	0-2	.24	5
	2-25	.32	
	25-60	.37	
BUDMAYR	0-5	.32	4
	5-15	.37	
	15-28	.28	
	28-60	.20	
BUELL	0-60	.20	2
BUENA VISTA	0-9	.15	2
	9-18	.15	
	18-35	.10	
BUFFINGTON		.32	5
BUFFMEYER	0-13	.15	5
	13-60	.10	
BUFORD	0-16	.20	3
	16-26	.15	
	26-60	.10	
BUFTON		.32	5
BUICK	0-7	.37	5
	7-60	.43	
BULLION	0-4	.43	1
	4-10	.32	
BULLNEL	0-8	.20	2
	8-39	.28	
BUNDO	0-30	.24	5
	30-56	.20	
	56-94	.10	
BUNDYMAN	0-4	.37	2
	4-25	.43	
BURGESS	0-9	.17	5
	9-30	.20	

SOIL SERIES	DEPTH INCHES	K	T
BUSKA		.43	3
BURGI GR-L	0-12	.20	3
L	0-12	.28	3
	12-60	.15	
BURNAC	0-12	.28	3
	12-31	.32	
	31-53	.24	
BURNETT	0-5	.28	5
	5-15	.32	
	15-66	.28	
BURNT LAKE	0-60	.15	5
BUSE	0-7	.28	5-4
BUSHVALLEY CB-SL,CB-FSL	0-5 SL	.17	1
CB-L	0-5	.43	
	5-10	.37	
BUTCHE		.24	2
BUTTERFIELD	0-30	.17	1
BYNUM	0-27	.32	2
BYRNIE	0-4	.37	1
	4-15	.43	
CABALLO	0-10	.32	3
	10-54	.17	
CABBA	0-18	.3	3
CABBART	0-3	.43	1
	3-18	.37	
CABEZON	0-4	.20	1
	4-12	.28	
CABIN	0-4	.17	4
	4-8	.17	
	8-30	.10	
	30-60	.10	
CACHE	0-4	.32	1
	4-72	.37	
CACIQUE	0-6	.20	2
	6-25	.32	
CADOMA	0-4	.32	3
	4-24	.43	
CALABASAS	0-44	.43	4
	44-60	.32	
CALICOTT	0-60	.10	5
CALITA	0-60	.32	3
CALIZA	0-22	.17	5
	22-60	.10	
CALKINS	0-14	.15	5
	14-60	.15	
CALLINGS	0-18	.24	2
	18-35	.17	
CAMBERN SL,CB-SL,GR-SL	0-3	.17	2
SIL, L	0-3	.49	
CB-L, GR-L	0-3	.43	
	3-14	.43	
	14-28	.32	
CAMPO	0-5	.37	5
	5-24	.32	
	24-60	.35	
CAMPSPASS	0-60	.32	3
CAMPUS	0-30	.28	3
CANBURN	0-25	.24	5
	25-60	.32	
CANELO	0-14	.15	5
	14-60	.20	
CANEZ	0-8	.32	5
	8-67	.32	
CANNINGER	0-20	.28	5
	20-60	.32	
CANUTIO	0-60	.10	5
CANYON		.32	1
CAPILLO	0-6	.28	4
	6-40	.24	
CAPULIN	0-10	.28	3
	10-41	.24	
	41-66	.20	
CARALAMPI	0-2	.10	5
	2-23	.32	
	23-60	.15	
CARALAMPI Brown Variant	0-11	.49	5
	11-39	.32	
	39-60	.24	
CARLITO	0-4	.24	5
	4-8	.24	
	8-60	.28	
CARBOL	0-7	.10	1
	7-14	.12	
CARDON	0-11	.24	2
	11-34	.28	
	34-62	.28	
CARELESS	0-8	.32	5
	8-26	.28	
	26-50	.24	
	50-66	.10	
CARLSTROM	0-7	.24	2
	7-26	.32	

SOIL SERIES	DEPTH INCHES	K	T
CARGILL	0-6	.32	2
	6-17	.28	
	17-30	.37	
CARNERO	0-28	.28	2
CARRACAS	0-4	.20	1
	4-14	.20	
CASA GRANDE	0-1	.20	5
	1-23	.37	
	23-60	.49	
CASAJO	0-10	.10	5
	10-21	.10	
	21-60	.10	
CASEBIER	0-14	.24	1
CASHEL	0-60	.32	5
CASHION	0-27	.28	5
	27-60	.49	
CASITO	0-12	.17	1
CAPUTA		.37	4
CASTELLEIA	0-19	.24	5
	19-26	.32	
	26-60	.10	
CASTELLO	0-60	.17	5
CASTINO	0-8	.17	2
	8-38	.17	
CASTLE	0-9	.37	5
	9-35	.64	
CASTO	0-28	.28	5
	28-60	.15	
CASTNER	0-16	.28	1
CATHAY	0-60	.32	3-2
CATHEDRAL	0-7	.10	1
	7-14	.10	
CAUSEY	0-19	.32	4
	19-40	.43	
	40-63	.37	
CAVAL	0-51	.20	5
CAVE	0-7	.15	1
	7-12	.43	
CAVELT	0-10	.43	1
CAVOUR	0-50	.32	3
CEBOLIA	0-10	.19	5
	10-15	.23	
	15-38	.20	
	38-60	.20	
CEBONE	0-19	.20	3
	19-38	.17	
CEDAR MOUNTAIN	0-14	.37	1
CELESTE	0-14	.10	1
CELLAR	0-8	.37	1
CENTER CREEK	0-20	.20	3
	20-60	.10	
CENTERFIELD	0-20	.49	2
	20-60	.15	
CERRILLOS	0-5	.24	2
	5-30	.32	
	30-60	.37	
CERRO	0-11	.17	5
	11-26	.24	
	26-60	.24	
CESTNIK	0-3	.32	5
	3-24	.37	
	24-60	.10	
CHAFFEE	0-11	.17	5
	11-50	.17	
	50-60	.10	
CHAMA	0-45	.37	5
CHAMBERINO	0-16	.24	2
	16-60	.17	
CHANTA	0-26	.28	4-3
	26-60	.10	
CHAPERTON	0-3	.32	3
	3-29	.37	
CHAPIN	0-6	.32	3
	6-20	.32	
	20-36	.32	
CHAPPELL		.10	3
CHARCOL	0-21	.15	2
	21-54	.24	
CHARLOS	0-6	.37	3
	6-17	.37	
	17-30	.28	
	30-62	.10	
CHASEVILLE	0-14	.10	5
	14-60	.10	
CHEADLE	0-8	.37	1
CHECKETT	0-19	.20	1
CHEDSEY	0-13	.20	2
	13-36	.24	
CHEESEMAN	0-15	.15	3
	15-26	.20	
	26-33	.10	

SOIL SERIES	DEPTH INCHES	K	T
CHEREETE	0-60	.15	5
CHERIONI	0-10	.43	1
CHERRY	0-60	.37	5
CHEVELON	0-5	.49	2
	5-30	.43	
CHEYENNE		.28	4
CHILSON CB-CL, ST-CL	0-3	.28	1
CB-L, ST-L	0-3	.43	1
CBV-CL, STV-CL	0-3	.32	1
	3-14	.24	
CHILTON	0-15	.28	5
	15-60	.17	
CHIMAYO	0-6	.32	1
	6-20	.17	
CHINOOK	0-60	.20	5
CHIPETA	0-17	.43	1
CHIPMAN	0-60	.32	3
CHIRICAHUA	0-2	.37	1
	2-21	.20	
CHRIS	0-7	.24	3
	7-16	.17	
	16-30	.10	
	30-60	.10	
CHRISTIANBURG	0-60	.24	5
CHUBBS	0-3	.32	2
	3-20	.28	
	20-30	.24	
CHUGTER	0-60	.43	3
CHURCH	0-11	.28	5
	11-60	.32	
CHUPADERA	0-6	.20	2
	6-24	.28	
CIBEQUE	0-42	.43	5
	42-60	.15	
CIMARRON	0-6	.37	5
	6-60	.34	
CIPRIANO	0-15	.43	1
	15-20		
	20-60		
CIRCLEVILLE	0-24	.24	2
CLAIRE	0-60	.15	5
CLAPPER	0-13	.32	5
	13-60	.28	
CLARK FORK	0-8	.17	2
	8-50	.10	
CLAYSPRINGS	0-4	.28	1
	0-4	.32	
	4-18		
CLAYBURN	0-24	.20	4
	24-60	.20	
CLEGG	0-10	.28	3
	10-32	.43	
	32-60	.37	
CLERGEN	0-12	.28	5
	12-60	.28	
CLEVERLY	0-60	.37	3
CLIFTERSON	0-4	.28	5
	4-60	.24	
CLONTARF	0-25	.20	
CLOUD RIM	0-14	.28	5
	0-14	.24	5
	14-60	.37	
CLOVERDALE	0-4	.37	5
	4-36	.32	
	36-84	.28	
CLOVER SPRINGS	0-14	.49	5
	0-14	.28	5
	0-14	.24	5
	14-72	.49	
CLOVIS	0-5	.24	3
	5-25	.32	
	25-60	.24	
CLOUD PEAK	0-4	.28	2
	4-18	.28	
CLOWERS	0-4	.37	5
	4-60	.49	
CLUFF	0-14	.43	2
	14-36	.20	
COAD	0-8	.28	5
	8-36	.32	
	36-60	.10	
COALDRAW	0-4	.37	2
	4-14	.43	
COALMONT	0-4	.24	2
	4-30	.32	
COBEN	0-5	.32	5
	5-34	.37	
	34-63	.43	
COCHETOPA	0-12	.28	5
	12-40	.17	
	40-60	.15	

SOIL SERIES		DEPTH INCHES	K	T
COE		0-6	.20	2
		6-60	.15	
COEROCK		0-4	.37	1
		4-15	.32	
COGSWELL	L	0-12	.49	5
	CL	0-12	.37	5
	C	0-12	.28	5
		12-26	.28	
		26-60	.32	
COHAGEN		0-17	.15	1
COKEL		0-22	.15	2
		22-60	.15	
COLBY		0-8	.32	5
		8-60	.43	
COLDCREEK		0.45	.32	3
COLLARD		0-20	.17	2
		20-60	.15	
COLLBRAN		0-13	.23	5
		13-26	.23	
COLLEGIATE		0-9	.20	3
		9-36	.15	
		36-60	.10	
COLLETT		0-12	.24	3
		12-34	.32	
		34-48	.37	
COLLINSTON		0-15	.28	1
		15-35	.32	
		35-60	.55	
COLMOR		0-4	.37	5
		4-64	.49	
COLOMBO		0-12	.32	5
		12-60	.24	
COLONA		0-4	.24	5
		4-60	.32	
COLUMBINE		0-6	.10	2
		6-60	.10	
COLVIN		0-60	.32	5
COMER		0-6	.28	5
		6-60	.32	
COMO		0-18	.17	3
		18-32	.10	
COMODORE		0-15	.24	1
COMORO		0-36	.49	5
		36-60	.49	
CONATA			.32	2
CONCHAS		0-5	.32	2
		5-30	.37	
CONCHO		0-5	.37	5
		5-60	.32	
CONDIE		0-25	.15	2
		25-42	.28	
		42-66	.28	
CONGER		0-17	.32	1
CONI		0-7	.19	1
		7-19	.24	
CONNERTON		0-8	.43	5
		8-60	.49	
CONTIDE		0-2	.28	5
		2-28	.43	
		28-52	.37	
		52-60	.43	
CONTINE		0-12	.32	5
		15-25	.28	
		25-66	.32	
CONTINENTAL	GR-SL	0-10	.20	5
	GR-SCL	0-10	.23	5
		10-31	.24	
		31-72	.17	
COOLIDGE		0-24	.20	5
		24-60	.20	
COPPERTON		0-60	.17	1
CORDES		0-34	.20	5
		34-60	.10	
CORLETTE		0-8	.12	5
		8-60	.12	
CORMONT		0-6	.17	4
		6-60		
CORNISH		0-10	.15	4
CORNVILLE	SL,FSL	0-3	.28	5
	L	0-3	.49	5
		3-30	.32	
		30-60	.43	
CORPENING		0-6	.28	1
		6-15	.32	
CORTA		0-4	.28	4
		4-60	.37	
COSTILLA		0-6	.10	5
		6-24	.10	
		24-60	.10	
COTHA		0-34	.28	2
COTOPAXI		0-8	.10	5
		8-60	.10	
COTTIER		0-4	.17	5
		4-15	.28	
		15-60	.15	
COTTONWOOD		0-8	.32	1
COURTHOUSE		0-3	.37	1
		3-14	.37	
COURTLAND		0-22	.17	5
		22-64	.20	
		64-72	.32	
COWAN		0-2	.15	5
		2-23	.17	
		23-60	.10	
COWDREY		0-12	.32	5
		12-60	.10	
COWERS		0-21	.20	3
		21-60	.20	
COWOOD		0-6	.32	1
		6-23	.28	
CRADDOCK		0-9	.32	3
		9-45	.28	
CRAGO		0-14	.37	5
		4-14	.32	
		14-50	.24	
		50-66	.10	
CRAGOLA		0-4	.20	1
		4-16	.24	
CREEDMAN		0-62	.43	5
CREIGHTON		0-60	.43	5
CRESBARD		0-60	.32	5
CRESPIN		0-9	.24	5
		9-60	.32	
CREST		0-10	.37	2
		10-26	.17	
CRESTLINE		0-12	.32	2
		12-60	.24	
CRESTON		0-42	.37	5
CREWS		0-6	.43	1
		6-16	.37	
CRISTO		0-13	.24	3
		13-21	.37	
		21-35	.15	
CRITCHELL		0-7	.20	5
		7-20	.24	
		20-60	.20	
CROOKED CREEK		0-60	.28	4
CROOKSTON		0-14	.24	4
		14-27	.28	
		27-56	.32	
CROSS		0-3	.32	1
		3-14	.28	
CROT	CL	0-5	.32	5
	SL, FSL	0-5	.20	5
	L, SIL	0-5	.55	5
		5-17	.43	
		17-60	.32	
CROW		0-54	.43	5
CROW CREEK		0-5	.37	5
		5-60	.55	
CROW FLATS		0-48	.43	5
CROWFOOT		0-11	.15	5
		11-55	.15	
		22-40	.32	
		40-60	.10	
CROWHEART		0-10	.37	1
CROWSHAW		0-10	.32	5
		10-52	.37	
CROYDEN		0-22	.24	3
		22-48	.32	
CRUCES		0-14	.28	1
CRUCKTON		0-8	.10	5
		8-24	.10	
		24-60	.10	
CRYSTOLA		0-18	.10	3
		18-34	.10	
		34-60	.10	
CUDAHY		0-23	.32	1
CUEVA		0-3	.20	3
		3-19	.32	
		19-33	.32	
CUEVOLAND		0-26	.37	3
		26-30	.43	
CUMBRES		0-4	.15	2
		4-16	.28	
		16-22	.10	
CUNDICK		0-10	.37	1
CUNDIYO		0-46	.17	5
		46-60	.10	
CURBERANT		0-20	.17	1
		20-36	.24	
CURDLI		0-60	.49	5
CURECANTI		0-7	.10	5
		7-20	.10	
		20-60	.10	
CURHOLLOW		0-15	.15	1
CURTIS CREEK		0-8	.24	1
		8-18	.32	
CURTIS SIDING		0-60	.10	5
CUSHMAN		0-24	.32	2
CUSHOOL		0-4	.24	3
CUTTER		0-60	.32	5
CYPHER		0-4	.20	1
		4-19	.17	
DACONO		0-9	.24	3
		9-20	.24	
		20-26	.15	
		26-60	.10	
DAGFLAT		0-30	.10	2
DAGLUM		0-45	.32	3
DAGOR		0-60	.37	5
DAHLQUIST		0-7	.15	5
		7-14	.20	
		14-28	.15	
		28-60	.10	
DAILEY		0-16	.15	5
		16-60	.15	
DALBY		0-60	.32	5
DALCAN		0-27	.24	2
DALHART		0-9	.24	5
		9-38	.32	
		38-72	.32	
DALIAN		0-42	.17	5
DALLAM		0-8(FSL)	.24	5
		0-8(LFS)	.20	5
		8-80	.32	
DANDREA		0-7	.43	2
		7-12	.32	
		12-29	.17	
DANKO		0-12	.37	1
DANVERS		0-44	.37	
		44-60	.28	
DARGOL		0-6	.24	3
		6-35	.28	
DARLING		0-5	.20	5
		5-21	.10	
		21-60	.10	
DARNEN		0-34	.28	5
		34-60	.37	
DARRET		0-8	.37	2
		8-13	.43	
		13-28	.32	
DAST		0-30	.20	2
DATELAND		0-17	.20	5
		17-33	.49	
		33-60	.37	
DATEMAN		0-24	.24	3
		24-34	.20	
DATINO		0-7	.24	1
		7-50	.28	
DATWYLER		0-11	.20	2
		11-28	.10	
		28-35	.15	
DAVIS			.24	5
DAVISON		-	.28	5
DAYBEL		0-16	.32	3
		16-31	.32	
		31-90	.10	
DAZE		0-2	.43	1
		2-20	.32	
DEACON		0-10	.24	5
		10-26	.24	
		26-60	.20	
DEAMA		0-13	.17	1
DEAN		0-7	.32	2
		7-60	.28	
DEAVER		0-4	.43	3
		4-24	.37	
DEBONE		0-8	.32	5
		8-26	.37	
		26-60	.32	
DECCA		0-15	.32	1
		15-60	.10	
DECKER		0-12	.32	2
		12-35	.32	
		35-60	.43	
DECROSS		0-9	.28	5
		9-30	.37	
		30-60	.43	

SOIL SERIES	DEPTH INCHES	K	T
DEER CREEK	0-14	.32	2
	14-34	.24	
	34-60	.32	
DEERTRAIL	0-5	.32	5
	5-23	.32	
	23-60	.24	
DEGREY		.37	3
DEJARENT	0-10	.32	3
	10-60	.32	
DELL	0-6	.32	3
	6-42	.37	
DELECO	0-10	.49	1
DELMONT		.28	3
DELNORTE	0-8	.10	1
DELPHILL	0-28	.37	2
DEMAR	-	.37	3
DEMERS	0-7	.43	3
	7-14	.37	
	14-24	.43	
	24-60	.10	
DEMKY	-	.32	3
DEMPSEY	0-8	.28	5
	8-60	.37	
DEMPSTER		.32	4
DENMARK	0-20	.32	1
DENVER	0-6	.17	5
	6-29	.17	
	29-60	.17	
DEPEW	0-60	.37	5
DERRICK	0-4	.15	1
	4-17	.15	
	17-60	.10	
DESART	0-25	.20	4-3
	25-48	.32	
DESERET	0-9	.43	5
	9-60	.43	
DES MOINES	0-18	.20	3
	18-36	.10	
	36-48	.10	
DESPAIN	0-16	.24	4
	16-30	.24	
	30-44	.32	
DETRA	0-27	.24	3
	27-41	.20	
DEV	0-50	.10	5
DEVOE	0-15	.28	2
DEWVILLE	0-10	.15	5
	10-30	.30	
	30-60	.20	
DIAMONDVILLE	0-7	.37	3
	7-28	.49	
DICKEY	0-31	.17	5
	31-60	.37	
DILLINGER			
DILTS	0-19	.32	2
DIMMICK	0-60	.28	5
DIMO		.24	4
DIMYAW	0-60	.64	5
DINNEN	0-8	.10	5
	8-60	.15	
DIOXICE	0-8	.32	3
	8-35	.37	
	35-60	.37	
DIPMAN	0-7	.24	5
	7-34	.32	
	34-60	.24	
DISTERHEFF	0-5	.49	2
	5-35	.28	
	35-40		
	40-60	.28	
DIVIDE	0-25	.28	4
	25-60	.10	
DIX		.15	2
DIXIE	1-15	.28	2
DOAK	0-5	.37	5
	5-60	.37	
DOBENT	-		
DOBROW	0-28	.17	5
	28-60	.10	
DOBY	0-13	.32	1
DOCT	0-9	.20	2
	9-30	.15	
DOGER	-	.17	5
DOLLARD	0-6	.35	2
	6-25	.35	
DOLORES	0-12	.25	3
	12-24	.25	
	24-60	.10	
DOMINGUEZ	0-9	.24	
	9-60	.24	
DOMINIC	0-5	.17	2
	5-11	.15	
	11-60	.10	

SOIL SERIES	DEPTH INCHES	K	T
DOMINSON	0-12	.15	5
	12-60	.10	
DONA ANA	0-6	.24	3
	6-39	.32	
	39-60	.28	
DONALD	0-5	.37	5
	5-15	.32	
	15-60	.28	
DONEY	0-21	.37	1
DONNARDO	0-60	.24	2
DONNER L	0-6	.28	1
CB-L,GR-L	0-6	.24	1
	6-34	.32	
DOOLEY	0-6	.24	5
	6-24	.32	
	24-60	.37	
DORAN	0-20	.28	5
	20-60	.37	
DORMILON	0-15	.28	1
DORNA		.32	5
DOUBLETOP	0-8	.37	5
	8-60	.55	
DOUGHTY	0-7	.37	5
	7-30	.32	
	30-66	.28	
DOVRAY	0-60	.28	5
DOWDEN	0-5	.32	5
	5-60	.24	
DOYCE	0-20	.32	3
	20-60	.20	-
DRAKE	0-60	.28	5
DRAPER	0-21	.24	5
	21-60	.32	
DREXEL	0-60	.32	3
DRUM	0-60	.49	2
DRY CREEK	0-9	.32	2
	9-26	.24	
	26-48	.24	-
DUCHESNE	0-9	.24	3
	9-42	.43	-
DUDA		.17	5
DUDLEY	-	.43	5
DUFFSON	0-8	.25	2
	8-20	.35	
	20-30	.32	
DUFFY	0-8	.37	2
	8-20	.32	
	20-36	.24	
DUGGINS	0-60	.24	5
DUMAS	0-7	.28	5
	7-80	.32	
DUNCAN	0-5	.49	2
	5-35	.28	
	35-40		
	40-60	.28	
DUNCOM	0-8	.32	1
	8-14	.49	
DUNDAY		.15	5
DUNTON	0-27	.32	2
	27-38	.24	
DUNUL	0-8	.10	1
	8-60	.10	
DUPREE		.28	2
DURANGO	0-9	.24	5
	9-60	.24	
DURFEE	0-16	.20	2
	16-60	.10	-
DUROC	0-60	.43	5
DURRSTEIN		.37	1
DURST	0-10	.20	1
	10-25	.24	-
DUTSON	0-8	.28	5
	8-36	.37	
	36-60	.32	
DUTTON	0-6	.37	2
	6-36	.43	
DWYER	0-6	.28	5
	6-60	.32	
DYE	0-4	.28	1
	4-19	.25	
DYRENG	0-60	.28	5
EACHUSTON	0-8	.10	5
	8-60	.10	
EAGER GR-L	0-30	.43	5
GR-CL	0-30	.28	
	30-50	.15	
EAKIN		.32	5
EARP	0-2	.43	5
	2-25	.28	
	25-60	.10	
EASTCAN	0-28	.20	5
	28-60	.28	
EASTONVILLE	0-10	.15	5
	10-34	.15	

SOIL SERIES	DEPTH INCHES	K	T
EBA	0-2	.37	5
	2-50	.20	
EBBS	0-60	.28	5
EBON	0-2	.43	5
	0-38	.20	
	38-60	.28	
ECCLES	0-62	.32	3
ECHARD	0-5	.20	5
	5-25	.28	
	25-47	.37	
ECHEMOOR	0-10	.32	3
	10-36	.43	
ECKLEY	0-4	.17	2
	4-15	.15	
	15-60	.10	
ECKMAN	0-8	.28	5
	8-60	.43	
ECTOR	0-8	.10	1
EDGAR	0-60	.37	5
EDGELEY	0-48	.28	4-3
EDGEWATER	0-18	.20	5
	18-36	.24	
	36-60	.10	
EDLOE	0-10	.10	2
	10-26	.10	
	26-36	.10	
EFFINGTON	0-3	.37	5
	3-19	.32	
	19-60	.49	
EGAN		.32	5
		.32	4
EGAS		.28	5
EGELAND	0-48	.20	5
	48-60	.37	
EICKS	0-3	.32	5
	3-15	.24	
	15-25	.24	
	25-48	.24	
EKAH	0-6	.32	5
	6-28	.37	
	28-60	.32	
EKALAKA	0-60	.24	3-2
ELBETH	0-13	.15	5
	13-60	.24	
ELDER HOLLOW	0-16	.28	1
	16-28	.24	
ELEPHANT	0-12	.28	5
	12-60	.43	
ELFRIDA L,SIL	0-13	.49	5
CL,SICL	0-13	.32	5
	13-60	.43	
ELK HOLLOW	0-4	.15	5
	4-11	.28	
ELK MOUNTAIN	0-4	.32	3
	4-30	.37	
ELKNER	0-6	.32	2
	6-12	.28	
	12-38	.15	
ELKOL	0-4	.32	5
	4-60	.37	
ELLEDGE CB-SL, SL	0-7	.15	2
CB-L,L	0-7	.49	
	7-30	.20	
ELLETT	0-5	.28	2
	5-14	.43	
ELLICOTT	0-4	.10	5
	4-60	.10	
ELLOAM	0-76	.49	5
ELPAM	-	.37	5
EL RANCHO	0-60	.32	5
ELS		.17	5
ELSMERE		.17	5
ELTSAC	0-6	.37	2
	6-26	.55	
ELWOOD	0-11	.24	3
	11-26	.28	
	26-38	.17	
ELZINGA	0-22	.32	4
	22-48	.43	
	48-62	.32	
EMBARGO	0-12	.17	2
	12-34	.20	2
EMBDEN	0-60	.20	5-4
EMBLEM	0-3	.28	3
	3-20	.37	
	20-31	.15	
	31-60	.10	
EMBLEM CLAYLOAM	0-3	.32	3
	3-20	.37	
	20-31	.15	
	31-60	.10	
EMBRY	0-60	.28	5
EMBUDO	0-20	.24	3
	20-60	.10	

SOIL SERIES	DEPTH INCHES	K	T
EMERALD	0-12	.25	5
	12-60	.30	
EMIGRANT	0-7	.24	3
	7-13	.24	
	13-30	.28	
EMIGRATION	0-18	.17	1
EMMONS L,FSL	0-7	.32	3
SICL	0-7	.28	3
	7-49	.37	
EMPEDRADO	0-10	.24	5
	10-24	.28	
	24-40	.24	
EMRICK	0-20	.28	5
	20-60	.37	
ENCIERRO	0-5	.28	1
	5-14	.32	
ENDLICH	0-22	.10	2
ENET	0-24	.28	3
	24-60	.10	
ENGLEWOOD	0-9	.15	5
	9-34	.17	
	34-60	.17	
ENLOE	0-60	.32	5
ENNING		.43	2
ENOS	0-34	.17	2
ENTENTE	0-60	.37	5
EPHRAIM	0-60	.32	5
EPPING		.43	1
EPSIE	0-18	.55	1
ERCAN	0-18	.24	4
	18-27	.32	
	27-56	.37	
ERD		.28	5
ERNEM	0-15	.28	1
ERRAMOUSPE	0-9	.24	2
	9-35	.28	
ERVIDE	0-23	.15	2
	23-32	.32	
ESCABOSA	0-15	.28	2
	15-23	.32	
ESCALANTE	1-27	.43	3
	27-39	.49	
ESMOND	0-9	.28	5-4
	9-60	.37	
ESPLIN	0-18	.37	2
ESS			
ESTELLINE	-	.32	4
ESTERBROOK	0-14	.28	5
	14-34	.24	
	34-60	.17	
ESTRELLA	0-24	.49	5
	24-60	.37	
ETCHEN	0-8	.20	2
	8-31	.17	
ETHAN	-	.28	5
ETHELMAN	0-7	.28	2
	7-29	.24	
ETHETE	0-4	.37	4
	4-21	.28	
	21-34	.32	
	34-60	.10	
ETHRIDGE	0-6	.32	5
	6-13	.37	
	13-63	.43	
ETIL	0-5	.20	5
	5-60	.10	
ETOE	0-11	.28	5
	11-36	.20	
	36-73	.15	
ETOWN	0-60	.17	5
ETTA	0-60	.20	5
EVANSTON	0-7	.32	5
	7-60	.37	
EVARO	0-21	.32	4
	21-36	.28	
	36-50	.10	
EVERMAN	0-8	.32	3
	8-32	.46	
	32-38	.35	
	38-60	.32	
EYEBROW	0-9	.37	5
	9-60	.43	
EYRE	0-8	.20	1
	8-16	.10	
EXLINE	0-60	.32	3
FAIM	0-14	.24	2
	14-40	.37	
	40-60	.32	
FAIRDALE	0-60	.32	5
FAIRFIELD	0-7	.37	5
	7-36	.32	
	36-60	.37	
FALCON	0-7	.10	1
	7-14	.10	
FALFA	0-12	.32	5
	12-36	.32	
	36-64	.43	
	64-70	.28	
FALKIRK	0-34	.28	5
	34-60	.37	
FALLSAM	0-9	.32	3
	9-46	.24	
FANNO	0-25	.28	3
FANNO acid variant	0-13	.43	3
	13-40	.24	
FARAWAY	0-8	.43	1
FARB	0-10	.24	1
FARGO	0-60	.32	5
FARISTA	0-4	.10	1
	4-12	.10	
FARLAND	0-4	.32	5-4
	4-18	.37	
	18-60	.32	
FARNUF	0-7	.32	5
	7-60	.37	
FARSON	0-3	.20	2
	3-10	.24	
	10-60	.10	
FASKIN (FSL)	0-8	.24	5
(LFS)	0-8	.20	5
	9-80	.32	
FATTIG	0-4	.20	2
	4-23	.32	
	23-33	.37	
FEATHERLEGS	0-5	.32	5
	5-19	.37	
	19-38	.43	
	38-60	.10	
FEDORA		.20	5
FELAN	0-68	.32	5
FELOR	-	.28	5
FELTNER	0-3	.24	2
	3-16	.28	
FERDIG	0-7	.49	5
	7-15	.43	
	15-60	.37	
FERGUS	0-4	.32	5
	4-28	.37	
	28-34	.28	
	34-47	.37	
FERNANDO	0-68	.43	5
FERN CLIFF	0-20	.17	5
	20-60	.20	
	60-80	.10	
FERRON	0-60	.49	5
FIELDING	0-10	.32	3
	10-34	.49	
	34-66	.55	
FIFER	0-6	.37	1
	6-20	.32	
FINNERTY			
FIRESTEEL		.32	4
FIRMAGE	0-60	.28	2
FIRO	0-3	.28	1
	3-15	.32	
FISHERS	0-12	.15	5
	12-60	.15	
FITZGERALD	0-26	.28	3
	26-60	.10	
FIVEMILE	0-5(SICL)	.43	5
	0-5(SCL)	.32	5
	5-60	.37	
FIVEOH	0-60	.32	5
FLANDREAU		.28	4
FLASHER	0-10	.17	2
FLATHEAD	0-24	.17	5
	24-44	.20	
	44-54	.15	
FLAXTON	0-22	.20	5-4
	22-60	.37	
FLECHADO	0-9	.24	5
	9-60	.17	
FLEER	0-30	.17	5
	30-60	.10	
FLEAK	0-17	.17	2
FLOM	0-60	.32	5
FLORISSANT	0-4	.15	3
	4-22	.20	
	22-31	.10	
FLOWELL	0-12	.20	3
	12-38	.37	
	38-72	.43	
FLOWEREE	0-6	.37	5
	6-60	.32	
FLUETSCH	0-10	.32	5
	10-30	.37	
	30-60	.20	
FLYGARE	0-17	.28	2
	17-36	.28	
	36-60	.24	
FLYNN			
FOLA	0-6	.15	3
	6-16	.10	
	16-60	.10	
FONDIS	0-7	.28	5
	7-23	.32	
	23-60	.30	
FONTREEN	0-60	.17	1
FORD	0-16	.28	1
	16-34	.20	
FORDVILLE	0-24	.24	4
	24-60	.10	
FORELLE	0-4	.28	5
	4-15	.32	
	15-60	.43	
FORESTBURG		.17	5
FORMAN	0-17	.28	5-4
FORNEY		.28	5
FORREST	0-4	.49	5
	4-29	.28	
	29-60	.37	
	29-60	.32	
FORSEY	0-30	.20	2
FORSGREN	0-8	.37	4
	8-38	.43	
	38-66	.49	
FORT COLLINS	0-8	.20	5
	8-18	.20	
	18-60	.20	
FORTWINGATE	0-13	.32	2
	13-23	.28	
	23-32	.28	
FOSSILON	0-15	.28	1
FOSSUM	0-8	.20	2
	8-60	.10	
FOURLOG	0-16	.17	5
	16-60	.20	
FOURMILE	0-9	.10	5
	9-24	.10	
	24-40	.10	
FOXPARK			
FOXTON	0-10	.24	3
	10-26	.32	
FOXOL	0-7	.24	1
	7-17	.17	-
FOY	0-11	.32	5
	11-60	.32	-
FRADDLE	0-4	.24	3
	4-33	.28	
FRAM	0-18	.28	5
	18-60	.37	
FRANCIS	0-23	.17	5
	23-73	.17	
FRAZER	0-60	.32	5
FRIANA	0-3	.32	5
	3-39	.37	
	39-54	.27	
FREECE	0-3	.28	2
	3-20	.24	-
FREEDOM	0-60	.49	5
FRISCO	0-16	.17	5
	16-80	.15	
FRIDLO	0-29	.32	1
	29-43	.49	
	43-60	.49	
FROLIC	0-35	.24	5
	35-42	.37	
	42-66	.55	
FRONTON	0-3	.20	1
	3-16	.28	
FRUITA	0-4	.24	5
	4-20	.32	
	20-60	.32	
FRUITLAND (cold variant)	0-26	.28	5
	26-39	.32	
	39-58	.15	
FRYE SL	0-12	.20	3
L	0-12	.49	3
SCL	0-12	.37	
	12-26	.28	
	26-38		
	38-60	.49	
FUERA	0-15	.28	5
	15-31	.28	
	31-64	.17	
FULCHER	0-11	.24	5
	11-42	.32	
	42-60	.30	
FULDA	0-60	.28	5
GABALDON	0-60	.37	5

SOIL SERIES		DEPTH INCHES	K	T
GACHADO		0-2	.37	1
		2-8	.32	
		8-13	.28	
GADDES		0-2	.39	1
		2-24	.43	
		24-54	.37	
GADSDEN	C	0-10	.28	5
	CL	0-10	.32	
		10-60	.28	
GAINES		0-22	.32	3
		22-32	.28	
		32-48	.15	
GALATA		0-8	.49	
		8-60	.55	
GALCHUTT		0-60	.32	4
GALETON		0-14	.10	5
		14-60	.10	
GALISTEO		0-6	.37	5
		6-60	.32	
GALLATIN		0-34	.43	4
		34-50	.20	
		50-60	.10	
GALLEGOS		0-21	.20	5
		21-50	.10	
GALLINA		0-10	.20	5
		10-21	.24	
		21-60	.17	
GAMBLER		0-13	.28	3
		13-20	.28	
		20-45	.24	
GANNETT			.20	5
GAPO				
GAPPMAYER		0-10	.28	2
		10-60	.32	
GARBER		0-8	.10	5
		8-60	.10	
GARDENA		0-22	.28	5
		22-60	.43	
GARDNER'S FORK		0-20	.15	2
		20-60	.28	
GARITA		0-9	.10	5
		9-60	.10	
GARLAND		0-4	.32	4
		4-30	.28	
		30-60	.10	
GARLET		0-72	.24	5
GARO		0-16	.28	1
GARRETT		0-4	.20	5
		4-30	.28	
		30-60	.32	
GARSID		0-3	.32	3
		3-28	.37	
GARZA		0-24	.32	5
		24-60	.37	
GAS CREEK		0-14	.15	2
		14-60	.10	
GATESON		0-2	.32	2
		2-14	.37	
		14-24	.32	
GATEVIEW		0-10	.10	5
		10-60	.10	
GATEWAY		0-10	.24	3
		10-15	.24	
		15-30	.32	
GAVINS			.43	2
GAYLORD		0-15	.43	5
		15-60	.37	
GAYNOR		0-6	.24	3
		6-30	.32	
GAYVILLE			.28	3
GEERTSEN		0-8	.24	1
		8-45	.20	
GELKIE		0-6	.28	5
		6-60	.20	
GENDA		0-60	.43	5
GERBER		0-66	.43	5
GERRARD		0-4	.17	5
		14-60	.10	
GETTYS		-	.28	5
GIBBLER		0-6	.20	3
		6-20	.17	
		20-26	.10	
GILA	(L,SIL)	0-12	.55	5
	(FSL)	0-12	.43	5
	(CL)	0-12	.37	5
		12-60	.55	
GILBY		0-33	.28	5
		33-60	.37	
GILCREST		0-9	.15	3
		9-22	.15	
		22-60	.10	
GILISPIE		0-6	.32	1
		6-20	.28	
GILKON		0-42	.37	5
		42-60	.28	
GILLAND		0-28	.17	3
GILMAN	FSL	0-13	.26	5
	L	0-13	.49	5
	CL	0-13	.37	5
		13-60	.49	
GILT EDGE		0-4	.49	5
		4-40	.55	
		40-60	.28	
GIRARDOT		0-8	.17	5
		8-60	.17	
GIRD		0-40	.37	5
		40-66	.43	
GLADEL		0-5	.20	1
		5-15	.28	
GLASSNER		0-6	.28	5
		6-60	.32	
GLENBAR	L	0-15	.55	5
	CL	0-15	.32	
		15-60	.32	
GLENBERG		0-6	.15	5
		6-60	.10	
GLENDALE	L,SIL	0-60	.49	5
	CL,SICL	0-60	.37	5
GLENDIVE		0-16	.32	5
		16-60	.24	
GLENDERSON		0-6	.24	5
		6-38	.28	
		38-60	.37	
GLENDING				
GLENHAM			.28	4
GLENROSS			.37	3
GLENTON		0-6	.24	
		6-60	.32	5
GLYNDON		0-60	.32	4
GOLDCREEK		0-9	.28	5
		9-60	.37	
GOLDFIELD		0-9	.22	1
GOLDVALE		0-19	.17	4
		19-60	.24	
GOLVA		0-5	.32	5-4
		5-60	.43	
GOMEZ	(FSL)	0-15	.24	5
	(LFS)	0-15	.17	5
		15-72	.24	
GOOCH		0-30	.32	1
		30-47	.20	
GORDO		0-20	.43	3
		0-20	.55	3
		20-40	.49	
		40-59		
GORING		0-7	.32	3
		7-22	.32	
		22-55	.32	-
GORUS		0-28	.37	5
		28-60	.28	
GOSHEN		-	.32	5
GOSHUTE		0-17	.24	1
GOSLIN		0-60	.32	5
GOTHARD		0-5	.28	3
		5-11	.49	
		11-42	.43	
		42-80	.20	
GOTHIC		0-12	.17	5
		12-18	.15	
		18-40	.10	
		40-60	.10	
GOTHO		0-16	.28	5
		16-60	.37	
GOURLEY		0-12	.32	5
		12-60	.37	
GOVE		0-17	.10	5
		17-28	.10	
		28-48	.17	
		48-60	.10	
GRABE	(SL,GR-SL)	0-16	.49	5
	(L,SICL)	0-16	.49	5
		16-60	.55	
GRABLE				
GRACEVILLE			.32	5
GRAFEN		0-10	.17	3
		10-30	.15	
GRAHAM		0-6	.32	1
		6-14	.20	
GRAIL		0-60	.32	5
GRAMM		0-18	.32	5
		18-60	.24	
GRANATH		0-13	.28	5
		13-60	.32	
		60-80	.24	
GRANER			.28	5
GRANILE		0-9	.15	5
		9-18	.15	
		18-41	.10	
		41-60	.10	
GRANO		0-48	.28	5
		48-60	.37	
GRANTSDALE		0-32	.37	3
		32-36	.10	
GRASSNA		0-60	.32	5
GRAYPOINT		4-16	.24	
		16-60	.10	
		0-4	.15	1
GRAT			.32	5
GREAT BEND		0-13	.32	5
		13-60	.43	
GREEN CANYON		0-9	.32	2
		9-16	.37	
		16-42	.15	
GREENOUGH		0-40	.37	3
		40-48	.32	
GREENLAW		0-14	.20	5
		14-42	.49	
		42-60	.15	
GREEN RIVER		0-60	.49	5
GREENSON		0-16	.32	3
		16-75	.43	
GRENADIER		0-3	.28	5
		3-18	.15	
		18-40	.10	
GREYBACK		0-18	.24	3
		18-28	.15	
		28-60	.10	
GREYBULL		0-4	.37	3
		4-28	.43	
GREYCLIFF		0-60	.37	5
GRIFFY		0-4	.32	5
		4-19	.28	
		19-60	.20	
GRIMSTAD		0-28	.20	5
GRIMSTONE		0-12	.17	2
		12-20	.24	
		20-27	.28	
GRIZZLY			.37	5
GROWLER		0-7	.49	5
		7-13	.32	
		13-60	.49	
GRUMMIT		-	.28	2
GRUVER		0-8	.32	5
		8-80	.32	
GUADALUPE		0-38	.28	4
		38-60	.17	
GUAJE		0-14	.17	2
GUBEN	GRV-L	0-14	.17	2
	GR-L	0-14	.24	2
		14-44	.17	
		44-54	.20	-
GUEST		0-10	.37	5
		0-28	.28	
		28-60	.28	
GUILDER		0-12	.24	5
		12-31	.32	
		31-65	.43	
GULNARE		0-6	.24	5
		6-39	.32	
		39-60	.28	
GUNBARREL		0-5	.10	5
		5-60	.10	
GUNSIGHT		0-18	.37	5
		18-60	.10	
GUNSONE		0-60	.32	5
GUY		0-15	.24	2
		15-60	.24	
GYPNEVEE		0-5	.49	4
		5-60	.55	
GYSTRUM		0-4	.43	2
		4-27	.49	
HACCKE		0-56	.43	5
HADES		0-24	.24	5
		24-72	.73	
HAGGA				
HAGERMAN		0-30	.32	2
HAGGERTY		0-10	.32	5
		10-30	.37	
		30-40	.32	
		40-60	.37	
HAGSTADT		0-3	.28	2
		3-23	.32	
HAILMAN		0-57	.28	3
HALFORD		0-19	.17	3
		19-33	.10	
HALF MOON		0-60	.37	5
HALGAITOH		0-48	.49	2

SOIL SERIES SERIES		DEPTH INCHES	K	T
HALL		-	.32	5
HALLECK		0-16	.20	5
		16-60	.17	
HAMAR		0-60	.17	5
HAMERLY		0-8	.28	5
		8-60	.37	
HAMILTON		0-48	.37	5
HAMLEY		0-60	.32	5
HANAKER		0-60	.37	5
HAND		.28	5	
HANDRAN		0-9	.10	3
		9-60	.15	
HANLY		0-60	.17	5
HANS		0-7	.37	3
		7-34	.43	
		34-60	.43	
HANSEL		0-14	.37	3
		14-33	.43	
		33-62	.49	
HANSON		0-8	.32	5
		8-14	.37	
		14-60	.28	
HANTZ		0-60	.24	5
HAP		0-3	.32	3
		3-50	.28	
HAPNEY		0-26	.32	5
		26-60	.15	
HARBORD		0-5	.20	5
		5-40	.20	
		40-60	.20	
HARDING		0-3	.28	1
		3-8	.28	
		8-72	.20	
HARDSCRABBLE		0-12	.24	3
		12-30	.24	
HARDY		0-15	.28	3
		15-35	.43	
		35-72	.49	
HARGREAVE		0-10	.28	3
		10-20	.37	
		20-32	.43	
HARKERS		0-14	.32	2
		14-42	.24	
HARKEY		0-60	.49	5
HARLAN		0-5	.43	5
		5-20	.49	
		20-60	.55	
HARLEM				-
HARMONY			.28	5
HARQUA		0-60	.10	5
HARRIET		0-60	.37	3
HARRISBURG		0-35	.24	3
HARRISVILLE		0-8	.43	2
		8-60	.43	
HARVEY		0-50	.37	5
HASKI		0-60	.49	4
HASKILL		0-27	.15	5
		27-32	.20	
		32-72	.10	
HASSELL		0-7	.43	3
		7-32	.37	
HAT		0-5	.32	5
		5-60	.43	
HATCH	CB-L	0-2	.17	2
	L	0-2	.24	2
		2-23	.32	
		23-36	.55	
HATERMUS		0-18	.49	1
HATERTON		0-2	.37	2
		2-14	.43	
HATHAWAY		0-24	.43	3
		24-60	.10	
HATTIE		0-60	.28	5-4
HAUGAN		0-15	.32	5
		15-35	.37	
		35-49	.32	
		49-66	.28	
HAUSER		0-12	.32	1
HAVERLY		0-24	.32	2
HAVERSON		0-6	.28	5
		6-60	.28	
HAVIG			-	-
HAVRE		0-60	.32	5
HAVRELON		0-60	.32	5
HAWKEYE		0-52	.15	5
HAWKINS		0-38	.20	5
		38-74	.28	
HAWKSELL		0-60	.20	5
HAWKSPRINGS		0-32	.24	4
		32-60	.10	
HAXTUN		0-7	.10	5
		7-24	.24	
		24-47	.32	
		47-60	.24	

SOIL SERIES	DEPTH INCHES	K	T
HAYFORD	0-5	.34	5
	5-19	.32	
	19-29	.24	
	29-60	.10	
HAYNESS	0-15	.32	5
	15-60	.37	
HAZTON	0-17	.15	1
HEADQUARTERS	0-29	.32	2
	29-51	.24	
HEATH	0-5	.32	5
	5-22	.32	
	22-60	.15	
HEBER	0-60	.15	5
HEBGEN	0-7	.17	3
	7-14	.24	
	14-24	.15	
	24-60	.10	
HECHT	0-4	.24	2
	4-9	.37	
	9-32	.28	
HECLA	0-72	.17	5
HEFLIN	0-4	.28	3
	4-36	.32	
	36-56	.32	
HEGNE	0-60	.28	5
HEIL	0-60	.28	3
HEIMDAL	0-19	.28	5-4
	19-60	.37	
HEINSAW	0-8	.28	5
	8-60	.24	
HEIST	0-12	.32	4
	12-42	.28	
	42-60	.10	
HELDT	0-6	.37	5
	6-60	.43	
HENDRICKS	0-15	.32	5
	15-66	.32	
HENEFER	0-20	.37	2
	20-60	.24	
HENHOIT	0-10	.17	3
	10-60	.28	
HENKIN		.20	5
HERD	0-20	.23	5
	20-70	.28	
HEREFORD	0-13	.37	5
	0-13	.20	5
	0-13	.49	5
	13-60	.32	
HERMERING	0-3	.28	5
	3-60	.24	
HESPER	0-44	.37	5
	44-60	.20	
HESPERUS	0-11	.28	5
	11-44	.32	
	44-60	.32	
HIERRO	0-10	.24	3
	10-29	.20	
	29-60	.10	
HIGGINS		.43	5
HIGHLAND	0-13	.32	5
	13-28	.43	
	28-72	.37	
HIGHMORE		.32	5
HIGH PARK	0-6	.32	5
	6-60	.32	
HIGHPOINT	0-8	.32	1
HIIBNER	0-6	.20	1
	6-52	.15	
HIKO PEAK	0-34	.20	1
	34-60	.10	
HIKO SPRINGS	0-14	.24	5
	14-60	.17	
HILGER	0-60	.32	5
HILLERY	0-18	.28	4
	18-60	.24	
HILLFIELD	0-21	.55	3
	21-60	.55	
HILLIARD			
HILLON	0-60	.32	5
HINMAN	0-7	.32	5
	7-18	.37	
	18-60	.37	
HISEGA		.43	3
HISLE		.28	1
HITCHEN	0-5	.32	1
	5-16	.28	
HOBACKER	0-23	.24	3
	23-30	.15	
HOBOG	0-13	.10	2
HOFFMANVILLE	0-9	.37	5
	9-28	.43	
	28-60	.15	
HOGELAND	0-60	.37	5

SOIL SERIES		DEPTH INCHES	K	T
HOGG		0-3	.20	3
		3-52	.24	
HOGRIS		0-60	.17	3
HOLDAWAY		0-20	.37	2
HOLDEN		0-13	.17	2
		13-43	.15	
		43-72	.10	
HOLDERNESS		0-11	.24	5
		11-40	.28	
		40-60	.24	
HOLLOMAN		0-9	.37	1
HOLLOWAY		0-9	.28	5
		9-64	.24	
HOLMES		0-21	.28	1
		21-60	.10	
HOLROYD		0-3	.28	5
		3-60	.32	
HOLT			.20	4
HOMELAKE		0-12	.24	5
		12-60	.24	
HONDALE	(L,SIL)	0-5	.43	5
	(S,SL)	0-5	.24	5
	(SICL)	0-5	.37	5
		5-41	.37	
		41-60		
HONDO		0-5	.37	3
		5-57	.32	
HONEYVILLE		0-13	.37	3
		13-64	.43	
HOODLE		0-13	.24	2
		13-42	.20	
HOOPER		0-5	.30	5
		5-18	.32	
		18-32	.24	
		32-60	.10	
HOPKINS		0-16	.17	1
HOPLEY		0-42	.37	3
HORATIO		0-4	.28	1
		4-19	.32	
HORD			.28	5
HORROCKS		0-42	.15	1
HORSLEY		0-6	.43	1
HOSKIN		0-7	.32	1
		7-28	.24	
HOSKINNINA		0-12	.49	1
HOSSICK		0-18	.10	2
		18-23	.10	
HOUDEK			.28	5
HOURGLASS		0-10	.28	2
		10-50	.32	
HOUSE MOUNTAIN	GRV-L, CBV-L, ST-L	0-12	.43	1
	GRV-CL, CBV-CL	0-12	.32	
HOVEN			.37	1
HOVENWEEP		0-10	.49	3
		10-32	.32	
HOVERT				
HOYE	L	0-4	.28	2
	GR-SL	0-4	.24	2
		4-60	.28	-
HUB		0-6	.32	5
		6-14	.37	
		14-60	.32	
HUBERT		0-15	.43	5
		15-48	.37	
		48-105	.28	
HUECO		0-5	.20	2
		5-30	.24	
HUFFINE		0-5	.32	3
		5-24	.37	
		24-35	.32	
		35-60	.10	
HUGGINS			.32	3
HUGHESVILLE		0-12	.28	2
		12-27	.24	
HUGUSTON		0-3	.32	2
		3-16	.37	
HUME		0-6	.24	1
		6-60	.37	
HUNCHBACK		0-14	.32	5
		14-60	.32	
HUNTING		0-60	.49	5
HUPP		0-18	.28	2
		18-60	.37	
HURLEY			.43	1
HUTT		0-4	.43	5
		4-66	.28	
HYANNIS		0-3	.32	2
		3-12	.10	
		12-30	.10	
HYAT		0-11	.32	3
		11-25	.37	
		25-28	.28	
		28-60	.10	

SOIL SERIES		DEPTH INCHES	K	T
HYATTVILLE		0-6	.28	2
HYDRO		0-11	.49	5
		11-21	.43	
		21-60	.37	
HYRUM		0-17	.28	2
		17-42	.20	
		42-57	.32	
HYSHAM		0-60	.43	5
IGNACIO		0-25	.24	2
ILDEFONSO		0-9	.24	3
		9-60	.15	
ILIAD		0-6	.37	5
		6-13	.43	
		13-66	.37	
ILIFF		0-8	.32	3
		8-22	.37	
		22-34	.32	
IMA		0-10	.32	5
		10-60	.37	
IMLAY			.32	2
INAVALE			.17	5
INCHAU		0-8	.32	3
		8-30	.28	3
INDART		0-12	.32	3
		12-32	.37	
INGA		0-10	.32	5
		10-60	.37	
IPAGE			.17	5
IPANO		0-19	.37	2
IRIM		0-11	.20	5
		11-60	.10	
IROCK		0-26	.24	3
		26-42	.17	
IRONTON		0-21	.32	2
		21-60	.43	
ISBELL		0-8	.24	4
		8-60	.24	
ISMAY		0-8	.37	5
		8-42	.43	
		42-70	.43	
ISOM		0-60	.10	1
IVES		0-8	.15	5
		0-60	.20	5
IVIE		0-30	.28	3
		30-72	.10	
IVINS		0-24	.20	3
		24-64	.15	
JACKS	FSL,ST-FSL	0-3	.24	3
	L,CB-L	0-3	.49	3
	CB-CL,ST-CL	0-3	.32	3
		3-42	.17	
JACQUES	L	0-10	.49	5
	CL	0-10	.32	
		10-44	.24	
JAL		0-12	.32	2
		12-60	.37	
JAMES			.28	5
JANSEN		.32	4	
JARITA		0-28	.32	2
JARRE		0-8	.24	3
		8-24	.28	
		24-60	.10	
JAVA			.28	5
JAYEM		0-60	.28	5
JEKLEY		0-22	.43	2
JELM		0-5	.37	1
		5-18	.49	
JENKINS		0-10	.15	5
		10-28	.10	
JENKINSON		0-8	.24	1
		8-14	.28	
JERAG		0-9	.37	1
		9-19	.28	
JERAULD			.43	3
JERRY		0-11	.32	5
		11-40	.37	
		40-60	.43	
JOCITY	SIC	0-9	.28	5
	SL	0-9	.20	5
		0-41	.37	5
		41-60	.28	
JOCKO		0-7	.32	3
		7-16	.15	
		16-36	.10	
JODERO		0-24	.28	5
		24-70	.24	
JOPLIN		0-8	.37	5
		8-60	.43	
JORDAN		0-7	.55	1
		7-60	.43	
JORNADA				
JUDITH		0-10	.32	4
		10-26	.37	
		26-44	.28	
		44-60	.15	

SOIL SERIES		DEPTH INCHES	K	T
JUDY		0-8	.37	5
		8-28	.37	
JUGET		0-14	.10	1
JULESBURG		0-6	.24	5
JUNCTION		0-60	.24	5
JUDSON			.28	5
JURA		0-60	.24	5
JUVAN				-
KADE		0-10	.24	2
		10-30	.28	
		30-42	.55	
KADOKA			.32	4
KALISPELL		0-8	.32	5
		8-45	.37	
KAMACK		0-6	.20	2
		6-15	.43	
		15-44	.24	
KANOSH		0-18	.32	3
		18-34	.49	
		34-72	.37	
KAPOD		0-13	.17	2
		13-65	.20	
KARDE		0-60	.37	5
KARRO		0-15	.49	5
		15-60	.43	
KASSLER		0-6	.10	5
		6-60	.10	
KATHER		0-7	.15	2
		7-32	.20	
KEARNS		0-9	.43	3
		9-39	.49	
		39-76	.55	
KEBLER		0-9	.15	2
		9-13	.15	
		13-24	.10	
KECH		0-4	.28	1
		4-16	.32	
KEELDAR		0-10	.10	5
		10-60	.10	
KEIGLEY		0-65	.43	5
KEISER		0-12	.37	5
		12-50	.32	
KEITH			.32	5
KELVIN		0-13	.28	5-4
		13-60	.37	
KEMMERER		0-4	.32	3
		4-24	.37	
KENNEBEC			.32	5
KENO		0-4	.24	5
		4-25	.32	
		25-48	.28	
KENSAL		0-32	.28	4
KENSPUR				
KEOTA			.32	4
			.37	4
KERMIT		0-84	.15	5
KERMO		0-64	.15	5
KERRICK		0-10	.32	2
		10-31	.32	
KERSICK		0-17	.32	1
KERWIN		0-66	.43	5
KESSLER	L	0-3	.32	2
	CBV-L	0-3	.24	2
		3-60	.43	
KETTLE		0-26	.10	5
		26-40	.10	
		40-60	.10	
KETTNER		0-17	.28	2
KEVIN		0-30	.32	5
		30-60	.37	
KEYA			.32	5
KEYNER		0-6	.17	5
		6-18	.24	
		18-60	.32	
KEZAR		0-10	.20	3
		10-26	.17	
KIDMAN		0-11	.43	3
		11-60	.55	
KIEV		0-12	.32	5
		.37		
KILBURN		0-11	.20	2
		11-60	.17	
KILDOR		0-10	.28	2
		10-30	.24	
KILFOIL		0-3	.17	2
		3-21	.28	
		21-30	.32	
KILLPACK		0-29	.43	2
KILN		0-10	.28	1
KIM		0-6	.37	5
		6-60	.43	
KIMBROUGH		0-8	.28	1
KIMMONS		0-8	.24	2
		8-30	.32	
KINESAVA		0-39	.24	3
		39-60	.20	

SOIL SERIES	DEPTH INCHES	K	T
KINKEAD	0-7	.32	5
	7-55	.28	
KINNEAR	0-10	.32	5
	10-60	.28	
KINREAD	0-66	.43	5
KIPPEN	0-15	.15	5
	15-60	.15	
KIRKHAM	0-34	.24	5
	34-68	.55	
KIRTLEY	0-4	.37	3
	4-30	.49	
KISSICK	0-11	.37	5
	11-60	.43	
KITCHELL	0-60	.17	2
KITTREDGE	0-8	.28	4
	8-24	.28	
	24-48	.28	
KITTSON	0-11	.24	5
	11-60	.32	
KIWANIS	0-9	.32	3
	9-36	.20	
	36-60	.10	
KJAR	8-0		
	0-60	.32	
KLONDIKE	0-14	.20	1
KLOTEN	0-16	.32	2
KNUTSEN	0-33	.10	3
	33-60	.10	-
KOBAR	0-6	.32	5
	6-66	.37	
KOKAN	0-60	.15	5
KOLLS		.28	5
KOLOB	0-10	.20	2
	10-52	.10	
KOONICH	0-23	.20	5
	23-40	.32	
	40-60	.15	
KORCHEA	0-60	.32	5
KORNMAN	0-12	.32	5
	12-60	.20	
KOVICH	0-29	.32	3
	29-60	.10	
KRANZBURG		.32	4
	-	.32	5
KRATKA	0-21	.17	5
KRAUSE	0-17	.28	2
	17-53	.10	
KREM	0-30	.17	5-4
	30-60	.37	
KREMLIN	0-66	.37	5
KRENTZ	0-4	.43	2
	4-8	.37	
	8-14	.10	
KUBE		.32	5
KUBLER	0-15	.24	5
	15-47	.17	
	47-60	.32	
KUMA	0-10	.32	5
	10-30	.37	
	30-60	.32	
KURO	0-15	.37	1
KUTCH	0-7	.20	2
	7-30	.20	
KUTLER	0-6	.10	2
	6-23	.10	
KYLE	0-4	.43	5
	4-60	.37	
LABARGE	0-5	.24	5
	5-16	.20	
	16-60	.10	
LA BRIER	0-49	.32	5
	49-77	.37	
LACHAPELLA	0-5	.28	4
LACITA	0-72	.49	5
LADDER	0-16	.28	1
	5-60	.37	
LADELLE	0-60	.28	5
LADNER	0-6	.17	3-2
	6-60	.28	
LAFONDA	0-8	.43	5
	8-60	.37	
LAHRITY		-	
LAIL	0-11	.32	6
	11-38	.28	
	38-60	.37	
LAJARA	0-22	.24	5
	22-60	.24	
LAKE CREEK	0-6	.28	2
	6-20	.32	
	20-30	.28	
LAKEHELEN	0-20	.32	4
	20-50	.28	
LAKE JANEE	0-66	.28	2
LAKEPORT		-	-
LAKESHORE	0-51	49	1

SOIL SERIES	DEPTH INCHES	K	T
LAKEWIN	0-27	.17	2
	27-60	.10	
LAKOA		.32	5
LAKOMA		.28	4
LALANDE	0-50	.37	5
LALLIE	0-60	.37	5
LAMANGA	0-6	.32	5
	6-19	.37	
	19-60	.17	
LAMARSH	0-5	.24	2
	5-24	.17	
LAMBERT	0-60	.37	5
LAMBETH	0-66	.43	3
LAMBMAN	0-3	.32	1
	3-14	.37	
	14-18	.43	
LAMO		-	
LAMONDI	0-28	.20	5
	28-73	.32	
LAMOURE	0-60	.28	5
LAMPHIER	0-16	.28	5
	16-60	.28	
LAMPSHIRE GR-S L, [illegible]-L, CB-L, CB-SIL	0-8	.32	1
GRV-L, CRV-L	0-8	.28	1
CBV-SL,GRV-SL,GR-SL,CB-SL	0-8	.15	1
LANE		.28	5
LANEY	0-4	.32	5
	4-60	.43	
LANGHEI	0-60	.32	5-4
LANKIN	0-24	.28	5
	24-60	.37	
LANTIN	0-4	.28	5
	4-22	.24	
	22-60	.28	
LANTRY		.43	4
LAP	0-4	.32	1
	4-19	.28	
LA PALMA SL	0-7	.20	2
L,VFSL,SIL	0-7	.55	2
	7-27	.37	
LAPLATTA	0-8	.20	3
	8-35	.28	
	35-55	.32	
LAPORTE	0-16	.32	1
LAPRAIRIE	0-60	.28	5
LARAND	0-16	.24	3
	16-32	.24	
	32-60	.28	
LARGO	0-65	.49	5
LARIM	0-15	.24	2
	15-60	.10	
LARIMER	0-7	.24	2
	7-22	.32	
	22-30	.10	
	30-60	.10	
LARKSON	0-20	.15	5
	20-60	.28	
LARRY			
LARSON	0-60	.32	3-2
LARVIE		.28	4
LAS		.32	3
LAS ANIMAS	0-6	.17	5
	6-60	.15	
LASAUSES	0-10	.17	5
	10-60	.24	
LASIL	0-9	.43	1
	9-48	.43	
LAS LUCAS	0-45	.49	4
LASSEL	0-8	.32	3
	8-26	.43	
	26-60	.10	
LATENE L	0-11	.49	5
FSL	0-11	.28	5
	11-37	.43	
	37-50	.15	
LATOM	0-8	.24	1
LAUREL	-	-	-
LAVATE	0-60	.28	5
LAVEEN SL	0-13	.15	5
L	0-13	.49	5
CL	0-13	.37	5
	13-60	.49	
LAVERKIN	0-60	.37	4
LAVINA	0-6	.43	1
	6-19	.37	
LAWTHER	0-60	.32	5
LAYTON	0-66	.20	5
LAZEAR	0-4	.20	1
	4-14	.20	
LEA	0-10	.28	3
	10-26	.32	
LEADVILLE	0-8	.28	5
	8-40	.10	
	40-60	.10	
LEAL	0-4	.15	5
	4-60	.10	

SOIL SERIES	DEPTH INCHES	K	T
LEAPS	0-60	.24	5
LEATHAM	0-10	.28	1
	10-54	.43	
LEAVITT	0-7	.32	5
	7-38	.37	
	38-60	.43	
LEAVITTVILLE	0-11	.28	5
	11-28	.43	
	28-60	.20	
LEBO	0-28	.32	5
	28-50	.28	
LEBSACK	0-6	.20	5
	6-34	.28	
	34-60	.28	
LEDGEFORK	0-13	.17	2
	13-31	.20	
	31-60	.24	
LEDRU	0-4	.28	1
	4-17	.32	
LEEDS	0-15	.37	5
	15-60	.37	
LEETON	0-9	.32	2
	9-36	.32	
	36-72	.20	
LEFOR	0-15	.20	4-3
LEHMANS	0-1	.32	1
C GR-C	1-14	.24	
GR-CL	1-14	.32	
LEHR	0-15	.28	3-2
	15-60	.10	
LELAND	0-38	.49	1
	38-58	.55	
LEMERT	0-60	.32	3
LEN	0-5	.37	3
	5-11	.32	
	11-30	.28	
	30-40	.15	
LENNEP	0-8	.49	5
	8-32	.37	
	32-73	.43	
LEOTA		.28	5
LEPLEY	0-66	.43	5
LESHARA	-	-	-
LETCHER	0-60	.28	3
LEWISTON	0-10	.20	4
	10-32	.24	
	32-50	.28	
LIBBINGS	0-34	.43	1
LIBBY	0-7	.28	5
	7-60	.32	
LIBEG	0-4	.28	5
	4-56	.24	
LICK	0-18	.37	5
	18-30	.32	
LICK CREEK	0-6	.32	1
	6-16	.37	
LIHEN	0-60	.17	5
LIKES	0-60	.15	5
LIMBER	0-3	.37	2
	3-15	.28	
	15-32	.24	
LIMON	0-4	.24	5
	4-60	.32	
LINNET	0-80	.43	5
LINOYER	0-60	.43	5
LINTON	0-60	.32	5-4
LISADE	0-60	.32	5
LISAM	0-15	.32	2
LISMAS	0-10	.43	2
LISMORE		.28	5
LITIMBER			
LITLE	0-10	.37	3
	10-22	.32	
LITTLEBEAR	0-23	.15	5
	23-60	.10	
LITTLE HORN	0-7	.43	2
	7-35	.37	
LITTLE POLE	0-16	.15	1
LITTSAN	0-2	.28	3
	2-24	.28	
LIVONA	0-15	.20	5
	15-60	.37	
LIZZANT	0-60	.20	2
LOBERG	0-12	.37	5
	12-27	.32	
	27-72	.28	
LOBERT		-	-
LOBURN		.37	3
LOCKERBY	0-38	.28	3
LODAR	0-20	.24	1
LOFTON	0-9	.32	5
	9-80	.32	
LOGAN	0-13	.20	2
	13-26	.32	
	26-45	.24	

SOIL SERIES	DEPTH INCHES	K	T
LOGGERT	0-19	.28	5
	19-60	.24	
LOHLER	0-60	.28	5
LOHMILLER		.37	5
LOHNES	0-60	.15	5
LOHSMAN	0-4	.28	2
	4-26	.37	
LOLO	0-18	.24	5
	18-60	.20	
LOLON	0-8	.32	3
	8-17	.28	
	17-28	.24	
	28-40	.10	
LOMA	0-5	.43	5
	5-28	.28	
	28-60	.32	
LOMITAS	0-13	.43	1
LONE PINE	0-6	.37	5
	6-40	.43	
LONE ROCK			
LONETREE	0-18	.10	5
	18-60	.10	
LONGMONT	0-60	.32	4
LONTI GR-L,CB-L	0-2	.43	5
GR-SL,SL	0-2	.15	5
	2-68	.28	
LOS ALAMOS	0-5	.28	3
	5-25	.37	
	25-40	.24	
LOS TANOS	0-24	.32	3
LOSEE GR-L	0-4	.17	2
GR-SL	0-4	.10	2
	4-17	.17	
	17-55	.28	
LOSTWELLS	0-60	.32	5
LOTHAIR	0-34	.32	5
	34-60	.37	
LOUP		-	
LOUVIERS	0-4	.32	1
	4-14	.37	
LOVELAND	0-11	.32	3
	11-30	.32	
	30-60	.10	
LOWRY		.32	5
LOZIER	0-8	.10	1
LUBRECHT	0-9	.37	2
	9-27	.43	
LUCKY	0-12	.15	2
	12-28	.20	
LUCKY STAR	0-13	.28	2
	13-35	.28	
	35-70	.28	
LUDDEN	0-60	.28	5
LUHON	0-8	.28	5
	8-60	.28	
LULUDE	0-22	.10	2
	22-30	.10	
LUNA CL	0-7	.37	2
CB-SIL	0-7	.49	
	7-30	.28	
	30-42	.49	
LUNCH	0-25	.10	5
	25-60	.22	
LUNDY	0-20	.28	1
LUPINTO	0-4	.32	5
	4-9	.28	
	9-60	.32	
LUTE		.24	1
LUTH	0-4	.49	5
	0-52	.43	5
	52-71	.24	
LUTON		.28	5
LUXOR	0-5	.24	1
LUZENA	0-10	.32	2
deep variant	10-34	.32	
LUZENA GR-L,CB-L	0-5	.43	1
GR-CL	0-5	.32	1
	5-20	.24	
LYMANSON	0-5	.32	3
	5-30	.43	
LYNNDYL	0-4	.15	4
	4-42	.24	
	42-72	.10	
LYNX FSL	0-2	.24	5
L	0-2	.49	5
	0-60	.37	5

SOIL SERIES	DEPTH INCHES	K	T
MABRAY CBV-L,GRV-L,STV-L	0-12	.37	1
L,CB-L,GR-L,GR-SIL,CB-SIL	0-12	.43	1
MACAR	0-38	.32	5
	38-62	.37	
MACFARLANE	0-18	.10	5
	18-40	.10	
	40-60	.10	
MACK	0-4	.20	5
	4-18	.28	
	18-36	.28	
	36-60	.10	
MADDOCK	0-60	.17	5
MAGNUS	0-60	.17	5
MACKEN		.28	5
MADDOCK		.17	5
MADUREZ	0-10	.20	5
	10-22	.32	
	22-60	.37	
MAGGIN	0-3	.32	3
	3-36	.28	
MAGINNIS	0-4	.28	1
	4-16	.24	
MAGNA	0-70	.28	1
MAGOTSU	0-17	.24	1
MAIDEN	0-6	.37	2
	6-13	.28	
	13-36	.24	
MAITLAND		.28	5
MAJADA	0-7	.24	3
	7-60	.17	
MAKOTI	0-34	.32	5
	34-60	.43	
MALJAMAR	0-24	.17	5
	24-50	.24	
MALPOSA		-	-
MALSTROM	0-25	.17	3
	25-60	.28	
MANASSA	0-60	.49	1
MANBURN	0-7	.10	1
	7-14	.10	
MANDAN	0-29	.32	5
	29-47	.43	
MANDERFIELD L	0-16	.24	2
GR-L	0-16	.20	2
	16-20	.10	
MANFRIED	0-60	.32	3
MANHATTEN	0-9	.20	5
	9-21	.24	
	21-29	.15	
	29-60	.20	
MANILA	0-17	.43	2
	17-42	.37	
	42-63	.43	
MANNING	0-23	.24	3
	23-60	.17	
MANSKER	0-12	.28	3
	12-66	.28	
MANTER	0-13	.15	5
	13-25	.15	
	25-60	.15	
MANVEL	0-4	.37	5
	4-60	.43	
MANTZ	0-4	.37	5
	4-24	.43	
	24-60	.55	
MANWOOD	-	-	
MANZANO	0-14	.28	5
	14-60	.32	
MANZANOLA	0-8	.24	5
	8-30	.28	
	30-60	.24	
MAPLE MOUNTAIN	0-10	.28	5
MARCETTA	0-10	.28	5
	10-33	.32	
	33-70	.28	
MARCIAL	0-52	.37	4
MARIAS	0-74	.37	5
MARICOPA	0-26	.37	5
	26-60	.10	
MARIPO	0-34	.17	3
	34-60	.10	
MARMARTH	0-7	.32	2
	7-35	.37	
MARRIOTT	0-22	.32	5
	22-61	.32	
MARSELL	0-10	.20	3
	10-33	.28	
	33-56	.20	
MARSHDALE	0-30	.37	4
	30-60	.37	
MARTINSDALE	0-6	.32	5
	6-14	.37	
	14-66	.32	
MARTINEZ	0-6	.43	5
	6-35	.24	
	35-60	.20	
MARTINI	0-70	.37	5
MARVAN	0-60	.37	5
MARY ELLEN	0-9	.20	1
	9-42	.28	
MARYSLAND	0-27	.28	4
MASCHETAH	0-65	.32	5
MATCHER	0-9	.15	3
	9-22	.15	
	22-60	.10	
MATHERS	0-2	.28	5
	2-7	.24	
	7-27	.15	
	27-60	.10	
MATHIS	0-13	.10	4
MAUGHAN	0-25	.28	3
	25-32	.49	
	32-60	.20	
MAUKEY	0-5	.37	3
	5-12	.32	
	12-48	.28	
MAURICE	0-13	.32	5
	13-60	.15	
MAWER		.20	3
MAX	0-16	.28	5-4
	16-60	.37	
MAXVILLE	0-18	.37	3
	18-32	.32	
	32-36	.10	
MAY DAY	0-17	.20	1
MAYFIELD	0-65	.37	5
MAYFLOWER	0-8	.24	5
	8-32	.32	
MAYLAND	0-9	.28	5
	9-14	.32	
	14-30	.24	
	30-60	.28	
MAYOWORTH	0-7	.37	2
	7-12	.43	
	12-34	.37	
MAYSDORF	0-4	.15	5
	4-10	.24	
	10-32	.28	
	32-60	.37	
MCALLISTER	0-2	.44	5
	12-47	.37	
	47-72	.28	
MCBETH	0-68	.28	5
MCCAFFERY	0-66	.15	5
MCCLAVE	0-19	.15	5
	19-60	.15	
MCCOOK		.28	5
MCCORMICK	0-11	.37	3
	11-72	.37	-
MCCORT	0-6	.20	5
	6-21	.24	
	21-31	.17	
	31-60	.24	
MCDONALD	0-10	.37	5
	10-42	.32	
	42-66	.37	
MCDONALDSVILLE	0-30	.28	5
	30-60	.17	
MCFADDIN	0-3	.20	5
	3-60	.24	
MCGAFFEY	0-60	.32	5
MCGINTY	0-19	.17	5
	19-60	.17	
MCILWAINE	0-3	.32	3
	3-33	.20	
	33-60	.10	
MCINTYRE	0-12	.17	2
	12-30	.32	
MCKENZIE	0-60	.28	5
MCKINNEY	0-6	.32	5
	6-60	.37	
MCMURDIE	0-14	.37	2
	14-33	.32	
	33-58	.49	
MCNARY CL	0-4	.32	5
C	0-4	.24	
	4-56	.20	
MCPAUL		-	
MCPHIE	0-12	.24	3
	12-60	.28	
MCQUARRIE	0-34	.20	2
MCRAE	0-60	.37	5
MCVICKERS FSL	0-15	.24	5
VFSL	0-15	.49	5
	15-22	.49	
	22-52	.24	
MEAD	0-6	.37	5
	6-60		
MEADIN		.28	3
MEANDER		-	-
MEDANO	0-12	.24	5
	12-60	.10	
MEETEETSE	0-3	.43	2
	3-24	.49	
	24-60	.43	
MELLENTHIN	0-15	.17	1
MELLAR	0-60	.55	1
MELOCHE	0-9	.32	4
	9-56	.37	
MELVILLE	0-5	.28	5
	5-23	.32	
	23-30	.28	
	30-60	.20	
MENDENHALL	0-10	.37	5
	10-60	.28	
MENDON	0-7	.32	3
	7-28	.32	
	28-48	.37	
MENEFEE	0-14	.32	1
MENOKEN	0-30	.43	3
MERDEN			
MEREDITH	0-30	.10	2
	30-60	.10	
MERGEL	0-10	.20	5
	10-60	.37	
MERNA	0-5	.37	5
	5-24	.43	
	24-60	.49	
MERINO	0-9	.28	1
MESA	0-4	.28	3
	4-20	.28	
	20-60	.10	
MESCAL	0-2	.24	5
	2-60	.49	
MESCALERO	0-10	.28	2
	10-28	.17	
MESITA	0-10	.24	2
	10-30	.28	
MESPUN	0-60	.10	5
METIGOSHE	0-26	.24	4-3
	26-60	.17	
METRE		.28	4
MICHELSON	0-5	.32	5
	5-38	.32	
	38-72	.24	
MIDDLE	0-12	.24	2
	12-28	.24	
MIDDLEWOOD	0-4	.28	1
	4-14	.32	
MIDESSA	0-10	.28	3
	10-60	.28	
MIDNIGHT	0-12	.28	1
MIDWAY	0-14	.43	1
MIKESELL	0-11	.32	4
	11-15	.37	
	15-45	.32	
	45-65	.37	
MILL	0-12	.15	5
	12-60	.15	
MILLARD L	0-10	.28	3
GR-L	0-10	.24	
	10-30	.28	
	30-72	.10	
MILLBORO	-	.28	5
MILLBURNE	0-4	.20	3
	4-8	.28	
	8-30	.10	
	30-60	.10	
MILLERLAKE	0-4	.28	5
	4-20	.37	
	20-60	.43	
MILLETT GR-SL,GR-LS	0-2	.15	5
GR-L	0-2	.49	5
	2-18	.37	
	18-40	.28	
MILL HOLLOW	0-34	.20	2
	34-60	.05	
MILLIKEN	0-14	.10	5
	14-60	.10	
MILLVILLE	0-12	.43	3
	12-65	.49	-
MILREN	0-3	.24	5
	3-60	.28	
MIMBRES	0-42	.43	5
	42-56	.28	
MINATARE	-	.28	1
MINCHEY	0-20	.37	3
	20-48	.20	
MINE	0-6	.10	5
	6-60	.10	

SOIL SERIES		DEPTH INCHES	K	T
MINERAL MOUNTAIN		0-8	.20	2
		8-34	.32	
		34-60	.43	
MINNEOSA		0-44	.17	5
		44-60	.37	
MINNEQUA		0-4	.32	2
		4-30	.32	
MINNEWAUKAN		0-60	.15	4
MION		0-14	.43	2
MIRABEL		0-23	.17	2
MIRACLE		0-4	.28	3
		4-30	.28	
MIRANDA		0-60	.32	3
MIRROR LAKE		0-16	.32	2
		16-70	.17	1
MIRROR		0-8	.15	3
		8-30	.10	
MISHAK		0-12	.10	5
		12-30	.10	
		30-60	.10	
MITCH	SIL	0-26	.24	5
	SL	0-26	.10	5
		26-60	.43	
MITCHELL			.43	5
MOANO		0-9	.43	1
MOBEETIE		0-10	.24	3
		10-60	.24	
MOBRIDGE			.32	5
MODALE				-
MODENA		0-6	.43	5
		6-54	.43	
MOEN		0-5	.32	2
		5-23	.37	
MOENKOPIE	SL,LS	0-9	.15	1
	GR-LS,GRV-LS	0-9	.10	1
	L	0-9	.49	1
MOEPITZ		0-30	.49	2
MOFFAT		0-60	.32	2
MOGOLLON		0-13	.28	5
		13-60	.37	
MOGOTE		0-8	.32	4
		8-37	.37	
		37-45	.20	
		45-60	.10	
MOHALL	SL	0-10	.20	5
	L	0-10	.49	5
	C,CL	0-10	.28	5
		10-35	.32	
		35-60	.20	
MOHAVE		0-11 (SL)	.49	5
	(L,CL)	0-11	.49	5
		11-55	.43	
		55-60	.37	
MOIESE		0-6	.32	
		6-11	.28	
		11-18	.20	
		18-60	.10	
MOKIAK		0-38	.10	3
MOLAS		0-18	.20	2
		18-33	.24	
MOLLMAN		0-34	.32	5
		34-60	.32	
MONAD		0-14	.37	5
		14-49	.37	
		49-74	.32	
MONDAMIN			.37	5
MONDEY		0-9	.20	5
		9-31	.32	
		31-60	.32	
MONROE		0-6	.28	5
		6-60	.37	
MONTE		0-7	.24	5
		7-60	.24	
MONTEROSA		0-12	.17	1
MONTICELLO		0-8	.37	5
		8-56	.43	
MONTOSA		0-6	.37	3
		6-18	.20	
		18-60	.10	
MONTOYA		0-60	.37	5
MONTVALE		0-18	.17	1
MONTWEL		0-12	.43	2
		12-37	.37	
MONUE		0-52	.49	4
MOODY			.32	5
		-	.32	4
MORD		0-16	.37	5
		16-70	.32	
MOREAU			.32	4
MORENO		0-8	.24	5
		8-14	.28	
		14-60	.20	

SOIL SERIES		DEPTH INCHES	K	T
MORET		0-6	.32	1
		6-15	.37	
MORGALA		0-4	.24	5
		4-29	.32	
		29-60	.32	
MORIARTY		0-60	.37	5
MORLING		0-14	.43	1
MORONI		0-60	.24	5
MOROP		0-10	.17	5
		10-25	.28	
		25-60	.32	
MORSET		0-7	.24	5
		7-18	.28	
		18-60	.24	
MORTENSON		0-12	.32	2
		12-60	.17	
MORTON		0-11	.32	4-3
		11-35	.43	
MORVAL		0-21	.32	5
		21-57	.43	
MOSCA		0-5	.10	5
		5-30	.15	
		30-60	.10	
MOSBY		0-30	.32	2
MOSHER			.43	3
MOSIDA		0-60	.43	5
MOSLANDER		0-60	.28	5
MOTA		0-60	.49	5
MOTOQUA		0-16	.10	2
MOTT		0-46	.20	5-4
		46-60	.15	
MOUNTAINVILLE		0-11	.15	1
		11-60	.15	
MOUNT HOME		0-17	.10	5
		17-60	.10	
MOWEBA		0-30	.20	3
		30-55	.24	
MOYERSON		0-18	.28	1
MUCET		0-17	.28	1
MUDRAY		0-2	.32	1
		2-12	.43	
		12-17	.37	
MUD SPRINGS		0-25	.15	2
MUGGINS		0-12	.15	5
		12-18	.15	
		18-50	.10	
		50-60	.10	
MUGHOUSE		0-4	.32	2
		4-24	.15	
MULT		0-14	.24	2
		14-24	.32	
MUNDOS		0-8	.24	5
		8-28	.28	
		28-60	.20	
MULLGULLO		0-2	.15	5
		2-18	.37	
		18-60	.10	
MULLINVILLE		0-4	.32	5
		4-12	.37	
		12-60	.43	
MUNJOR			.24	2
MUNK		0-17	.28	2
		17-32	.10	
MURDO			.24	2
MURDOCK		0-27	.43	2
MUSINIA		0-8	.20	5
		8-60	.32	
MUSSEL		0-41	.37	5
		41-47	.20	
		47-59	.37	
		59-73	.24	
MUSSELSHELL		0-7	.32	5
		7-26	.37	
		26-56	.24	
		56-72	.10	
MYSTEN		0-60	.10	5
MYTON	SL,L	0-6	.28	2
	ST-SL,ST-S	0-6	.20	2
		6-14	.32	
		14-36	.20	
NAGEESI		0-62	.28	5
NAHON		0-60	.32	3
NAKAI		0-60	.49	3
NAMBE		0-60	.15	5
NAMON		0-48	.49	4
NAPA		-	.43	3
NAPALTO		0-60	.49	5
NAPLENE		0-60	.37	5
NAPLES	L	0-20	.43	5
	SL	0-20	.28	5
		20-72	.49	
NARROWS				
NASER		0-60	.49	5

SOIL SERIES		DEPTH INCHES	K	T
NATHROP		0-8	.24	2
		8-15	.32	
		15-28	.43	
NATRONA				
NATURITA		0-4	.24	1
NAVAJO		0-60	.43	5
NEBEKER		0-14	.37	3
		14-55	.24	
		55-70	.43	
NECHE		0-10	.32	5
		10-60	.43	
NEDERLAND		0-7	.10	5
		7-20	.10	
		20-60	.10	
NEESOPAH		0-14	.24	5
		14-60	.24	
NEHAR		0-47	.10	2
NELMAN		0-10	.15	3
		10-26	.15	
NELSON		0-9	.20	3
		9-30	.20	
NEMOTE		0-3	.15	5
		3-80	.10	
NEOLA		0-12	.28	1
NEPALTO		0-60	.49	5
NEPESTA		0-15	.37	5
		15-60	.37	
NEPHI		0-10	.32	2
		10-33	.43	
		33-70	.55	
NESDA		0-8	.32	5
		8-60	.10	
NESKAHI		0-69	.49	5
NETO		0-13	.20	3
		13-38	.20	
		38-58	.15	
NETTLETON		0-18	.43	5
		18-30	.37	
		30-50	.32	
		50-66	.17	
NEVEE			.32	5
NEVILLE		0-10	.28	5
		10-60	.37	
NEVINE		0-17	.32	5
		17-32	.28	
		32-60	.17	
NEWCASTLE		0-60	.28	5
NEWCOMB		0-15	.24	5
		15-60	.10	
NEWFORK				
NEWKIRK		0-7	.24	1
		7-17	.28	
NEWLIN		0-8	.10	3
		8-17	.10	
		17-22	.10	
		22+	.10	
NIBLEY		0-13	.28	3
		13-43	.37	
		43-58	.43	
NICKEL		0-11	.17	2
		11-19	.17	
		19-60	.17	
NIELSEN		0-19	.28	1
NIHILL		0-8	.24	5
		8-60	.20	
NIKEY	SL	0-26	.24	3
	STV-SL	0-26	.20	3
		26-60	.24	
NIMBRO			.32	5
NIOBELL		0-60	.32	3-2
NIPPT		0-9	.28	2
		9-14	.24	
		14-40	.10	
NIRADA		0-13	.28	5
		13-60	.24	
NISHNA			.28	5
NISHON			.43	3
NIWOT		0-14	.28	5
		14-60	.10	
NOBE				
NODEN		0-5	.24	5
		5-20	.28	
		20-60	.37	
NOEL			-	
NOKHU		0-14	.28	5
		14-32	.28	
		32-60	.24	
NOLAM		0-9	.17	3
NOONAN		0-60	.32	3-2
NORA			.32	5
			.32	4
NORBERT		0-27	.37	1
NORCAN		0-15	.24	1
		15-60	.32	

SOIL SERIES		DEPTH INCHES	K	T
NORDIC		0-15	.20	4
		15-40	.24	
		40-70	.20	
NORKA		0-7	.32	5
		7-13	.32	
		13-60	.32	
NORREST			.37	4
NORRISTON		0-9	.10	3
		9-16	.10	
		16-60	.10	
NORTE		0-30	.10	2
		30-60	.10	
NORTHDALE		0-8	.43	3
		8-31	.37	
NORTONVILLE		0-12	.37	5
		12-60	.43	
NORWAY FLAT		0-12	.20	1
		12-60	.20	
NOVARY				
NUCLA		0-10	.32	5
		10-60	.32	
NUGGET		0-6	.37	5
		6-21	.32	
		21-50	.43	
NUMA		0-12	.20	5
		12-30	.20	
		30-60	.10	
NUNN		0-10	.24	5
		10-47	.28	
		47-60	.24	
NUTLEY		0-60	.28	5-4
NUTRAS		0-9	.28	5
		9-60	.15	
NUTRIOSO	CL	0-17	.37	5
	L	0-17	.55	5
		17-36	.55	
		36-44	.37	
		44-60	.20	
OAHE			.28	4
OAKDEN		0-7	.28	1
OAK LAKE			.28	5
OASIS		0-13	.32	5
		13-48	.49	
		48-60	.49	
OBRAST		0-60	.20	5
OBRAY		0-7	.24	4
		7-60	.32	
OBURN		0-7	.32	5
		7-36	.49	
		36-60	.15	
OCEANET		0-5	.24	1
		5-14	.28	
OGLALA			.32	5
OHAYSI		0-9	.28	1
		9-14	.17	
OJATA		0-8	.32	5
		8-60	.43	
OKATON			.32	2
OKO			.28	5
OKREEK			.28	4
OLDHAM		0-27	.28	5
		27-60	.43	
OLGA		0-11	.43	3-2
		11-60	.32	
OLJETO		0-69	.49	5
OLNEY		0-8	.24	5
		8-16	.32	
		16-22	.32	
		22-60	.24	
OLTON		0-8	.32	5
		8-80	.32	
OMADE			.32	5
ONASON		0-3	.24	1
		3-11	.20	
ONOVA			-	-
ONAWA			.28	5
ONEILL			.20	4
ONITA			.28	5
ONITE		0-60	.24	5
ONRAY		0-6	.32	5
		6-25	.28	
		25-60	.32	
OPAL			.28	4
ORCHARD		0-5	.28	3
		5-24	.28	
		24-60	.10	
ORDNANCE		0-4	.32	3
		4-34	.28	
ORDWAY		0-16	.24	3
		16-35	.32	
ORELLA		-	.32	2
OREM		0-72	.32	5

SOIL SERIES		DEPTH INCHES	K	T
ORO GRANDE		0-10	.28	1
		10-16	.17	
OROFINO		0-4	.32	5
		4-23	.28	
		23-48	.17	
ORSA		0-20	.10	5
		20-60	.10	
ORTIZ		0-28	.28	3
ORTON			.28	4
ORWET				
OSAKIS		0-14	.28	3-2
		14-60	.10	
OSCURA		0-60	.37	5
OSGOOD		0-30	.10	5
OSHA		0-32	.20	3
		32-50	.15	
OSMUND		0-10	.32	5
		10-30	.28	
		30-60	.20	
OSORIDGE		0-5	.20	2
		5-23	.28	
OSOTE		0-33	.24	4
		33-55	.28	
OSTLER		0-18	.28	5
		18-60	.28	
OTERO	(SL,FSL)	0-14	.10	5
	(GR-SL)	0-14	.10	5
		14-60	.10	
OUARD		0-2	.24	2
		2-16	.28	
OURAY		0-20	.24	2
		20-60	.10	
OVERGAARD	GR-L	0-10	.43	5
	LFS	0-10	.15	5
	FSL	0-10	.28	5
	GR-SL,GR-FSL	0-10	.15	5
		10-42	.20	
		42-52	.28	
OVERLY		0-60	.32	5-4
OWEN CREEK		0-6	.37	3
		6-36	.43	
PACK		0-60	.32	5
PACTOLA			.37	5
PAGODA		0-16	.23	4
		16-46	.43	
		46-60	.49	
PAGOSA		0-22	.24	4
		22-44	.28	
PAHREAH		0-12	.15	2
		12-38	.28	
PAICE		0-31	.28	2
PAINTROCK		0-4	.37	2
		4-12	.43	
		12-30	.32	
PAJARITO		0-5	.17	5
		5-60	.32	
PAKA			.32	5
PALA		0-3	.24	5
		3-18	.17	
		18-40	.15	
PALACIO		0-4	.20	3
		4-22	.28	
		22-44	.17	
PALISADE		0-16	.28	5
		16-72	.43	
PALMA		0-7	.24	5
		7-60	.28	
PALMER CANYON		0-4	.32	5
		4-28	.28	
		28-60	.20	
PALOMAS		0-16	.17	5
		16-66	.28	
PALOMINO	L	0-9	.49	1
	FSL	0-9	.24	1
	STX-FSL	0-9	.10	1
	STX-L	0-9	.28	1
		9-15	.17	
PALOS VERDES	GR-SL	0-1	.15	3
	GRV-SL	0-1	.10	3
	GR-L	0-1	.49	3
		10-21	.32	
		21-60	.20	
PANGUITCH		0-11	.28	5
		11-47	.20	
		47-56	.15	
PANKY		0-6	.32	3
		6-24	.32	
		24-60	.28	
PAOLI		0-20	.20	5
		20-25	.20	
		25-60	.20	
PARCHIN			.32	3

SOIL SERIES		DEPTH INCHES	K	T
PARIETTE		0-8	.43	2
		8-21	.37	
		21-30	.32	
PARKAY		0-8	.24	1
		8-60	.20	
PARLEYS		0-15	.32	3
		15-33	.32	
		33-60	.49	
PARLIN		0-11	.24	3
		11-31	.15	
		31-60	.10	
PARLO		0-11	.37	3
		11-30	.43	
		30-40	.15	
PARNELL		0-60	.28	5
PARSHALL		0-60	.20	5
PARTRI		0-15	.32	5
		15-28	.28	
		28-60	.28	
PASSAR		0-12	.17	3
		12-60	.37	
PASS CANYON		0-14	.15	1
PASSCREEK		0-4	.32	2
		4-14	.37	
		14-23	.28	
PASTURA		0-10	.32	1
PATENT		0-60	.32	5-4
PATIO		0-13	.15	2
		13-26	.20	
PATRICIA		0-17(FSL)	.24	5
		0-17(LFS)	.10	
		17-80	.24	
PAULSON		0-5	.37	5
		5-10	.49	
		10-34	.32	
		34-60	.49	
PAUNSAUGUNT		0-3	.20	1
		3-15	.17	
PAVANT		0-19	.28	1
PAVILLION		0-3	.24	3
		3-32	.28	
PAYMASTER				
PAYSON		0-4	.49	1
		4-24	.37	
		24-30	.55	
PECOS		0-56	.32	5
PEDRICK		0-17	.24	5
		17-60	.17	
PEELER		0-16	.15	5
		16-32	.15	
		32-60	.15	
PEETZ		0-9	.10	5
		9-28	.10	
		28-60	.10	
PEEVER		0-49	.28	5-4
		49-60	.37	
PENA		0-18	.24	3
		18-60	.17	
PENASCO		0-12	.20	1
PENDERGRASS		0-5	.24	1
		5-14	.24	
PENDROY		0-42	.37	5
		42-70	.43	
PENINSULA		0-7	.32	5
PENISTAJA		0-4	.24	5
		4-28	.32	
		28-60	.24	
PENITENTE		0-60	.15	5
PENNEL		0-60	.32	5
PENO			.28	5
PENROSE		0-12 (L)	.15	1
	(CN-L)	0-12	.10	1
PENSORE		0-3	.32	1
		3-12	.28	
PENTHOUSE	ST-L	0-3	.37	3
	CB-CL	0-3	.32	3
		3-27	.28	
		27-60	.24	
PERCETON		0-20	.15	3
		20-34	.15	
PERCIVAL				
PERELLA		0-18	.28	5
		18-60	.43	
PERITSA		0-31	.37	2
PERMA		0-15	.32	5
		15-60	.15	
PERRY PARK		0-12	.10	5
		12-60	.10	
PERRYVILLE	GR-L	0-9	.49	5
	SL	0-9	.17	
		9-38	.49	
		38-60	.20	

SOIL SERIES		DEPTH INCHES	K	T
PERSAYO		0-14	.37	1
PESCAR		0-22	.24	3
PESO		0-32	.17	2
PETEETNEET				
PETRIE		0-60	.49	5
PEYTON		0-9	.10	5
		9-13	.15	
		13-29	.10	
		29-60	.10	
PHAGE	L	0-13	.28	2
	CB-L	0-13	.24	2
		13-60	.10	
PHARO		0-8	.15	2
		8-29	.17	
		29-60	.37	
PHIFERSON		0-8	.24	2
		8-30	.28	
PHILDER		0-12	.32	1
		12-18	.17	
PHILLIPS		0-7	.43	5
		7-15	.37	
		15-78	.43	
PHILLIPSBURG		0-9	.28	5
		9-20	.32	
		20-60	.28	
PICAYUNE		0-53	.20	3
PICKRELL		0-19	.49	1
PICTOU		0-4	.20	2
		4-14	.20	
		14-60	.10	
PIERIAN		0-6	.15	5
		6-60	.10	
PIERRE		0-4	.32	2
		4-33	.37	
PIMA		0-8	.49	5
		0-26	.37	
		26-60	.32	
PIMA		0-9	.37	5
Sandy clay loam		19-40	.38	
subsoil		40-60	.20	
PIMER	CL,SICL	0-15	.32	5
	SIC	0-15	.24	5
		15-60	.37	
PINAL		0-12	.49	1
		12-60		
PINAL		0-34	.49	2
Moderately deep variant		34-45		
PINALENO		0-31	.37	5
		31-60		
PINAMT		0-22	.28	3
		22-60	.15	
PINATA		0-10	.28	3
		10-45	.20	
PINAVETES		0-60	.17	5
PINEDALE		0-5	.15	5
		5-23	.17	
		23-60	.10	
PINELLI		0-3	.32	5
		3-60	.37	
PINEQUEST		0-2	.32	4
		2-60	.10	
PINETOP		0-60	.24	5
PINKEL		0-13	.17	2
		13-30	.10	
PINO		0-10	.32	3
		10-16	.37	
		16-40	.28	
PINON		0-16	.28	1
PINTLAR		0-7	.28	5
		7-80	.32	
PINTURA		0-65	.20	5
PISHKUN		0-10	.32	5
		10-48	.28	
PIUTE		0-9	.49	1
PLACK		0-8	.32	1
PLAINVIEW		0-6	.24	3
		6-28	.20	
		28-60	.15	
PLATNER		0-10	.32	5
		10-18	.20	
		18-25	.32	
		25-60	.28	
PLATORO		0-18	.24	
		18-26	.10	
		26-60	.10	
PLAYMOOR		0-38	.28	5
		38-60	.43	
PLEASANT		0-5	.24	5
		5-50	.28	
		50-60	.24	
PLEASANT GROVE		0-21	.20	2
		0-21	.20	2
		21-60	.28	
PLEASANT VALE	GR-CL	0-17	.37	5
	L	0-17	.43	5
		17-60	.55	
PLEASANT VIEW		0-25	.32	5
		25-34	.37	
		34-67	.24	
PLOME		0-16	.10	5
		16-35	.17	
		35-60	.10	
PODO	GR-SL	0-6	.10	8
	LS	0-6	.10	2
		6-20	.24	
POGAL		0-4	.49	2
		4-60	.55	
POGANEAB		0-8	.28	5
		8-60	.37	
POJOAQUE		0-60	.28	5
POINSETT			.32	5
POKEMAN		0-3	.43	2
		3-10	.49	
		10-30	.55	
POKER		0-10	.28	2
		10-30	.37	
POLELINE		0-44	.17	2
POLEO		0-7	.32	5
		7-38	.37	
		38-60	.32	
POLEY	SCL	0-6	.37	5
	GR-SL	0-6	.15	5
		6-24	.24	
		24-60	.15	
POLICH		0-60	.37	5
POLSON		0-10	.37	5
		10-60	.43	
POLVADERA		0-40	.24	3
POMAT		0-10	.43	
		10-56	.53	
		56-65	.37	
PONCHA		0-8	.15	2
		8-27	.15	
		27-60	.10	
PONIL		0-4	.32	5
		4-60	.24	
POPPLETON		0-60	.15	5
PORTALES		0-15	.28	3
		15-60	.32	
POSANT		0-5	.17	1
		5-16	.10	
POST		0-6	.49	5
		6-67	.37	
POTTER		0-9	.28	1
POTTS		0-4	.37	5
		4-18	.43	
		18-60	.55	
POUDRE		0-10	.17	5
		10-60	.17	
POVERTY		0-10	.28	1
		10-30	.10	
POWDERHORN		0-17	.28	5
		17-24	.20	
		24-46	.20	
		46-60	.20	
PREATORSON		0-2	.28	1
		2-11	.17	
		11-60	.10	
PRESTON		0-6	.10	5
		6-64	.10	
PREWITT		0-14	.28	5
		14-60	.32	
PRIDHAM		0-5	.49	5
		5-25	.24	
		25-54	.37	
PRIETA		0-4	.28	1
		4-15	.32	
PRING		0-15	.10	5
		15-60	.10	
PRINGLE		0-19	.24	2
		19-60	.10	
PRITCHETT		0-12	.32	2
		12-24	.43	
		24-60	.17	
PROGRESSO				
PROMISE			.28	5
PROMO		0-14	.32	1
PROMONTORY		0-10	.20	2
		10-24	.24	
		24-30	.24	
PROSPER			.28	5
PROVO		0-15	.24	1
		15-60	.10	
PROVO BAY		0-60	.24	5
PROW		0-18	.37	1
PTARMIGAN		0-12	.20	2
		12-30	.10	
PUERCO		0-60	.37	5
PUGSLEY		0-4	.20	3
		4-24	.28	
PULLMAN		0-6	.37	5
		6-80	.37	
PULTNEY		0-9	.32	3
		9-24	.32	
PURGATORY		0-2	.49	2
		2-14	.20	
		14-34	.37	
PURNER		0-15	.49	1
PYLON		0-6	.37	2
		6-34	.43	
PYOTE		0-34	.17	5
		34-76	.24	
QUAKER		0-60	.43	5
QUAMON		0-16	.10	1
		16-60	.10	
QUANDER		0-8	.10	5
QUAY		0-50	.43	5
QUAZO		0-18	.10	2
QUEALMAN		0-5	.32	5
		5-60	.37	
QUEALY		0-10	.37	1
		10-15	.43	
QUERC		0-5	.37	3
		5-14	.49	
		14-35	.37	
QUIETUS		0-3	.32	2
		3-11	.37	
		11-27	.28	
QUIGLEY		0-50	.32	5
		50-60	.28	
QUIMBY				-
QUINNEY		0-8	.43	2
		8-39	.49	
		39-58	.43	
QUIVERA		0-3	.37	5
		3-28	.24	
		28-60	.43	
RABER			.28	5
RACHERT	GRV-L	0-8	.15	1
	GR-L	0-8	.20	1
		8-18	.10	
RADERSBURG		0-4	.28	5
		4-15	.28	
		15-60	.32	
RADNOR				
RAFAEL		0-60	.43	5
RAGO		0-9	.32	5
		9-41	.37	
		41-60	.28	
RAIRDENT		0-15	.37	5
		15-22	.32	
		22-60	.43	
RAKE		0-13	.17	1
RALLOD		0-3	.24	1
		3-12	.28	
RALPH			.32	4
RAMBLER		0-6	.28	5
		6-60	.32	
RANCE		0-50	.49	3
RANDMAN		0-6	.15	2
RANSLO			.37	5
RAPELJE		0-5	.32	5
		5-43	.37	
		43-60	.20	
RAPHO		0-60	.28	5
RAPLEE		0-22	.49	2
RARICK		0-8	.20	1
		8-21	.15	
RASBAND		0-30	.32	3
		30-60	.15	
RATAKE		0-10	.17	1
		10-15	.15	
RATON		0-9	.28	1
		9-15	.20	
RATTLER		0-7	.37	5
		7-55	.28	
RAUVILLE		0-27	.28	5
		27-60	.43	
RAUZI		0-8	.32	5
		8-24	.28	
		24-60	.24	
RAVALLI		0-4	.43	5
		4-15	.32	
		15-60	.37	
RAVOLA		0-60	.49	5
RAWAH		0-7	.28	2
		7-30	.28	
RAYADO				-
RAYNESFORD		0-16	.28	5
		16-28	.32	
		28-66	.24	

SOIL SERIES		DEPTH INCHES	K	T
RAZOR		0-28	.37	2
REAGEN		0-30	.32	4
		30-60	.32	
REAKOR		0-65	.37	5
RECLUSE		0-4	.32	3
		4-30	.37	
REDBANK		0-5	.37	5
		5-60	.43	
RED BUTTE		0-8	.24	2
		8-16	.24	
		16-60	.24	
REDCAN		0-15	.20	1
REDCHIEF		0-7	.28	5
		7-13	.32	
		13-34	.32	
		34-60	.24	
REDCLOUD		0-60	.17	5
REDCREEK		0-15	.43	1
REDFEATHER		0-8	.17	1
		8-12	.10	
		12-17	.10	
REDFIELD		0-60	.49	5
REDIG			.32	3
REDLANDS		0-7	.37	5
		7-18	.28	
		18-60	.32	
REDLODGE				
REDMANSON		0-5	.32	5
		5-60	.37	
REDNUN		0-10	.32	5
		10-42	.32	
		42-60	.32	
REDOLA	L	0-20	.32	5
	GR-L	0-20	.28	5
		20-60	.28	
REDONA		0-10	.24	5
		10-68		
REDRIDGE		0-10	.10	5
		10-26	.10	
		26-60	.10	
REDROB				-
RED ROCK		0-9	.37	5
		9-37	.37	
		37-84	.43	
REDSTOE			.28	4
RED SPUR		0-26	.28	4
		26-48	.37	
		48-56	.32	
REDSTONE			.28	4
REDTHAYNE		0-9	.24	5
		9-18	.28	
		18-60	.20	
REDTOM		0-12	.10	5
		12-60	.10	
REDVALE		0-4	.28	5
		4-20	.37	
		20-34	.32	
		34-60	.10	
REDVIEW		0-60	.49	5
REDWASH		0-6	.32	1
REE		-	.28	5
REEDER		0-36	.28	4-3
REEVES		0-79	.37	3
REFUGE		0-47	.43	1
		47-61	.17	
REGAN		0-60	.32	5
REGENT		0-10	.37	2
		10-40	.43	
REGNIER			-	
REKOP		0-4	.37	1
		4-16	.43	
RELAN		0-13	.28	5
		13-26	.32	
		26-62	.20	
RELIANCE			.32	5
			.32	4
RELSOB		0-2	.20	5
		2-24	.28	
		24-60	.10	
REMMIT		0-44	.20	5
		44-62	.37	
REMUNDO		0-60	.37	5
RENBAC		0-12	.17	1
RENCALSON		0-5	.32	3
		5-32	.37	
RENCOT		0-4	.28	1
		4-14	.32	
		14-18	.28	
RENNER			.28	5
RENOHILL		0-7	.37	2
		7-14	.32	
		14-30	.37	

SOIL SERIES		DEPTH INCHES	K	T
RENSHAW		0-15	.28	3-2
		15-60	.10	
RENTILL		-	.28	3
RENTSAC		0-7	.28	1
		7-18	.24	
REPP		0-25	.24	5
		25-65	.28	
REPPART		0-10	.28	3
		10-39	.32	
		39-57	.28	
RESERVE		0-40	.37	5
RETRIEVER		0-8	.43	1
		8-14	.32	
REYAB		0-60	.49	5
RHAME		0-34	.20	4-3
RHOADES		0-49	.32	3
RHOAME		0-8	.28	5
		8-60	.24	
RHOAMETT		0-3	.37	5
		3-60	.32	
RICHEAU		0-4	.32	5
		4-60	.37	
RICHEN		0-19	.20	4
		19-56	.32	
RICHEY		0-5	.37	5
		5-24	.43	
		24-67	.37	
RICHFIELD		0-6	.32	5
		6-60	.37	
RICHLIE		0-28	.24	5
		28-64	.20	
RICHMOND		0-8	.28	1
		8-18	.28	
RICHVILLE		0-12	.28	3
		12-28	.43	
RICKMAN		0-4	.37	3
		4-30	.49	
RICKMORE		0-8 (SL)	.24	5
		0-8 (LFS)	.20	5
		8-32	.32	
		32-80	.32	
RICKS		0-4	.20	2
		4-18	.24	
		18-58	.17	
RICOT		0-8	.28	5
		8-16	.32	
		16-34	.17	
		34-60	.17	
RIDD		0-26	.17	1
		26-36	.17	
RIDGELAWN		0-24	.32	3
		24-60	.10	
RIDGEVIEW			.37	3
RILLINO	GR-L	0-11	.43	5
	GR-SL,GR-FSL	0-11	.15	
	GR-FSL,GR-SL	11-49	.17	
	GR-L	11-49	.43	
		49-60	.10	
RILLITO		0-2	.49	5
		2-10	.24	
		10-32	.43	
		32-41	.15	
		41-59	.43	
RILLOSO		0-45	.15	5
RIMROCK		0-34	.28	2
RIMTON		0-8	.32	3
		8-13	.37	
		13-36	.28	
RING		0-14	.28	5
		14-60	.17	
RINGLING		0-13	.28	3
RISTA				
RIVRA		0-8	.20	1
		8-60	.10	
RIZOZO		0-10	.32	1
ROB ROY		0-8	.24	1
		8-19	.24	
		19-31	.24	
ROBANA		0-6	.37	5
		6-20	.49	
		20-52	.43	
		52-60	.49	
ROBLEDO			-	
ROCK RIVER		0-3	.20	5
		3-10	.28	
		10-60	.24	
ROCKWELL		0-19	.28	5
		19-27	.15	
		27-48	.43	
ROCKY FORD		0-12	.32	5
		12-60	.37	
ROGERT		0-14	.10	1
ROLETTE		0-60	.32	5

SOIL SERIES		DEPTH INCHES	K	T
ROLISS		0-16	.28	5
		16-60	.37	
ROLLA		0-60	.32	5
ROMBERG		0-3	.32	5
		3-29	.28	
		29-60	.32	
ROMBO		0-20	.32	3
		20-30	.24	
RONAN		0-4	.43	5
		4-60	.37	
ROND		0-3	.49	3
		3-14	.32	
		14-54	.24	
RONSON			.20	4
ROOSET		0-7	.28	5
		7-11	.28	
		11-60	.20	
ROOTEL		0-23	.28	2
ROSAMOND		0-8(SL,FSL)		
		0-8(L,CL)		
		8-60		
ROSANE		0-28	.10	2
		28-60	.10	
ROSEBUD			.28	3
ROSEGLEN		0-60	.32	5
ROSHE SPRINGS		0-20	.24	1
		20-52	.43	
ROSWELL		0-88	.15	5
ROTHIEMAY		0-48	.32	5
		48-60	.28	
ROTTULEE		0-15	.37	1
		15-22	.32	
ROUBIDEAU		0-4	.28	5
		4-8	.28	
		8-12	.43	
		12-32	.37	
ROUND BUTTE		0-7	.37	5
		7-14	.32	
		14-67	.43	
ROUNDLEY		0-3	.32	3
		3-12	.37	
		12-24	.37	
ROUNDTOP		0-3	.49	2
		3-8	.32	2
		3-36	.24	
ROUNDUP		0-7	.32	3
		7-28	.37	
ROUNDY		0-16	.32	2
		16-31	.24	
		31-48	.24	
ROUTT		0-28	.24	5
		28-36	.28	
		36-60	.37	
ROXAL		0-6	.28	2
		6-15	.32	
ROXBURY			.32	5
ROY		0-6	.32	5
		6-60	.28	
ROZLEE		0-18	.24	2
		18-30	.24	
RUBY		0-6	.24	1
		6-13	.10	
RUDD		0-13	.43	1
RUKO		0-4	.24	1
		4-19	.24	
RULE		0-18	.15	2
		18-32	.15	
RUNE	L	0-2	.49	5
	CL,SICL	0-2	.37	
		2-23	.37	
		23-60	.24	
RUSO		0-22	.20	4
		22-60	.10	
RUSSLER		0-34	.43	3
RYAN		0-60	.28	3
RYAN PARK		0-4	.32	5
		4-60	.24	
RYARK		0-2	.15	3
		2-18	.24	
		18-30	.17	
		30-60	.10	
RYEGATE		0-9	.24	2
		9-17	.32	
		17-32	.28	
RYELL		0-8	.28	3
		8-28	.24	
		28-60	.10	
RYORP		0-34	.20	2

SOIL SERIES	DEPTH INCHES	K	T
SADDLE	0-14	.24	3
	4-14	.24	
	14-30	.28	
SADDLEBACK	0-10	.32	5
	10-60	.24	
SAGE			
SAGECREEK	0-4	.32	5
	4-60	.37	
SAGUACHE	0-10	.15	1
	10-60	.10	
SALADON	0-60	.15	5
SALAS	0-31	.17	2
SALIX			
SALMO		.28	5
SALTAIR	0-60	.55	1
SALT LAKE	0-6	.24	1
	6-66	.28	
SAMBRITO	0-4	.24	5
	4-60	.17	
SAMPSON	0-6	.24	5
	6-26	.24	
	26-60	.24	
SAMSIL		.28	2
SAN ARCACIO	0-4	.24	2
	4-26	.28	
	26-60	.10	
SANBORN		.43	3
SANCHEZ	0-17	.20	1
SANDALL	0-16	.23	2
	16-35	.24	
SANDIA	0-25	.20	3
	25-41	.17	
SANDLAKE			
SANDLEE	0-6	.32	5
	6-32	.28	
	32-60	.24	
SANELI	0-32	.28	3
	32-50	.17	
SANFORD	0-13	.17	2
	13-30	.17	
SANGREY	0-14	.24	.5
	14-34	.28	
	34-66	.24	
SAN ISABEL	0-5	.10	1
	5-18	.10	
	18-60	.10	
SAN JON	0-12	.32	2
	12-26	.37	
SAN JOSE	0-42	.32	5
SAN LUIS	0-7	.15	3
	7-30	.32	
	30-60	.10	
SAN MATEO	0-42	.32	5
SANPETE	0-11	.28	1
	11-60	.17	
SANPITCH	0-60	.32	1
SANSARC		.28	2
SANSON	0-3	.37	5
	3-60	.37	
SANTA FE	0-8	.20	1
SANTANA	0-8	.28	1
	8-12	.20	
SAPINERO	0-10	.17	3
	10-20	.17	
	20-36	.10	
	36-60	.10	
SAPPHIRE	0-8	.28	
	8-20	.32	2
SAPPINGTON	0-6	.28	5
	6-11	.32	
	11-30	.32	
	30-50	.24	
SARATON	0-5	.10	5
	5-60	.10	
SANTAQUIN	0-72	.32	5
SANTO TOMAS	0-40	.17	5
SARPY		.15	5
SATANKA	0-4	.37	3
	4-35	.28	
SATANTA		.28	5
SAVAGE	0-60	.32	3
SAVENAC	0-4	.49	5
	4-16	.43	
	16-27	.43	
	27-48	.37	
	48-63	.43	
SAVO		.32	5
SAVOIA	0-12	.24	5
	12-42	.28	
SAWATCH	0-28	.24	3
	28-60	.10	
SAWCREEK	0-21	.20	2

SOIL SERIES	DEPTH INCHES	K	T
SAWPIT	0-8	.24	1
	8-15	.24	
SAYLES	0-5	.32	5
	5-60	.37	
SAXBY	0-18	.24	1
SCAVE	0-16	.32	3
	16-34	.37	
	34-46	.20	
SCHAMBER		.17	2
SCHMUTZ	0-60	.24	5
SCHNEBLY	0-4	.37	1
	4-14	.20	
	14-25	.24	
SCHOFIELD	0-16	.15	2
	16-32	.15	
SCHOLLE	0-60	.28	3
SCHOONER	0-4	.17	1
	4-14	.32	
SCHRADER	0-7	.15	3
	7-60	.15	
SCHRAP	0-3	.28	1
SCHUSTER	0-18	.15	1
	18-29	.32	
	29-60	.28	
SCOBEY	0-6	.32	5
	6-19	.28	
	19-80	.32	
SCORUP	0-22	.43	3
	22-44	.43	
SCRAVO	0-6	.28	2
	6-17	.15	
	17-30	.10	
SCOTT			-
SCOUT	0-18	.43	2
	18-32	.24	
	32-62	.32	
SCROGGIN	0-28	.37	2
SEARING	0-28	.28	4-3
SEBUD	0-4	.32	5
	4-22	.37	
	22-49	.32	
	49-62	.37	
SEDILLO	0-60	.17	4
SEDWELL	0-47	.32	3
SEEDSKADEE	0-4	.24	2
	4-12	.24	
	12-16	.28	
SEELEZ	0-68	.20	5
SEIS	0-30	.17	2
SEITZ	0-14	.17	5
	14-32	.17	
	32-60	.10	
SELON	0-30	.24	5
	30-60	.32	
SEN	0-6	.32	4-3
	6-34	.43	
SERDEN	0-60	.15	4-3
SERNA			
SEROCO	0-60	.15	5
SESSIONS	0-13	.17	2
	13-61	.24	
SEVY	0-16	.24	2
	16-60	.32	
SHAAK	0-6	.37	5
	6-15	.32	
	15-44	.43	
	44-60	.28	
SHALEY	0-12	.24	1
SHAM	0-60	.32	5-4
SHAMBO	0-46	.28	5
	46-60	.15	
SHANE	0-5	.37	2
	5-28	.32	
SHANTA	0-60	.32	4
	50-60	.10	
SHARLAND	0-4	.32	2
	4-12	.28	
	12-16	.20	
	16-60	.10	
SHARPS	0-9	.20	5
	9-25	.28	
	25-30	.28	
SHARROTT	0-7	.24	2
	7-17	.28	
SHARVANA	0-6	.24	1
	6-14	.32	
SHAVANO	0-4	.32	2
	4-26	.37	
SHAWA	0-60	.28	5
SHAWMUT	0-16	.32	5
	16-28	.37	
	28-60	.15	

SOIL SERIES		DEPTH INCHES	K	T
SHAY		0-12	.32	3
		12-60	.32	
SHEAR		0-60	.28	5
SHEDADO		0-36	.49	2
SHEEP CREEK		0-7	.32	1
		7-15	.24	
		15-28	.28	
SHEEPROCK		0-60	.10	5
SHENA			.37	2
SHEPPARD		0-60	.49	5
SHERBURNE		0-18	.32	5
		18-46	.37	
		46-90	.28	
		90-100	.32	
SHERLOCK		0-16	.37	5
		16-42	.32	
		42-60	.28	
SHERM		0-5	.37	5
		5-80	.37	
SHERRYL		0-3	.32	5
		3-9	.37	
		9-60	.43	
SHINBARA		0-2	.37	1
		2-8	.43	
SHINDLER			.28	5
SHINGLE		0-4	.32	2
		4-15	.49	
SHIPMAN		0-10	.15	5
		10-60	.10	
SHIPROCK		0-60	.24	5
SHIRK		0-6	.32	2
		6-26	.43	
SHONKIN				
SHOOF		0-26	.32	5
		26-64	.28	
SHOOFLIN		0-12	.32	3
		12-51	.28	
SHOOK		0-16	.17	5
		16-28	.20	
		28-40	.15	
SHOSHONE				
SHOTWELL		0-12	.24	1
SHOWALTER		0-10	.20	3
		10-30	.20	
		30-56	.28	
SHOWLOW		0-3	.43	4
		3-31	.43	
		31-44	.43	
		44-52	.37	
SHRINE		0-60	.32	5
SHUE			.17	5
SHUGE		0-17	.28	1
SHULE		0-16	.28	3
		16-36	.28	
SHUPERT		0-2	.28	5
		2-43	.37	
		43-72	.49	
SHUMWAY		0-60	.28	5
SHURTLEFF		0-4	.17	5
		4-18	.20	
		18-60	.15	
SIBYLEE		0-8	.32	1
		8-15	.37	
SICKLESTEETS		0-8	.28	5
		8-27	.24	
		27-45	.28	
		45-72	.24	
SIEBERT		0-15	.10	2
		15-33	.10	
SIECHE			.28	5
SIELO		0-9	.32	2
		9-60	.24	
SIESTA	CB-SIL	0-5	.49	3
	SIL	0-5	.55	
		5-31	.24	
		31-46	.32	
SIGNAL		0-2	.43	5
		2-19	.20	
		19-60	.28	
SIGURD		0-60	.24	1
SILI				-
SILVER		0-60	.32	5
SIMMONT		0-5	.20	2
		5-22	.28	
		22-30	.37	
SIMONA		0-16	.24	1
SINAI		0-35	.28	5
		35-60	.43	
SINGAAS			.28	5
SINNIGAM		0-6	.24	1
		6-17	.20	

SOIL SERIES	DEPTH INCHES	K	T
SIPPLE	0-7	.28	5
	7-42	.32	
	42-60	.28	
SIOUX	0-5	.24	2
	5-60	.10	
SISSETON		.32	5
SIXMILE	0-4	.24	5
	4-30	.24	
SIZER SIL,L	0-8	.49	2
GR-SIL,GR-L	0-8	.43	2
GRV-SIL,GRV-L	0-8	.37	2
	8-18	.32	
	18-60	.10	
SKAGGS	0-14	.28	2
	14-34	.24	
SKUMPAH	0-60	.55	1
SKUTUM	0-17	.24	3
	17-36	.20	
	36-44	.24	
SKYLICK	0-27	.32	5
	27-60	.37	
SKYWAY	0-23	.15	3
	23-32	.15	
SLAUGHTER	0-5	.32	1
	5-15	.32	
SLIPMAN	0-11	.20	3
	11-27	.24	
	27-50	.20	
SLOCUM	0-14	.32	5
	14-40	.37	
SLUICE	0-5	.24	5
	5-13	.28	
	13-55	.24	
SMARTS	0-22	.32	3
	22-60	.32	
SMOOT	0-11	.43	5
	11-60	.49	
SMUGGLER	0-22	.20	3
	22-60	.25	
SNAKE HOLLOW	0-35	.24	3
	35-60	.10	
SNOMO		.28	5
SNOWVILLE	0-18	.32	1
SOLDIER CBV-L,GRV-L	0-11	.37	5
CB-L,GR-L	0-11	.43	5
	11-19	.15	
	19-62	.20	
SOFIA	0-7	.32	5
	7-40	.43	
	40-50	.10	
SOGZIE	0-80	.49	5
SOLOMON		.28	5
SOMERS	0-8	.28	3
	8-30	.37	
	30-60	.15	
SONOITA	0-60	.43	5
SONTAG	0-2	.32	5
	4-27	.24	
SORDO	0-6	.32	2
	6-13	.37	
	13-24	.32	
SORUM	0-15	.24	3-2
	15-33	.32	
	33-60	.24	
SOTELLA	0-9	.24	2
	9-22	.20	
SOTIM	0-50	.37	5
	50-60	.24	
SOUTHFORK	0-4	.15	1
	4-12	.20	
	12-15	.15	
SOUTHACE	0-4	.28	5
	4-60	.32	
SPAA	0-17	.37	1
SPACE CITY	0-60	.15	5
SPANGLER	0-6	.32	3
	6-36	.37	
SPEARFISH	0-8	.32	2
	8-16	.37	
SPEARMAN	0-15	.28	2
	15-23	.32	
SPENLO	0-14	.24	5
	14-64	.20	
SPICERTON	0-2	.32	5
	2-60	.32	
SPLITRO	0-8	.20	1
	8-16	.28	
SPONSELLER	0-4	.49	4
	4-42	.32	
SPOOL	0-2	.15	1
	2-7	.17	
SPOON BUTTE	0-6	.20	2
	6-16	.24	
SPOTTSWOOD	0-25	.28	4
	25-60	.10	
SPRINGER	0-16(LFS)	.17	5
	0-16(FSL)	.20	
	16-80	.20	
SPRINGERVILLE	0-4	.20	3
	4-39	.20	
SPUR	0-15	.28	5
	0-15(FSL)	.24	
	15-60	.28	
SPURLOCK	0-7	.24	5
(L,CL)	0-7	.28	
	0-28	.32	
STADY	0-29	.28	4
	29-60	.10	
STAGECOACH	0-16	.10	5
	16-60	.10	
STAPLETON	0-60	.10	5
STARLEY	0-9	.24	1
	9-15	.20	
STARMAN	0-4	.24	1
	4-8	.28	
STECUM	0-5	.20	1
	5-28	.15	
STEED	0-17	.32	2
	17-60	.10	
STEGALL	0-7	.32	2
	7-28	.32	
STEINAUER	-	.32	4
STELLAR	0-60	.28	5
ST. ELMO	0-10	.15	5
	10-30	.10	
	30-60	.10	
STERLING	0-16	.24	2
	16-48	.20	
STETTER		.28	5
STEWART L	0-9	.55	2
SL,FSL	0-9	.20	2
	9-22	-	
STICKNEY		.37	3
STINGAL	0-6	.43	3
	6-48	.55	
	48-74	.64	
ST GEORGE	0-60	.43	5
STILLMAN FSL	0-10	.55	2
GR-FSL	0-10	.43	2
	10-60	.10	
STIRK		.28	5
STIRUM	0-7	.24	3
	7-44	.32	
	44-60	.17	
ST MARYS	0-50	.20	1
STODA	0-11	.28	4
	11-67	.55	
STOKES	0-11	.49	1
	11-24	.37	
	24-68	.55	
STONEHAM	0-4(L)	.20	5
	0-4(SL)	.17	5
	4-9	.20	
	9-60	.20	
ST ONGE		.24	5
STORLA		.28	4
		.28	3
STORMITT	0-6	.28	5
	6-14	.37	
	14-28	.32	
	28-72	.28	
STORY	0-6	.32	3
	6-36	.37	
	36-60	.10	
STOUT	0-16	.24	1
STOVHO		.37	5
STRAIN	0-7	.28	5
	7-14	.49	
	14-60	.37	
STRAUSS			
STRAW	0-60	.32	5
STROUPE	0-24	.17	2
STRYKER			
STUBBS	0-6	.32	3
	6-34	.43	
STUKEY	0-29	.32	5
	29-60	.32	
STUMBLE			
STUMPP	0-3	.32	3
	3-32	.32	
	32-60	.10	
STUNNER	0-7	.15	5
	7-25	.24	
	25-60	.28	
STUTZMAN	0-60	.37	5
SUBLETTE	0-15	.24	5
	15-60	.28	
SUDDATH	0-4	.28	5
	4-20	.37	
	20-60	.43	
SUGARDEE	0-9	.28	4
	9-30	.43	
	30-60		
SUGARLOAF	0-19	.20	4
	19-60	.10	
SUGLO	0-11	.28	4
	11-60	.32	
SULA	0-9	.32	5
	9-22	.37	
	22-60	.32	
SULLY		.43	5
SUNBURST	0-6	.28	5
	6-60	.24	
SUNCITY	0-1	.43	1
	1-13	.43	
SUNSET	0-68	.43	5
SUNSHINE	0-21	.10	2
	21-36	.10	
	36-60	.10	
SUNUP	0-5	.28	1
	5-14	.32	
SUPERSTITION	0-60	.10	5
SUPERVISOR	0-22	.24	2
SVEA	0-21	.28	5
SVERDRUP	0-24	.20	3-2
	24-60	.15	
SWANBOY		.28	5
SWAPPS	0-15	.32	2
	15-23	.28	
SWASEY	0-4	.20	1
	4-27	.37	
SWASTIKA	0-11	.37	5
	11-30	.32	
SWEETGRASS	0-4	.28	3
	4-17	.24	
	17-26	.28	
	26-32	.17	
	32-60	.10	
SWENODA	0-29	.20	5-4
	29-60	.37	
SWIFT CREEK	0-8	.17	5
	8-60	.20	
SWIFTON	0-72	.24	5
SWIMS	0-4	.32	5
	4-25	.37	
	25-54	.43	
	54-60	.15	
SWINT		.32	5
SYRACUSE	0-60	.20	3
SYRENE	0-17	.28	2
	17-60	.17	
SYRETT	0-12	.10	2
	12-23	.24	
	23-38	.37	
TABERNASH	0-6	.24	3
	6-34	.32	
	34-60	.10	
TABIONA	0-7	.32	5
	7-60	.37	
TABLE MOUNTAIN	0-24	.28	5
	24-60	.32	
TACAN	0-60	.10	5
TACNA	0-2	.20	5
	2-41	.20	
	41-60	.15	
TAFOYA	0-14	.28	3
	14-39	.17	
	39-46	.24	
TAJO	0-3	.43	2
	3-28	.37	
TALAG	0-5	.37	5
	5-22	.28	
	22-49	.37	
TALLY	0-60	.20	5
TALMO		.20	2
TAMBIONA		-	-
TAMELY	0-15	.28	5
	15-62	.15	
TAMPICO	0-6	.32	5
	6-50	.28	
TANNA	0-6	.37	2
	6-27	.43	
	27-31	.24	
TANSEM	0-60	.28	5
TAOS	0-22	.24	3
	22-60	.15	
TAPIA	0-24	.28	3
	24-60	.24	

SOIL SERIES		DEPTH INCHES	K	T
TARKIO		0-9	.37	5
		5-60	.24	
TARRETE		0-60	.24	5
TARRYALL		0-10	.17	2
		10-30	.17	
TASSEL			.24	1
TASSELMAN		0-3	.24	1
		3-14	.24	
TATIYEE		0-12	.43	5
		12-30	.20	
		30-60	.32	
TAYLORSFLAT		0-20	.32	2
		20-72	.37	
TAYLORSVILLE		0-7	.32	2
		7-59	.43	
TEAPO		0-9	.24	3
		9-30	.28	
TEALSON		0-10	.15	1
		10-16	.10	
TECOLOTE		0-20	.17	5
		20-60	.17	
TEELER		0-4	.20	5
		4-10	.24	
		10-23	.17	
		23-60	.20	
TEEMAT		0-3	.20	5
		3-60	.24	
TELEFONO		0-14	.28	2
		14-26	.24	
		26-36	.15	
TELEPHONE	CBV-SL,STV-SL	0-17	.15	1
	CB-SL,ST-SL	0-17	.15	1
	GR-SL	0-17	.15	1
TELFER		0-60	.17	5
TELLMAN		0-8	.15	5
		8-30	.15	
		30-60	.10	
TELLURA		0-14	.17	5
		14-36	.10	
		36-60	.10	
TELSTAD		0-5	.28	5
		5-38	.37	
		38-62	.43	
TEMVIK		0-6	.32	5-4
		6-60	.43	
TENCEE		0-7	.15	1
TENEX		0-11		
		11-23	.24	
		23-70	.17	
TENIBAC		0-12	.32	5
		12-36	.24	
		36-48	.37	
TENORIO		0-6	.32	2
		6-22	.28	
		22-60	.10	
TENRAG		0-21	.28	3
		21-53	.32	
TENSLEEP		0-2	.43	5
		2-7	.47	
		7-60	.55	
TEOCULLI		0-60	.32	5
TEPEE				-
TERADA		0-3	.24	3
		3-29	.28	
TERINO		0-15	.17	1
TERMINAL		0-10	.37	2
		10-22	.43	
TERRAD		0-7	.43	5
		7-	.24	
TERRERA		0-15	.24	1
TERRY		0-5	.20	3
		5-14	.20	
		14-26	.20	
TESAJO		0-60	.24	5
TESUQUE				
TETON		0-6	.24	2
		6-32	.37	
		32-38	.24	
TETONKA			.24	3
TEX		0-10	.15	5
		10-45	.15	
		45-60	.10	
TEXLINE		0-10	.32	5
		10-80	.32	
TEZUMA		0-18	.49	2
		18-60	.28	
THAYNE		0-12	.32	5
		12-24	.32	
		24-60	.24	
THEBO		0-30	.24	2
THEDALUND		0-4	.32	2
		4-20	.32	
THERMOPOLIS		0-4	.43	2
		4-15	.55	
THESS			-	-
THIEL		0-20	.24	3
		20-60	.10	
THIOKOL		0-5	.37	3
		5-36	.43	
		36-60	.55	
THOENY		0-6	.49	5
		6-20	.28	
		20-60	.32	
THOROUGHFARE		0-4	.28	5
		4-60	.28	
THORREL		0-5	.37	3
		5-20	.28	
		20-30	.32	
		30-60	.10	
THREEMILE				
THUNDERBIRD	(CB-CL)	0-2	.32	2
	(ST-CL)	0-2	.32	2
		2-31	.37	
THURLONI		0-33	.28	3
THURLOW		0-4	.32	5
		4-60	.37	
THURMAN			.17	5
TIAGOS		0-12	.15	5
		12-60	.15	
TIBAN		0-23	.32	5
		23-60	.37	
TICELL		0-6	.32	1
		6-15	.37	
TIDWELL	SL	0-16	.17	1
	L	0-16	.49	1
TIFFANY		0-60	.20	5
TIGERON		0-7	.20	5
		7-13	.24	
		13-25	.32	
		25-66	.28	
TIGIWON		0-3	.15	3
		3-13	.24	
		13-60	.10	
TIGON		0-2	.24	1
		2-15	.28	
TIJERAS		0-19	.24	3
		19-40	.15	
TILFORD			.32	5
TILTON		0-12	.24	5
		12-60	.28	
TIMBERG		0-7	.32	2
		7-32	.37	
TIMPANOGOS		0-15	.32	3
		15-27	.43	
		27-60	.55	
TIMPOONEKE		0-11	.24	2
		11-60	.28	
TINAJA		0-60	.17	5
TINE		0-10	.15	3
		10-18	.10	
		18-60	.10	
TINGEY		0-60	.32	4
TINSLEY		0-4	.17	2
		4-60	.10	
TINYTOWN		0-12	.10	5
		12-60	.10	
TIPPER		0-28	.17	3
TIPPERARY		0-5	.17	5
		5-60	.15	
TISWORTH		0-3	.32	5
		3-8	.37	
		8-24	.49	
		24-60	.32	
TIVOLI		0-7	.17	5
		7-60	.17	
TOBLER		0-13	.28	5
		0-13	.37	5
		13-60	.28	
TOBISH		0-35	.10	1
TOBY		0-60	.24	5
TODDLER		0-60	.24	5
TOEHEAD		0-60	.37	5
TOHONA		0-5	.32	2
		5-34	.37	
TOLBY		0-80	.15	5
TOLMAN		0-4	.32	1
		4-7	.28	
		7-16	.24	
TOLNA		0-30	.28	4
		30-60	.10	
TOLTEC		0-36	.49	2
		36-60	.20	
TOLTEC variant		0-24	.37	2
		24-60	.20	
TOLUCA		0-9	.32	5
		9-60	.37	
TOLVAR		0-14	.15	5
		14-40	.10	
		40-60	.10	
TOMAH		0-11	.10	5
		11-17	.10	
		17-50	.10	
		50-60	.10	
TOMAS		0-15	.49	5
TOME		0-50	.43	5
		50-70	.24	
TOMICHI		0-10	.17	2
		10-60	.10	
TONCAN		0-24	.28	5
		24-60	.24	
TONGUE RIVER		0-5	.37	2
		5-9	.43	
		9-28	.37	
TONKA		0-19	.32	5
		19-60	.43	
TONRA		0-29	.32	3
		29-52	.10	
TONUCO		0-15	.15	1
TOOLE		0-5	.37	5
		5-66	.43	
TOONE		0-27	.24	3
		27-60	.28	
TOQUOP		-		
TOQUERVILLE		0-16	.10	2
TORCHLIGHT		0-4	.43	3
		4-60	.49	
TOREX		0-24	.17	5
		24-60	.32	
TORREON		0-6	.28	5
		6-60	.24	
TORRINGTON		0-5	.32	4
		5-40	.37	
TORSIDO		0-6	.17	2
		6-19	.15	
		19-30	.17	
		30-60	.10	
TORTUGAS	CBV-L	0-12	.37	1
	GRV-L	0-12	.37	1
TOSTON		0-2	.49	5
		2-16	.55	
		16-60	.43	
TOTELAKE		0-4	.24	5
		4-28	.15	
		28-60	.24	
TOTTEN		0-26	.32	3
		26-60	.10	
TOURS		0-60	.37	5
TOWNER		0-29	.17	5
		29-60	.37	5
TOYAH		0-16	.28	5
		16-55	.28	
TOZE		0-60	.28	4
TRAIL		0-12	.43	5
		12-60	.43	
TRAIL CREEK				
TRAPPER		0-6	.32	5
		6-23	.28	
		23-46	.32	
TRAPPS		0-6	.28	5
		6-59	.32	
TRAVELERS		0-16	.10	1
TRAVESSILLA		0-8	.24	1
TREBOR			.37	3
TRELONA		0-7	.32	2
		7-14	.37	
TREMANT		0-23	.32	5
		23-60	.43	
TREMBLES		0-60	.24	5
TRENT			.28	5
TRENTON		0-8	.37	1
		8-60	.24	
TRES HERMANOS		0-40	.28	3
		40-60	.17	
TRESANO		0-3	.24	5
		3-60	.28	
TRICON		0-7	.32	2
		7-33	.28	
TRIDELL		0-8	.32	3
		0-8	.28	3
		8-38	.20	
		38-50	.17	
TRINCHERA		-		
TRIPIT		0-4	.37	3
		4-12	.43	
		12-30	.49	
TRIPP			.32	5

SOIL SERIES		DEPTH INCHES	K	T
TRIX		0-60	.43	5
TROJAN		0-11	.20	2
		11-50	.15	
TROOK		0-7	.24	5
		7-12	.24	
		12-27	.28	
		27-60	.24	
TROUT CREEK		0-8	.24	2
		8-24	.37	
		24-30	.37	
TROUTDALE		0-9	.24	3
		9-24	.28	
		24-32	.24	
TROUTVILLE		0-3	.15	5
		3-60	.10	
TRUCKTON		0-8	.10	5
		8-24	.10	
		24-60	.10	
TRUEFISSURE		0-11	.24	5
		11-72	.28	
TRULL		0-8	.37	5
		8-50	.43	
TRULON		0-7	.37	2
		7-15	.43	
		15-30	.37	
TRUMP		0-16	.32	1
TSCHICOMA		0-48	.28	5
		48-52	.17	
TUBAC	GR-SL,SL	0-14	.15	5
	L,GR-L	0-14	.49	5
		14-31	.28	
		31-60	.28	
TUCSON	L	0-14	.49	5
	CL	0-14	.37	5
		14-36	.37	
		36-65	.49	
TUCUMCARI		0-60	.32	5
TUFFIT		0-4	.37	5
		4-12	.43	
		12-29	.37	
		29-48	.24	
TULAROSA		0-60	.37	5
TULLOCK		0-28	.20	2
TURK		0-7	.20	3
		7-24	.24	
TURKEYSPRINGS		0-45	.32	4
TURLEY		0-60	.28	5
TURNER		0-7	.24	3
		7-26	.32	
		26-30	.15	
		30-60	.10	
TURRAH		0-4	.28	4
		4-22	.32	
		22-38	.28	
		38-42	.24	
		42-60	.10	
TURNERVILLE		0-3	.43	5
		3-60	.49	
TURNEY		0-21	.32	3
		21-48	.20	
TURRET		0-9	.10	3
		9-18	.10	
		18-24	.10	
		24-60	.10	
TURSON		0-10	.32	5
		10-24	.37	
		24-60	.10	
TUSLER		0-12	.24	4
		12-26	.17	
TUTHILL			.20	4
			.28	4
TWILIGHT			.24	4
TWIN CREEK		0-7	.28	5
		7-30	.32	
		30-66	.37	
TWO DOT		0-7	.32	5
		7-60	.37	
TWOTOP			.28	5
TYRONE		0-7	.32	5
		7-27	.32	
		27-60	.32	
UBAR		0-10	.49	5
		10-60	.43	
UCOLA		0-10	.37	3
		10-72	.25	
UFFENS		0-60	.24	1
UINTA		0-12	.17	5
		12-60	.20	
ULA		0-5	.15	2
		5-17	.15	
		17-37	.20	
ULEN		0-60	.17	4

SOIL SERIES		DEPTH INCHES	K	T
ULM		0-9	.32	5
		9-60	.37	
ULRIC		0-9	.32	2
		9-21	.24	
		21-42	.28	
ULYSSES			.32	5
UNAWEEP		0-10	.15	5
		10-60	.15	
UNCOMPAGRE		0-14	.24	5
		14-60	.24	
UNSON		0-3	.28	5
		3-60	.32	
UPSATA		0-14	.17	2
		14-60	.10	
UPSON		0-33	.17	3
		33-36	.15	
UPTON		0-13	.28	1
URACCA		0-4	.17	1
		4-13	.15	
		13-17	.10	
		17-60	.10	
USHAR	L	0-9	.32	3
	CB-L	0-9	.28	3
		9-31	.37	
		31-60	.10	
UTABA		0-10	.24	5
		10-46	.32	
		46-60	.43	
UTALINE		0-4	.10	5
		4-60	.10	
UTE		0-8	.24	5
		8-36	.32	
		36-60	.28	
UTICA		0-6	.28	2
		6-19	.17	
		19-72	.10	
UVADA		0-5	.55	1
		5-48	.37	
VABEM		0-4	.32	2
		4-16	.43	
VADO		0-60	.17	5
VALE		0-60	.32	4-3
VALENCIA		0-26	.17	5
		26-60	.37	
VALENCIA saline-alkali		0-26	.17	5
		26-60	.37	
VALENT		0-4	.15	5
		4-60	.15	
VALENTINE		0-72	.10	5
VALLE		0-28	.49	5
		28-60	.28	
VALLEONO		0-9	.37	3
		9-24	.32	
		24-30	.32	
		30-60	.10	
VALLERS		0-60	.32	5
VALMONT		0-4	.24	3
		4-24	.32	
		24-60	.10	
VAMER		0-16	.28	1
VANAJO		0-60	.28	5
VANANDA		0-60	.24	5
VANDA		0-60	.24	5
VANET		0-14	.24	8
		14-21	.28	
		21-32	.32	
VANG		0-25	.28	4
		25-60	.10	
VANOCKER			.24	3
VAN WAGONER		0-20	.24	1
VASQUEZ		0-11	.10	5
		11-24	.10	
		24-60	.10	
VASTINE		0-30	.28	3
		30-60	.10	
VEBAR		0-32	.20	4
VECONT		0-14	.37	5
		14-41	.24	
		41-60	.32	
VEGA		0-15	.32	5
		15-52	.37	
VEKOL		0-3	.49	5
		3-33	.28	
		33-60	.15	
VELVA		0-60	.20	5
VENABLE		0-23	.28	5
		23-60	.10	
VENEZIA		0-2	.37	1
		2-10	.49	
VENLO		0-13	.20	5
		13-60	.15	
VERHALEN		0-60	.32	5

SOIL SERIES		DEPTH INCHES	K	T
VERMEJO		0-60	.37	5
VERNAL		0-4	.20	2
		4-24	.28	
		24-60	.10	
VERNON		0-21	.32	2
VETAL			.20	5
VEYO		0-19	.10	1
VIBLE		0-16	.24	5
		16-60	.15	
VIBORG			.28	5
VICTOR		0-26	.24	3
		26-36	.15	
		36-60	.10	
VIDA		0-5	.32	5
		5-60	.37	
VIENNA			.32	4
			.32	5
VIKING		0-60	.32	5
VILLA GROVE		0-8	.20	
		8-34	.20	
		34-44	.20	
		44-60	.32	
VILLY				
VINGO		0-18	.20	5
		18-48	.24	
		48-80	.32	
VINT	LFS,LS	0-12	.15	5
	FSL	0-12	.24	
		12-60	.15	
VINTON		0-60	.24	5
VIRKULA			.37	5
VOLGA			.28	4
VOLIN			.28	5
VONA		0-8	.10	5
		8-30	.10	
		30-60	.10	
VULCAN		0-8	.20	2
		8-16	.15	
		16-36	.15	
		36-60	.10	
WABEK		0-5	.28	2
		5-60	.10	
WAGES		0-4	.32	5
		4-14	.20	
		14-60	.28	
WAHPETON		0-60	.28	5-4
WAITS		0-17	.24	5
		17-23	.37	
		23-60	.32	
WAKONDA			.28	5
WALCOTT		0-30	.17	5
		30-60	.15	
WALDEN		0-10	.17	3
		10-35	.17	
		35-60	.10	
WALDROUP		0-7	.32	2
		7-35	.20	
		35-38	.28	
			.10	
WALKE			.32	5
WALL		0-6	.32	5
		6-60	.20	
WALLIS				
WALLROCK				
WALLSON		0-4	.17	5
		4-60	.28	
WALSH		0-10	.28	5
		10-60	.43	
WALSTEAD		0-8	.28	5
		8-22	.32	
		22-60	.28	
WALTERS		0-10	.32	5
		10-34	.24	
WALUM		0-40	.20	3-2
		40-60	.10	
WANBLEE			.32	1
WANETTA		0-6	.32	3
		6-17	.37	
		17-32	.28	
		32-60	.10	
WANN			.24	3
WARSING		0-18	.28	2
		18-60	.15	
WASA			.28	4
WASHOE				
WATERINO		0-8	.32	5
		8-39	.37	
		39-60	.32	
WATERS		0-8	.20	3
		8-29	.32	
WATROUS		0-24	.28	4
WAUBAY			.28	5

SOIL SERIES	DEPTH INCHES	K	T
WAUKON	0-9	.24	5-4
	9-60	.32	
WAYBE	0-5	.32	1
	5-18	.37	
WAYDEN	0-3	.43	1
	3-15	.43	
WEBER	0-9	.24	3
	9-32	.28	
	32-60	.10	
WEED			
WEISER			
WELD	0-5	.32	5
	5-19	.37	
	19-40	.28	
WELLSVILLE	0-7(L,CL)	.20	5
	0-7(GR-L)	.17	5
	7-20	.15	
	20-60	.10	
WELLTON	0-6	.10	5
	6-60	.15	
WEMINUCHE	0-20	.15	5
	20-36	.10	
	36-60	.10	
WEMPLE	0-12	.32	3
	12-40	.20	
	40-48	.15	
WENDOVER	0-4	.24	1
	4-10	.24	
	10-18	.17	
WENDTE		.28	5
WENTWORTH		.32	5
WERLOW	0-60	.32	5
WERNER	0-17	.28	3
WESSELL	0-8	.28	2
	8-33	.24	
	33-49	.10	
WESTCREEK	0-24	.15	5
	24-48	.32	
	48-60	.15	
WESTOVER		.32	4
WESTPLAIN	0-17	.32	2
	17-60	.10	
WETMORE	0-12	.10	1
WETTERHORN	0-20	.24	3
	20-36	.10	
WEWELA		.20	4
WHEATRIDGE	0-10	.24	3
	10-30	.37	
	30-60	.10	
WHEATVILLE	0-60	.28	4-3
WHITEFISH	0-8	.24	5
	8-40	.28	
WHITE HOUSE	0-3	.43	5
	0-3	.37	5
	3-26	.24	
	26-60	.37	
WHITELAKE		.24	3
WHITEWOOD		.28	5
WHITLOCK	0-29	.20	5
	29-60	.10	
WHITORE	0-7	.28	5
	7-50	.37	
WIBAUX	0-4	.28	1
	4-12	.24	
WIDTSOE	0-3	.10	2
	3-8	.20	
	8-15	.24	
	15-42	.20	
WIGTON	0-10	.10	5
	10-60	.10	
WILCOXSON	0-7	.28	3
	7-44	.24	
WILDCAT	0-2	.49	2
	0-2	.15	
	2-7	.55	
	7-32	.24	
WILEY	0-4	.37	5
	4-16	.37	
	16-60	.49	
WILLARD	0-60	.43	2
WILLHAND	0-4	.28	5
	4-7	.32	
	7-20	.28	
	20-60	.32	
WILLIAMS	0-24	.28	5-4
	24-60	.37	
WILLOUGHBY	0-6	.28	3
	6-30	.32	
	30-40	.10	
WILLOW CREEK	0-9	.32	5
	9-36	.37	
	36-60	.49	
WILLOWMAN	0-5	.28	5
	5-13	.24	
	13-60	.15	
WILLWOOD	0-5	.10	4
	5-60	.10	
WILTON	0-27	.28	5
	27-60	.37	
WINDHAM	0-6	.24	5
	6-12	.28	
	12-60	.20	
WINDMILL	0-23	.32	3
	23-60	.40	
WINEG SL,GR-SL	0-2	.17	5
L	0-2	.49	
	2-14	.37	
	14-60	.20	
WINETTI	0-17	.10	3
	17-24	.28	
	24-52	.20	
WINIFRED	0-36	.37	2
WINK	0-24	.20	3
	0-24(FSL)	.20	
	24-60	.20	
WINKEL	0-16	.15	2
WINKLEMAN	0-7	.32	5
	7-60	.37	
WINKLER	0-9	.20	5
	9-22	.24	
	22-80	.32	
WINN	0-13	.32	5
	13-60	.43	
WINNEMUCCA	0-11	.24	2
	11-18	.24	
	18-28	.17	
	28-42	.28	
WINNETT	0-6	.49	2
	6-30	.55	
WINONA	0-15	.43	1
WINTERSBURG CL	0-12	.37	5
C	0-12	.24	5
	12-60	.49	
WISCOW	0-9	.37	1
WISHARD	0-12	.28	5
	12-20	.32	
	20-58	.28	
WITCH	0-22	.10	1
WITT	0-47	.43	4
	47-60	.32	
WITTEN		.28	5
WOLF	0-4	.32	5
	4-14	.37	
	14-60	.32	
WOLFORD	0-4	.20	5
	4-21	.28	
	21-60	.17	
WOLF POINT	0-60	.32	5
WOODHALL	0-24	.10	3
WOODHURST	0-12	.28	2
	12-26	.32	
WOODLY	-	.20	5
WOODROCK	0-13	.17	2
	13-26	.24	
	26-30	.20	
WOODROW	0-60	.43	5
WOODS CROSS	0-37	.32	5
	37-72	.32	
WOODSIDE	0-18	.20	1
	18-27	.10	
WOOLY	0-9	.17	4
	9-46	.20	
WOONSOCKET		.20	5
WOOSLEY	0-12	.28	2
	12-35	.43	
WORF	0-5	.37	2
	5-9	.37	
	9-14	.43	
WORK	0-4	.32	5
	4-22	.37	
	22-38	.32	
	38-60	.28	
WORLAND	0-4	.20	2
	4-30	.24	
WORMSER	0-34	.43	2
WOROCK	0-10	.32	5
	10-26	.28	
	26-44	.32	
	44-68	.20	
WORTMAN		.32	3
WORTHING		-	-
WRENMAN	0-10	.32	2
	10-32	.37	
WYARD	0-32	.28	5
	32-60	.37	
WYARNO	0-4	.37	5
	4-60	.43	
WYNDMERE	0-60	.20	5
WYRENE	0-21	.20	3
	21-60	.15	
XAVIER	0-5	.37	
	5-62	.43	
YAKI	0-19	.10	2
YAMAC	0-5	.32	5
	5-60	.37	
YANA	0-50	.28	5
YANKEE	0-9	.32	5
	9-27	.28	
	27-60	.32	
YARDLEY	0-10	.28	5
	10-60	.43	
YAWDIM	0-15	.32	2
YEATES HOLLOW	0-11	.17	1
	11-46	.17	
YECROSS		.10	5
YEFULL	0-60	.15	5
YEGEN	0-7	.24	5
	7-34	.32	
	34-60	.28	
YELJACK	0-34	.20	5
	34-60	.37	
YENCE	0-16	.15	2
	16-42	.20	
YENRAB	0-60	.24	5
YEOMAN	0-16	.37	5
	16-34	.28	
YESUM	0-65	.43	5
YETULL	0-15	.15	5
	15-66	.10	
YOUJAY	0-1	.28	1
	1-14	.37	
YOUNGSTON	0-60	.37	5
YOURAME	0-10	.28	5
	10-52	.15	
	52-77	.24	
YOUVIMPA	0-4	.24	1
	4-15	.28	
	15-24	.32	
YTURBIDE	0-8	.15	5
	8-60	.10	
YUBA	0-60	.32	5
ZAHILL	0-60	.37	5
ZAHL	0-5	.28	5-4
	5-60	.37	
ZANE	0-13	.32	5
	13-60	.55	
ZEESIX	0-13	.28	2
	13-60	.17	
ZELL	0-11	.32	5-4
	11-60	.43	
ZENIFF	0-6	.55	5
	6-14	.24	
	14-60	.55	
ZEONA	0-60	.17	5
ZIEGLER	0-8	.37	2
	8-18	.24	
	18-24	.28	
	24-80	.10	
ZIGWEID	0-6	.32	5
	6-60	.43	
ZILLMAN	0-8	.28	5
	8-60	.20	
ZITA	0-7	.28	4
	7-60	.32	
ZUKAN	0-16	.28	2
ZUNI	0-16	.24	3
	16-36	.28	
	36-45	.24	

APPENDIX B

The following are Soil Conservation Service State Office Locations of the U.S. Interior West:

Soil Conservation Service
P O. Box 17107
Denver, Colorado 80217

Soil Conservation Service
3008 Federal Bldg.
230 No. First Ave.
Phoenix, Arizona 85025

Soil Conservation Service
517 Gold Ave. S.W.
Rm 3301 Box 2007
Albuquerque, New Mexico 87103

Soil Conservation Service
Rm 4012 Federal Bldg.
125 So. State Street
Salt Lake City, Utah 84138

Soil Conservation Service
Federal Bldg. Rm 270
Rosser Ave. & Third St.
P. O. Box 1458
Bismarck, North Dakota 58501

Soil Conservation Service
239 Wisconsin Ave. S.W.
Huron, South Dakota 57350

Soil Conservation Service
Federal Bldg.
P. O. 970
Bozeman, Montana 59715

Soil Conservation Service
Federal Bldg.
100 E. "B" St.
P. O. Box 2440
Casper, Wyoming 82601

APPENDIX C
COMMENTS MADE BY TRANSCRIPT REVIEWERS

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

LAND QUALITY DIVISION

STATE OFFICE BUILDING — TELEPHONE 307-777-7756 — CHEYENNE, WYOMING 82002

June 10, 1977

Mr. Arnold King
USDA, Soil Conservation Service
P.O. Box 17107
Denver, CO 80217

Dear Mr. King:

I appreciate the opportunity to review the draft copy of your anticipated publication. I shall be anxious to see this material published so that it shall be available for industry use.

I made numerous comments on the manuscript as I read through it. It is probably to late in the review process for many of my comments or recommendations to be given much consideration, however, I felt they should be made. I feel that use of this document, as it exists, may allow for conservative estimates and possible undesign of erosion treatments on surface mined lands. Many of my commments are directed toward developing more liberal estimates so that the trend will be to overdesign. I feel this is especially important when the accuracy of the equation results on surface mined lands has not been proven.

Keep up the fine work.

Sincerely,

Gary Beach
Soil Scientist

GB/fs
Enclosure

c.c.: Dan Kimball
U.S.E.P.A., Region VIII
Office of Energy Activities
1860 Lincoln St.
Denver, CO 80295

Comments on Draft "Preliminary Guidance for Estimating Erosion on Areas Disturbed by Surface Mining Activities - Interior Western U.S.".

Re: Section 3.2, para. 11, page 10, (Draft Copy).

It should be noted that the soils listed in Appendix A are of Established Series. There are numerous soils in Wyoming for which a series name has not been developed. Thus, not all soils mapped by the SCS in the interior states can be found in Appendix A.

Re: Section 3.3, para. 3, page 11, (Draft Copy).

In Wyoming there are many proposed final slope conditions that will exceed 400 feet horizontal distance (HI). We have accepted in mountainous or hogback terrain slopes as great as 1,200' HI. So, I feel it is untrue to make the statement that slopes in the Interior States will rarely exceed 400' in length, for in rough terrain it is quite customary to realize slopes of this length or slightly greater.

Re: Section 3.4, para. 4, page 13, and table 4, page 17.

The reported "C" values in table 4, are not applicable to conditions initially existing on retopsoiled surface mined lands. As indicated in the table title these are factors for permanent pasture and rangeland. The factors were derived to include a "type III - soil residual effect" (Wischmeier,1972). However, on retopsoiled surface mined lands the soil residual effect will be minimal, thus the factors for "Type III effect" would approach 1.0.

With omission of the soil residual effect a "C" factor for a site having "No appreciable canopy", "no canopy cover %", and no mulch or residue cover (column 3, table 4) would be near 1.0. This value differs significantly from the 9.45 value reported in column 4 -- table 4, which is the only value that a user could use for the site conditions listed in the previous sentence. Clyde et al (1976) list factors for bare soil conditions on construction sites ranging from 1.0 to 0.8. In my judgment these values more accurately represent "C" values for bare totally disturbed surface mine topsoil conditions during the initial year.

To make the "C" values more applicable to reclamation conditions their derivation should be basic to the anticipated minesoil - cover conditions. I suggest that "C" values which do not account for "Type III residue effect" (report in Wischmeier, 1972) be established for bare recently redistributed topsoil conditions. Primary emphasis in erosion control design will be in the initial years of revegetation.

Further, the factors listed in tables 4 and 5, when plugged into the equation will result in conservative estimates. Initial erosion and sedimation research on mined lands has indicated much higher rates of soil loss than those occurring on "natural" or nondisturbed sites. (Lusby and Toy, 1976; Gee et al, 1976). Thus, I recommend that all factors be weighted towards what would be considered liberal estimates. Based on the current accuracy of the equation for this situation it is better to overdesign than underdesign.

Re: Section 3.5, table 6, page 19 (Draft).

Enclosed as Table 2 are values I have encountered and adjusted to utilize for a "P" factor on surface mined lands. Note the terracing factor in column 4 Although the terracing factor in the table has limited usefulness in actual design, the following equation (1) can be utilized to break exceedingly long slope lengths down into acceptable lengths by terraces, level benches etc.:

Land Slope (%)	Number of Equally Spaced Intervals	
≥ 15	$n = (1/u)^{1.67}$	(1)

Where:

n = number of approximately equal-length intervals into which the field slope is divided.

u = permissable soil loss ratio (permissable soil loss (T/ac/yr) / RKLSCP).

Terracing may become an important tool for reclamation of exceedingly long and relatively steep slopes.

I have adjusted the contour furrowing factors (column 3 of enclosed table) for 19-24 and $\geq$ 25 percent slope upward to enable more liberal estimates for the steeper slope condition.

Is "contour stripcropping" an applicable erosion control treatment in surface mine reclamation? To my knowledge I do not know of it being a viable treatment. If you should question its useability then I would suggest you leave it out so as to not confuse the user with extraneous information.

Re: Section 4.0, para. 4, page 20.

Enclosed as Appendix A is a discussion on the "T" value or permissable soil loss level (PSL). Paragraph 3 of this appendix relates our attitude towards establishing a PSL for predictive measurements. We generally utilize 15T/ac/yr as a PSL for the initial years of reclamation. This value is utilized on construction sites for water qulaity control and control of sediment delivery to sediment traps, (Personal communications, George Foster, Hydraulic Engineer, Purdue University.

Re: Section 4.0, para. 6, page 21

Gee et al (1976) measured soil erosion using a rainfall simulator on a Flaxton sandy loam spread over mine spoil. They measured a 35% increase in the "K" value over that listed by the SCS or calculated by the Wischmeier nomograph. Because of these early results I suggest that the SCS K values be skewed upward to enable more liberal calculations or when estimating the "K" by the Wischmeier nomograph the mine soil be considered massive or structureless and the permeability reduced.

Re: Section 3.3, table 1, page 12.

As was stated earlier in the comments, we encounter numerous occasions in a reclamation contour map where final proposed slopes exceed 20% and are $\geq$ 400'. Thus, regardless of how speculative "LS" factors may be at this magnitude of slope conditions, it is important that "LS" values reported for these conditions are the best available and should be liberal rather than conservative.

Many of the values reported in table 1 for the greater slope - length conditions appear to be less than what has recently been accepted as more accurate.

Example:

Table 1 reports for 20% slope and 400 foot length a "LS" value of 8.0.

By the following equation where slope length (n) = 400' and % slope (S) = 20 :

$$LS = \left(\frac{.43 + .3(20) + .\text{-}43(20^2)}{6.613}\right)\left(\frac{400}{72.6}\right)^{0.6}\left(\frac{10,000}{10,000+(20^2)}\right) = 9.6$$

The above modified equation is from Clyde et al (1976) and a nomograph for "LS" values is shown in enclosed Figure 5-11.

It appears that the reported value of 8.0 in Table 1 was calculated using an exponent of 0.5 on the length fraction of the equation:

$$LS = \left(\frac{.43 + .3(20) + .043(20^2)}{6.613}\right)\left(\frac{400}{72.6}\right)^{0.5}\left(\frac{10,000}{10,000+(20^2)}\right) = 8.1$$

Clyde et al (1976) and Foster (personal communications, 1976) indicated that for slopes > 10% an exponent of 0.6 should be utilized on the length fraction of the equation.

I suggest that these changes be considered for Table 1.

References Cited

Clyde, C.G. et al. 1975. "Erosion Control During Highway Construction." Natl. Coop. High. Res. Program, Proj. 16-3, Transp. Res. Board. Natl. Res. Counc., Vol. II, 103p.

Foster, George. 1976. (Personal Communications). Purdue University.

Lee, G.W. et al. 1976. "Use of Soil Properties to Estimate Soil Loss by Water Erosion on Surface-Mined Lands of Western North Dakota." North Dakota Farm Research Vol. 34 (2).

Lusby, G.C. and T.J. Toy. 1976. "An Evaluation of Surface-mine Spoils Area Restoration in Wyoming Using Rainfall Simulation." Earth Surface Processes, Vol.1:375-386

Wischmeier, W.H. 1975. "Estimating the Soil Loss Equation's Cover and Management Factor for Undisturbed Areas." Proc. Sediment-Yield Workshop, 1972.

State of Montana
Office of The Governor
Helena 59601
Northern Powder River Basin EIS
Power Block Bldg., Rm. 221

THOMAS L. JUDGE
GOVERNOR

July 8, 1977

Mr. Arnold C. King
SCS, USDA
P.O. Box 17107
Denver, Colorado 80217

Dear Mr. King:

Through Messrs. Dan Kimball and Gary Parker of the EPA, Denver, I received a copy of your draft report on the application of the Universal Soil Loss Equation to surface mined lands in the West. I was asked to submit substantive comments directly to you. My comments are enclosed.

I necessarily view all slope erosion studies and applications as part of a larger picture, that of the drainage basin. Slope and channel processes are interrelated to the extent that generally only the basin unit provides a comprehensive perspective of erosion/deposition phenomena. Accordingly, I consider an application of the USLE to the reclamation process to be of limited utility. However, I concur with you in that it apparently is the best thing we have going at present which attempts to quantify even a portion of the action.

I must also point out that my experience primarily derives from Montana, and to a lesser extent, Wyoming. Therefore, my comments are biased towards this experience.

I hope the enclosed comments will be of some use to you. If you have any questions, please feel free to contact me.

Regards,

David Stiller

David Stiller
Hydrologist-Geologist
NPRB EIS State Team

DS:gs
Enclosure
cc: Dan Kimball, EPA
Gary Parker, EPA

Comments: "Preliminary Guidance for Estimating Erosion on Areas Disturbed by Surface Mining Activities in the Interior Western United States"

1) Numerous references are made in the text to research apparently in progress or in the planning stages. Inasmuch as a summary work of this type is only current as of a given manuscript date, it would be advantageous to the reader if the studies referred to are specifically described such that future readers will have an idea of when and where they were completed. If you and the SCS are involved in any of this research, it should be so stated.

A specific need is for the quantification of the K factor for surface mine reclamation areas. To a lesser extent, other factors of the USLE are also unquantified insofar as the mining process is concerned. As noted by researchers in North Dakota, "The applicability of the equation for mine spoil areas appears sound, but the coefficients K, C and S are not known with confidence at mine sites, since virtually no work has been done as yet to evaluate these factors on drastically disturbed lands." (Gee, et al., 1976). Research is in progress by Forest Service personnel involved with the SEAM Project in Bozeman, Montana, to derive the limits of K for surface mining situations.

I suspect that quantification of the K factor in the West will prove to be difficult, especially for topsoil salvaged from surface mining operations. Soil pH, salts, sodium concentrations, etc. are all substantially different in western soils than in the soils indigenous to the Midwest where the USLE was derived.

The accuracy of the R factor is subject to more than, as you state, "...upon how close the actual precipitation events match the yearly averages." The concept you mention is itself dependent upon both the length of record at the weather stations considered and the density of these stations over the area being mapped. Distribution of weather stations and records in the West is relatively sparse; therefore, the accuracy of R factor determinations is suspect when mapped at a small scale. Regional generalizations based on sparsely distributed data points tend to ignore significant local variations, such as orographic influences.

I see no easy way around the problem of inaccurate or misleading R factors, for solutions are always only as good as the data used. Nonetheless, it should be made very clear to the reader that R factors in the West are subject to regional error.

2) In the example problem on predicting soil loss, the assumption that K "may remain relatively constant if the surface soil is redistributed in the approximate vicinity where it was removed," is without basis in light of Montana experience. Until more definitive methods of defining post-mining K values are developed, and for the purposes of simplification if not accuracy, one might assume that pre-mining and post-mining K values are equal. However, it does not follow that topsoil will be redistributed over the recontoured spoils in the same general vicinities

as where it was initially collected. Topsoil salvaging operations, as practiced in Montana and much of Wyoming, involve operators scraping approximate surface thicknesses of all soil units and stockpiling everything together. Such being the case, it is impossible for the operator to redistribute the stockpiled soils in the same manner as they originally formed. Perhaps a better method of deriving a post-mining K value, until current studies are completed, may be to use a weighted average of K for all soil types found on the pre-mining site.

You also assume that major portions of reclaimed surface will be returned immediately to pastureland. I am not aware of how other states handle the matter, but Montana requires a minimum of a 5 year bond and reclamation period before the regulatory agency can release the surface for customary land uses. Put differently, no private grazing occurs for at least 5 years following initial reclamation and revegetation attempts. If other western states have similar practices you might consider them to make the text example representative of current techniques.

3) I find sections 4.0 and 5.0 to contain the most interesting material. In the first paragraph of the former, the rationale and practical limit of the USLE is stated: "The USLE was developed to predict soil loss from agricultural lands due to sheet and rill erosion. It does not account for gully erosion, which cannot be predicted by any known formula." You have accurately noted the original intent of the USLE, and you have cautioned the reader that at least one other geomorphic process may be unaccounted for in the equation. The potential user, especially if technically unfamiliar with the scope of erosion/deposition phenomena, must be made aware that sheet and rill erosion may account for only a minor portion of the erosion occurring on reclaimed slopes. It may be said that the primary difference between a rill and a gully is one of size; making the distinction between a large rill and a small gully may be difficult. For that matter, when does a rill become a gully?

Additional erosive processes also occur on reclaimed slopes in the West, none of which are measured by the USLE. These include, but are not limited to: wind action, piping, saturated flow, and soil creep. The relative magnitude of these processes, degree of interaction, and how they tie in with the channel processes which ultimately attempt to remove slope-deposited sediments from the basin are all virtually unknown. Indeed, to quantify all of the above would probably tax an innovative computer modeller. I doubt that the formulators of the USLE ever intended their equation to cover the above phenomena.

You state in Section 5.0 that, "Gross erosion can be estimated by use of the Universal Soil Loss Equation". I must take exception to this statement. Sheet and rill wash are only a few of the erosive activites operating on slopes in attempted reclamation areas. Likewise, it should be clear that the USLE only covers two processes and excludes the others. Until a comprehensive analysis is undertaken of the relative magnitude of all processes operating on post-mining slopes, I consider it premature to equate gross erosion with sheet and rill wash. Inasmuch as different processes may account for more sediment moved on post-mining slopes than in the undisturbed state, using the USLE as an estimate of gross erosion may provide estimates off by several orders of magnitude.

An additional point should be clarified, and that is your definition of gross erosion in the Glossary: "The total amount of water erosion occurring on a site. Includes sheet and rill and gulley (?) erosion." I have two observations. First, the use of the word gross implies an all-inclusive context, whereas your definition includes only water erosion, to the exclusion of wind and gravity, which may be equally as important. Second, your use of the term gross erosion in the text in Section 5.0 apparently is not intended to include gully erosion. (Section 4.0: the USLE, "...does not account for gully erosion, which cannot be predicted by any known formula.") I suggest that the definition be reworded.

I want to emphasize that my intent is not to disparage the possible value of a quantifiable method of comparing reclamation plans. I realize full well that it is frequently too easy to criticize without making suggestions for improvement. In this case, however, such suggestions may not be possible because science simply has not advanced sufficiently. Application of the USLE, however lacking and inappropriate in many cases, may be all we have. Nonetheless, I want to impress upon the non-technical reader that this application of the USLE should be used within very strict and well-defined limits. Too frequently, individuals use equations without an understanding of its inherent limitations. I wish to state those limitations at the outset.

Reference: Gee, G.W., Gilley, J.E., and Bauer, Armand, 1976, "Use of Soil Properties to Estimate Soil Loss by Water Erosion on Surface-Mined Lands of Western North Dakota", North Dakota Farm Research, vol. 34 (2), pp. 40-43.