IN-PLACE ARCHAEOLOGICAL SITE
CONSERVATION AND STABILIZATION

BIBLIOGRAPHY

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EDITOR'S NOTE

Because this bibliography is in the beginning stages, it is not all-inclusive, nor is it available in a bound version. Citations are added on a regular basis as new references become available or as older projects are brought to the attention of the National Clearinghouse. The May 30, 2000 version is the latest update at this time. We can provide current versions (WordPerfect format) of the bibliography on diskette if requests are accompanied by blank diskettes.

BIBLIOGRAPHY OVERVIEW

The following bibliography is divided into four sections that are intended to support the conceptualization, design and development, and implementation of archaeological site stabilization and preservation projects. Annotations are included with some of the entries. References to the stabilization and preservation of standing structures have been intentionally omitted since this subject area is beyond the scope of resources considered by the National Clearinghouse for Archaeological Site Stabilization.

Section 1, PHILOSOPHY, provides a philosophical overview for site preservation and stabilization. While not all-encompassing, it does provide sufficient background to justify, at least philosophically, archaeological site stabilization projects. Direct references to statutory and regulatory support may be found elsewhere.

Section 2, TECHNICAL SUPPORT, draws together a corpus of technical information generally unknown to archaeologists. Reliance on and a knowledge of these data are integral to the design of stabilization projects, particularly if cost-effective and innovative stabilization measures are to be put into place.

Section 3, MANAGEMENT RECOMMENDATIONS, contains a mix of projects for which site stabilization was not considered the best choice, but stabilization efforts were finally selected as the best mitigation approach. References included here should provide the user with an idea of how other projects have been approached.

Section 4, PRACTICAL APPLICATIONS, presents specific archaeological site stabilization case histories. Data contained within will provide an insight into the planning and implementation of stabilization projects already in place, and serve as a partial base for the development of new projects.

Section 1 – PHILOSOPHY

Adams, William Y.

1973 "Strategy of Archaeological Salvage" in Man-Made Lakes: Their Problems and Environmental Effects. Geophysical Union, Washington.

Aten, Lawrence E.

1986 "Planning the Preservation of Archaeological Sites" in Rescue Archaeology, Papers from the First New World Conference on Rescue Archaeology. Edited by Rex L. Wilson and Gloria Loyola, National Trust for Historic Preservation, Organization of American States, The Preservation Press.

Dixon, Keith A.

1971 "Archaeological Site Preservation: The Neglected Alternative to Destruction", Pacific Coast Archaeological Society Quarterly, Vol. 7, No. 4.

Ford, Richard I.

1983 The Archaeological Conservancy, Inc., the Goal is Site Preservation. American Archaeology, Vol. 3, No. 3, pp. 221-224.

Ford discusses the Archaeological Conservancy, describing how it was formed, its objectives, and how it is to function. He also includes a description of how sites are to be preserved through acquisition of properties and their subsequent placement in the public domain. He indicates that the Conservancy is a voluntary organization dependent on increased membership and funding. SITE ACQUISITION

Fowler, Don D.

1986 Conserving American Archaeological Resources in American Archaeology Past and Future, edited by David J. Mitzer, Don D. Fowler and Jeremy A. Sabloff, pp. 135-162. Society for American Archaeology, Washington, D.C.

Garrison, E.G.

1975 "A Qualitative Model for Inundation Studies for Archaeological Research and Resource Conservation," Plains Anthropologist, Vol. 20(F), Part I, pp. 279-296.

Lipe, William D.

1974 A Conservation Model for American Archeology. The Kiva, Vol. 39, Nos. 3-4.

2000 "Conserving the In Situ Archaeological Record", The Getty Conservation Institute Newsletter, Volume 15, No. 1. Getty Conservation Institute, Los Angeles, CA.

Lipe briefly summarizes the advances that have been made in the interpretation of the archaeological record, and comments on the mechanisms that have negatively impacted archaeological sites over the past century. He expresses the hope that as underdeveloped countries improve their economic a conditions, Archaeological properties will l be better protected and advocates continued efforts on the part of the professional community as well as national and international governments to conserve the remains of the past.

McMillan, E. Bruce, M. Grady, W. Lipe, A. Anderson, H. Davis, L. Dierson, M. Weide

1977 Cultural Resource Management. In The Management of Archaeological Resources: The Airlie House Report., edited by C.R. McGimsey and H.A. Davis, pp. 25-63. Society for American Archaeology, Washington, D.C.

Nickens, Paul R., Editor

1991 Perspectives on Archeological Site Protection and Preservation. Technical Report EL-91-6, U.S. Army

Engineer Waterways Experiment Station, Vicksburg, MS.
"This report consists of papers from two symposiums that focused on issues related to cultural site protection and preservation topics. Both sessions were organized under the auspices of the U. S. Army Corps of Engineers Environmental Research Program. Topics discussed in the papers include site preservation and protection planning and implementation, Federal and State agency regulations and policies, project monitoring, ongoing research and future research needs, along with some case studies. The contributions originate from Federal and State agencies as well as the private sector."

Shiffer, Michael B., and George J. Gummerman
1977 Conservation Archaeology. Academic Press, New York.

Thorne, Robert M.
1991 "Preservation is a Use". Paper presented at the 1988 Society for Applied Anthropology, Tampa in Perspectives on Archaeological Site Protection and Preservation, Paul R. Nickens, Editor, Technical Report EL-91-6, U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
Stabilization, Protection Lessen Resource Damage. Federal Archaeology Report, Vol. 4, No. 1, USDI, National Park Service, Archaeological Assistance Division, Washington, D.C.

1992 Archaeological Site Stabilization: The American Experience. Paper presented at the Stabilization Seminar, Birmingham, England, September, 1992.

Thorne, Robert M. and J. Bennett Graham
1987 Archaeological Site Stabilization and Protection in the Tennessee River Valley; A Pilot Program. Paper presented to the Third New World Conference on Rescue Archaeology, Carupano, Venezuela.

U. S. Congress, Office of Technological Assessment

1986 Technologies for Prehistoric and Historic Preservation. OTA-E-319, U. S. Government Printing Office, Washington, D.C.

This summary presents the primary findings of an assessment requested by the House Committee on Interior and Insular Affairs. The subcommittee on public lands is carrying out a major review of how federal agencies implement federal preservation policy. This assessment directly supports the committee's review by showing how the uses of certain methods, techniques, as well as tools and equipment can assist federal, state, and local preservation efforts.

The assessment focuses on the applications of preservation technologies rather than preservation disciplines. The laws, regulations and legislation under consideration in the 99th Congress which pertain to prehistoric and historic preservation are listed in table form. Participants in this assessment cited the need to establish a federally funded institution as a mechanism to coordinate research, disseminate information, and provide training about new technologies for preservation. The preservation process and research technologies are discussed, but solutions to preservation problems and the application of specific technologies to specific preservation problems are not discussed. ASSESSMENT, LAWS, PRESERVATION, FEDERAL GOVERNMENT

U. S. Government
1976 Professional Considerations Surrounding Non-aqueous Burial of Archaeological Sites. Interagency Archaeological Program Administrative Memorandum No. 4; Supplement No. 1. Interagency Archaeological Services, National Park Service. Washington, D.C.

Section 2 – TECHNICAL SUPPORT

Albertson, Paul Edwin

1994 A Geoscience Strategy for Cultural Resource Management. Masters Thesis submitted to the Office of Graduate Studies, Texas A & M University. College Station, Texas.

This thesis documents the advantages of using a geoscience approach in the identification of buried cultural resources in an alluvial valley setting. Three shipwreks ate used as test cases, and include the *Burtrand*, the *USS Eastport*, and an unnamed British Merchant vessel. Of primary interest is the geotechnical location of the *USS* Red River cutoff. The conceptual excavation design was derived from geotechnically derived data coupled with historic documentation research. MAGNETOMETER SURVEY, GEOTECHNICAL DATA

Allen, Hollis H. and C.V. Klimas

1986 Reservoir Shoreline Revegetation Guidelines, Technical Report E-86-13, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report synthesizes the results of revegetation efforts at three lakeshore study sites. Pertinent revegetation concepts are also reviewed and a set of revegetation guidelines for shorelines having fluctuating water levels are presented. Emphasis was placed on reduced costs, proper planning, procurement of plant materials, appropriate planting times and methods, and special planting techniques. EROSION, VEGETATION, SHORELINE, STABILIZATION

Allen, Hollis H. and James W. Webb

1983 Erosion Control With Saltwater Vegetation, in Proceedings of the Third Symposium on Coastal and Ocean Management, American Society of Civil Engineers, June 1-4, 1983, San Diego, CA, pp. 735-748.

Allen, Hollis H., J.W. Webb, and S.O. Shirley

1984 Wetlands Development in Moderate Wave-Energy Climates, in Proceedings of the Conference Dredging 1984, Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, November 14-16, 1984, Clearwater Beach, Florida.

Andropogon Associates, Ltd.

1988 Earthworks Landscape Management Action Plan for the Petersburg National Battlefield. National Park Service, Mid-Atlantic Regional Office, Philadelphia, PA.
This paper describes the processes involved in solving the problem of the need to maintain stable cover on earthworks while managing them for interpretive purposes. The two parks involved in the study were Richmond and Petersburg National Battlefields. The National Park Service hired a private consulting firm, Andropogon, to research the problem. Incorporated in the solution to the problem is the coordination of the action plan with the maintenance management system (MMS), a computer-coordinated management program which tracks and predicts actual and recommended maintenance needs, highlights performance standards and references and resources for each major activity. Previously MMS had been used only sparingly to deal with landscape maintenance, and it was felt that the work being spent on MMS should, in effect, institutionalize the guidelines of the earthworks landscape management manual. Landscape management recommendations for several units are given along with planning guideline sheets for various maintenance activities. The resulting earthworks management manual is referenced under Andropogon 1989 in this Bibliography. STABILIZATION, SOIL BIOENGINEERING, NPS, MANAGEMENT

1989 Earthworks Landscape Management Manual; Section 1. Prepared for the Mid-Atlantic Regional Office, National Park Service, Philadelphia, PA.

The manual's primary focus is to develop management strategies and interpretive guidelines that resolve current conflicts between the requirements for preservation and the impacts of interpretation and visitor use at the earthwork sites. The manual serves as a guide for all earthworks in the NPS system and for application to similar environments within the NPS system with limited study. A major observation noted during the review of the sites evaluated for the preparation of the manual was that earthwork sites stabilized by healthy, native plant communities are in the best condition, while some current management practices have contributed directly to the degradation of the resource. The manual is divided into 2 major sections. The first section is a review and evaluation of current management practices and an assessment of present vegetative cover types. Recommendations are made for an overall management program aimed at integrating preservation and interpretation objectives. The second section begins with procedures for evaluating and monitoring a site with respect to the proposed guidelines. Since many of the management techniques focus on native plant communities, the management of which is unfamiliar to many park employees, various levels of workshops were held. Hands-on sessions taught park employees how to use the soil bioengineering techniques and begin restabilization and revegetation on damaged ground surfaces needing immediate attention. Critical to the soil bioengineering techniques is the need to prioritize problem areas to include both short- and long-term management. (See Andropogon 1988.)

MANAGEMENT, STABILIZATION, EVALUATION, SOIL BIOENGINEERING, NPS

Anonymous

1984 "Erosion Control Mesh Has Environmental Advantages." Grounds Maintenance p. 50.
This article describes Enkamat, a three-dimensional nylon mesh, as a replacement for four-inch concrete, riprap, and asphalt lining in ditches and on embankments. Specific examples of its successful use in Georgia, Virginia, New Jersey and Ohio are given. Installation of Enkamat at $7.50 per square yard compared to $42.50 per square yard for riprap is given for relative cost. GEOTEXTILES, STREAMBANK PROTECTION

1985 "Riverbank Stabilization." Grist, U.S. Department of Interior, National Park Service, Summer, Volume 29, No. 3, Washington, D.C.

This article briefly describes a shoreline stabilization technique that employs large (10 foot) tires laid along the shoreline. Once in place, the tires were filled with waste rock and survived heavy flood with no ill effects. An address is given for a video-tape that illustrates the entire process. EROSION, TIRES, ROCK

1997 Polymer Holds Soil, Cuts Irrigation Loss, Progressive Farmer, Progressive Farmer, December 1997, Birmingham, Alabama.

This is a short article describing the use of agricultural polyacrylamide (PAM) as a soil consolidant in plowed fields. The manufacturers suggest that the rate of erosion can be reduced by as much as 95% and no cropping capabilities are lost. The material can be applied in irrigation water. The flocculant or clumping of soil particles is responsible for erosion abatement. Cost is presently estimated at $5/acre/application.

EROSION CONTROL, CHEMICAL CONSOLIDANT, SURFICANT, FLOCCULENT

Bates, A. Leon, Sidney S. Harper, Kenneth R. Kelley, David H. Webb

1997 Banks and Buffers; A Guide to Selecting Native Plants for Streambanks and Shorelines. Clean Waters Initive Program, Environmental Research Center, Tennessee Valley Authority, Muscle Shoals, AL.

This is an active users guide for the selection of native plants for streambank and shoreline protection. Printed material contains Quick Key charts for the selection of appropriate plants, based on six zones that begin with a submerged aquatic zone and terminate on the dry upland. The volume contais data about 117 plant species that are common to the Tennessee River Valley region but that are also found in other areas of the eastern United States. The plant database is also included on a CD ROM containing software that will guide the user through the selection of plants that are appropriate for ecelogical restoration. The *Riparian Plant Selector* indicated the distribution of individual species within the Tennessee Valley, provides a diagram of the preferred growth habitat for each species, a color picture, and a brief written description of the characteristics of the species selected. The software program will allow the user to describe the area to be protected and appropriate species are selected. A list of nurseries in the Tennessee Valley region is also included. The publication and the CD ROM are available from: Sidney Harper, TVA, CTR 1A, Muscle Shoals, AL 35662 (Email ssarper@tva.gov. REVEGETATION, RIPARIAN ENVIRONMENT, SHORELINE STABILIZATION

Bishop, Craig T., Laurie L. Broderick and D. Donald Davidson

1985 Proceedings of the Floating Tire Breakwater Workshop, 8-9 November 1984. Technical Report CERC-85-9, U.S. Army Waterways Experiment Station, Vicksburg, MS.

This is a compilation of papers presented at the Floating Tire Breakwater Workshop held in Niagara, New York, in 1984. Paper topics include field research, design consideration, breakwater performance and maintenance, and mooring and fastening alternatives. BREAKWATERS, TIRES

Bowie, A.J.

1981 Investigations of Vegetation for Stabilizing Eroding Streambanks, Streambank Stability, Appendix C. Report submitted to the U.S. Army Engineers, Vicksburg District. U.S.D.A. Sedimentation Laboratory, Oxford, MS.

This article describes erosion control studies in northern Mississippi where combinations of vegetation, bank shaping, and structural materials are being tested. Survival of grasses and woody species has been generally good, with native species surviving better than introduced species. Tested species are identified. EROSION, STREAMBANK STABILIZATION, RIPRAP, CELLULAR BLOCKS, VEGETATION

Brown, Daniel C.

1988 Controlling Erosion With Geosynthetic Systems. Engineering & Technology, Highway & Heavy Construction, July, 1988.

Brown, Robert L.

1962 Stabilizing Sand Dunes on the Pacific Coast with Woody Plants. Miscellaneous Publication No. 892, Soil Conservation Service, U. S. Department of Agriculture, Washington, DC.

Campbell, F.B.

1966 Hydraulic Design of Rock Riprap. Miscellaneous Paper No. 2-777, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

The report addresses the serious need for valid criteria for the hydraulic design of riprap. The treatment of the design of riprap begins with the simplest problem with the least number of independent variables and progresses through a sequence of problems of increasing complexity. The following problems are considered: uniform tranquil flow with fully developed turbulence in straight channels and channel bends; highly turbulent flow (example: immediately downstream from energy dissipators) involving bottom riprap and bank riprap. In other words "the designer needs to determine the effective size of riprap which will be stable for the velocity acting on the rock." RIPRAP, DESIGN CRITERIA

Comes, R.D. and Timothy McCreary

1986 Approaches to Revegetate Shorelines at Lake Wallula on the Columbia River, Washington-Oregon. Technical Report E-86-2, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

This is a report of three years of field studies to identify plant species and revegetation techniques adaptable to reservoir shorelines in the Portland and Walla Walla Corps of Engineer Districts. Transplanted vegetation was subjected to various inundation treatments, and survival and growth responses were evaluated. Twenty-nine native and naturalized riparian species were tested. Study results indicate that several species have a potential for use in shoreline revegetation. REVEGETATION, FLOOD TOLERANT VEGETATION, RESERVOIRS
Department of Soil Science

1966 Dune Stabilization with Vegetation on the Outer Banks of North Carolina, Solid Information Series No.8, North Carolina State University, Raleigh, N.C.

Doerr, T.B. and M.C. Landin

1987 Recommended Species for Vegetative Stabilization of Training Lands in Arid and Semi-Arid Environments. Technical Report N-85/15, U.S. Army Construction Engineering Research Laboratory, Champaign, IL.

Espey, Huston and Associates

1992 Monitoring Report for Beach Prisms Demonstration Project, Jefferson Patterson Park and Museum, Calvert County, Maryland. Report prepared for the Maryland Historical Trust, St. Leonard, Maryland.

The authors report on the use of concrete breakwaters that were sold under the trade name Beach Prisms. Prism breakwaters were tested along the shoreline of Jefferson Patterson Park and Museum as a means of protecting the shoreline and the archaeological materials contained in the shoreline. In the setting that the prisms were placed in, they proved to be an unsuccessful shoreline stabilization and protection technique. COASTAL, EROSION, BEACH PRISMS

Fonseca, M.S., W.J. Kenworthy, K.M. Cheap, C.A. Currin, and W.G. Thayer

1985 A Low-cost Transplanting Technique for Shoalgrass (Halodule wrightii), Manatee Grass (Syringodium filiforme). Instruction Report EL-84-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report details the steps that have been devised for a low-cost transplanting technique for two species of seagrasses. Mature vegetative sprouts that are free of sediment are employed. Selection of stock, species growth rate and depth of planting are discussed for the benefit of estimating transplanting projects. VEGETATION, MARINE ENVIRONMENT, SEAGRASSES

Fonseca, M.S., W.J. Kenworthy, G.W. Thayer, D.Y. Heller, and K.M. Cheap

1985 Transplanting of the Seagrasses Zostera marina and Halodule wrightii for Sediment Stabilization and Habitat Development on the East Coast of the United States. Technical Report EL-85-9. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Study sites where these species of grasses occur were located and growth success criteria were identified for transplanting both species. Site design characteristics for transplanting are presented as are rates of success predictions. Both species have a primary function of site stabilization rather than site accretion. Seagrass meadow sediment accretion appears to be balanced by sediment erosion. VEGETATION, STABILIZATION, MARINE, DESIGN CRITERIA

Garfinkel, Alan and Bobby L. Lister

1983 **Effects of High Embankment Construction on Archaeological Materials. Office of Transportation Laboratory, California Department of Transportation.**
The authors report on a field study conducted by CALTRANS to determine the effects of placing a 75-foot high embankment over an archaeological deposit constructed to simulate a North American Indian site. Two small test units were excavated and artifacts were placed in three layers. The location of all artifacts was carefully plotted and both units were instrumented with soil pressure meters. Access to the test units beneath the fill for monitoring was through a five-foot culvert that terminated with a 72-inch "T" section. Ground water levels beneath the fill were monitored through a well drilled into the "T" section. Soil pressure meters were also placed in an actual site on an adjacent project to provide comparative data. Examination of the buried materials indicated soil compaction around the artifacts, and gross morphological changes in the test materials were noted. Guidelines and recommendations for future site burial projects are included. EXPERIMENTAL BURIAL, ARTIFICIAL SITE, GUIDELINES

Gatto, Lawrence, W.

1984 **Effects of River Traffic on Bank Erosion, Present Knowledge and Research Gaps. Paper prepared for the ASCE Hydraulics Division Task Committee on the Effects of River Traffic on Bank Erosion. Informal memorandum for limited distribution. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.**

1988 **Techniques for Measuring Reservoir Bank Erosion. Special Report 88-3, Cold Regions Research and Engineering Laboratory, Hanover, NH.**
"This report summarizes the processes that cause and conditions that contribute to bank erosion along reservoirs, lakes, rivers and coasts. It suggests measurements, techniques and measurement frequencies for four different levels of bank erosion study. Details on specific procedures for a particular technique must be obtained from references cited. There are neither standard measurements to make nor standard methods to use during erosion studies, but this report can be useful to investigators selecting an approach for future work." EROSION, RATES, LAKES, RESERVOIRS, RIVERS

Gilbert, Susan

1986 **"America Washing Away". Science Digest, Volume 94, No. 8:31.**
This article, written in layman's terms, discusses beach erosion in relationship to the destructive effects of wave action aggravated by rising sea levels and intensive coastal development. Diagrams show how waves move sand to form dunes and how the destruction of beaches and barrier islands occurs because of the construction of groins, seawalls and jetties. Dams constructed on the upper reaches of rivers prevents sand from reaching the beaches making them narrower and less able to absorb the energy of the waves. The best solution for beach protection so far is to pile on new sand. Imported sand erodes more quickly for two reasons. The equilibrium of the beach with the seafloor is destroyed since the beach is steeper and absorbs a heavier blow from each wave. Normal beach sand is almost always more coarse than other sands and does not wash as fast as finer grained sand. The study of beach and dune ecosystems show that salt-tolerant beach grasses indicated the inland movement of the high-water line. Using this information construction is moved away from the beaches to allow beaches to move and change naturally. BEACH EROSION, WAVE ACTION

Godfrey, K.A., Jr.

1984 **"Retaining Walls: Competition or Anarchy?" Civil Engineering Magazine ASCE.**
This article is a brief summary of a dozen different construction techniques for the erection of stabilizing walls. Some of the summarized designs center around a contractors inability to gain construction access to adjacent properties. Design company and suppliers addresses are provided. Modifications of these designs might prove useful in archaeological site stabilization. BULKHEADS, WALLS

Gonzalez, Tania

1989 **Study of Soils Buried under Embankments to Determine the Potential of Burial as a Preservation Technique for Archaeological Sites. Masters Thesis submitted to the Office of Graduate Studies of Texas A & M University, College Station, Texas.**
The author reports on a study of natural soils buried under engineered embankments in order to develop the effect of burial on soil properties. Soils in the study group had been buried from 40 to 130 years at depths that ranged between 12 cm and 2.8 m. Factors controlling changes in buried soils are localized and include geology, climate, hydrogeology and geomorphology. Parent material for the buried soil controls the original property of the soil which in turn are responsible for the compressibility and permeability of the buried soil as well as its chemical composition. Most changes in buried soils seem to occur shortly after burial. The results of the investigation suggest that burial protects the site from micro-and macro-organisms. Other parameters to which buried soils may be subjected are increased ground moisture and changes in pH. Organic matter may be better preserved under more moist conditions. EARTH BURIAL

Grau, Richard H.

1984 **Engineering Criteria for Use of Geotextile Fabrics in Pavement and Railroad Construction. Technical Report GL-84-6. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.**
Available literature on the use of geotextiles as separators between granular and subgrade materials is reviewed. Geotextiles tests using a rolling wheel cart are also reported as is an inspection of Corps criteria for geotextile use. Roadway construction is the primary focus of this review and testing report. GEOTEXTILES, DESIGN CRITERIA

Gray, Donald H. and Andrew T. Leiser

1989 **Biotechnical Slope Protection and Erosion Control. Robert E. Krieger Publishing Company, Malabar, Florida.**

Gray, Donald H., Anne MacDonald and F. Douglas Shields, Jr.

1989 **The Effects of Vegetation on the Structural Integrity of Levees. Technical Report REMR-EI-5, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS. (In press.)**

Grisafe, David A.

1992 **Stabilization of Dakota Sandstone Surface of the Faris Cave Petroglyphs; Kanopolis Lake Project, Kansas. Contract Report EL-92-2, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Ms.**

Grisafe points out that some of the most difficult adverse impacts to rock art sites to control result from weathering or deterioration of the stone itself. He discusses the results of field and laboratory experiments that were directed toward strengthening and waterproofing to the Dakota Formation Sandstone in central Kansas. This is a porous and poorly bonded formation. Chemicals based on organosilicon dissolved in a ketone carrier provided substantial cementation of the sand grains of the test areas. He notes that there were no detrimental changes in color, porosity or permeability of the stone.ROCK ART, CHEMICAL STABILIZERS, SANDSTONE

Grisafe, David A. and Paul R. Nickens

1991 **Chemical Stabilization of Porous Sandstones Bearing Petroglyphs. Paper presented at the 56th Annual Meeting of the Society for American Archaeology, New Orleans, LA, April 1991.**
The authors report on a chemical stabilization test conducted on petroglyph bearing sandstone in central Kansas. Four basic requirements were identified that the stabilizing agent should meet: (1) increased stone strength; (2) good depth of penetration; (3) no discoloration of the stone; and (4) pores in the stone would not be sealed. The chemical tested was ethyl silicate dissolved in methyl ethyl ketone. Laboratory tests indicate that the procedure was successful in meeting the four basic

requirements. CHEMICAL STABILIZERS, ROCK ART, PETROGLYPHS

Grissinger, E.H. and A.J. Bowie

1982 Constraints on Vegetative Stabilization of Stream Banks. Paper presented to the American Society of Agricultural Engineers, June 27-30, University of Wisconsin —Madison.

Grosser, Roger D.

1991 Historic Property Protection and Preservation at U.S. Army Corps of Engineers Projects, Technical Report EL-91-11, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Ms.

This study was conducted to assist Corps of Engineers historic property managers in identifying site impacts and selecting site protection and preservation strategies at operation and maintenance (O&M) projects. Additionally, the study reviews how the Corps' internal structure and its assigned missions are integrated in the historic preservation process at O&M projects. Each Corps District was contacted to obtain information on the types of O&M projects in the District, the major impacts to historic properties at these projects, and past and ongoing protective techniques used to mitigate these impacts. CE PROJECT LANDS, HISTORIC PROPERTIES, SITE IMPACTS, SITE PRESERVATION, SITE PROTECTION

Hafenrichter, A.L., John L. Schwendiman, Harold L. Harris, Robert S. McLauchlan and Harold W. Miller

1968 Grasses and Legumes for Soil Conservation in the Pacific Northwest and Great Basin States. Agricultural Handbook 339, Soil Conservation Service U.S.D.A., Washington, D.C. (updated 1979) This Handbook was revised in 1979 and is no longer listed as a Handbook. This volume identifies grasses and legumes that are suitable for erosion control, breaking them up according to the projected life of the grass/legume. Each species is discussed and line drawings as well as Agricultural Zone maps are included. Planting directions are a part of each species description and an Appendix lists recommended planting rates. EROSION, VEGETATION

Hamel, Gillian E. and Kevin L. Jones

1982 Manual of Vegetation Management on New Zealand Archaeological Sites. New Zealand Historic Places Trust Publication No. 17, Wellington, New Zealand.

Harding, Michael V.

1987 Erosion Control and Revegetation on Unusual Sites. Public Works, December, 1987.

Heede, Burchard H.

1980 Stream Dynamics: An Overview for Land Managers. U.S.D.A. Forest Service, General Technical Report RM-72, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, CO.
Concepts of stream dynamics are presented through a discussion of processes and process indicators. Theory of stream dynamics is minimized except where necessary to explain concepts. A basis for predicting how management actions will affect stream and environmental behavior is presented. This report will help the inexperienced manager to understand stream mechanics. STREAM DYNAMICS

Hemphill, R.W. and M.E. Bramley

1989 Protection of River and Canal Banks: a Guide to Selection and Design. Construction Industry Research and Information Association, Butterworths, London. ISBN-0-408-03945-0.
This volume contains chapters that discuss the processes of bank failure, planning and preliminary design, natural bank protection, vertical bank protection and revetments.

Henderson, J.E., and Shields, F.D., Jr.

1984 Environmental Features for Streambank Protection Projects, Technical Report E-84-11, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
This report provides guidance for incorporating environmental considerations into streambank protection projects. The stability of the streambanks of a channel is related to both site-specific and

basin wide stream reach factors. Streambank erosion or failure is a natural fluvial process that is often accelerated by changes in geotechnical or hydraulic factors and especially the activities of man, e.g., reservoir construction or land use changes. Streambank protection projects stabilize the streambank, preventing or stopping erosion. Stabilization results in a range of environmental changes.

An information review was performed to identify environmental features for streambank protection projects. Environmental features are those planning, design, construction, and maintenance procedures or practices that minimize adverse environmental impacts or enhance terrestrial and aquatic habitats and the aesthetic quality of land and water associated with streambank protection projects. Such features include structural and nonstructural designs; construction procedure that are environmentally compatible; maintenance procedures; and institutional, planning and management approaches for streambank protection projects.Each feature is discussed in terms of concept, the purpose or appropriate use of the feature, environmental considerations, limitations to use of the feature, performance history and cost. STREAMBANK PROTECTION, VEGETATION, BANK STABILIZATION STRUCTURES.

Hoffman, George R., Stephen G. Shetron, Charles V. Klimas and Hollis H. Allen

1986 Lakeshore Revegetation Studies at Lake Oahe, South Dakota. Technical Report E-86-3, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

Jones, C.W.

1970 Effect of a Polymer on the Properties of Soil Cement, Bureau of Reclamation Report No. RFC-OCF-20-18, Denver, CO.

Kautz, Harold M.

1969 Chapter 16—Streambank Protection. Engineering Field Manual for Conservation Practices. U.S. Department of Agriculture Soil Conservation Service.
Technical Assistance for clearing and snagging and for simply designed streambank protection methods is provided in this section of the Engineering Field Manual. Protection of Lake fronts or streambanks in tidal areas is not considered in this manual. A discussion of the causes of streambank erosion is followed by a section on design considerations. Various treatments are outlined with specific instructions for their construction. They include channel clearing and snagging, use of vegetation, setted willow poles, tree revetment, piling revetment with wire facing, sacks, brush mats and rock riprap. The majority of these treatments make use of many materials which are locally available thereby minimizing the cost.

Keown, Malcolm P.

1983 Streambank Protection Guidelines. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
This publication is written in layman terms and is intended to provide general information to the public on the subject of streambank stabilization. The nature of streams and reasons for streambank erosion and failure are discussed. A variety of standard streambank stabilization techniques are presented for consideration. EROSION, STABILIZATION, STREAMBANKS

Keown, Malcolm P. and Elba A. Dardeau, Jr.

1980 Utilization of Filter Fabric for Streambank Protection Applications. Technical Report HL-80-12. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
This report presents a state-of-the art literature survey of filter fabric use. Corps of Engineers offices as well as filter cloth manufacturers were queried for both published and unpublished histories of filter fabric use for streambank stabilization. Indications are that if properly selected, filter fabric can serve as a replacement for natural filters. Other possible uses are described. A bibliography is included.

FILTER FABRIC, BIBLIOGRAPHY

Keown, M.P., N.R. Oswalt, B.B. Perry, and B.A. Dardeau Jr.

1977 Literature Survey and Preliminary Evaluation of Streambank Protection Methods. Technical Report H-77-9. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This literature survey emphasizes known streambank protection methods. Mechanisms contributing to streambank erosion are identified and the effectiveness of various methods are evaluated. Appendix B lists commercial concerns that market streambank protection products. A selected bibliography is included. EROSION, STABILIZATION METHODS, BIBLIOGRAPHY

Kinter, E.B.

1975 Development and Evaluation of Chemical Soil Stabilizers, Federal Highway Administration Report No. FHWA-RD-75-17, Washington, D.C.

A study of chemical stabilization of soils began in 1954 with a program enlisting the aid of the chemical industry in the search for effective chemicals. Nineteen firms signed a letter of agreement, and others cooperated on an informal basis. Federal participation consisted mainly of consultation, instruction, development of suitable laboratory evaluation test procedures, and review of test results furnished by cooperators. A number of chemicals, notably phosphoric acid, PDC, Terbec, lignins and quaternary amines, were proposed and evaluated in laboratory and field tests. Many others were given limited examination and laboratory testing. At about 1965, industry's interest shifted largely toward chemicals affecting compaction and moisture-density relationships of soils. Several proprietary compaction aids were evaluated by laboratory tests and one was the subject of field testing. A report on laboratory evaluation of two compaction aids has been prepared. No single chemical or combination of chemicals has been found acceptably effective or economical as a major soil stabilizer. However, further work with phosphoric acid and phosphates may make use of some of these substances possible. Prospects are promising for chemicals to improve moisture-density relationships and to supplement or enhance the effects of the major stabilizers, lime and portland cement. CHEMICAL STABILIZERS, SOILS

Klimas, Charles V. And Hollis H. Allen

1981 Approaches to Revegetate Reservoir Shoreline of Lake Texoma. U.S. Army Engineer Waterways Experiment Station Information Exchange Bulletin, Vol. E-81-2, Vicksburg, MS.

This brochure describes an experimental shoreline revegetation program. A list of plants tested for flood tolerance is included as are the preliminary results of two years of testing. EROSION, SEDIMENTATION, VEGETATION

Knutson, Paul L.

1977a Planting Guidelines for Marsh Development and Bank Stabilization. Coastal Engineering Technical Aid No. 77-3. Coastal Engineering Research Center, Fort Belvoir, VA.

This Technical Aid discusses the techniques that may be applied in the regeneration of a marsh environment. Site characteristics are discussed as are plant selection, methods of revegetation, the determination of fertilizer requirements, and estimations of revegetation cost. Three Appendices detail techniques for obtaining plants, planting methods and maintenance of the revegetated areas. MARSH DEVELOPMENT, PLANTING TECHNIQUES, COLLECTION TECHNIQUES

1977b Planting Guidelines for Dune Creation and Stabilization. Coastal Engineering Technical Aid 77-4, Coastal Engineering Research Center, Fort Belvoir, VA.

Beach grasses have been used to stabilize dune systems. Techniques are available to propagate beach grasses. Guidelines, for selecting plants and planting methods, obtaining plants, storing, planting and maintaining plants and estimating labor requirements for dune vegetation projects are included.

VEGETATION, DUNES, STABILIZATION, COLLECTION TECHNIQUES, PLANTING TECHNIQUES

Koerner, Robert M.

1990 **Designing With Geosynthetics. Prentice Hall, Second Edition.**
This volume is a particularly important reference for anyone who wishes to address stabilization problems through the use of geosynthetics. While the content of the book relies on the presentation of some technical data, the accompanying text is well written and easily understood. Koerner begins with a general introduction to geosynthetics and progresses through sections of geosynthetic design that includes geotextiles, geogrids, geonets, geomembranes and geocomposites. Two of the four appendices are particularly pertinent as they deal with geotextile specifications and product suppliers with technical data for each of their products included. GEOSYNTHETICS, PROJECT DESIGN, SUPPLIERS

Lawson, Daniel E.

1985 **Erosion of Northern Reservoir Shores, An Analysis and Application of Pertinent Literature. Monograph 85-1. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.**

"This monograph describes the current state of knowledge of northern reservoir shore erosion, primarily by examining the results of erosional studies on lakes, coasts and rivers. The major erosional processes of reservoir beaches and bluffs and their mechanics are discussed in detail. Thermal and physical parameters affecting the erodibility of shores, the environmental impacts of erosion, and the basic characteristics of the unique reservoir environment are reviewed. Current models of shore zone development are also presented. This literature analysis revealed that knowledge of erosion and recession in northern impoundments is severely limited. Quantitative analysis of the processes of erosion and their relative importance, parameters determining the nature, rate and timing of erosion, and models to predict the erodibility of a shore for use in minimizing shoreline recession remain in need of basic field research." EROSION, RESERVOIRS, SHORES, WAVES, COLD REGIONS

Livingston, Robert J.

1988 **Proposed Restoration of Seagrass Beds Affected by the Construction of the Choctawhatchee Bay Bridge. Environmental Planning & Analysis, Inc., Tallahassee, FL.**

Logan, Leon D. et al.

1979 **Guidelines for Streambank Erosion Control Along the Banks of the Missouri River from Garrison Dam Downstream to Bismarck, North Dakota. USACE Omaha District, U.S. Forest Service, Northern Region, and North Dakota State Forest Service, Missoula, MT.**

MacDonald, Anne

1990 **Surface Erosion and Disturbance at Archaeological Sites: Implications for Site Preservation. Miscellaneous Paper EL-90-6, Environmental Impact Research Program, U.S. Army Corps of Engineer Waterways Experiment Station, Vicksburg, MS. ARCHEOLOGICAL SITE PROTECTION, SURFACE EROSION**

Markle, Dennis G. and Mary A. Cialone

1987 **Wave Transmission Characteristics of Various Floating and Shallow-Fixed Rubber Tire Breakwaters in Shallow Water. Miscellaneous Paper CERC-87-8, U. S. Army Waterways Experiment Station, Vicksburg, MS.**

A two-dimensional, 1:4 scale model of a rubber-tire breakwater was tested. Floating and bottom-fixed models were tested. Incident wave height, wave period, water depth, wave steepness, relative wave

height, and relative depth are presented in graphic and tabular form. The concepts are ranked from best to worst relative to wave protection that they appear to provide in shallow water. BREAKWATERS, TIRES

Martin, James S.

1985 Erosion Control and Revegetation Mats: A Cost-Effective Approach. Public Works, March, 1985.

Mathewson, Christopher C., Tania Gonzalez, and James S. Eblen

1992 Burial as a Method of Archaeological Site Protection. Environmental Impact Research Program, Contract Report EL-92-1, Center for Engineering Geosciences, Texas A & M University, College Station, Texas.

"Federal and State laws require that archaeological sites must be protected from adverse impacts caused by engineering projects. Archaeological excavation has been the most common means of providing site protection. However, it has been proposed that sites can be protected through burial below an engineered cover, if the engineering project does not require excavation. An investigation of the physical and chemical changes in buried soils was carried out at fill sites ranging in age from 40 to 130 years. It was found that buried soils differ taxonomically from unburied soils at the suborder and lower levels. Buried soils have thicker soil profiles; yellower hues, lower values, and lower chromas; coarser structure; fewer calcium carbonate concretions; increased gleying and mottling; and preserved organic carbon. A related field test using burial to protect against construction equipment loading was carried out at an artificial archaeological site. Protection against equipment loading increases as the thickness or stiffness of the cover increases. Burial was found to cause some breakage of the test artifacts. Physical and chemical changes in the buried soils are controlled by the site geology, climate, hydrogeology, and local geomorphology. Artifact breakage is controlled by the depth of burial, the compressibility of the burial matrix, and artifact orientation. Burial of an archaeological site tends to increase the moisture content, induce reducing conditions, and increase site compression, while excavation of the site removes the artifacts from their naturel environment and destroys spatial relationships. SITE BURIAL

Mathewson, Christopher C.

1988 Protection and Preservation of Archaeological Sites Through Burial: A Multidisciplinary Problem. Paper presented at the 1988 Society for Applied Anthropology meeting. Paper on file at the Center for Engineering Geosciences, Texas A & M University, College Station, Texas 77843-3115.

1989 Interdisciplinary Workshop on the Physical-Chemical-Biological Processes Affecting Archaeological Sites. Environmental Impact Research Program Contract Report EL-89-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report, divided into 15 parts and one appendix, is a compilation of paper presented at an interdisciplinary workshop held at Texas A & M in 1987. The purpose of the workshop was to develop an archaeological site decay model, using the physical, chemical and biological processes that affect archaeological deposits. Each of the first 14 chapters addresses a different subject while the last chapter presents the decay model. Inspection of the model, as it is visually portrayed will aid in designing archaeological site stabilization projects. SITE DECAY, MODELING

Maynord, Stephen T.

1984 Riprap Protection on Navigable Waterways. Technical Report HL-84-3. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Three physical models of the use of riprap protection in navigable waterways are investigated. All three locals are in areas of heavy (towboat), high horsepower propeller wash areas. The determination of appropriate riprap size is the primary focus of two of the studies. RIPRAP, DESIGN CRITERIA

Metzger, Todd R.

1989 Current Issues In Ruins Stabilization In The Southwestern United States, Southwestern Lore, Official Publication, The Colorado Archaeological Society, Vol. 55, No. 3.

This article describes ruins stabilization in the southwest as purely technical in approach using contemporary construction methods that have served to replace the original architecture rather than to preserve it. As a result, most stabilization has been conducted as pure construction projects that have held little regard for the preservation of the features, components and artifactual materials that make an archaeological resource important. In addition there are no suitable standards or guidelines to bring the preservation of the structural fabric of a ruin and the remainder of the archaeological resource of that ruin together in the same preservation effort. Sites thus stabilized retain very little scientific information and their value as interpretive tools and archaeological sites is greatly reduced. Some problems which contribute to the current negative perception of stabilization are discussed. They include use of incongruous materials and techniques, lack of appropriate documentation, lack of guidance and training, lack of support from professional organizations and conflicting perspectives of the historical preservation community, archaeologists and archaeological resource managers. STABILIZATION, RUINS

Mills, A.P., H.W. Hayward and L.F. Rader

1955 Materials of Construction. John Wiley Publishing Co., pp. 406.

Morrison, W.R.

1971 Chemical Stabilization of Soils and Laboratory And Field Evaluation of Several Petrochemical Liquids For Soil Stabilization, Bureau of Reclamation Engineering and Research Center. Report No. REC-ERC-71-30, Denver CO.

Laboratory and field evaluations of several petrochemical liquid soil stabilizers were conducted. Laboratory tests indicated that a sprayable liquid vinyl polymer has excellent properties for stabilizing sandy soil. Initial observations showed that a deep penetrating liquid cutback asphalt was performing satisfactorily in stabilizing dune sand around transmission tower sites along Fort Thompson- Grand Island 345-Kv Transmission Line. A water base acrylic copolymer is providing satisfactory erosion control on test sections of spoil banks at the Tehama-Colusa and Putah South Canals in California. However, the high cost would limit the use of the material to minimum wind and water erosion control. None of 5 protective coating applied to shale seams at Paonia Dam, Colorado, were effective in reducing air-slaking. CHEMICAL STABILIZERS, SOILS

Morrison, W.R. and L.R. Simmons

1977 Chemical and Vegetative Stabilization of Soils. U.S. Department of the Interior, Bureau of Reclamation, Report No. REC-ERC-76-13, Denver, CO.

This report contains the results of a study on various chemical and vegetative methods of soil stabilization. The three main items of work accomplished under the study are: (1) laboratory studies of 30 liquid soil stabilizers to establish performance requirements; (2) discussion of where various chemical and vegetative methods have been used in the field; and (3) includes a survey of chemical stabilization of soils and revegetation methods and materials for erosion control. Results of this study indicate the potential effectiveness of chemical and vegetative stabilization. EROSION, CHEMICAL SEALANTS, VEGETATION, SLOPE PROTECTION, REVEGETATION

Mott, David N.

1994 Streambank Stabilization/Riparian Restoration Action Plan, Buffalo National River Arkansas. Plan

on file at USDI National Park Service, Harrison, Arkansas.

This plan details plans to stabilize and restore 14 streambank locations on the Buffalo River. The plan addresses environmentally sound, holistic and long term cost effective techniques for returning the banks and channel to a stable condition. Of the 14 sites, eight contain cultural deposits, which will require archaeological mitigation prior to the initiation of bank/channel treatment.

The plan contains sections explaining local erosion processes, a geomorphic description of each of these sites, a section describing each location in detail and the mitigation strategy that will be employed at each site. Mitigation of cultural deposit damage will be undertaken when necessary.

The primary approach to be applied will be to backslope the banks to an angle of repose that will support revegetation, install cedar revetments, and plant locally available cane (Arundenarea spp.) and willow (Salix spp.) on the foreslope. Woody vegetation will be planted for reforestation on the top of the bank. This plan can serve as an excellent model for stabilization projects elsewhere. REVEGETATION, CEDAR REVETMENT

Murphy, Thomas E. and John L. Grace, Jr.

1963 Riprap Requirements for Overflow Embankments. Miscellaneous Paper No. 2-552, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report determines riprap requirements for two typical overflow embankments using a series of 1:4 scale model tests. Typically overflow embankments are over topped yearly, consequently riprap was chosen to minimize repair and maintenance costs following each overflow. RIPRAP, EMBANKMENTS, DESIGN CRITERIA

National Trust for Historic Preservation

1992 Saving Place, Project Prepare, Workbook for State Legislation. National Trust for Historic Preservation. A Project by the Northeast Regional Office, Boston, MA.

Nelson, Linda S., Kurt D. Getsinger and Kien T. Luu

1992 Evaluation of Plant Growth Regulators for Use in Grounds Maintenance at Military Installations. Technical Report EL-92-24, U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

The authors report on a 3 year study to evaluate the use of plant growth regulators for reducing grounds maintenance. Objectives of the study were to : (a) evaluate species; (b) determine the cost effectiveness of regulators versus mowing practices; and (c) to provide guidance for incorporating regulators into grounds maintenance programs.

Test evaluations at four installations were completed and are reported here with incorporation recommendations. HERBICIDES, GROUNDS MAINTENANCE

Newcombe, Curtis L.

1978 The Role of Marsh Plants in Shoreline Stabilization, in Proceedings of the International Erosion Control Association Conference Ix, pp. 12-14, Irvine, CA.

Newcombe, Curtis L. et al.

1979 Bank Erosion Control With Vegetation, San Francisco Bay, California. Report MR-79-2, U.S. Army Engineer Coastal Engineering Research Center, Fort Belvoir, Va.

Nickens, Paul R.

1993 Use of Signs as a Protective Measure for Cultural Resource Sites. Technical Report EL-93-6, U. S.

Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Ms.

Olson, R. J.

1989 Soil-Structure Interaction Testing for Assessing the Impact of Pipe Laying Operations at the Kauffman II Archaeological Site, Report submitted to Texas Eastern Gas Pipeline Company by Battelle, Columbus Division, Columbus, OH.

This is the second study completed by Battelle on the effects of weight loading of archaeological deposit soils. A variety of materials characteristic of an archaeological deposit were tested in a laboratory environment for the effects of pressure loading of these materials. Experimentation test techniques are described and results indicated that for the specified conditions, the use of weight distribution mats should be a safe method for protecting an archaeological site from the effects of pipe laying equipment.

WEIGHT DISTRIBUTION, CONSTRUCTION MATS, SOIL PRESSURE

Puffer, Willard, Richard C. Gearhart, and Ricardo Escobar

1983 New Stabilization Method Uses Chemicals, Geotextiles. Forest Industries, February, 1983.

Rushmore, Forest Paul, III

1988 Quantifying Breakage Parameters of Fragile Archaeological Components to Determine the Feasibility of Site Burial. Masters Thesis submitted to the Office of Graduate of Texas A & M University, College Station, TX.

The author indicates that site burial is an option for resource protection and indicates that ceramic vessels and osteological remains that have been excavated from various mounds serve as evidence of the viability of the burial technique. He further indicates that ceramic preservation in mounds in contingent on the physical, chemical and biological environment at any give site. Differential setting of mound fill is frequently responsible for the mechanical breakage of ceramics and bone. Laboratory testing is reported and vessels with an average wall thickness of 6mm buried no deeper than 25 cm would fracture under a surface load of 30 psi. Strain rather than stress forces seem to be the controlling factor. The author indicates that..."site burial - is feasible if the amount of differential settlement is less than the displacement necessary to cause failure of the artifact." EARTH BURIAL

Schiechtl, Hugo

1980 Bioengineering For Land Reclamation and Conservation. The University of Alberta Press, Edmonton, Alberta, Canada.

This book illustrates how the products of scientific and technical research can be integrated with natural materials to realize effective and economic means of stabilizing, protecting and actually improving the condition of our environment. It is a specific aid in improving co-operation between the civil engineer and bioengineer. The author begins with a description of the technical preparation, usually done by civil engineers, and shows in succeeding chapters how bioengineering is integrated into these various protection methods to further enhance and protect earthworks and waterways. The criteria for the selection of various plant materials used in bioengineering are fully discussed, as is how, why and where they should be used. A section on the cost of bioengineering is included. The appendices contain a listing of suitable plants, commercially available, for a wide range of environments. STABILIZATION, NATURAL MATERIALS, PLANTS, STABILIZATION STRUCTURES

Selwitz, Charles

1992 Epoxy Resins in Stone Conservation. The Getty Conservation Institute, Research in Conservation, No. 7.

The author provides a broad background of the use of epoxy resins for the stabilization of stone. He

discusses the chemistry of epoxies and curing agents, penetration of stone, color formation and resistance to biodegradation. He also includes chapters on nonsolvent systems, compares epoxies to other consolidants and discusses the effects of resin solvents. He also presents case studies from California and Kentucky. STONE BUILDINGS - CONSERVATION AND RESTORATION, BUILDING STONES - DETERIORATION, EPOXY RESINS

Sharp, W. Curtis, Cluster R. Belcher and John Oyler

n.d. Vegetation for Tidal Shoreline Stabilization in the Mid-Atlantic States. USDA-Soil Conservation Service, Broomall, Pennsylvania

The authors discuss the procedures for using vegetation to stabilize eroding surfaces on tidal streams and estuaries. Of particular interest is the section describing how one determines if vegetation is an appropriate treatment. A section is included which discusses appropriate species. VEGETATION, COASTAL EROSION

Shelford, Victor E.

1974 The Ecology of North America. University of Illinois Press, Urbana.

Sifers, Samuel I. and James B. Beard

1990 Building a Better Sports Field. Ground Maintenance, Volume 25, No. 3, March 1990. Intertect Publishing Co., Overland Park, Kansas (ISSN-4688).

This article discusses the use of a polypropylene mesh that is used in an admixture of soil to promote plant regeneration and growth. While acting as a soil stabilizing agent, it also serves to help retain soil moisture and serves as a binding agent as vegetation roots intertwine through the matrices of the numerous mesh rectangles. Rectangles measure 2 x 4 inches with 0.4 inch openings. EROSION, SOIL STABILIZATION, GEO-TECHNICAL

Sisson, David A.

1987 Supplement to the Lone Pine Bar Site Stabilization Plan. Bureau of Land Management, U.S. Department of the Interior, Cottonwood Resource Area, Cottonwood, Idaho.

Sotir, Robbin B. and Donald H. Gray

1992 Soil Bioengineering for Upland Slope Protection and Erosion Reduction. U. S. Department of Agriculture, Soil Conservation Service, Engineering Field Handbook, Chapter 18, U.S.A./SCS, Washington, D.C.

Stovall, Randall H. (Editor)

1981 Proceedings of the Eighth Annual Conference on Wetlands Restoration and Creation, May 8-9, 1981. Environmental Studies Center, Hillsborough Community College, Tampa, FL.

Thornburg, A.

1982 Plant Materials for Use on Surface Mined Lands in Arid and Semiarid Regions. USDA Soil Conservation Service, Washington, D.C.

Thorne, Robert M.

1988a Filter Fabric: A Technique for Short-term Site Stabilization. Archaeological Assistance Program, Technical Brief No. 1, U.S. Department of the Interior, National Park Service, Washington, D.C.

This report briefly discusses what filter fabrics are and their usual applications. The advantages and disadvantages of filter fabric are discussed. A specific example of the application of filter fabric to an archaeological site is given, and the details of the processes involved in choosing the specific

stabilization technology which was applied to the site are fully discussed. The actual installation of the filter fabric is described in detail. Installation monitoring is explained. A video tape (VHS) of the installation process is available on a loan basis. STABILIZATION, LACUSTRINE EROSION, GEOTEXTILES, VIDEO TAPE

1988b Guidelines for the Organization of Archaeological Site Stabilization Projects: A Modeled Approach. Technical Report EL-88-8, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This set of guidelines is designed to identify means for evaluating archaeological site preservation technical options and to set up a procedure for selecting the proper options to be employed in specific situations. In the absence of any prior guidelines, these guidelines are based on interviews with Federal and State archaeologists with direct personal experience on specific site preservation situations. The guidelines were tested at a prehistoric mound site on Huffine Island, Tennessee, and those efforts are presented as a case study in site preservation. STABILIZATION, MODEL, GUIDELINES, TEST CASE, FILTER FABRIC

1989 Intentional Site Burial: A Technique to Protect Against Natural or Mechanical Loss. Archaeological Assistance Program, Technical Brief No. 5, Department of the Interior, National Park Service, Washington, D.C.

This is the second technical brief in the series on site stabilization and maintenance. The object of this report is to provide guidance on the design of an effective project for intentional site burial. It identifies the processes which must be addressed by an archaeological program manager considering intentional site burial. These processes include evaluation of the components of the site in terms of Mathewson's Matrix, which considers how a sites's artifact and ecofact components have and will react to their physical and chemical environments through time. The measurement of potential impacts, including decay processes, against the goals for protecting the site is covered, as is assessing the benefits of intentional site burial. Specifying the methods and procedures to be used in the project include a discussion of the actual mechanics of burying a site, the process of establishing a monitoring program and the triggering mechanism for the program and how to price out site burial. STABILIZATION, SITE BURIAL, TECHNOLOGY

1990 Revegetation: The Soft Approach to Archaeological Site Stabilization. Archaeological Assistance Program, Technical Brief No. 8, Department of the Interior, National Park Service, Washington, D.C.

This technical brief addresses the use of revegetation as an alternative to the conservation of archaeological sites. The advantages of the use of plant materials are discussed as are the limits and liabilities of the use of vegetation as a mitigation technique. Sources of plant data and planting guidelines are included. REVEGETATION

Thorne, Robert M., P.M. Fay and James J. Hester

1987 Archaeological Site Preservation Techniques: A Preliminary Review. Technical Report EL-87-3, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report indicates that the combination of civil engineering techniques with a knowledge of the characteristics of archaeological site in an effort to stabilize and preserve a resource is an emerging approach to resource management. Research on site preservation technology is based on questionnaires sent to over 400 archaeologists, principally in the federal service. Results of the survey indicated little first-hand experience, few published cases of preservation action, and little past installation evaluation. Site impacts were divided into naturally and culturally stimulated. Techniques that are available to counter these effects are divided into manmade or natural and further subdivided into vertical and horizontal and each is discussed. STABILIZATION

U.S. Army Coastal Engineering Research Center

1981 Low Cost Shore Protection: A Property Owner's Guide, Washington, D.C.

1984 Shore Protection Manual, Volumes I and II. U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

This manual, divided into two volumes (Chapters 1-5 and Chapters 6-8 with Appendices A-D), has become the standard reference for the engineering design of shoreline erosion protection projects since its initial publication in 1973. It addresses both the natural and man-induced changes in the coastal zone, the structural and non-structural protection against these changes, and the desirable and adverse impacts of possible solutions to problem areas on the coast. Since no two coastal problems are alike, the approach taken by the manual is to thoroughly study and clearly define each problem. The solutions are then evaluated in terms of physical and environmental effects, advantageous and detrimental, and compares these with cost, maintenance and benefits to arrive at the solution.

"The shore protection manual provides sufficient introductory material and engineering methodology to allow a person with an engineering background to obtain an understanding of coastal phenomena and to solve related engineering problems. The manual includes detailed summaries of applicable methods, techniques and useful data pertinent to the solution of coastal engineering problems." COASTAL EROSION, STABILIZATION, DESIGN CRITERIA

U.S. Army Corps of Engineers

1987 Historic Preservation Program. Engineering Regulation 1130-2-438, Department of the Army, U.S. Army Corps of Engineers, Washington, D.C.

1989 Environmental Engineering for Coastal Protection. CECW-EH Engineer Manual No. 1110-2-12-4, Department of the Army, U. S. Army Corps of Engineers, Washington, DC.

1992 Proceedings Second Interagency Symposium on Stabilization of Soils and Other Materials. U. S. Army Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, Federal Highway Administration, Environmental Protection Agency, Naval Facilities Engineering Command, Metairie, LA.

U.S. Army Engineer Waterways Experiment Station

1942 Investigation of the Unconfined Compressive Strength of Soil-Cement Mixtures, Technical Memorandum No. 187-1, Vicksburg, MS.

1986 Field Guide for Low Maintenance Vegetation Establishment and Management. Instruction Report R-86-2, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

1988 The Archaeological Sites Protection and Preservation Notebook. Environmental Impact Research Program, Environmental Laboratory, Vicksburg, MS.

This loose-leaf notebook contains a series of technical notes that are synopses of articles and publications that deal with archaeological site preservation and protection. Eleven subject areas cover: 1) Impacts; 2) Site Burial; 3) Structural Stabilization; 4) Soil and Rock Stabilization; 5) Vegetative Stabilization; 6) Camouflage and Diversionary Tactics; 7) Site Stabilization; 8) Stabilization of Existing Structures; 9) Faunal and Floral Control; 10) Signs; 11) Inundation. As additional notes are printed, they can be added to the notebook. TECHNICAL NOTES

U.S. Department of Agriculture

1976 Plant Materials Study: A Search for Drought-Tolerant Plant Materials for Erosion Control,

Revegetation, and Landscaping Along California Highways. Soil Conservation Service Research Project USDA/SCS LPMC-1, Davis, CA.

"Plant materials were assembled, propagated, and established along California state highways. Grasses, legumes, and the California poppy were evaluated for erosion control, fire control, and aesthetic purposes. Shrubby species were evaluated for revegetation and general landscaping. Emphasis was placed upon drought-tolerant, low-growing plants which would require a minimum of maintenance. A herbaceous seeding guide and a list of native shrubs and trees were prepared for California, classified by major land resource areas. Special and supplementary studies relevant to plant propagation and establishment were conducted. Whenever possible, the plants were evaluated on representative highway sites using common methods applied by contractors. Most data were collected by visual observation, no statistical analyses were made beyond simple arithmetic averages. Some continued monitoring of plantings is recommended to assess anticipated future changes." REVEGETATION, LANDSCAPING

1990 Improved Conservation Plant Materials Released by SCS and Cooperators Through December 1990. U.S. Department of Agriculture, Soil Conservation Service, National Plants Material Center, Beltsville, MD.

This is a listing of improved erosion control plants released by the Soil Conservation Service between 1939 and 1990. Listing is by scientific name and by growth type (grasses, legumes and forbs, woody plants). Common names are included as is the source of the plant, allowing users to identify non-native species. REVEGETATION, PLANTS FOR EROSION CONTROL

1999 National Plant Data Center. Progressive Farmer, August 1999

This is a short article that describes the USDA National Plant Data Center. The Center's database contains information of 40,000 plant species found in the United States. Species listed include both indigenous and exotic species. Can be accessioned on the WEB at: plants.usda.gov VEGETATION, PLANT SPECIES

U.S. Department of the Interior

1982 Laboratory and Field Studies in Soil Stabilizers, Volume IV. U.S./U.S.S.R. Joint Studies on Plastic Films and Soil Stabilizers, U.S. Department of the Interior, Bureau of Reclamation, Denver Federal Center, Denver, CO.

Vogel, Willis G.

1981 A Guide for Revegetating Coal Mine Soils. General Technical Report NE-68 U.S. Forest Service, Northeastern Forest Experiment Station, Berea, Kentucky.

This report provides information, recommendations, and guidelines for revegetating land in the eastern United States that has been disturbed by coal mining regions in the east, and a discussion of minesoil properties and procedures for sampling, testing, and amending minesoils. Plant species that have been used for revegetating surface - mined lands are identified and described. Selection criteria for plant species and methods and requirements for seeding and planting are explained. Some of the data on tree species used in reforestation were obtained from recent surveys of 30-year-old experimental planting in several eastern states. Included are maps showing the eastern coal regions or portions of them where a plant species has been used successfully, or its use is recommended. STABILIZATION, GRASS, TREES, SHRUB MAPS, SOIL TESTING, CLIMATE DATA

Ware, John A.

1989 Archaeological Inundation Studies: Manual For Reservoir Managers. Contract Report EL-89-4, U.S.

Army Engineer Waterways Experiment Station, Vicksburg, MS.

"Development and operation of freshwater reservoirs create a variety of potential impacts on archaeological resources. These impacts accrue from several sources, including mechanical, biochemical, and human and other processes associated with the reservoir environment. This report summarizes the findings of the National Reservoir Inundation Study, a multi-agency project designed to assess the range of effects of inundation on archaeological resources. Potential effects are discussed within three discrete zones of differential impact: (a) the conservation pool, (b) the fluctuation zone, and (c) the backshore zone." ARCHAEOLOGICAL SITES, INUNDATION IMPACTS, RESERVOIR PROCESSES

Warnock, Robert A., Lila Fendrick, Barbara E. Hightower and Terry Denise Tatum

1983 Vegetative Threats to Historic Sites and Structures. U.S. Department of the Interior, National Park Service, Park Historic Architecture Division, Washington, D.C.

Westmacott, Richard

1985 "Box and Mattress Gabions." Landscape Architecture, Volume 75, No. 3, May/June.
In this article several gabion shapes are described, along with construction materials, characteristic and suggested methods of use, and their advantages and disadvantages. Cost estimates for gabion use are also included. STABILIZATION, GABIONS

White, Dewey W., Jr.

1981 Evaluation of Membrane-Type Materials for Streambank Erosion Protection. Miscellaneous Paper GL-81-4. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

"The objective of this study was to investigate new materials and construction techniques for streambank protection by preventing erosion of the banks. The specific materials used were: T15, Laminated vinyl-coated nylon; T16, Neoprene-coated nylon; Hypalon, Synthetic rubber-coated 5x5 and 10x10 Polyester scrim membranes; and Bidim C-34 and C-38, Spunbonded, continuous polyester filament filter fabrics." Laboratory tests determined the physical characteristics of the materials. The membrane materials were installed in two different locations by three different construction techniques. Riprap placed over the filter fabrics was the standard for comparing the performance of all test materials. Test results indicated that all membrane materials used performed satisfactorily in protecting streambanks and riverbanks from erosion during normal streamflows as long as the banks remain stable. STABILI-ZATION, FILTER FABRICS, RIPRAP, MEMBRANE ENCAPSULATED SOIL LAYER (MESL)

Whitlow, Thomas H. and Richard W. Harris

1979 Flood Tolerance in Plants: A State-of-the-Art Review. Technical Report E-79-2, U. S. Army Waterways Experiment Station, Vicksburg, MS.
Both basic aspects of flood tolerance and applied aspects of establishing vegetation are discussed. Tables by common name and scientific name are included. This information would be useful in planning shoreline stabilization/ revegetation efforts. Out of print; available from NTIS. FLOOD TOLERANCE, PLANTS, RESERVOIRS, VEGETATION

Whitten, Charlie B. and David M. Patrick

1981 Engineering Geology and Geomorphology of Streambank Erosion, Report 2, Yazoo River Basin Uplands, Mississippi. Technical Report GL-79-7, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Ms.

Four streams --Perry, Tillatoba, Goodwin, and Hotopha Creeks--were selected as study sites to determine the cause of the excessive bank erosion. All four streams are located along or close to the bluff line. Historical comparative analyses were used to identify significant changes in stream and

basin geomorphology and to detect mechanisms that produced or could produce these changes. Chronological sequences of aerial photographs, field observations, maps, and survey data were the principal means used to measure the basic hydraulic and geomorphic conditions that define the fluvial geomorphic system. Stream width, stream depth, channel slope, and sinuosity were the more easily measurable variables, but general observations about the flow, sediment discharge, and sediment size could also be made. Changes in hydraulic and geomorphic conditions have caused streambed and streambank erosion as the streams adjust to the changes. Channelization has been the factor most responsible for streambed and streambank erosion. All of the major streams and many of the tributaries in the Yazoo River Basin and the Mississippi River Basin have been channelized to some extent. The stream distance to zero-base level (Gulf of Mexico) has been shortened approximately 10.5 to 13.6 percent. Channel degradation believed to be caused by the increased gradient and to a lesser degree, other causes. STREAMBANK EROSION, CHANNELIZATION

Williams, Lance R.

1978 Vandalism to Cultural Resources of the Rocky Mountain West. Cultural Resources Report No. 21, USDA Forest Service, Southwestern Region, Albuquerque, NM.

Young, W.C.

1973 Plants for Shoreline Erosion Control in Southern Areas of the United States, modified by W.C. Ackerman, G.F. White, E.B. Worthington in Man-Made Lakes: Their Problems and Environmental Effects. Geophysical Monograph Series No. 17, American Geophysical Union.

This paper discusses various species of plants that have been tested for their adequacy in stabilizing eroding shorelines. Maiden cane is specifically identified as a good choice for across the water line protection. EROSION, MAIDEN CANE, VEGETATION

Section 3 – MANAGEMENT RECOMMENDATIONS

Advisory Council on Historic Preservation

1980 Treatment of Archaeological Properties, A Handbook. GPO-875-937, Washington, D.C.

1982 Manual of Mitigation Measures (MOMM). Advisory Council on Historic Preservation, Washington, D.C.

1984 Memorandum of Agreement between the Advisory Council on Historic Preservation and the Federal Highway Administration, Jefferson City, Missouri. Final Document transmitted on April 18, 1984. While the original Memorandum of Agreement did not call for site burial, an amendment submitted to the Advisory Council recommended that portions of site 23LN104 be buried rather than excavated. One-half of the total number of features identified would be left at least 50% in situ. Selected features were to be left completely intact. Missouri Highway and Transportation Department design specifications were modified to accommodate the burial of the site under four inches of sand and the subsequently placed road fill. Three research questions regarding site burial are incorporated into the Memorandum of Agreement. SITE BURIAL

1989 Preparing Agreement Documents: How to Write Determinations of No Adverse Effect, Memoranda of Agreement, and Programmatic Agreements Under 36 CRF Part 800. Working with Section 106. Advisory Council on Historic Preservation, Washington, DC.

Barnes, Mark R.

1983 Archaeological Site Preservation Through Interagency Cooperation: A Model From the San Juan

Basin. American Archaeology, Vol. 3, No. 3.
This article reports on the formation of an Interagency Archaeological committee whose goals are to insure timely and research oriented compliance and to create preservation options based on state-of-the-art research. Elements necessary for the identification and evaluation of resources have been developed. Primary emphasis of the program is interagency cooperation in the face of unprecedented growth. PRESERVATION PLAN, INTERAGENCY COOPERATION

Burns, Mary Gregorie
1997 The Goat Island Campsite, Tivoli Bays, Hudson River: Potential for Environmental Information From a Heavily Looted Archaeological Site. A Masters Thesis submitted to the faculty of the Graduate School of Environmental Studies, Bard College, Annandale-on-Hudson, New York.

The "Campsite" was partially excavated professionally in 1939 and was before and has since been the target for looting. At the time that the site was reassessed in 1994 at least 200 looters holes covered an area of about 0.3 HA. The thesis presents a plan for the stabilization of the site as well as backfilling of the looters holes. Burial of the site is the recommended approach to long term site protection. LOOTING, SITE BURIAL

Briuer, Frederick L. and Charles M. Niquette
1983 Military Impacts to Archaeological Sites. Cultural Resource Analysts, Inc., Lexington, KY.

"Recent archaeological research conducted at Fort Hood, Texas, has emphasized that traditional anthropological and archaeological objectives in the execution of contract investigations on military installations may be inadequate for the design and implementation of effective management strategies. This is not to say that essential anthropological research should be omitted, but rather that non-anthropological research questions must also be addressed. Unlike most federal undertakings that result in cataclysmic destruction of archaeological sites, military impacts to cultural resources frequently represent ongoing and poorly understood processes. Initial research regarding the processes of military impacts on archaeological sites has allowed specific impacts to be identified and measured at two different military installations: Fort Hood, Texas, and Fort Leonard Wood, Missouri. The objective of this paper is to compare results of impact research at each installation and to demonstrate that the quantitative results of impact research may provide an appropriate foundation for defensible and cost-effective management recommendations."

CALTRANS Engineering Service Center
1995 Assessment and Mitigation of Construction Activities at an Archaeological Site(CA-FRE-61) at Wahtoke Creek, California. Memorandum from Engineering Service Center to CALTRANS District Director, Fresno, CA.

This Memorandum describes the engineering criteria necessary to construct the approach ramp and bridge at site CA-FRE-61. This was determined to be a significant site that was also of concern to Native Americans who desired that the site be conserved. Site burial was selected at the appropriate mitigation approach. Design features indicate minimum site disturbance at 95% compaction beneath the appropriate thickness of fill, with no predicted significant change in the soil chemistry or pH of the site matrix by using processed aggregate sand and gravel. Subgrade filter cloth was recommended for subgrade reinforcement. This project met the mitigation requirements of the Advisory Council. SITE BURIAL, FILTER CLOTH, CALTRANS

Carlson, David L. and Frederick L. Briuer
1986 Analysis of Military Training Impacts on Protected Archaeological Sites at West Fort Hood, Texas.

Archaeological Resource Management Series, Report Number 9, U.S. Army Fort Hood. (See annotation with same entry under Practical Applications section.)

Carrell, Toni, Sandra Rayl and Daniel Lenihan

1976 The Effects of Freshwater Inundation of Archaeological Sites Through Reservoir Construction: A Literature Search. U.S. Department of Interior, National Park Service, Cultural Resources Management Division, Washington, D.C.

Galm, Jerry R.

1986 A Preservation Plan for Archaeological Site 45CH302, Chelan County, Washington. Report prepared for and submitted to Chelan County Public Utility District No. 1, Chelan County, State of Washington.

The author presents traditionally derived archaeological data as a background for the recommended preservation measures to be put into place at 45CH302. Loss of the cultural material at the site is attributed to erosion of the bankline of the Columbia River that is caused by a combination of factors including stream bank undercutting from wave activity, looting of artifacts from the exposed cultural deposit and the lack of protective vegetation. Recommended stabilization techniques include filling the bankline to a 2:1 sloop and armoring this new slope profile with riprap with a filter cloth underlayment and capping of the upper surface of the site with up to 6" of clean fill. Filter cloth underlayment is also recommended for the area to be filled. RIPRAP, SITE BURIAL

Garrett, Susan E.

1983 Coastal Erosion and Archaeological Resources on National Wildlife Refuges in the Southeast. Archaeological Services Branch, National Park Service, Southeastern Region, Atlanta, Georgia. This report provides a synthesis of erosional impacts to coastal wildlife refuges and is designed to serve as the basis for the development of a management and preservation plan. Potentially useful control measures are discussed including both structural and non-structural techniques from the perspective of applicability and cost-effectiveness in comparison to data recovery. COASTAL EROSION, STABILIZATION, COST-EFFECTIVENESS

Hickerson, Lynn (Editor)

1990 Historic Maritime Resources: Planning for Preservation. Office of Maritime Preservation, National Trust for Historic Preservation, Washington, DC.

Mott, David N.

1994 Streambank Stabilization/Riparian Restoration Action Plan, Buffalo National River Arkansas. Plan on file at USDI National Park Service, Harrison, Arkansas.

This plan details plans to stabilize and restore 14 streambank locations on the Buffalo River. The plan addresses environmentally sound, holistic and long term cost effective techniques for returning the banks and channel to a stable condition. Of the 14 sites, eight contain cultural deposits, which will require archaeological mitigation prior to the initiation of bank/channel treatment.

The plan contains sections explaining local erosion processes, a geomorphic description of each of these sites, a section describing each location in detail and the mitigation strategy that will be employed at each site. Mitigation of cultural deposit damage will be undertaken when necessary.

The primary approach to be applied will be to backslope the banks to an angle of repose that will support revegetation, install cedar revetments, and plant locally available cane (Arundenarea spp.) and willow (Salix spp.) on the foreslope. Woody vegetation will be planted for reforestation on the top of the bank.
This plan can serve as an excellent model for stabilization projects elsewhere. REVEGETATION, CEDAR REVETMENT

National Register of Historic Places

1977 Guidelines for Local Surveys: A Basis For Preservation Planning. National Register Bulletin 24, National Register of Historic Places, Interagency Resources Division, National Park Service, U. S. Department of the Interior, Washington, DC.

Phillips, John C.

1986 Archaeological Data Recovery From 22LA545, Lafayette County, Mississippi. Report submitted to U.S. Army Corps of Engineers, Vicksburg, MS.

Schiffer, Michael B. and George J. Gumerman (Editors)

1977 Conservation Archaeology, A Guide for Cultural Resource Management Studies. Academic Press, Inc. New York, NY.

Sisson, David A.

1983 "Lower Salmon River Cultural Resources Management Plan," U.S. Department of the Interior, Bureau of Land Management, Cottonwood Resource Area, Idaho.

Recommended measures for use in the protection of cultural resources along the Lower Salmon are divided into two categories: physical measures and administrative measures. The former category includes the use of structural stabilization, vegetation, buried obstructions, electronic surveillance, barriers, patrolling, signing and monitoring among others. A brief discussion of each of these potentially useful approaches is included. STRUCTURES, VEGETATION, BURIED OBSTRUCTIONS, ELECTRONICS, BARRIERS SIGNS

Smith, Gerald P.

1982 The Rock Creek Archaeological Project: Natchez Trace Parkway, Colbert County, Alabama. Report submitted to Southeast Archaeological Center, National Park Service, Tallahassee, FL.
Chapter Five of this report includes recommendations for the protection of sites 1CT44 and 1CT45. Only the latter is of interest here and Smith recommended grassing the site over and if agriculture is to be allowed, he recommends the use of hay crops only. He makes passing mention of burial of the site but discourages the possibility. (Ed. Note: This site was ultimately buried under 12 inches of topsoil over an intervening and compacted 3-4 inch level of clay- gravel. See Larson (Practical Applications) in this bibliography). STABILIZATION, GRASS

Thorne, Robert M.

1992 In-Place Conservation for Archaeological Site on Island in Llangosse Lake Crannog. Recommendations report submitted to Cawd: Welsh Historic Monuments, Cardiff, Wales, United Kingdom.

Archaeological properties at this site are being damaged through fluctuations in the water level of the lake as well as through wave activity generated by both wind and pleasure boats. Recommended techniques for stabilization and rebuilding of the shoreline include the revegetation of the marsh surrounding the island. The development of a marsh will create a stilling basin environment which will allow the accumulation of sediment as well as protect the shoreline from wave activity. REVEGETATION, STILLING BASIN, WALES

1999 Archaeological Site Stabilization and Conservation Recommendations for Eight Sites on Santa Cruz and Santa Rosa Islands, Channel Islands National Park, California. Report submitted to Channel Islands National Park, Ventura, CA.

Ehrenhard, John and Robert M. Thorne

2000 Archaeological Site Stabilization Observations for Resources Located in Tsurai (CA-HUM-118)

Humboldt County, California. Report submitted to National Park Service Archaeological Assistance Program, San Francisco.

Archaeological Site Stabilization Observations for Resources Located in Tshapek (CA-HUM-129) Hum

Trinkley, Michael, Debi Hacker and William B. Barr

1996 A Conservation Assessment and Preliminary Preservation Plan for Fort Howell, Hilton Head Island, Beaufo

This report provides an assessment of the loss of the earthworks at Fort Howell on Hilton Head Island. Natural erosion, as well as erosional loss resulting for pedestrian traffic as well as trail bikes and all terrain vehicles have contributed to the loss of the definition of the earthworks. Some looting activity is also suggested. The authors present a plan for management of pedestrian traffic as well as curtailing the use of bikes and ATV's on the property. EROSION CONTROL, PEDESTRIAN CONTROL

U.S. Army Corps of Engineers

1982 Walth Bay Archaeological Site Bank Stabilization; Missouri River, Oahe Dam - Lake Oahe, South Dakota and North Dakota, Design Memorandum No. MO-217, Omaha, NE.

This document is a draft copy of the Design Memorandum for protection of the Walth Bay site and is not in final form. The document contains a brief description of the site as well as a discussion of the mechanisms leading to the ultimate loss of the resource: vandalism, recreational development, and erosion. Four alternatives for protection of the site are considered and include: (1) doing nothing and (2,3, & 4) three design plans for the use of stone facing (riprap). The document also includes copies of correspondence from the various agencies who must either approve or permit the use of riprap to protect the site. Cost estimates and specifications are included. VANDALISM, RECREATION, EROSION, RIPRAP

1989 Digest of Water Resources Policies and Authorities. CECW-RR Pamphlet No. 1165-2-1. Department of the Army, U. S. Army Corps of Engineers, Washington, DC.

1992 Section 14 Feasibility Report for Emergency Streambank Protection, Drayton Hall, Charleston County, South Carolina. Charleston District, Charleston, S.C.

This feasibility identifies and evaluates six structural means of alleviating erosion of the river bank at the orangery at Drayton Hall. Each potential solution is discussed and installation costs are presented. Cost-benefit ratios are included and compared with the cost of complete excavation, analysis, report preparation, and curation. RIP RAP, COST-BENEFIT

U.S. Army Engineer District, Omaha

1981 Crow Creek Archaeological Site, Lower Bank Slope Protection, Missouri River, Fort Randall Dam—Lake Frances Case, South Dakota, Design Memorandum No. MR-130 (revised April 1981), Omaha, NE.

Erosion of the Crow Creek site is defined as the cause of the resource loss. Excavation is considered as are five alternatives for upper bank protection and four alternatives for lower bank protection. The set of five alternatives include: a training dike, a gabion wall, sheet piling, tiebacks, a fence wire basket. Alternatives for lower slope protection include: slope flattening, longards, excavation, and riprap. Discussions of the advantages and disadvantages of each approach are included. The document also incorporates copies of correspondence from the various agencies who must either approve or permit the use of riprap to protect the site. EROSION, TRAINING, DIKE, SHEET PILING, TIEBACKS, FENCE WIRE BASKET, LONGARDS, RIPRAP

U. S. Department of Agricultural

1989 Request for Proposal, River Point Erosion Control. USDA Forest Service, U. S. Department of Agriculture, Superior National Forest, Duluth, MN.

U. S. General Accounting Office

1987 Cultural Resources, Problems Protecting and Preserving Federal Archaeological Resources. Report to Congressional Requesters, GAO/RCED-88-3, U.S. General Accounting Office, Washington, DC.

Warnecke, Lisa

1990 Geographic Information Systems Use in State Government Agencies. Cultural Resources Information Management Series, U. S. Department of the Interior, National Park Service, Cultural Resources, Washington, DC.

Zeichner, Lauren Lubin (Thesis)

1988 Landscape Management Plan for Dungeness, Cumberland Island National Seashore, GA. CPSU Report No. 44, National Park Service Cooperative Unit, Institute of Ecology, The University of Georgia, Athens, GA.

Section 4 – PRACTICAL APPLICATIONS

Almy, Marion M. and George M. Leur (Principal Investigators)

1992 A Window to the Past: An Archaeological Discovery at Historic Spanish Point Sarasota County, Florida. Archaeological Consultants Incorporated, Sarasota Florida.

This reports contains a very brief history of the development of the building that was constructed to enclose the large opening in the midden at Historic Spanish Point. The building was designed to place a roof over the entire opening and closed on the front with a store-front facade to protect the midden from vandalism from people entering the area by boat. Since the interior of the closed area was to serve as a display space, the opening was floored. A lack of incorporated ventilation, combined with the rising and falling of the very shallow water table, set up an ideal environment for mold and mildew growth. The situation was remedied through the installation of proper ventilation. The display is open to the public.PUBLIC ACCESS, DISPLAY AND INTERPRETATION,

Anderson, Gary, Chris Zabawa and Jordan Lerau

n.d. Maryland's Demonstration Shoreline Protection Project, Jefferson Patterson Park and Museum, Patuxent River, Calvert County. Brochure produced by Maryland Department of Natural Resources, Tidewater Administration, Coastal Resources Division, Annapolis, MD.

The authors describe the use and installation of a combination of techniques, riprap breakwaters & vegetation that were used to protect a portion of the shoreline at Jefferson Patterson Park and Museum. Installation procedures are described and cost factors are included.
EROSION, COASTAL, BREAKWATERS, VEGETATION

Anderson, W.J., Jr.

1982 Letter correspondence to Groton, Connecticut housing officer regarding alterations to size of area at Baldwin Ridge Archaeological Site Preservation and retaining of certain trees. (See Soulsby this section.) HOUSING DEVELOPMENT, SITE BURIAL, SAND, TOPSOIL

Anonymous

1901 Sixteenth Annual Report. Ohio Archaeological and Historical Publications, Vol. 9. (Indicates tax status.)

Ardito, Anthony J.

1993 Reducing the Effects of Heavy Equipment Compaction Through a Program of In-Situ Preservation. Report prepared for Iroquois Gas Transmission System, L.P., Shelton, Connecticut.

This is the report of the implementation of a study to determine the effects of compaction of buried cultural materials, caused by the movement of heavy pipeline equipment as it moved across the site. Pre and post-construction soil samples were taken at the test sites and included PH, moisture content, particle size and shear strength of the soil using cone penetrometer readings. The study indicated that where construction impacts will occur over a relatively short period of time that compaction of the cultural deposit can be reduced or prevented through the placement of a protective overburden.
SITE BURIAL, CONSTRUCTION EQUIPMENT

Barnes, Mark

1979 Examples of Site Protection Across the Nation, in Vandalism of Cultural Resources: The Growing Threat to Our Nation's Heritage, compiled by Dee F. Green and Steven LeBlanc. Cultural Resources Report No. 28, USDA Forest Service, Southwestern Region, Albuquerque, NM.

Barnes points out that while site preservation was once synonymous with visitor center development,

the concept now extends to in situ protection, excavation, as well as the use of a site for public interpretation. He further indicates that site preservation now derives as a result of an appropriate decision making process. He cites as examples coastal sites in Maine, Cahokia Mounds, Bear Butte in South Dakota, Mimbres Valley sites in New Mexico as well as sites in Puerto Rico, California and Texas. The role of the Nature Conservancy and the Galivan Foundations are also discussed.

Berry, Andre Q. and Ian W. Brown (Editors)

1994 Erosion on Archaeological Earthworks: Its Prevention, Control and Repair. Clwyd Archaeology Service, Clwyd County Council, Department of Development and Tourism, Shire Hall, Mold. Clwyd, CH7 6NB, England.

Brookes, Samuel O.

1976 The Grand Gulf Mound; Salvage Excavation of an Early Marksville Burial Mound in Claiborne County, Mississippi. Archaeological Report No. 1, Mississippi Department of Archives and History, Jackson, MS. FENCING

Brown, Margaret Kimball

1983 Mothballing Albany Mounds. American Archaeology, Vol. 3, No. 3.

The Albany Mound site, consisting of some 40-50 mounds and three village areas, is owned by the Illinois Department of Conservation. Preservation of the site, with a very limited budget was a multidisciplinary effort. Invasion species were removed from the site and prairie grasses and brush and trees that would have been a part of the original prairie community were left to grow to maturity. Management of the prairie environment will be through controlled burns and the expense of maintenance will be minimized. VEGETATION

Bryant, Richard M. and Steven L. Petersen

1996 Restoration of Disturbed Areas, Bryce Canyon Road Project, Bryce Canyon National Park, Utah. Report on file, Bryce Canyon National Park, Utah.

The Rim Road in Bryce Canyon National Park was originally constructed in the late 1930's and realigned in 1994 and 1995, resulting in the disturbance of approximately 70 acres that required revegetation to prevent erosion and to create a visual appearance approximating the natural vegetation of the surrounding areas. This report includes a discussion of the planning process, the selection and installation of native vegetation, and the results of the revegetation process. VEGETATION, REVEGETATION

Calabrese, Francis A.

1986 Personal Communication Concerning Bank Stabilization Project, Knife River Indian Villages National Historic Site. Memoranda and Correspondence on file at Midwest Archaeological Center, National Park Service, Lincoln, Nebraska.

The National Park Service and U.S. Army Corps of Engineers cooperated to stabilize part of the river-bank fronting on the Knife River Indian Village National Historic Site. Approximately 1,680 linear feet of revetment-type bank protection was constructed—one example of long-term archaeological resources preservation. Acquisition of certain plots of land was also necessary before the protective measures could be undertaken. The actual structure includes an earth-fill berm, protected on the riverward side with a stone-fill toe and riprap blanket placed upon the upper bank. The visible surface voids of the riprap and toe were filled with gravel. The entire crown and riverward slope were then covered with a layer of topsoil and vegetation, including native grasses and shrubs. Photographs of the project after completion show that efforts to preserve the terrain's natural appearance by varying the structure crown widths and elevations were successful. RIPRAP, REVEGETATION

Callum, Kathleen and Thomas Buchanan

1996 ***In Situ*** **Site Burial: The Efficacy of a Geotextile and Gravel Fill Cover as Protection Against Construction-Related Traffic Over an Archaeological Site. Report submitted to Vermont Gas Systems, Inc., prepared by GEOARCH, Inc. Brandon Vermont.**

This report details the experiment burial or covering of an archaeological site to provide a short-term access road for pipeline construction related activities. An underlayment of geotextile (Mirafi 500X) was placed across the site and was covered with a 12 inch course of crushed gravel fill. Test units were excavated within the travelway prior to construction of the temporary surface. Following completion of the pipeline work, the prepared surface was removed and additional test units were dug both within and without the travelway. Compaction information was ambiguous and could possibly be attributed to the short duration of use as well as to the limited scope of the experiment. There was no apparent damage to artifacts recovered from the within-the-travelway test units, and little surficial damage was observed. Additional testing of this form of site burial is recommended. Geotextile specifications tables as well as engineering recommendations are included as appendicies to the text. GEOTEXTILE, SITE BURIAL, SOIL REINFORCEMENT

Carlson, David L. and Frederick L. Briuer

1986 Analysis of Military Training Impacts on Protected Archaeological Sites at West Fort Hood, Texas. U.S. Army Fort Hood Archaeological Resource Management Series, Research Report Number 9, Fort Hood, TX.

This report presents a statistical analysis of data gathered during site monitoring in a program of site protection designed to decrease the impact of military maneuver training on archaeological sites. Site protection measures were designed on a case-by-case basis for each site. Sites were monitored over an eighteen month period. Protection measures were successful, but better methods of measuring on-going impact are needed. One very significant conclusion is that "site protection measures are more cost effective than data recovery in those instances where the flow of military training can be successfully directed around archaeological sites." STRUCTURES, SITE BURIAL, SIGNS, WIRE, MONITORING FORMS

Carnes-McNaughton, Linda F.

1995 Summary Report of the Erosion Control Project, Town Creek Indian Mound State Historic Site, Montgomery County, North Carolina. Report on file with State of North Carolina, Department of Cultural Resources, Raleigh, NC.

This report includes a description of the planning process that was employed to design an appropriate stabilization program and describes the technique selected. The placement of the gabions is described. STREAMBANK EROSION, GABIONS

Chace, Paul G.

1981 "Perspectives on Archaeological Site Capping." Contract Abstracts and CRM Archaeology (Now American Archaeology), Volume 3, No. 1, Atechison, Inc., Albuquerque.

This article presents a cogent argument for capping archaeological sites as a means of stabilization. Chace discusses four considerations in the decision making process for selecting capping as a preferred alternative. A limited bibliography dealing with site capping is included and planning requirements are discussed. SITE BURIAL, PLANNING GUIDELINES

Chapman, Lloyd N.

1982 Letter correspondence from National Park Service to U.S. Navy regarding Baldwin Ridge Archaeological Site, Groton, CN. (See Soulsby this section.) HOUSING DEVELOPMENT, SITE

BURIAL, SAND, TOPSOIL

Dallas, Herb

1988a Site Midden Stabilization/Protection, Andrew Molera State Park. Statewide Resource Management Project Status Report, California Department of Parks and Recreation, Monterey, CA.
This report describes the efforts to stabilize and revegetate an 800 square meter blowout in a sand dune environment caused by eolian erosion. Extended use by park visitors (foot traffic) caused a loss of protective vegetation on a portion of archaeological site CA-MNT-73 in the Andrew Molera State Park. A wooden causeway was built across the blowout area to redirect and contain foot traffic. Trail barriers and signs were built from railroad ties at appropriate spots to control erosion. Railroad ties were also used to control erosion on unstable segments of the park trail which traversed the site. Snow fence was placed on either side of the wooden causeway to catch sand and reduce wind velocity. Native plants are currently being cultivated and will eventually be used to replant portions of the blowout area. Total cost $6,500.42. EOLIAN EROSION, DUNES RAILROAD TIE BARRIERS, SNOW FENCE, SIGNS, VEGETATION, MONITORING

1988b Archaeological Midden Stabilization, Ano Nuevo State Park. Statewide Resource Management Program Project Status Report, California Department of Parks and Recreation, Monterey, CA.

This report describes the efforts to stabilize archaeological site CA-SMA-18 which is located in an active dune area in Nuevo State Park. Eolian erosion and destruction of the dune vegetation by elephant seal traffic resulted in the exposure of artifacts, including two human burials. Three sources of impact to the site are noted: erosion, park visitors and elephant seals. The following measures were taken to lessen the impacts. First, the area was closed to visitor traffic by directing the seal tours away from the archaeological site. The area was posted by means of an area closed sign. The site was then carefully buried under 3 to 4 feet of sand by pushing sand from the edge inward. Snow fencing was used to enclose the affected area of the site. The bare sand inside the fence was planted with bunches of straw to prevent wind erosion of the sand directly covering the site. Revegetation of the site with native plants will begin in the fall of the year. Total cost $2472. EOLIAN EROSION, DUNES, SIGNS, SNOW FENCE, VEGETATION, MONITORING

1992 Hunters and Gatherers at CA-SLO-977, San Luis Obispo County, California. In Archives of California Prehistory; Archaeological Investigations of Some Significant Sites On the Central Coast of California, Number 37, Coyote Press, Salinas, CA.

This article discusses the eolian erosion of ocean-front sand dune sites. In addition to eolian erosion, the site is located in Montana de Oro State Park and is additionally being damaged by loss from pedestrian traffic. Protection of the site was accomplished by the construction of a boardwalk and the placement of barriers to prevent the additional destruction of native plant colonies. Subsequent inspection of the site in 1995 indicated that additional attention is necessary for the expansion of the vegetative cover. EOLIAN EROSION, VEGETATION, BOARDWALKS, PEDESTRIAN TRAFFIC

Demas, Martha, Neville Agnew, Simon Waane, Jerry Podany, Angelyn Bass and Donatius Kamamba

1996 "Preservation of the Laetoli Hominid Trackway in Tanzania. Archaeological Conservation and its Consequences, ed. by Ashok Roy and Perry Smith. Contributions to the Copenhagen Congress, 26 - 30 August, 1996. The International Institute for Conservation of Historic and Artistic Works, 6 Buckingham Street, London, U.K.

This article reports on the conservation of the Laetoli trackway in Tanzania following its excavation and reburial in the late 1970's. As a result of the reburial at that time, naturally invading vegetation produced some root damage occurred to the cultural deposit. Damage was partially attributed to the lack of monitoring and maintenance, and the subsequent invasion of vegetation. Restoration included reexcavation of the trackway and the application of a combination of surface consolidants (Acrysol

WS-24)). Additional damage to the footprints and the surrounding tuff was attributed to the use of Bedacryl [poly (butyl methacrylate}. This was a commonly used consolidant during that period of time and led to the darkening of the footprints and the surrounding area. Reburial was chosen as the long-term preservation method. The technique that was applied involved covering the trackway with multiple layers of water-permeable geotextile, Biobarrier, fine granular fill, local soil fill, and Enkamat erosion control matting. Lava boulders were stacked to a height of a meter over the fill, with the sides sloped to nearly 14 degrees to insure proper surface water runoff. Biobarrier is a polypropylene geotextile that is studded with nodules of root inhibiting trifluralin. This material is not water soluble and thus does not migrate, but effectively stopped root intrusions in local testing prior to application. It has a projected lifespan of approximately 40 years at an average soil temperature of 20 degrees C at a depth of 10cm and 20 years at 25 degrees C at the same depth. Vegetation is not killed The combination of the geotextiles serve both as root growth inhibitors as well as horizon markers. Regular maintenance is recommended through the removal of new growth. SITE BURIAL, GEOTEXTILES, ROOT INHIBITORS, SOIL CONSOLIDANTS

Ebert, James I., Eileen L. Camilli and Lu Ann Waudsnider

1989 Reservoir Bank Erosion and Cultural Resources: Experiments in Mapping and Predicting the Erosion of Archaeological Sediments at Reservoirs Along the Middle Missouri River With Sequential Historical Aerial Photographs. Contract Report EL-89-3, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

This report reviews remote sensing capabilities for assessing archaeological site erosion using sequen-tial, historical aerial photographs. Photointerpretation for bank erosion measurement documents the rates of site loss and is used to model differential rates of erosion between and within sites. Historical photographs (aerial) establish this medium as an important time/rate of loss technique. REMOTE SENSING, RESERVOIR SHORELINE EROSION, CULTURAL RESOURCE PROTECTION

Ehrenhard, John E. (Editor)

1990 Coping With Site Looting: Southeastern Perspectives. Essays in Archaeological Resource Protection. Interagency Archaeological Services, National Park Service, Atlanta, GA.

Ehrenhard, John and Robert M. Thorne

1991 An Experiment in Archaeological Site Stabilization; Cumberland Island National Seashore. Cultural Resource Management, Volume 14, No 2, U. S. Department of the Interior, National Park Service, Washington, D. C.

This article is a description of the construction of an artificial shell rake on an area that fronted an eroding midden deposit on the western side of Cumberland. The rake that was constructed was intended to mimic naturally occurring shell deposits that formed depositional basins that served to trap wave carried sands and silt toward the shoreline. It was also intended to serve as a catchment basin for sands eroding from the shoreline. Bagged oyster shell was placed in a closed semi-circle across the front of the site. Over time, the bags deteriorated, the shell slumped into a rake, and sediment was trapped to form a surface for the invasion of marsh plant species. The effort was monitored over a period of time and the effort as successful in trapping silt. Some species of salt tolerant grasses invaded the area, but grazing of the tender grasses by the wild horses in the area served to inhibit the rate of growth. OYSTER SHELL, SHELL RAKE, SHORELINE EROSION, REVEGETATION

Espey, Huston and Associates

1992 Monitoring Report for Beach Prisms Demonstration Project, Jefferson Patterson Park and Museum, Calvert County, Maryland. Report prepared for the Maryland Historical Trust, St. Leonard, Maryland.

The authors report on the use of concrete breakwaters that were sold under the trade name Beach

Prisms. Prism breakwaters were tested along the shoreline of Jefferson Patterson Park and Museum as a means of protecting the shoreline and the archaeological materials contained in the shoreline. In the setting that the prisms were placed in, they proved to be an unsuccessful shoreline stabilization and protection technique. COASTAL, EROSION, BEACH PRISMS

Fay, Patricia, M.

1987 Archaeological Site Stabilization in the Tennessee River Valley Phase III. Archaeological Papers of the Center for Archaeological Research-Number 7, University, Mississippi and Tennessee Valley Authority Publications in Anthropology Number 49, Chattanooga, TN.

This report is the second in a continuing series of reports dealing with the experimental program of site stabilization in the Tennessee River Valley. The author reports on monitoring efforts on projects first reported in 1985 as well as some additional experimentation. Future stabilization recommendations are also presented. An Appendix discusses the short-term stabilization of an eroding mound by installing a covering of non woven filter fabric. EXPERIMENTAL STABILIZATION, MONITORING, RECOMMENDATIONS, FILTER FABRIC

Ferguson, Albert and Christopher Turnbull

1980 Ministers Island Seawall: An Experiment in Archaeological Site Preservation. In Proceedings of the 1980 Conference on the Future of Archaeology in the Maritime Provinces, ed. by D.M. Schemabuku. Occasional Papers in Anthropology No. 8, Department of Anthropology, St. Mary's University, Halifax, Nova Scotia.

This report details the construction of a gabion wall 35 meters in length. Monitoring of the rate of site loss by erosion took place for about 6 months before construction of the gabion wall began. Preparation of the beach-front of the site involved a small amount of normal archaeological excavation. A bulldozer was then used to level the front of the site. The footing for the wall, which was slanted at 8 degrees was prepared, and a trench dug along the entire length of the wall. Filter cloth (trade name-Typar) was used to line the trench the shelf between the trench and wall and the wall itself. The filter cloth was anchored in the trench by riprap which extended to the foot of the gabion wall. 3'x 3' x 12' wire mesh gabions were used for the wall which when finished measured 40 meters in length by over 2 meters high in some places. The top of the gabion wall was carried above the site and then backfilled. Cost of the project is $300 per meter of shoreline protected. Hurricane David, which struck during the last stages of construction, buried the wall in sand, thus rebuilding the former beach contour and adding to the riprap protection. Monitoring is implied. BEACH EROSION, STABILIZATION, GABIONS, RIPRAP, GEOTEXTILES

Florida Department of State

2000 Best Management Practices; An Owner's Guide to Protecting Archaeological Sites. Florida Department of State, Division of Historical Resources, Bureau of Archaeological Research. Tallahassee, FL

This publication is one of a series that is geared toward the protection of archaeological resources by private property owners. Management practices and strategies are discussed, and the possibilities of parterning with various organizations and agencies for site protection. A sample site location form is included as is an archaeological resources checklist form. A short multi-purpose bibliography is included also. PRIVATE OWNERSHIP, STABILIZATION

2001 Archaeological Site Stabilization Guide: Case Studies in Protecting Archaeological Sites. Florida Depa

This is another in the series devoted to the preservation and protection of archaeological sites. Thi publication briefly describes the preservation efforts that have been put into place at 13 sites throughout the State of Florida. Black and white photos and line drawings accompany each case study. An abbreviated reference section is also included. It appears that none of these cases have been formally written up and

anyone interested in learning more about the techniques that have been employed should contact the Florida Bureau of Archaeological Research. BEACH EROSION, STABILIZATION RIPRAP, REVETMENTS, REVEGETATION

Francis, Peter D. and E. Gwyn Langemann

1993 "Cultural Resource Management and Archaeological Research Initiatives at the Christensen Site, Banff National Park", Research Bulletin No. 303, Environment Canada, Minister of Supplies and Services, Canada.

The authors describe the management process that was devised for the Christensen Site, which is listed on the National Inventory of Threatened Sites. The site was being adversely effected by erosion from the Bow River as well as from the Canadian Pacific Railway. In order to expedite the mitigation process, a partnership was formed between the Department of Archaeology at the University of Calgary and Parks Canada. Riverbank erosion was mitigated by excavation as was an area adjacent to the railroad. This area was then stabilized through retaining wall construction of poured concrete. Monitoring of site for additional loss and evaluation of retaining wall will occur on a regular basis. RETAINING WALL

Galm, Jerry R.

1978 The Archaeology of the Curtis Lake Site (34Lf-5A), Leflore County, Oklahoma. Research Series No. 2, Appendix E, Archaeological Research and Management Center, University of Oklahoma.

Preservation of the Curtis Lake Site (34LP-5A) in Leflore County Oklahoma is proposed through the use of a spray-on cement mixture. This Appendix includes design plans for the project as well as a statement of the appeal of such an approach. [Ed. Note: This project is said to have been completed although no published report is available]. CEMENT, GUNITE

Getty Conservation Institute

1987 In Situ Archaeological Conservation; Proceeding of meetings April 6 - 13, Mexico. Henry W. M. Hodges, Senior Editor, Getty Conservation Institute, Century City, CA.

This publication is a compilation of papers presented at the 1986 in situ conservation held in Mexico City in April of 1986. The contents are divided into three sections: (1) The Sites and their Contents; (2) Materials; (3) Three case studies in Mexico. Each section's papers address specific conservation problems in archaeology, pointing out both problems and some solutions. IN SITU CONSERVATION, ARTIFACT CONSERVATION, CASE STUDIES IN MEXICO

Grisafe, David A.

1992 Stabilization of Dakota Sandstone Surface of the Faris Cave Petroglyphs; Kanopolis Lake Project, Kansas. Contract Report EL-92-2, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Ms.

Grisafe points out that some of the most difficult adverse impacts to rock art sites to control result from weathering or deterioration of the stone itself. He discusses the results of field and laboratory experiments that were directed toward strengthening and waterproofing to the Dakota Formation Sandstone in central Kansas. This is a porous and poorly bonded formation. Chemicals based on organosilicon dissolved in a ketone carrier provided substantial cementation of the sand grains of the test areas. He notes that there were no detrimental changes in color, porosity or permeability of the stone. ROCK ART, CHEMICAL STABILIZERS, SANDSTONE

Hall, Ron

l992 SCS Radar Helps Ensure That Historic Indian Burial Site Remains Undisturbed. USDA News, U. S. Department of Agriculture, Volume 51, No. 1, January-February, Washington, D.C.

The author reports on the use of ground penetrating radar (GPR) as a technique that was used to identify prehistoric burial locations prior to the stabilization of a portion of the bankline of the Mississquoi River near Highgate, Vermont. The site, which is estimated to be approximately 2,000 years old was eroding into the River. Based on the GPR data, the streambank stabilization project was redesigned to accommodate the burial location. GROUND PENETRATING RADAR, STREAMBANK STABILIZATION

Hatoff, Brian

1977 "Cultural Resources Management at Grimes Point," Nevada Archaeological Survey Reporter, Vol. 10, No. 2.

Hughes, David F.

1980 The McCutchan-McLaughlin Mound (34Lt-11) Stabilization Project: Archaeological Site Preservation in Oklahoma. Report submitted to the Oklahoma Historical Society and Oklahoma Archaeological Survey.

This mound site was gradually being destroyed as a result of erosion from the adjacent creek and total loss of the site was estimated to be completed within 20-30 years unless some means of protection was installed. A riprap retaining wall was selected as the best alternative after consideration of other approaches. Drawings of the proposed project indicate the use of a silt and gravel filter below the riprap facing. STREAM EROSION, RIPRAP

Jensen, Peter M.

1976 Archaeological Investigations at CA-MER-27. The First California Site For Which Total Coverage With Soil Has Been Agreed to as Partial Mitigation. Report prepared for U.S. Bureau of Reclamation, Sacramento, California.

Jensen presents the results of archaeological investigations that were conducted prior to the burial of CA-MER-27. He includes a ten page discussion of the future burial of the site and raises a series of questions regarding the validity of site burial as a reasonable mitigation measure. He concludes what appears to be a negative view of site burial by indicating that the limited nature of archaeological data is sufficient justification for site preservation. More importantly, Appendix 2 describes the proposed burial activity and includes, as part of that description, portions of the Bureau of Reclamation's original burial proposal, and data that deals with compaction, settlement and slumping that is the basis for predictions on how the archaeological component will react to being buried under a three-foot protective covering. This appendix provides a great deal of insight into the planning and testing that is required prior to the burial of an archaeological property. SITE BURIAL

Jones, Kevin L.

1989 Reconstructing Earthwork Fortifications: An Example From the Western Ureweras, New Zealand. Science and Research Series No. 7, Science and Research Directorate, Department of Conservation, Wellington, New Zealand.

Fire fighting activities led to the accidental destruction of this fortification and partial reconstruction of the earthwork was deemed appropriate. Air photos and archaeological data were used as baseline documentation of partial reconstruction activities. Techniques involved the use of revegetation, sodding and the use of brush to support the reconstructed earthworks. RECONSTRUCTION, REVEGETATION

Jones, Kevin L. and Philip G. Simpson

1995 Archaeological Site Stabilisation and Vegetation Management. Case Studies I: Coromandel, Bay of Plenty, and Hawkes Bay, Central Volcanic Plateau and Taranaki. Science and Research Series No.84, Science and Research Directorate, Department of Conservation, Wellington, New Zealand.

This is a report of a revisitation program to assess the impacts of earlier efforts to stabilize archaeological sites. Based on the revisitation recommendations have been structured for improving the state of the preservation effort. VEGETATION MONITORING

Archaeological Site Stabilisation and Vegetation Management. Case Studies II: Auckland and Northland, Otago and Canterbury, and Wellington. Science and Research Series No.90, Science and Research Directorate, Department of Conservation, Wellington, New Zealand.

This is a report of a revisitation program to assess the impacts of earlier efforts to stabilize archaeological sites. Based on the revisitation recommendations have been structured for improving the state of the preservation effort. VEGETATION MONITORING

Jones, Terry

1991 Archaeology in Big Sur: 1990 V.C. Davis Field School. Newsletter of the Society for California Archaeology, Volume 25, No. 1, January 1991.

While Jones' report deals primarily with the activities of the V.C. Davis field school, he does report that excavation sites were backfilled with site stability as a primary goal. The technique that was employed at the sites was a combination of filter fabric and backdirt filled bags. The excavation trenches were lined with the filter fabric and backfilling was accomplished through the use of the bags. Photo-monitoring from previously established stations is planned for each of the sites. FILTER CLOTH, SAND BAGS

Klinger, Timothy C.

1982 The Mangrum Site, Mitigation Through Excavation and Preservation. Arkansas Archaeological Survey Research Series No. 20, Fayetteville, AR.

The majority of this report deals with the excavation of a portion of the Mangrum Site but does include a minimal statement regarding burial of undisturbed portions of the site during levee construction. One of the goals of the project is to assess site burial as a preservation technique. There is a brief discussion of the projected impact of burial and a recommended schedule of evaluation over a forty-six year period. Klinger further recommends publication of the results of the evaluation program in American Antiquity. SITE BURIAL, MONITORING

Larson, Jon R.

1982 Letter on file Natchez Trace Parkway referring to covering of archaeological site in Colbert County, Alabama. Tupelo Office, Natchez Trace Parkway, Tupelo, MS.
This letter contains the request for permission to bury 1CT45 under a protective soil layer and indicates that the proposed blanket be between 8 and 12 inches in depth. (Ed. Note: The blanket was ultimately put into place over the site once a 3-4 inch thick level of clay gravel had been compacted in place. This letter appears to represent the only evidence that the project was completed. Post hole testing of the site some five years after Parkway completion indicated that the overburden was not being adversely effected by farming at that time). SITE BURIAL

Lebow, Clayton G. and Richard M. Pettigrew

1989 Rehabilitation of a Vandalized Prehistoric Site in the John Day Canyon, Sherman County, Oregon. Report submitted to the USDI, Bureau of Land Management, Prineville District and on file in that office.

The authors report on the rehabilitation of a prehistoric pithouse site in John Day Canyon in Sherman County, Oregon. Seven of the ten pit houses at the site had been vandalized (looted). Rehabilitation included site mapping before and after work was initiated and completed, backfilling of the looter's excavations, and recontouring of the restored ground surface to approximate the undisturbed pit house depressions. Prior to backfilling, each depression was marked with recent vintage pennies. The bottoms and sides of each pit were then covered with fiberglass cloth which was then covered with a one to three inch deep layer of sand borrowed from the nearby river bed. Completed backfilling was accomplished with material dug from each of the house units. Subsequent monitoring of the site has shown that cattle had walked across some of the backfilled areas and some of the fiberglass was exposed. A second visit to the site showed that the rehabilitation work was operating as planned. REHABILITATION, FIBERGLASS CLOTH, BACKFILLING

Lenihan, Daniel J.

1981 The Final Report of the National Reservoir Inundation Study. Volume I - Summary. U.S. Department of the Interior, National Park Service, Southwest Cultural Resources Center, Santa Fe, NM.

1981 The Final Report of the National Reservoir Inundation Study. Volume II - Technical Reports. U.S. Department of Interior, National Park Service, Southwest Cultural Resources Center, Santa Fe, NM.

Lynott, Mark J.

1984 Stabilization Plan: Clyde Creek Archaeological Site (21Ls35). Midwest Archaeological Center. National Park Service, Lincoln, NE.
This report describes site stabilization at Clyde Creek. The site was being destroyed by raised lake levels because of a dam built in the early twentieth century. Stabilization efforts included limited salvage excavation, removal of some vegetation, protection by filter cloth, a layer of soil covered with turf stabilization mat sowed with grass seeds. A band of riprap was used to anchor the turf mat at the elevation of summer high water level. EROSION, GEOTEXTILES, VEGETATION, RIPRAP

1988 Stabilization Riprap of Shoreline Archaeological Deposits at the Sweetnose Island Site, 21SL141, Voyageurs National Park, Minnesota. Midwest Archaeological Center, National Park Service, Lincoln, NE.
Stabilization of the Sweetnose Island Site was initiated in 1985. Vegetation was removed and sediment was piled on the bank to reduce the severity of the slope. Filter fabric was laid over this fill which was covered in turn with six-inch layer of soil. Grass seeds were planted in the newly placed soil and a turf stabilization mat was used to hold the seeds in place. Riprap was laid along the foreslope to the height of the summer high water levels. EARTH FILL, RIPRAP, EROSION

1989 Stabilization of Shoreline Archaeological Sites at Voyageurs National Park. Reprinted from American Antiquity, Vol. 54, No. 4, pp. 792-801.

"Elevated lake levels resulting from dam construction in the early twentieth century is producing widespread shoreline erosion at Voyageurs National Park, Minnesota. In an effort to preserve a sample of the more significant archaeological sites, the National Park Service has initiated a program of site stabilization. Stabilization of the Clyde Creek and Sweetnose Island sites was accomplished during the winter months by transporting materials and supplies across an ice road. The use of filter fabric and turf-stabilization matting in association with large quantities of sediment and riprap have produced a new shoreline that serves to protect the respective archaeological deposits. This approach has successfully preserved these intact archaeological resources and avoided the costs associated with large-scale data recovery and curation of collections." FILTER FABRIC, RIPRAP

Maclean, J.P.

1939 Ancient Works at Marietta, Ohio. Ohio Archaeological and Historical Publications, Vol. 12.

Mathewson, Christopher C.

1994 Intentional Burial of Two Archaeological Sites in Montague County, Texas as a Means of Site Protection: Analysis of Dynamic Loading During Construction. Report Prepared for the Texas Department of Transportation, Division of Highway Design, Environmental Section, Austin TX.

The author reports on the testing of breakage limits of artifacts buried in an artificially prepared archaeological site. Test results indicated that low-ground pressure equipment can be used to place cover materials in a site burial project. Gauge measurements of ground pressure from various entities ranging from a 280 pound man to a fully loaded water truck are presented. Testing indicated that dynamic loading is filtered out below about 5 feet (1.7 m) below the surface. Burial of an archaeological site tends to increase moisture content, induce reducing conditions, increase site compression, reduce dynamic loading on cultural materials, reduce site erosion and weathering, and limit human and animal intrusion into the site. He further indicated that compression is not as likely to cause breakage of subsurface materials as is lateral movement of materials, particularly those in contact with each other. SITE BURIAL, FIELD TESTING, DYNAMIC LOADING

Neil, George M.

1996 Archaeological Stabilization at Drayton Hall, Charleston, S.C.

This is not a published report, but is a packet of all materials related to the stabilization of archaeological deposits along the Ashley River. Initial stabilization included a rock revetment which left a portion of the site unprotected from wave driven erosion. The final solution was through the construction of a "bio-engineered" revetment using volunteered labor and a minimal amount of money ($2,954) to protect an area 100' x 30'. BIO-ENGINEERING, VEGETATION, WAVE EROSION

Nielson, Jerry J. and Bennie C. Keel

1983 A Case Study in Historic Preservation Strategy: Roods Creek Mounds, Georgia. American Archaeology, Vol. 3, No. 3 1983, Albuquerque, pp. 211-213.

The Roods Creek Mounds are situated on the shore of the Walter F. George Reservoir in west central Georgia. Creation of the Reservoir created an erosional environment that would eventually lead to the loss of the site. Several stabilization alternatives were considered and included cantilevered sheet piling, a log boom, and riprap were presented in 1973. Installation of the piling was undertaken during 1976 and 1977. A history of pricing of the project is included as an example of how agencies can cooperate in stabilization efforts and how costs can be shared. EROSION, BULKHEAD, SHEET PILING

Olsen, Stanley J., George A. Teague, John W. Olsen and B. Dean Treadwell

1993 Wide Reed Ruin; Hubbell Trading Post National Historic Site. Southwest Cultural Resources Center, Professional Papers, No. 51.

The authors report on the salvage excavation of a portion of the Hubbell Trading Post National Historic Site. The excavations were intended to retrieve data in danger of being lost to erosion by Pueblo Colorado Wash. Excavations were completed only on that portion of the site in imminent danger of being lost, with the underlying sterile matrix being laid back to a natural angle of repose. Further preservation of the bank of the Wash was through use of the screened backdirt as fill material along the base of the bank. Further protection of the toe of the bank was completed by placing sandstone blocks from wall rubble along the bank to serve as a hard armor.Excavations were completed in June of 1972, but other preventative measures were not implemented, the sand and rock reinforcement was washed away during the following winter. RUBBLE ARMOR

Prewitt, Elton R.

1990 Stabilizing the Talus Cone in Bonfire Shelter (41VV218), Val Verde County, Texas. Texas

Archaeology, vol. 34, No. 2.
The author briefly describes the stabilization of the eroding slope of a Talus cone in Bonfire shelter, site of a long-term buffalo jump, that had been partially excavated in 1963-1964. The stabilization technique included an underliner of burlap bags that were wire clipped together. This was in turn overlain with plastic mesh netting with 1.5 inch openings. The two run off dispersion elements were wire clipped together to further strengthen the facade. EROSION, GEOTEXTILE, BURLAP

Putnam, Frederick Ward

1887 The Serpent Mound Saved. Ohio Archaeological and Historical Publications, Vol.

1890 The Serpent Mound of Ohio. Century Magazine, Vol. 39, April 1890, pp. 871-888.
Putnam describes his first visit to the Great Serpent mound and the various activities which led to its acquisition for purposes of preservation. He indicates that the passage of tax relief legislation by the Ohio legislature was the first preservation law passed in the U.S. and by footnote indicates that federal protection of Casa Granda followed and was the result of the efforts of some of the same ladies who raised money for the Serpent Mound purchase. PRESERVATION LAW, TAX RELIEF

Ramiller, Neil and David A. Fredrickson

1983 Archaeological Site Protection Warm Springs Dam - Lake Sonoma. Draft report prepared for the U.S. Army Corps of Engineers, San Francisco, Ca.
The author reports on the burial of two archaeological sites at Lake Sonoma. Both sites would be inundated for a majority of the time with only infrequent periods of exposure. Following adequate testing, the surface of both sites were brought to a relatively smooth surface configuration. Both sites were covered with a woven filter cloth (Mirafi 100) and then covered with a minimum of one foot of gravel. Gravel was chosen as the covering agent that would best resist hydraulic action. Monitoring of the effectiveness of the stabilization is recommended. SITE BURIAL, GRAVEL, FILTER CLOTH

Rispoli, J.A. LCDR

1982 Letter correspondence to Connecticut SHPO regarding Baldwin Ridge Archaeological Site, Groton, Connecticut. (See Soulsby this section.) HOUSING DEVELOPMENT, SITE BURIAL, SAND, TOPSOIL

Rolingson, Martha A.

1986 Erosion Control Methods and Practices, Toltec Mounds State Park, Arkansas. Paper on file at Toltec Mounds State Park and at the Center for Archaeological Research, University of Mississippi, University, MS, 38677. REVEGETATION, SHORELINE STABILIZATION WITH TIMBERS

Snethkamp, Pandora E.

1983 Archaeological Investigations on San Miguel Island: 1982 Erosion Control and Site Stabilization Treatments. Draft report submitted to the Western Region, National Park Service, San Francisco.
Seven archaeological sites on San Miguel Island were incorporated into an eolian erosion stabilization program that included the placement of datum markers; photographic recording; establishment of paper recording of erosion; and placement of horizontal and vertical measurement devices to determine artifact movement. Sandbags were used to stabilize five sites, four of which also employed a woven filter fabric. Biodegradable matting was also used in four locations. Some problems of accelerated erosion around the sandbags is reported. EOLIAN EROSION, SANDBAGS, FILTER CLOTH, NETTING, MONITORING TECHNIQUES

Soulsby, Mary G., Robert R. Gradie and Kevin A. McBride

n.d. Phase II Archaeological Survey, U.S. Navy Housing Project, Groton, Connecticut. Report prepared for the U.S. Department of the Navy by Public Archaeological Survey Team, Inc., University of Connecticut.
Archaeological testing demonstrated that the Baldwin Ridge Site in Groton, Conn. was eligible for admission to the Register and the recommendation was made that the site should be entirely excavated.

The Conn. SHPO, NPS, and the Navy Department chose to stabilize and protect the site through burial with sand and topsoil. HOUSING DEVELOPMENT, SITE BURIAL, SAND, TOPSOIL

Strickland, Clark J.

1982 Letter correspondence to U.S. Navy from Connecticut SHPO regarding Baldwin Ridge Archaeological Site, Groton, Connecticut. (See Soulsby this section.) HOUSING DEVELOPMENT, SITE BURIAL, SAND, TOPSOIL

Thorne, Robert M.

1981 Archaeological Data Recovery and Preservation of Hurricane Mound (22LA516), Lafayette County, Mississippi. Report submitted to the Vicksburg District Office, U.S. Army Corps of Engineers, Vicksburg, MS.
This report describes the mitigation effort taken to preserve a pyramidal mound being eroded mostly by wind generated waves. The mound was subjected to an annual inundation cycle dependent on rainfall. The mitigation measures were completed in 2 stages: (1) archaeological date recovery and (2) covering of the mound. The archaeological data recovery consisted of surface collections, scraping of the mound to reveal surface features, aerial photography and three backhoe trenches to reveal the extent of the mound. The initial step in covering the mound was to trench completely around the periphery of the area to be covered. Sheets of filter cloth in 42' x 100' sections were then laid over the mound surface and the edges were tucked into the trenches and backfilled. Overlapping sheets of filter cloth were pinned to the mound surface using 18 inch long steel pins. Riprap was then spread over the area covered with filter cloth and beyond its edges by several feet on all four sides for a total dimension of 148 (n-s) x 109 (e-w) feet. LACUSTRINE EROSION, GEOTEXTILES, RIPRAP

1985 Preservation is a Use: Archaeological Site Stabilization, An Experimental Program in the Tennessee River Valley. Archaeological Papers of the Center for Archaeological Research No. 5. University of Mississippi, Tennessee Valley Authority Publications in Anthropology, Number 40, Chattanooga, TN.
This report discusses potential means for stabilizing archaeological sites from the perspective of established stabilization technology. The second chapter chronicles reported cases of archaeological site stabilization as a background for efforts to stabilize a variety of sites across the nation. The third chapter details experimental site stabilization efforts in The Tennessee River Valley.
STABILIZATION TECHNIQUES, EROSION, LOOTING, VANDALISM, EXPERIMENTAL STABILIZATION

1987 "Archaeological Site Stabilization on Huffine Island Watts Bar Lake, Tennessee" in Archaeological Site Stabilization in the Tennessee River Valley Phase III, by Patricia M. Fay, Archaeological Papers of the Center for Archaeological Research - Number 7, University of Mississippi, and Tennessee Valley Authority Publications in Anthropology, Number 49, Chattanooga, TN.
Lateral lacustrine erosion of a mound on Huffine Island has been an ongoing process since the closure of the dam on Watts Bar Lake. Protection of the vertical cutbank on a short-term basis was determined to be the most expedient approach as a long-term approach was identified and put into place. A covering of non-woven filter fabric was placed over an underliner of black plastic. Regular monitoring of the effectiveness of the applied material and upgrading of the material is declared to be an integral part of the stabilization process. EROSION, LACUSTRINE EROSION, FILTER FABRIC, MONITORING

U.S. Army Corps of Engineers

1984 Reconnaissance Report: Poverty Point State Commemorative Area, Bayou Macon, West Carroll Parish, Louisiana. U.S. Army Corps of Engineers, Vicksburg District, Vicksburg, MS. RIPRAP

U. S. Army Corps of Engineers, Seattle District

1996 Chief Joseph Dam and Rufus Woods Lake, Letter Supplement 8 to Design Memorandum 35, Bank Protection Plan for the Buckley Bar Cemetery Site. Seattle, WA.

This reference deals with a low bank (ca. 3 meters max.) stabilization project on an island on the main stem of the Columbia River. A barge and crane was used to place riprap along the shoreline. The cost of the effort was reduced as a result of the contractor purchasing and rehabilitating an idled tug moored at the loading point. In addition to the protection afforded the Cemetery Site, an additional benefit was the improvement of the public boat-launching ramp at the loading point that is operatedby the Bureau of Reclamation. Cost figures for the total project, including design and construction was $570K. RIPRAP

1998 Chief Joseph Dam and Rufus Woods Lake, Letter Supplement 4 to Design Memorandum 38, Cultural Resources, Bank Protection at Sites 45-OK-2A, 45-OK-5, and 45-OK-20. Seattle, WA

This Memorandum covered the stabilization of a low bankline at these three sites which contain house pits. Access to the sites and placement of the riprap with a backhoe was by road. Material costs were held down through the use of stone quarried from a BIA/Tribal quarry located near the sites. Addition benefits from the stabilization effort was improved habitat for river mink, exclusion of trafic from wildlife management lands, and improvement of the boat launching facility. Total cost for the three projects, including National Register evaluation at one site, design and construction was ca. $150K. RIPRAP

U. S. Department of Agriculture

1988 River Point Resort Archaeological Site Erosion Control Project Specification. U.S. Forest Service, Superior National Forest, Kawishiwi Ranger District, Duluth, MN.
The majority of the work to be completed under this plan/Request for Proposal is to be accomplished while the lake shore is iced in. A layer of filter cloth is to be anchored to the shoreline and laid out on the ice where a line of tires will be laid on the filter cloth which will then be doubled back over the tires. Class IV riprap will be placed in the tires on top of the filter fabric. Class II riprap will be placed between the Class IV stone and the bankline. As the ice melts, the stabilizing materials will settle to the bottom. A second class of geotextile will be laid over about 1/2 of the width of the Class II riprap as a barrier between topsoil to be placed on the bank and the riprap. The newly placed topsoil is to be seeded. EROSION, TIRES, RIPRAP, GEOTEXTILES, VEGETATION

Whatford, J. Charles

1995 In-Place Conservation and Stabilization Plan: Site CA-MEN-828, MacKerricher State Park, Mendocino County, California. Report on file, California Department of Parks and Recreation, Silverado District, Sonoma, CA.

This report details the proposed work plan to stabilize archaeological sites along a portion of the California coastline north of San Francisco. Sites are being damaged by a combination of pedestrian traffic and hydraulic and eolian erosion. The plan calls for rerouting and formalizing pedestrian travel ways, the excavations and considerable revegetation using indigenous species. REVEGETATION, COASTAL EROSION, EOLIAN EROSION

1996 Site Stabilization Management Plan for Four Archaeological Sites along Sonoma Creek, Sugarloaf Ridge State Park, Sonoma County, California. Report on file, California Department of Parks and Recreation, Silverado District, Sonoma, CA.

This stabilization plan details the strategies and technologies to be employed to stabilize four sites along Sonoma Creek. These sites have been damaged as a result of streambank erosion. Proposed strategiesinclude the removal of some streambank vegetation, partial excavation, the use of geosynthetics, and brush mattresses to deflect the force of the current away from the sites. Revegetation is also included in the plan. REVEGETATION, GEOTEXTILES, EROSION

White, R. F. and R. Iles (Editors)

1989 Archaeology in National Parks. National Park Staff Association, Yorkshire Dales National Park, Yorebridge House, Bainbridge, Leyburn, North Yorkshire, DL8 3BP, England.

Wilkie, Duncan C., Michael T. Aide and Ray Knox

1986 Testing for the Impact of Burying Sites Under a Highway; Phase III, Archaeological Mitigation of Archaeological Sites 23BU239 and 23BU241. Report submitted to the Missouri Highway and Transportation Department, Jefferson City, MO.

The authors summarize both the Phase I and II work completed at these two sites and the Scope of Work for the project that they will report on. Site burial and artifact reburial are included as basic components of the mitigation plan. They further indicate that the research design for Phase III work be based on an improvement of the CALTRANS site burial test project. Both the authors of the report and the Scope of Work indicate that the present project is experimental. Portions of both sites were excavated with the unexcavated portions of both sites scheduled to be covered as a part of the construction phase of Route 60. Features were treated similarly, with partial excavation and artifacts were recovered for analysis. Following detailed analysis of the recovered artifacts, representative examples were returned to the site and reburied in their original locations. Recommendations for measuring burial impact include soil chemistry testing on two year intervals and reexcavation of both the unexcavated features and reburied artifacts after a 10 year interval. This period of time should allow the detection of any impacts that burial and reburial will have on the site and its contents. Neither the Scope of Work, its responding proposal nor the report of archaeological efforts contain a description of the engineering design that was used in the burial of these two sites. One is left to assume that standard Missouri Highway and Transportation Department engineering and construction design was used. Complete physical, chemical and some soil compaction data as gathered to serve as a baseline in future studies. SITE BURIAL, EXPERIMENTATION, MONITORING

APPENDIX A

ROOT CHARACTERISTICS FOR ARCHAEOLOGICAL SITE STABILIZATION PROJECT DESIGN

Users Notation: The reference data which follows is intended to provide the user with a beginning reference set for the development of an understanding of the characteristics of various tree and shrub root systems and their relationship to the design of a revegetation program for archaeological site protection and conservation. It is by no means exhaustive, but should provide a starting point from which the search for site specific data might be derived. As is always the case, new references provided to the Clearinghouse will be added to the bibliography.

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McKay, H. M. and D. C. Malcolm
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1983 Root Development of Loblolly Pine Seedlings in Compacted Soils. USDA Forest Service General Technical Report Southeastern United States, Southeastern Forest Experiment Station, Ashville, N.C. March 1983, pp 26 - 29. ROOTS

Wu, T. H., Dayanand P. Bettadapura, and Philip E. Beal
1988 Forest Science. Volume 34, No. 4, pp. 980 - 997. ROOTS

APPENDIX B

USEFUL WEB SITES

National Plant Data Center (See Entry Under **TECHNICAL SUPPORT** USDA)
Baton Rouge, LA

http://plants.usda.gov

Architects First Source for Products
This site requires user registration at no charge. This is a comprehensive listing of building products, and other products that are useful in site preservation projects. Word search by category or specific item as well as by manufacturer or product type..

http**://afsonl.com**

Geosource
This site has a multiple listing of various geosynthetics by product type (geotextile, geogrid, geocell, etc.

www.geosource.com

International Erosion Control Association
This site contains links to members of the Association who provide a variety of products that are usefuil

in erosion control.

www.ieca.org/links/product.html

Straw Wattles

This site describes a stabilization technique used on sloping surfaces from Colorado and Idaho westward. The wattles are cylindrical burlap tubes stuffed with straw and are laid horizontally on surfaces that are prone to erosion. A page of application photographs is included on the Web site.

www.strawwattles.com