RECLAMATION RESEARCH IN NORTH DAKOTA

PART B

RESEARCH PUBLICATION BRIEFS

EROSION AND RUNOFF (ER)

Title: **USE OF SOIL PROPERTIES TO ESTIMATE SOIL LOSS BY WATER EROSION ON SURFACE MINED LANDS OF WESTERN NORTH DAKOTA**

Authors: G.W. Gee, J.E. Gilley, and A. Bauer

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 34(2):40-43, 1976

Key Index Words: Erosion, Spoil Properties, Topsoil, K-Values

Brief Description

Using soil physical properties and Wischmeier's nomograph, soil erodibility (k) values were estimated for mined and unmined sites at Beulah, Center, Stanton, and Zap in North Dakota. Soil losses of up to 118 tons per acre were predicted to occur from reshaped mined land with steep slopes and covered with sandy loam topsoil. Seeding such areas into permanent pasture is advisable, but soil losses would still be high during the initial year of establishment. Reducing the slopes would minimize soil losses and optimize the land use.

Analysis of Conclusions

This paper discusses the implications of using the Universal soil loss equation and estimating soil erodibility factors for predicting water erosion from surface mined lands in western North Dakota. By comparing the erodibility of different soil types, spoil, and replaced soil materials, using calculated as well as SCS values, much useful information for developing water erosion control measures has been provided.

Title: **RUNOFF AND EROSION FROM SNOWMELT ON SURFACE MINE SITES IN WESTERN NORTH DAKOTA**

Authors: J.E. Gilley, G.W. Gee, and A. Bauer

Organization: North Dakota State University, Fargo, ND

Format: Report

Reference: North Dakota Agricultural Experiment Station Research Report No. 62, 1976

Key Index Words: Erosion, Runoff, Soil Properties, Topsoil

Brief Description

The results of runoff and erosion studies conducted at the Indian Head Mine from 1971-1975, involving a native range site, three mined sites with different spoil textures, and a topsoiled site are discussed in this report. Runoff averaged 41% for spoil and 71% of snow water equivalent for topsoiled plots. Soil loss averaged 0.04, 1.92 and 0.38 tons/ha for rangeland, spoil and topsoiled plots, respectively.

Analysis of Conclusions

This study has demonstrated that soil loss is greatest from bare spoils. Also useful data has been provided to determine the effects of slope and texture on the runoff and erosion occurring on disturbed and undisturbed areas.

Title: **PARTICLE SIZE DISTRIBUTION OF ERODED MATERIALS ON SURFACE MINE SITES IN WESTERN NORTH DAKOTA**

Authors: J.E. Gilley, G.W. Gee, and A. Bauer

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 34(2):35-36, 1976

Key Index Words: Erosion, Runoff, Spoil Properties, Topsoil, Tillage

Brief Description

This paper describes the results of runoff and erosion studies conducted on shaped mine spoil at Indian Head Mine near Zap, ND. Particle size distribution was studied for surface soil material prior to runoff and of the eroded material under conditions of tillage and no tillage. Evaluations were made of changes in particle size distribution in runoff samples collected during the course of a storm occurrence.

Analysis of Conclusions

The particle size distribution of spoil materials eroded from nontilled plots was similar to surface conditions preceding rainfall. However, tillage caused changes in particle size distribution of eroded materials. These results are important in understanding the mechanism of water erosion on reshaped mined lands under different tillage systems.

Title: **WATER QUALITY OF IMPOUNDMENTS ON SURFACE MINED SITES**

Authors: J.E. Gilley, G.W. Gee, and A. Bauer

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 34(2):37-39, 1976

Key Index Words: Impoundments, Water Quality, Erosion

Brief Description

This paper describes the results of water quality determinations made on samples collected from recently established impoundments on strip mined areas and from over 25 year old impoundments located outside the mine area. Values of some chemical parameters were found to be higher in water from the recently established impoundments, whereas values of other constituents were higher at older sites.

Analysis of Conclusions

This study established that water quality factors of potential concern include SAR, TDS, and sulfate. The authors recommended that chemical characteristics of an impoundment be determined before it is used as a livestock or irrigation source. This publication has been used as reference for performing probable hydrological consequences and cumulative hydrological impact assessments by the PSC staff. Additional research should be done in this area to identify long-term quality degradation.

Title: **EFFECT OF TILLAGE ON WATER MOVEMENT INTO SURFACE MINED MATERIALS**

Authors: J.E. Gilley, G.W. Gee, and A. Bauer

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station, Farm Research 34(2): 37-39, 1976

Key Index Words: Infiltration, Spoil Properties, Tillage

Brief Description

This paper evaluates the effects of tillage on water movement into surface mined materials of high SAR at Indian Head Mine near Zap, ND. Single plots were located on noncultivated, moldboard plowed and disked spoil materials having SAR of 37. Tillage treatments were imposed immediately preceding topsoil placement in July, 1975. Tillage treatment depths were approximately 4 and 6 inches on the disked and moldboard plowed plots, respectively. About 3.1 inches of precipitation fell on these plots prior to testing. The infiltration study was conducted in November, 1975. Disking the spoil interface of high sodium adsorption ratio before topsoil placement increased the depth of water penetration into the spoil by about 3 inches. No significant difference appeared in water storage between nontilled and moldboard plowed spoil materials. The underlying spoil on both the tilled and nontilled treatments greatly restricted downward water movement.

Analysis of Conclusions

Additional research of this type, particularly on reclaimed sites, would be desirable.

Title: **INFILTRATION ON SURFACE MINE SITES IN WESTERN NORTH DAKOTA**

Authors: J.E. Gilley, G.W. Gee, A.W. Bauer, W.O. Willis, and R.A. Young

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 34(2): 32-35, 1976

Key Index Words: Infiltration, Spoil Properties, Tillage

Brief Description

This paper reports the results of water infiltration studies conducted at the Indian Head Mine near Zap, ND. Water movement into a sandy loam soil at a native range site was found to be unrestricted. Infiltration was minimal on spoil plots left undisturbed. Although rototilling did not affect water movement into a sandy clay loam spoil, it did affect clay loam and silty clay loam spoil materials. Water movement into these materials was restricted, however, to a depth of less than 6 inches. Water storage on the topsoil sites was limited to the topsoil material. Disking of the topsoil interface had no effect on water movement into the spoil medium.

Analysis of Conclusions

The results of this study are useful in developing better water management practices on the mind lands. Additional research using sites with topsoil and subsoil are needed.

Title: **RUNOFF AND EROSION CHARACTERISTICS OF SURFACE MINED SITES IN WESTERN NORTH DAKOTA**

Authors: J.E. Gilley, G.W. Gee, A. Bauer, W.O. Willis, and R.A. Young

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: Transactions of the American Society of Agricultural Engineers 20:697-700, 704, 1977

Key Index Words: Erosion, Runoff, Mulch

Brief Description

The results of runoff and erosion studies (under simulated rainfall) conducted in 1975 at Indian Head Mine near Zap, ND are described. Soil losses were greatest on bare topsoiled plots and least on the noncultivated rangeland site. Application of a straw mulch reduced erosion from topsoiled plots by over 90%. However, erosion and runoff from the mulched topsoil sites were still more than 50% higher than erosion and runoff from rangeland sites.

Analysis of Conclusions

This and other similar studies have provided valuable information on the erosion potential of mined lands in North Dakota. Confirmation of such studies on reclaimed sites in different stages of revegetation are necessary and should be encouraged.

Title: **SOIL EROSION BY WATER AND ITS CONTROL**

Authors: D.L. Dodds and E.H. Vasey

Organization: NDSU-Cooperative Extension Service, Fargo, ND

Format: Circular

Reference: North Dakota State University Cooperative Extension Service Circular SC-616, January, 1977

Key Index Word: Erosion, Runoff, Topography, Infiltration

Brief Description:

Discusses the problems of soil erosion on agricultural lands as a result of water being added (through rainfall or snowmelt) faster than it can be absorbed by the soil. The effect of agricultural practices and topography on erosion and runoff are addressed.

Analysis of Conclusions:

An excellent paper on water erosion processes, their resulting effects and conservation practices.

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

Authors: USDA, Soil Conservation Service Staff

Organization: USDA, Soil Conservation Service

Format: Report

Reference: US EPA Interim Final Report No. 908/4-77-005. 26 p. + Appendixes A, B, and C, 1977

Key Index Words: Erosion, K-Values

Brief Description

This publication provides background information on the Universal Soil Loss Equation, and includes pertinent data needed to apply the equation to mined land situations. An illustrative example of an erosion study for lands disturbed by surface mining is also given.

Analysis of Conclusions

This is an important study describing the use of Universal Soil Loss Equation for determining erosion potential of mined lands.

Title: **RUNOFF AND EROSION FROM MINED LANDS IN WESTERN NORTH DAKOTA**

Author: J.E. Gilley

Organization: Colorado State University, Fort Collins, CO

Format: Paper

Reference: Adequate Reclamation of Mined Land? A Symposium, pp. 5-1 to 5-18, Soil Conservation Society of America and WRCC-21 Committee, Billings, MT, March 1980

Key Index Words: Erosion, Runoff, Mulch

Brief Description

This is an overview presentation of the results of erosion and runoff studies conducted by the author in North Dakota. Erosion and runoff, resulting from natural and simulated rainfall, were measured from plots representing pre-mined, mined, and post-mined conditions. Soil losses were greatest from bare topsoil plots and least from noncultivated rangeland site. Straw mulch on topsoil plots reduced erosion from simulated rainfall by 66%. Snowmelt runoff on rangeland, spoil, and topsoil plots was found to be minimal. The erosion potential was decreased as vegetation became established.

Analysis of Conclusions

This paper is useful in understanding the relative potential for erosion and runoff on mined lands under different conditions (or stages) of reclamation and revegetation. However, additional studies involving types and degrees of vegetative cover are very necessary.

Title: **SUSPENDED OR DISSOLVED SOLIDS IN RUNOFF FROM RANGELAND AND SURFACE MINED SITES IN WESTERN NORTH DAKOTA**

Authors: J. Gilley, F. Schroer, and L. Zimmerman

Organization: NDSU-Agricultural Experiment Station, Fargo, ND

Format: Report

Reference: NDSU-Agricultural Experiment Station Research Report No. 88, August 1981

Key Index Words: Erosion, Runoff, Water Quality

Brief Description

The investigators compared TDS & TSS concentrations in surface runoff generated by specific precipitation events on plots having various surface treatments. Surface treatments included 1) undisturbed rangeland, 2) spoil, and 3) 6 inches topsoil layer over spoil. Runoff for rangeland, spoil and topsoiled sites averaged 4, 22, and 31 percent of the rainfall amount. Concentration of dissolved solids was generally higher in runoff from spoil materials than from topsoiled or rangeland sites.

Analysis of Conclusions

Conclusions provided justification for requiring SO_4, and EC determinations in current water monitoring programs. The information is useful as reference in probable hydrologic assessment and cumulative hydrologic impact assessment determinations. Publication is quite valuable in identifying possible changes to surface water quality as a result of surface mining activities.

Title: **SOIL EROSION CONTROL-CLEAN WATER THROUGH CROP MANAGEMENT PROGRAMS**

Authors: C. Fanning, and T. Reff

Organization: NDSU-Cooperative Extension Service, Fargo, ND

Format: Circular

Reference: North Dakota State University Cooperative Extension Service Circular SC-710, 1981

Key Index Word: Runoff, Erosion, Nutrient Requirements, Eutrophication, Fertilizer Use

Brief Description:

Discusses the relationships between clean water, farmland, and erosion with respect to agricultural production. Problems addressed include phosphorus and algal growth, sedimentation, pesticide contamination, reservoir storage capacity loss, eutrophication, and fertilizer use and nutrients in stream flow. Acceleration of these problems via man's activities and identification of potential problems is discussed.

Analysis of Conclusions:

A very informative paper useful in maintaining water quality through recommended cropping practices.

Title: **EROSION AND NUTRIENT LOSS FROM INTERRILL AREAS ON STRIP-MINE LAND TOPSOILS**

Authors: K.J. Lang and L. Prunty

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 41(2). 18-21, 1983

Key Index Word: Erosion, Stockpiled Soil, Nitrogen, Mulch

Brief Description:

Topsoil was taken from a stockpile at the Falkirk Mine which consisted of Arnegard and Bowbells soils with a history of cultivation. Topsoil was also taken from a stockpile at the Indian Head Mine which consisted of Cabba and Cohagen soils under native prairie. The soils were tested in an artificial rainfall situation for the effects of slope, straw mulch, and antecedent moisture condition on water runoff, soil loss, OM, and available N and P.

Analysis of Conclusions:

This study contains information on the effects of slope, straw mulch, and antecedent moisture on topsoil erosion and the effects that erosion has on land productivity. The conclusions are general and emphasize the need for more research to evaluate nutrient loss from mined land soils.

Title: **RELATIONSHIP OF RUNOFF AND SOIL LOSS TO GROUND COVER OF NATIVE AND RECLAIMED GRAZING LAND**

Authors: L. Hofmann, R.E. Ries, and J.E. Gilley

Organization: USDA-ARS, Northern Great Plains Research Laboratory, Mandan, ND

Format: Paper

Reference: Agronomy Journal 75:599-602, 1983

Key Index Words: Grazing, Sediment, Soil Loss, Runoff

Brief Description:

A simulated rainfall study was conducted near Center, North Dakota to determine the relationship of ground cover factors to runoff and soil loss. A ten-point frame was used to estimate both first-hit and basal vegetation cover. Artificial rain was applied at a rate of 46 mm/h. Ungrazed, lightly grazed, moderately grazed, heavily grazed, and burned treatments were established on reclaimed areas. Native range treatments were ungrazed, closely grazed, and burned. Soil loss, runoff and soil loss/runoff ratios were similar among reclaimed light and ungrazed treatments and closely grazed native grassland, while live surface cover was greatest on native ungrazed areas. Live surface cover was not the primary cover component controlling these runoff factors. Total cover was determined to be the primary component. The authors concluded that bare ground, the complementary of total cover, can be measured to evaluate whether the vegetative cover is adequate to control water erosion and stabilize soil on permanently vegetated grasslands.

Analysis of Conclusions:

This study addresses the amount of ground cover necessary to control surface erosion on reclaimed mine lands. It also emphasizes that measurements of bare ground also can be used to evaluate erosion and runoff potential.

Title: **INTERRILL EROSION AS AN INDEX OF MINED LAND SOIL ERODIBILITY**

Authors: K.J. Lang, L. Prunty, S.A. Schroeder, and L.A. Disrud

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: Transactions of the ASAE 27(1):99-104, 109, 1984

Key Index Words: Erosion, Runoff, Soil Properties

Brief Description

Laboratory investigations using rainfall simulation techniques were conducted to study the influence of slope steepness, mulch rate, and antecedent soil moisture condition on runoff and soil loss from interrill areas on two mined land topsoils. Topsoils were obtained from stockpiles at Falkirk and Indian Head mines. Soil type and slope was found to have no effect on interrill runoff. Mulching reduced runoff during dry runs but not during the wet runs. Soil loss was greater from Falkirk topsoil than Indian Head topsoil; increasing slope steepness increased soil loss, but mulching reduced the same. Soil in splash was rich in sand while interrill sediment was rich in clay and fine silt.

Analysis of Conclusions

The information presented in this paper is highly useful in developing and refining the management techniques required for controlling erosion from topsoiled mined lands. Research along these lines needs to be continued to study the long term effects of erosion control measures.

Title: **EFFECT OF CRUSTING ON RUNOFF AND EROSION FROM RESHAPED SPOIL**

Authors: S.A. Schroeder

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Proceedings of the Second Annual Meeting of the American Society for Surface Mining and Reclamation, PP. 205-211 Denver, CO October 8-10, 1985

Key Index Word: Runoff, Erosion, Spoil Properties, K Values

Brief Description:

Runoff and sediment yield from crusted and roughened spoil surfaces were compared using a rainfall simulator at two mine sites. Under dry conditions, the crusted surface produced more runoff and soil loss than the roughened surface. Under wet conditions, the difference was not always discernible. Slope effects and spoil quality had different effects for the two mine sites. The surface seal which formed during the dry test resulted in similar runoff and erosion under wet conditions at both sites.

Analysis of Conclusions:

This study contributes additional data for prediction of K values in the Universal Soil Loss Equation, which is used to determine sediment pond size on mines.

Title: **REPORT TO KNIFE RIVER COAL MINING COMPANY ON RESEARCH CONDUCTED AT THE KNIFE RIVER MINE NEAR BEULAH**

Authors: NDSU-Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Center,
Mandan, ND

Format Report

Reference: Land Reclamation Research Center Report, 1985

Key Index Word: Erosion, Spoil Properties, K-Values

Brief Description:

Replicated (6 x 16 ft.) plots were constructed at two sites, one in crusted spoil and one in freshly respread spoil. At each site plots with 2, 4, and 11% slopes were used. A 2.2 iph rainfall was simulated and hydrology and sedimentology samples were taken over 10 minute intervals.

Analysis of Conclusions:

This report compares the hydrology and sedimentology of spoil material in a crusted and fallow condition. It contains data on the tons per acre lost of spoil material and the inches of runoff. Further analysis of this data is in process.

Title: **REPORT TO BASIN ELECTRIC POWER COOPERATIVE ON RESEARCH CONDUCTED AT THE GLENHAROLD MINE NEAR STANTON, ND**

Authors: NDSU-Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Laboratory, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Report, 1985

Key Index Word: Erosion, Runoff, K-Values, Topography

Brief Description:

Replicated 6 x 16 foot plots were installed at three sites at Stanton, ND in 1985. At each site plots with approximately 3, 6, and 9% slopes were used. The sites consisted of a four-year old reclamation site, a seven year old reclamation site, and a native site. A rainfall simulation was used to simulate a 2.2 iph rainfall. Both sedimentology and hydrology measurements were taken over ten minute intervals.

Analysis of Conclusions:

This report compares the hydrology and sedimentology of native and reconstructed soils. It compares the effect gradient has on the native, 4-year old, and 7-year old reclamation sites. This report also contains information dealing with universal soil loss equation factors.

Title: **SEASON-LONG GRAZING EFFECTS ON EROSION FROM RECLAIMED PASTURES**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Technical Report No. 5, 1986

Key Index Words: Erosion, Runoff, Revegetation, Grazing

Brief Description:

Effects of season-long grazing on erosion and runoff from reclaimed and undisturbed native grasslands were studies at the Baukol-Noonan Mine, using simulated rainfall technique. Grazing increased runoff from both reclaimed, and native grasslands under wet surface conditions, but the increased runoff was not highly erosive because of good vegetative cover. Soil losses from well managed reclaimed grasslands were only slightly higher compared to undisturbed grasslands. Soil conservation service CN values estimated for reclaimed and undisturbed grasslands were statistically similar. The report also includes soil erodibility K values for undisturbed and reclaimed lands.

Analysis of Conclusions:

Although increased runoff from well-managed reclaimed grasslands may not be accompanied by increased soil losses, yet lack of opportunity for infiltration and storage of water in the soil profile may cause decreases in vegetation production, especially in dry years. Surface roughness, soil porosity, vegetative cover, and grazing intensity are some of the factors that require further evaluation in relation to erosion and runoff on reclaimed mine lands.

Title: **RUNOFF CURVE NUMBER ESTIMATIONS FOR RESHAPED FINE-TEXTURED SPOILS**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Reclamation and Revegetation Research, 6: 129-136, 1987

Key Index Words: Slope Gradient, Sodium Adsorption Ratio, Runoff

Brief Description

The objectives of this study were to 1) estimate runoff curve number (CN) values for reshaped fine-textured spoil areas for use in sediment pond designs, and 2) determine the effects of spoil surface conditions - (crusted vs. noncrusted, slope gradient (0.1 to 11.1%) and SAR (2.0 50 20.0) - on the resultant CN values. Field experiments were conducted at the Center and Beulah Mines, using a portable rainfall simulator to apply three consecutive rainfall applications. Differences in slope gradient and SAR had no effect on the estimated CN values. The results of this study indicated that CN values in the mid 90's should be used for designing sediment ponds for controlling runoff from graded fine-textured spoils.

Analysis of Conclusions

The conclusions that CN values were not affected by slope gradient and SAR because of low hydraulic conductivity of the fine-textured spoils have not been supported by actual measurement of hydraulic conductivity. The CN values recommended for pond design are only approximate. Moreover, due to the variability of other elements in the SCS runoff estimation formula, the recommendations made in this study have only a limited application.

Title: **RUNOFF FROM RECLAIMED GRASSLANDS COMPARED TO UNDISTURBED GRASSLANDS**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Combine Fourth Biennial Billings Symposium on Mining and Reclamation in the West and the National Meeting of the American Society for Surface Mining and Reclamation, pp. G-8-1 to G-8-7, Billings, MT, March 1987

Key Index Words: Erosion, Runoff, Grassland, Revegetation, Hydraulic Conductivity

Brief Description

This investigation was conducted to study the effects of slope gradient, antecedent moisture conditions, and age-after-revegetation on runoff, using artificial rainfall simulation techniques. The revegetated sites included a 2-year old site at the Center Mine and a 4-year and 7-year old site at the Glenharold Mine. The undisturbed grassland sites, used for control, were located on a Williams soil at the Center Mine and a Temvik-Zahl soil association at the Glenharold Mine. Under initial dry conditions, the runoff and SCS curve numbers for revegetated and undisturbed sites was similar. But under wet and very wet conditions both parameters measured significantly higher on the revegetated sites compared to undisturbed sites. Reduced porosity and hydraulic conductivity in the respread topsoil of revegetated sites were given as the possible reasons for these differences. Age-after-revegetation seemed to have little effect on the amount of runoff.

Analysis of Conclusions

The author's suggestion that until the values of total porosities and hydraulic conductivities of the reclaimed grasslands approach those of the undisturbed sites, quick establishment of vegetative cover and use of sedimentation ponds to manage runoff on mined lands is in keeping with the current regulatory practice.

Title: **SLOPE GRADIENT EFFECTS ON EROSION OF RESHAPED SPOIL**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Soil Science Society of America Journal 51: 405-409, 1987

Key Index Words: Erosion, Universal Soil Loss Equation, Crusting, Slope Gradient

Brief Description

The objective of this research was to determine the applicability of the Universal Soil Loss Equation's (USLE) slope function for predicting spoil erosion rates. The effect of slope gradient on sediment losses from reshaped spoil at two surface mines (Center and Beulah) was quantified by using a rainfall simulator. Slope gradient ranged from 0.1 to 11.1%, and surface conditions included crusted and non-crusted (tilled) spoil. Sediment losses increased with increasing slope, but no differences in the slope gradient equations were found under surface crusted conditions. The USLE curvilinear soil loss ratio (SLR) function underestimated the slope gradient effects on sediment loss for slopes less than 9% and overestimated at slopes greater than 9%.

Analysis of Conclusions

The author claims that the use of developed spoil SLR function and USLE monograph K values should provide adequate prediction of spoil erosion losses for designing sediment ponds. However, additional research is needed to determine the reliability of the empirical spoil SLR function and K prediction model, especially for steeper and longer slopes, coarse-textured spoils, and high SAR spoils.

Title: **SOIL LOSS COMPARISONS BETWEEN RECLAIMED STRIP-MINED AND UNDISTURBED GRASSLANDS IN NORTH DAKOTA**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Journal of Environmental Quality 18(1):30-34, 1989

Key Index Words: Revegetation, Erosion, Runoff, Cover

Brief Description

Field experiments were conducted at the Center and Glenharold Mines to determine the erodibility of reclaimed vs. undisturbed lands. Soil-loss/runoff (SLRO)ratios were calculated following collection of relevant data from field plots on reclaimed and undisturbed land subject to simulated rainfall. No differences were found in SLRO or soil losses between the reclaimed and undisturbed land at the Center Mine, but at the Glenharold Mine these parameters showed differences under all (dry, wet, and very wet) surface conditions. The author concludes that as the reclaimed lands in North Dakota become well vegetated their productivity will not be impaired by soil loss through erosion because it is similar to that occurring on the undisturbed lands.

Analysis of Conclusions

The conclusions drawn underscore the importance of establishing a good vegetative cover on the reclaimed lands as quickly as possible. Also, the reclaimed areas may not behave similarly with regard to their erodibility or revegetation potential.

Title: **ANTECEDENT MOISTURE CONDITIONS FOR NORTH DAKOTA RUNOFF PREDICTIONS**

Authors: S.A. Schroeder, J.W. Enz, and J.K. Larsen

Organization: NDSU - Land Reclamation Research Center, Mandan, and Department of Soil Science, Fargo, ND

Format: Paper

Reference: North Dakota Farm Research 48(3):8-11, 1990

Key Index Words: Erosion, Runoff, Soil Moisture

Brief Description

The Soil Conservation Service's curve number (CN) method for determining runoff volumes from watersheds uses soil type, surface condition, and antecedent moisture condition (AMC) as variables to describe the hydrologic properties of the catchment basin. There are three AMC groups recognized, namely low runoff potential (AMC I), average condition (AMCII), and highest runoff potential (AMCIII). However, because of low rainfall and high evapotranspiration these AMC groups are suspect in North Dakota,. Therefore, the authors studied the frequency distribution of the AMC categories during the North Dakota growing season, developed frequency distributions based on smaller increments within AMC groups I and II, and compared the log-term average 5-day precipitation totals at 50 percent probability level between the growing and dormant seasons. The results of this analysis indicated that the use of CN with AMCI, during the North Dakota growing season, would be appropriate 90 percent of the time, but AMCII would overestimate the expected runoff mat least 95 percent of the time.

Analysis of Conclusions

The authors conclude that the AMC groupings are not as applicable under the semiarid climates as they are in areas of high rainfall amounts and frequency. This implies that by using the present AMC groupings, the runoff volume from mine disturbance sites could be overestimated resulting in unnecessary oversize designing of sedimentation ponds.

Title: **REVEGETATION INFLUENCE ON RECLAIMED MINELAND SOIL EROSION**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Report to the North Dakota Legislative Council, pursuant to Section 5 of H.B. 1005 of the Fifty-second Legislative Assembly, pp. 13, June 30, 1993.

Key Index Words: Revegetation, Erosion, USLE, Soil Loss, Cover Factor

Brief Description

Experiments were conducted at the Center and Glenharold Mines to study the relationship between soil erodibility and vegetation established on reclaimed lands. Specifically, the objective was to develop a first estimate of the amount of basal cover necessary to control soil erosion by water to acceptable limits. Weighted soil losses were regresses with cover factor (cover as a fraction of the bare ground) and found to have a linear relationship. As plant cover increased, soil loss decreases.

Analysis of Conclusions

The general conclusion that "rapid establishment of vegetation will reduce soil erosion to permissible levels and prevent both on site and off site problems caused by transported sediment" is quite well known. However the derived regression may be helpful in estimating the amount of cover needed to retain soil loss to a predetermined level.

Title: **COVER/SOIL EFFECTS ON RECLAIMED MINELAND EROSION**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND.

Format: paper

Reference: Planning, Rehabilitation and Treatment of Disturbed Lands, pp. 116-123, Sixth Billings Symposium, 1993.

Key Index Words: Revegetation, Erosion, USLE, Soil Loss, Cover Factor

Brief Description

Erosional losses to simulated rainfall were studied at some of the reclaimed sites at the Center and Glenharold Mines. The objective was to develop a relationship between basal cover and soil loss on reclaimed minelands. Linear relations were noted between cover and adjusted soil loss values.

Analysis of Conclusions

The study provides some basic data which may be helpful in determining the amount of plant cover needed to minimize soil losses occurring on reclaimed lands due to water erosion.

Title: **RELIABILITY OF SCS CURVE NUMBER METHOD ON SEMI-ARID, RECLAIMED MINELANDS**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: paper

Reference: International Journal of Surface Mining, Mining, Reclamation and Environment 8: 41-45, 1994.

Key Index Words: Erosion, Runoff, Soil Moisture

Brief Description

Using simulated rainfall, runoff was measured from reclaimed plots located at the Center and Glenharold Mines, representing various gradients, topsoil textures and basal cover. The objective was to determine the relationship and accuracy of the SCS-generated values for initial abstraction (Ia), maximum potential retention (S), and curve number (CN) as compared to field measured values, and to determine the effect of vegetative cover on CN. The SCS method overestimated Ia and CN values and underestimated S when Ia was assumed to be 20% of S. Basal cover had much greater influence on CN values for dry compared to wet conditions.

Analysis of Conclusions

The author concludes that overall the SCS curve number method is reliable for predicting the runoff characteristics of semiarid, reclaimed minelands. The calculated vales for initial abstraction and retention were close enough to those assumed in the SCS method.

Title: **FIRST ESTIMATION OF COVER FOR RECLAIMED MINELAND EROSION CONTROL**

Authors: S.A. Schroeder

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Journal of Soil and Water Conservation 50(6) 668-671, 1995

Key Index Words: Revegetation, Erosion, Cover

Brief Description

The objective of this study was to evaluated the effect of established vegetation on reducing erosion losses from reclaimed lands with different soil textures and slope gradients, so that the percentage of cover necessary to meet the regulatory requirements could be estimated. Field experiments were carried out at the Center and Glenharold Mines under various simulated rainfall conditions. Regression analysis between the adjusted (by RUSLE) soil loss values and measured cover factor showed a linear decreases in soil loss as the percent cover increased. The author contends that since all factors , except cover, within RUSLE are known, a first estimate of the needed cover can be easily made.

Analysis of Conclusions

If all the assumptions made in this study are valid, the method proposed to estimate the percentage of plant cover needed to satisfy the regulatory requirements provides a valuable tool to the industry and the regulators.