

**HANDBOOK**  
*OF*  
**WESTERN RECLAMATION**  
**TECHNIQUES**



**Second Edition**  
**2006**

## **FOREWARD**

Permission is granted for the public to duplicate any part of this work, but use of the material must be properly referenced or linked. The techniques presented in this handbook have been field-tested and work. However, the techniques do not come with a guarantee. Sites, contractors, materials, specifications, implementation techniques, and expectations differ, and will affect the success of the method. The user must bear responsibility of his actions.

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**NOTE:** The first edition of this handbook can be obtained in its entirety from the website on which this edition is published.

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## **EDITORS**

### **MANAGEMENT COMMITTEE FOR THE SECOND EDITION:**

Wanda Burget

Robin Carlson

Phil Dinsmoor

D. G. Mickey Steward, Coordinating Editor ([seacross@vcn.com](mailto:seacross@vcn.com))

Robert R. Stowe

Laurel E. Vicklund

### **SECTION EDITORS:**

Frank K. Ferris

Larry H. Kleinman

Bonnie C. Postovit

D. G. Steward

Robert R. Stowe

Laurel E. Vicklund

## INTRODUCTION TO THE SECOND EDITION

Reclamation is the practice of returning lands that have been disturbed to a use equal to or better than that which existed prior to disturbance. Reclamation is required for surface mines in the United States and is practiced world-wide by the mining industry. Since its inception in 1978, comprehensive reclamation has evolved rapidly. The primary impetus for this evolution was the Federal Surface Mine Control and Reclamation Act (SMCRA) of 1977 and State statutes such as the Wyoming Environmental Quality Act (WEQA) of 1973. Successful reclamation is integral with successful mining, not only for release of the large bonds required by State and Federal law alike, but also as a necessary adjunct to continued mining. The principles employed for the reclamation of surface mines are applicable to other types of disturbance that may occur in the landscape.

The roots of reclamation science lie in the conservation practices developed during the dustbowl and depression years of the 1930's. Many of the practices developed, and much of the work done during that time, were funded by Federal and State governments. For this reason, many of the names associated with early reclamation of mined lands -- McKell; Bjugstad; Power, Sandoval, and Ries; Aldon; Plummer; Richardson and Farmer; and Hodder -- are also names from the Soil Conservation Service, the Agricultural Research Stations, and land grant universities. Early mine reclamation was so associated with agriculture that reclamation and revegetation were considered virtually synonymous.

While some agricultural emphasis continues today, the technology has expanded greatly to embrace soils, hydrology, wildlife, and land use. Reclamation science has responded to legal requirements, reconstruction of endangered habitats, revitalization of damaged environmental systems, and establishment of wetlands. Reclamation methods are used to minimize the impact of human development in housing subdivisions, on ski slopes, and in highway reconstruction.

Early reclamation investigations in the arid and semi-arid Western United States were based on research trials for replacing materials suitable for plant growth and re-establishing vegetation. Cook et al. (1974), Power et al. (1976), the SEAM program (1979), and DePuit and Coenenberg (1981) are good examples of earlier efforts that continue today in work by Schuman et al. (1993). Plant materials centers and agricultural research stations continue to provide tools for reclamation efforts (e.g. Ries et al. 1976, Aldon 1981, Bjugstad 1984, and Majerus et al. 1985).

Researchers such as Shroeder (1985), Toy (1983), and Toy and Parsons (1987) produced research on geomorphic processes such as erosion, infiltration, and sediment yield, while Beauchamp (1973), Dollhopf (1978), Berg (1983), and Halvorson and Doll (1985) investigated spoil and soil in the reclaimed environment. A great deal of applied research has been conducted by mining companies interested in seeking new solutions to reclamation problems. Much of this work is reported in the annual reports required by State agencies for each active mine.

Postovit (1981), Hingtgen and Clark (1984a and 1984b), Yoakum (1984), Clark and Medcraft (1986), and Medcraft and Clark (1986) studied the effects of mining on wildlife populations. Olendorf et al. (1981) and Nelson et al. (1978) described techniques for wildlife habitat restoration. Methods and classification for reconstruction of stream channels are being developed by Wesche et al. (1993) and Rathburn et al. (1993).

There are many works that suggest technologies of various kinds, report on field trials, and recommend plant species for use in reclamation. However, almost thirty years after the earliest trial efforts, a considerable body of practical knowledge has been developed by the specialists responsible for compliance with State and Federal statutes and regulations governing reclamation of mined lands. For the most part, this knowledge is not formalized elsewhere than in this handbook.

This Second Edition of The Handbook of Western Reclamation Techniques represents significant cooperative effort between the mining industry, industry professionals, the academic community, and regulatory agencies. It documents field-proven reclamation methods and demonstrates the diversity with which similar objectives can be accomplished. Some of the methods were developed through trial and error; some were developed from scientific studies and have matured over time. Many of the authors began as reclamation specialists and have moved onward to other positions; some have now retired. The legacy these professionals leave behind is a tribute to the ability of humankind to manage its environment for the better. Their efforts will always be appreciated.

Many people contributed to the second edition of this handbook, particularly Phil Dinsmoor and Robin Carlson. In addition, the support and determination of Wanda Burget and Laurel Vicklund were instrumental in its production. Bj Kristiansen, as always, is to be commended for his fine efforts on the web production. Any errors that have crept into the second edition as a result of editorial tinkering are the sole responsibility of the editor. The fine works otherwise presented remain the products of the authors identified in each subsection

**D.G. Mickey Steward, coordinating editor**

Gillette, Wyoming

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