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St. Louis District

Rhode Island Department of Transportation Archaeological Collections Center

Collections Management Plan

**Mandatory Center of Expertise
for the Curation and Management
of Archaeological Collections**

April 2004

Rhode Island Department of Transportation Archaeological Collections Center

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Prepared by

U.S. Army Corps of Engineers, St. Louis District
Mandatory Center of Expertise for the
Curation and Management of Archaeological Collections

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Preface

This *Collections Management Plan* has been developed in order to standardize the preparation of collections for long-term curation and preservation in the new Rhode Island Department of Transportation Archaeological Collections Center that is now housed in the historic Woonsocket Depot in the City of Woonsocket. Standardization is necessary to enable staff to monitor collections efficiently and effectively. These standards and guidelines clarify requirements for all collections which Rhode Island Department of Transportation and Federal Highway Administration-sponsored archaeological projects have generated and bring these collections into compliance with applicable standards found in 36 CFR § 79.

These collections must be managed and preserved according to professional standards and practices. To ensure that collections are preserved for study, analysis and interpretation by future generations, it is necessary to stabilize and conserve collections to the extent possible and to provide proper storage environments that will preserve each artifact. These standards and guidelines for collections are intended to provide assistance to professional archaeologists, project sponsors, agency officials and others who participate in the process of preserving the archaeological heritage of Rhode Island.

For additional information on the Rhode Island Department of Transportation Archaeological Collections Center, the *Collections Management Plan* or to schedule an appointment to view the collections, please contact:

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Acknowledgments

This *Collections Management Plan* (CMP) was prepared by staff of the Mandatory Center of Expertise for the Curation and Management of Archaeological Collections, U.S. Army Corps of Engineers, St. Louis District, for the Rhode Island Department of Transportation (RIDOT). It has been developed to insure that RIDOT's Archaeological Collections Center (Center) at the Woonsocket Depot, 1 Depot Square, Woonsocket, meets the standards set forth in 36 CFR §79 (Curation of Federally-owned and Administered Archeological Collections), RI General Laws, Chapters 42-45, and Sections 6 and 7 of the Rhode Island Historical Preservation & Heritage Commission's *Performance Standards and Guidelines for Archaeological Projects.* The CMP contains the policies and procedures for operating the Center so as to provide professional care and management of the collections. The CMP will be periodically updated and made available to other agencies, archaeological consultants, and interested persons.

The Disaster Plan presented in Chapter 5 is based upon the Rhode Island State Archives Disaster Plan. The Chapter 5 section on Integrated Pest Management was based in part on the Department of Interior's Standards published in 1993.

Guidelines in the Chapter 5 sections on Preservation and Maintenance, Security, Environmental Monitoring, the Emergency Management Plan, and the entirety of Chapter 6 were drawn in part from the 1997 version of the San Diego Archaeological Center Operations Manual. For more information please contact Cindy Stankowski, Director, San Diego Archaeological Center, 16666 San Pasqual Valley Road, Escondido, CA 92027. Telephone number: (760) 691-0370.

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Introduction

Over the last 25 years the Rhode Island Department of Transportation (RIDOT) has accumulated a large volume of archaeological collections. These collections are derived from transportation projects where archaeological work has been performed. The archaeological materials and associated documentation (a collection) that are generated during these projects must be properly curated in accordance with Federal and State of Rhode Island laws and regulations. The majority of the archaeological work has been and continues to be funded jointly by RIDOT and the Federal Highway Administration (FHWA) in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. From 1974 until 2003, RIDOT collections had been temporarily stored at the repository maintained by the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) and in storage areas owned or leased by a number of RIDOT's archaeological consultants. Finding a repository that can provide the proper care and maintenance has been an ongoing problem for state agencies. As part of the administrative conversion of the Woonsocket Train Depot into an Intermodal Transportation Facility, the Depot was adapted for use as an archaeological collections center. The basement-level collections center houses archaeological collections generated by RIDOT projects. To guide archaeological collections management at the Center and to assist archaeological consultants in the preparation of collections for transferal to the Center, the following archaeological collections management plan (CMP) has been developed in accordance with Federal (36 CFR §79) and State (RIGL 42-45) laws and regulations.

The goal of the CMP is to provide information on collections management and conservation to assist archaeologists and others who provide the initial care for collections. This information is intended to establish standards for collections care at the Archaeological Collections Center (Center). The standards presented here should be followed for all collections curated at the Center, thus ensuring the same quality of care for all artifacts and facilitating the monitoring and maintenance of collections.

Mission Statement

The primary mission of the Center is to provide proper housing, storage, and long-term curation (care and management) of all archaeological collections and associated documentation in the custody of RIDOT. It is important to insure proper curation as archaeological collections are irreplaceable records of the past. Once a site has been excavated, the archaeological material remains, associated records, and reports are the only evidence left. Critical information is lost if collections are allowed to disintegrate, become disorganized, or are separated. A secondary mission is to provide assistance and space to people who use the collections. The research value of a collection is preserved if its provenience information is kept intact. There is still much to learn from existing collections. Advances in the field will continue to bring about new research methods and analytical techniques that will alter the research and interpretive values of existing collections.

Guiding Principles for Curation

Four principles guide the Center's curation policies and practices. These principles are:

1. Curation begins before archaeological materials are collected or associated documentation is created.

No fieldwork should be conducted without a rigorous laboratory processing and curation plan. The plan should outline guidelines for collection as well as field and laboratory processing for archaeological materials and records.

All researchers should realize that archaeological materials and associated documentation reach equilibrium with the environment in which they are located. When they are removed and placed elsewhere, they are subjected to new environmental factors such as temperature, humidity, ultraviolet radiation, air pollution, acidity, and visible light. They will eventually reach equilibrium with the new environment, but may be subject to hydration, dehydration, oxidation, mold growth, pest damage, embrittlement, and other agents of deterioration including human use, after they have been removed from their original environment. Consult with a professional collections manager before going into the field and a conservator before removing any unusual objects (e.g., waterlogged, sunken watercraft).

2. Consider that all actions may have permanent rather than temporary effects.

Every action or treatment associated with archaeological materials and records should be reversible if at all possible. Use only archival-quality materials at all stages of an archaeological investigation regardless of whether the present action is intended to be temporary, such as the transfer of collections from the field to the repository, or whether the action is intended to be long-term, such as housing at the repository or exhibition in a permanent display. Many extant collections that initially used temporary measures to conserve the collections until they could be treated with more permanent or archival measures have evidence of the long-term use of "temporary" methods and materials. As a result, improper curation has decreased the survivability of these collections.

3. Document each action.

A curation history should be created for each collection. The history contains details of how the collection was excavated, processed, created, labeled, and packaged, and what products were used in each of these steps. Specific notations on individual specimen condition, treatment, and destructive analysis should be recorded in the collection catalog.

By documenting all actions that have occurred to a collection, RIDOT will maintain a chain of custody and administrative control of collections that are accepted into the Center. In turn, these data may provide critical information to future users of the collection. Are specific specimens or collections suitable for particular research questions, analytical techniques, or public interpretation? Have previous conservation treatments, such as cleaning, mending, or repairing, contributed to the present condition of an artifact? Was an artifact found in a context that suggests it may be a funerary object or a sacred object?

4. The Center will meet the basic professional standards of 36 CFR § 79.

The Center must be able to provide curation services that are long-term and professional in accordance with 36 CFR § 79 (Table 1). Temporary storage such as that provided by an archaeological contractor is not suitable. The Center has sound collections management and use policies, a formalized mission statement, scope of collections, collecting plan, long-range goals, and a policy that facilitates access and use of its collections for researchers, educators, and the interested public. The Center also includes an appropriate storage system and controls for temperature, humidity and light, an Emergency Management Plan, and an Integrated Pest Management System.

Administrative Control of Collections

The Center is responsible for maintaining administrative control over collections derived from state-owned lands or collections obtained from private land as part of a RIDOT/FHWA project. Collections derived from federal lands are the administrative responsibility of the federal agency.

Table 1.
Implementing the Requirements of 36 CFR § 79

Applicable Section of 36 CFR § 79	Archaeological Materials	Associated Documentation
Professional Museum Practices (79.9(a))	Maintain written policies and proceduresfor museum staff and prospective collection donors. Review policies every five years. Policies should include Field Curation Procedures, Standards for Acceptance of Collections, Accession and Deaccession Procedures, Collections Management Policy (including care of collections; access policy; conservation procedures; use of specimens for research, ceremonies, destructive analyses, exhibit, loans, and publication), and an Emergency Plan.	Maintain a written records management plan. Review plan every five years. Policies to be included in the plan are Field Curation Procedures, Standards for Acceptance of Collections, Accession and Deaccession Procedures, Records Management Plan (including policies for tracking records, processing and rehabilitating records, conservation procedures, creating finding aids, access policy, and use of records for exhibit, loan, and publication), and an Emergency Plan.
Accession	Create an accession record for each collection. Assign a unique accession number; note the collection owner, provenience, acquisition history, terms of the curation agreement, and a general description of the collection.Create a file that includes the Accession Record and copies of all associated documentation from project management, project results, ongoing curation procedures, uses of the collection, and physical location(s). Cross index all collections by archaeological site number.	Create an Accession Record (if one has not been created for the artifacts). Include all documentation associated with the original archaeological investigation (e.g., project administrative records, project field notes, project results). Add documentation of ongoing procedures used to curate the associated documentation (e.g., the initial inventory and assessment of the documents, preservation worksheets for documents that require special treatment, the storage location). Cross index any associated artifacts.
Catalog	Assign a unique specimen number to each object or lot, and record the number and all associated data concerning provenience, condition, and description of object into a catalog list or computerized database. Index all associated documentation by format type and contents, and create a finding aid.	Assess all associated documentation for retention and condition. Organize and arrange documentation according to the guidelines in the records management plan, and assign a unique identification number. Create archives finding aid, and maintain both paper and electronic forms. Paper copies should be printed on acid-free paper with a laser printer. Create a duplicate or safety copy of each collection on acid-free paper, archival microfilm, or, if quick access is critical and affordable, onto electronic media such as CD ROM after scanning.
Label	Label specimens directly if feasible (use an isolating base coat, apply specimen number in indelible ink, and add an isolating topcoat). If indirect labels are necessary, they can be adhered or tied, or placed loose inside the artifact storage container. Use only archival-quality materials—no correction fluid or nail polish. Label all artifact containers and all storage units or containers. Loose labels on acid-free paper can be placed inside artifact containers such as bags or boxes. Also label the exteriors of all storage containers.	Label paper directly if feasible; label photographic media with foil-back archival labels, or label the photo sleeve or envelope. Attach labels to audiovisual and electronic media. Place in an archival quality document container suitable for each media, e.g., acid-free lignin-free file folders, boxes, or photo sleeves. Boxes should not be glued or of metal construction. Label box, folder, and other cross-referencing tools. These labels may be produced by direct labeling in indelible ink or with a #3 graphite pencil. Adhesive archival labels (generally, foil-backed) may be printed using a laser printer.

Table 1.
Implementing the Requirements of 36 CFR § 79 (Continued)

Applicable Section of 36 CFR § 79	Archaeological Materials	Associated Documentation
Conserve (see 36 CFR § 79.11)	Perform initial condition assessment upon receipt of collection. Prioritize conservation needs; perform treatments as necessary; maintain records of all treatments of individual objects; and tie the conservation records into the master catalog so that all information concerning an object is centrally located. Perform initial condition assessment upon receipt of collection. Prioritize conservation needs; perform treatments as necessary; maintain records of all treatments of individual objects; and tie the conservation records into the master catalog so that all information concerning an object is centrally located.	Perform initial condition assessment upon receipt of collection and complete preservation worksheet for associated documentation. Identify and prioritize conservation needs and treatments to ensure physical survival of materials; maintain records of all treatments performed; treatments can also be recorded in an electronic system so that all information on a specific collection of associated documentation may be readily identified and reported. Perform initial condition assessment upon receipt of collection and complete preservation worksheet for associated documentation. Identify and prioritize conservation needs and treatments to ensure physical survival of materials; maintain records of all treatments performed; treatments can also be recorded in an electronic system so that all information on a specific collection of associated documentation may be readily identified and reported.
Complete and Accurate Records (79.9(b)(1))	All records related to the daily operations of the repository and those documenting any activities performed on the artifacts or specimens in a collection should be current, maintained, and accurate. Records like these that must be maintained by the repository include, at a minimum: acquisition, or accession, records; catalogs and inventory lists; collection condition records and conservation treatments performed; loan information; inspection records; records on lost, deteriorated, damaged, or destroyed property; records of destructive analysis conducted on specimens; deaccession, transfer, repatriation, discard records; and records documenting the physical location of the material remains (e.g., shelf addresses, loan agreements, and materials on exhibit).	All records related to the daily operations of the repository and those documenting any activities performed on the associated documentation in a collection should be current, maintained, and accurate. Records like these that must be maintained by the repository include, at a minimum: acquisition, or accession, records; catalogs and inventory lists; collection condition records and conservation treatments performed; loan information; inspection records; records on lost, deteriorated, damaged, or destroyed property; deaccession, transfer, repatriation, discard records; and records documenting the physical location of the associated documentation (e.g., shelf addresses, loan agreements, and materials on exhibit). In addition to maintaining records documenting the collection within the repository, any materials that are compiled, created, or generated during an archaeological investigation are considered to be associated documentation for the collection and must be preserved following the guidelines outlined above. It may include, but is not limited to, field notes, site forms, draft and final reports, analysis records, administrative records, maps and other locational information, photographic materials, survey records, results of literature searches, and any background material or historical data gathered or generated during the investigation.
Storage 79.9(b)(2)		
Storage space must not be used for non-curatorial purposes that would endanger the collection	Storage areas should be physically separate from offices, research areas, conservation areas, registration activities, or any other non-storage function. Access should be restricted and monitored. Lights should remain off unless personnel are in the storage area. No food or beverages should be brought into the storage area.	Same as listed for archaeological materials.

Table 1.
Implementing the Requirements of 36 CFR § 79 (Continued)

Applicable Section of 36 CFR § 79	Archaeological Materials	Associated Documentation
Structural Adequacy 79.9(b)(3)(I)	The repository should meet all local, county, and state building codes. The repository should be regularly inspected, as required by local, county, or state regulations. Additionally, a building and storage inspection for structural soundness should occur at least once every five years for buildings less than 10 years of age and every three years for any building older than 10 years.	Same as listed for archaeological materials.
Fire Detection and Suppression 79.9.b.3.ii		
Fire detection and suppression system	A dry pipe, zoned, fire suppression sprinkler system is recommended for storage areas. A fire detection system (e.g., heat and smoke sensors) that is wired to the local fire department is desirable. At a minimum, fire alarms and ABC-type fire extinguishers should be placed throughout the storage areas. A Halon fire suppression system is not recommended.	Same as listed for archaeological materials.
Meets local fire codes	The repository and collections area should meet all local, county, state, and, if applicable, federal fire codes.	Same as listed for archaeological materials.
Regular inspections	The repository and particularly the storage areas should be inspected a minimum twice yearly by certified fire officials.	Same as listed for archaeological materials.
Documentation storage in fire resistant cabinets, safes, or vaults	All such repository-generated documentation of actions taken or performed on archaeological materials should be stored in cabinets that are securable, insulated, and provide protection against fire, smoke and water damage.	Same as listed for archaeological materials.
Duplicate copies of records stored in a separate location and with a third party	All such repository-generated documentation (see above) should be duplicated and stored in a separate location. These duplicate materials must include copies of site forms, artifact inventory lists, accession records, and any files on computer disks and tapes.	In addition to the requirements for the repository generated documentation, a duplicate or safety copy of the project generated associated documentation should be created on acid-free paper or archival microfilm, and stored in a safe, environmentally suitable area, in a separate location if possible.
Security 79.9(b)(3)(iii)		
Intrusion detection and deterrent system	Install deadbolt locks on all interior and exterior doors and windows leading to the collections area. Illuminate the exterior of the storage facility. Install motion and sound detectors in the collections area and connect them to a private security company or local police. The grounds should also be patrolled by security officials when the facility is unoccupied.	Same as listed for archaeological materials.

Table 1.
Implementing the Requirements of 36 CFR § 79 (Continued)

Applicable Section of 36 CFR § 79	Archaeological Materials	Associated Documentation
Valuable item and document storage 79.9.b.3.v	Extremely rare or monetarily valuable items should be kept in a secure location such as a safe, vault, or securable cabinet that is environmentally sound (i.e., temperature and humidity levels can be monitored and maintained).	Same as listed for archaeological materials.
Regular inspections	The storage facility should be inspected a minimum of once a month for any faults or lapses in security.	Same as listed for archaeological materials.
Limited access/control	Access to the collections area should be limited to individuals who have direct daily business in the facility (e.g., curator of collections). If any individual with access to the collections area that is no longer employed at the repository, locks or security codes should be changed. If there are any visiting scholars to the collections area, they should be monitored at all times and a record of the items they are using should be maintained and checked prior to their departure.	Same as listed for archaeological materials.
Duplicate copies of records stored	See above sections. Documentation should be stored in fire resistant cabinets, safes, or vaults and duplicate copies of records stored in a separate location and with a third party.	See above sections, Documentation should be stored in fire resistant cabinets, safes, or vaults and duplicate copies of records stored in a separate location and with a third party.
Inventories to account for collections	See Limited Access/Control above. Regular inspections of a sample of all collections should be conducted at least twice a year to determine whether any items are unaccounted for.	Same as listed for archaeological materials.
Emergency Management Plans 79.9(b)(3)(iv) Fire, flood, natural disasters, civil unrest, acts of violence	A written policy concerning these topics should be generated and updated to reflect changes in general museum policy and industry standards. The Emergency Plan should incorporate the services and facilities available locally from city, county, or state emergency agencies. All staff responsible for executing the emergency plan should receive annual training in implementing the plan. Periodic (not less than once a year) review of the emergency management plans should be performed.	Same as listed for archaeological materials.
Structural failures	Regular inspections of the storage facility should be made and any hazards or structural inadequacies should be corrected. See Structural Adequacy above.	Same as listed for archaeological materials.

Once the collections have been placed in the Center, the Center's Director is responsible for the following:

1. Know the location and condition of all collections (archaeological materials and associated documentation). Maintain an up-to-date list of this information in electronic format.

2. Routinely inspect the storage locations and take immediate action to correct any problems noted during the inspection or when problems are reported.

3. Make the collections available for all appropriate uses.

4. Budget for long-term curation and conservation costs.

Each of these measures will insure that the ultimate goal of curation is achieved—archaeological collections are preserved and are accessible. Collections that have been properly prepared, curated, and administered can be used repeatedly to interpret Rhode Island's heritage to the public, to provide research data for future investigations, or to assist native peoples conducting traditional religious ceremonies.

Significant public funds are spent generating collections. Significant sums are required to curate them. It is critical that these funds are well spent, from the inception of the archaeological investigation to the ultimate disposition and use of the collection materials and data.

Museum Records

During the course of day-to-day activities of a repository, a variety of documentation is generated that enables the staff to effectively manage the collections under their care. These repository-generated documents are often referred to as museum records or housekeeping files. Standard museum forms and documents such as accession records, conservation treatment forms, registration checklists, and curation histories are a few examples of typical museum records. These records allow a repository to establish and maintain intellectual control over its collections. In a practical sense, intellectual control can be defined as knowing a collection's content, characteristics, and location without having to physically search through the repository or collection.

Museum records differ from archaeological associated documentation in both their content and the time of their creation. Archaeological associated documentation typically is generated in the field and the laboratory during the course of an archaeological investigation. It also may include background research compiled prior to fieldwork. In essence, any documentation generated during the course of, or describing, the investigation becomes part of the archaeological associated documentation and forms an integral part of the archaeological collection. Once the investigation is complete and the collection has been transferred to a curation facility, the repository then begins generating museum records to facilitate and document the use and management of the collection in the repository. The requirements of 36 CFR §79 address both museum records and associated documentation (see Table 1).

General Description and Composition of Collections

The archaeological collections of the Center are representative of the long human use of Rhode Island and its adjacent waters. The Center, through the generation, acquisition, research, and interpretation of its collections, should reflect the diversity of ethnic and cultural groups that comprise the population of Rhode Island. In addition to a wide variety of Native American and historic period archaeological materials, the collection includes information about these materials (including both museum and associated records) such as accession records, catalog descriptions, field notes and records, plans, maps, video recordings, photographs, published papers, unpublished reports, contracts, and correspondence. There are currently approximately 450 cubic feet of boxed archaeological artifacts and approximately 40 linear feet of records.

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Processing Archaeological Collections for Curation

As each archaeological investigation is completed, the collection generated by that investigation must be prepared for long-term curation. All investigations will produce associated documentation; some may also produce archaeological materials (artifacts and material samples). All must be prepared for long-term curation. Whether a collection is being processed for the first time or is being "rehabilitated," that is, processed again to bring it up to current standards by reboxing, rebagging, or relabeling the collection, the concerns are the same.

The procedures begin with pre-field planning and continue through each processing step to the final placement of objects and associated records into short-term or long-term storage. These basic procedures are drawn from protocols developed by the MCX-CMAC for the U.S Army Environmental Center (Mandatory Center of Expertise for the Curation and Management of Archaeological Collections 1998).

Pre-field Planning

Before any archaeological materials or data are collected, pre-field planning should estimate (1) the types of archaeological materials that may be present, (2) any conservation treatments that may be needed in the field, (3) the volume and types of archival materials that will be required to transport the collection from the field to the laboratory or repository, and (4) how data can best be collected so that they too will be preserved. Check with the Center's Director for any special requirements the Center may have or for advice concerning the ultimate organization of the collections prior to submission.

Preservation of archaeological materials begins prior to collection. Knowing what types of archaeological materials may be present at an archaeological site or region will assist archaeologists in planning the types of excavation techniques, conservation treatments, or special supports that may be necessary to transport objects from the field to the laboratory without incurring damage (Longford 1990; Sease 1987; Smith 1983; Sullivan and Childs 2003). Use archival-quality materials to collect and transport artifacts. Although they are more expensive, they protect objects during the interval between collection and processing, which can vary from days to many years.

Use archival-quality materials in the field. Anticipate the documents that will be needed in the field to record data and use archival materials when possible to produce them (e.g., standard forms may be created on acid-free paper, and journals constructed from archival materials may be purchased). This can reduce the cost of copying information onto archival-quality media later. Remember that documentation on electronic media alone is not sufficient because of the instability of these media and their contents. Pre-field planning can also reduce the time and expense of making sure that all documentation has been compiled for submission with the collection. At a minimum, anticipate that the following types of associated documentation will ultimately be created for each archaeological investigation and consequent collection:

1. Administrative records – documents describing the current investigative effort (e.g., scopes of work, budgets, and curation plans).

2. Background records – reference materials that document previous work relevant to the current investigation (e.g., investigation, site record searches, published and unpublished reports, and title searches).

3. Field records – data generated in performing current investigation fieldwork (e.g., level records, daily logs, mapping data, topographic maps used to record field data, photographs, video tapes, audio tapes).

4. Analysis records – documentation generated during the analysis phase of the current investigation (e.g., catalogs, databases, data printouts, analyses, and laboratory reports).

5. Report records – draft and final reports, as well as appendices.

The documents in each of the above categories may be composed of one or more of the six documentation formats: paper records, cartographic materials, photographic media, audio and video tapes, microformat records, and electronic media. Each of these formats has specific preservation requirements that are discussed in greater detail below.

Creating the Collection—Artifacts

Whether artifacts are collected from the ground surface or excavated from below-surface contexts, care must be taken in handling and transporting specimens. Once an artifact is removed from its context and transported to another location, it may undergo significant changes in temperature and relative humidity that may affect the stability or condition of the specimen.

Recovering buried artifacts must always be undertaken with care even when their condition appears to be stable. Many buried items reach equilibrium with the surrounding soil, thereby stabilizing the condition of the artifact and retarding further decomposition. When the artifact is removed from its soil matrix, it is exposed to an entirely new set of environmental conditions that will introduce agents of deterioration. The artifact condition may also be affected by physical damage incurred during its removal and transport to the laboratory. Measures should be taken then to preserve the object as it was found originally. There are several methods available to achieve this goal. For example:

1. Extremely fragile artifacts should be photographed and sketched in place prior to removal.

2. Damp, wet, or fragile artifacts should be removed while embedded in their surrounding matrix. This helps to stabilize the item and reduces the rate of deterioration until the artifact can be placed in an environment that best replicates the original surrounding environment. Place damp artifacts in closed plastic containers or bags that will not absorb the moisture and will best preserve the original environment. These items should be opened and processed as soon as they reach the laboratory. A professional conservator should be consulted concerning the care of any damp, wet, or fragile objects of any size.

3. Bulk samples are often heavy and large in size. They require transport in containers that can sustain the weight with the least amount of damage to the specimens. Polypropylene containers with lids or cloth bags may be used to transport the materials to the laboratory, where they may be divided and repackaged for specialized processing according to the requirements of the research design.

4. Other fragile artifacts may require special support or packaging to ensure that they do not move during transport (see Handling, Packaging, and Padding, below).

5. Artifacts that may be used in chemical analysis, botanical washes, flotation, or as chronometric samples must be placed in sample appropriate containers and marked clearly as potential samples so that they are not damaged accidentally or contaminated by mishandling. Greases, oils, dirty fingers, airborne pollen, or plasticizers from polyethylene bags should not come into contact with these samples. Clean metal tools should be used to remove the samples and place them directly into a container that is appropriate for the intended sample.

6. Before going into the field, obtain clear collection and packaging instructions from those individuals who will be performing the analyses. Cleaning artifacts in the field is not recommended unless a formal laboratory is established on or near the field site. Important data can be destroyed or the artifact condition can be compromised. If field cleaning is

absolutely necessary, remove only the surface dirt with gentle brushing. Resist the temptation to wash artifacts, other than those already subjected to wet screening. Note which items have been treated by either method.

7. Some artifacts may require consolidation in the field prior to removal from the site. Consolidation should be undertaken in consultation with a professional conservator.

8. Document any and all special treatments applied in the field to each artifact. Maintain this information so it is available to laboratory personnel and future users.

9. Prominently label all containers with site number, provenience, date, and recorder.

Creating the Collection—Associated Records

Although it is difficult to maintain clean, dry records while in the field, every effort should be made to minimize damage. Keeping records and maps out of direct sunlight, rain, and wind will reduce material deterioration from ultraviolet radiation and moisture and help prevent ink from fading. Using archival field journals, No. 3 or No. 4 pencils, and waterproof paper are some of the precautions that should be taken to reduce damage to records and maps in the field. Numbers 3 and 4 pencils (or H and 2H lead in mechanical pencils) are recommended because harder leads do not smear as much as soft leads and are considered more durable. For a truly permanent record, however, carbon- based permanent ink should be used.

As with artifacts, a little advance planning can prevent the destruction of records in the field. Temporary storage often becomes permanent storage. Oversized materials such as project maps are often the most handled items in the field. They should never be taped together or folded. These actions create irrevocable damage to the item. Instead, photocopy a "taped together composite map" onto a larger-sized page and roll the document to save space. Rolled items may be flattened in the laboratory creating no permanent damage to the item. Do not use colored or water soluble inks, avoid adhesives on paper and photographic materials, and do not use metal fasteners or rubber bands to keep records together. Whenever possible, keep documents in a closed container to reduce the damage created by dirt, dust, and other airborne particulates. Initial arrangement of documentation while still in the field will make the final arrangement of the documents easier and less prone to error (see Longford 1990; Sease 1987).

Preventive Conservation

The following discussion is an overview and is not intended to teach a novice how to be a professional conservator. The information presented provides cultural resource management personnel with the range of potential problems they may encounter in caring for archaeological collections. In many cases a professional conservator should be consulted.

Measures can be taken to slow natural deterioration by providing a sympathetic environment for the object or document. The rate of deterioration is dependent upon the inherent chemical stability of the material, in combination with external influences such as the environment, storage conditions, and handling procedures. Environmental factors that can hasten the deterioration include temperature, humidity, light, air pollutants, and biological agents.

Light

Organic materials such as paper, basketry, photographs, textiles, and floral remains must be protected from ultraviolet (UV) radiation and visible light, both of which cause objects to deteriorate and speed up chemical reactions. In addition, light creates heat, which can permanently damage audiovisual, microformat, and electronic records. When possible, these light-sensitive materials should be stored in closed containers, away from sunlight or direct lighting. When they must be handled or exhibited, indirect, low light levels (preferably non-ultraviolet or with UV filters in place) should be used.

Temperature

In general, colder temperatures are best for the preservation of objects and documentary materials. However, maintaining collections at cold temperatures is impractical because people must use collection areas. More critical than temperature level, however, is temperature constancy. Dramatic changes in temperature, particularly those that occur frequently, are often more damaging than storage in a

slightly overheated area. For example, "it has been estimated that the useful life of paper is cut approximately in half with every 10° F increase in temperature. Conversely, with every 10° F decrease, the expected life of paper is effectively doubled" (Ritzenthaler 1993:46). However, many material classes have specific narrow temperature ranges that must be maintained for optimal storage conditions (see Conservation Criteria section below).

Relative Humidity

Low or high relative humidity speeds up the rate of deleterious chemical reactions and encourages mold growth. More critical than relative humidity level is relative humidity constancy. Dramatic changes in relative humidity, particularly those that occur frequently, are often more damaging than storage in constant low or high relative humidity areas. Relative humidity is the measure of moisture in the air relative to the temperature. Archival materials, metals, and organics are very sensitive to moisture and will expand and contract with changing humidity and temperature. While this process cannot be seen with the naked eye, continuing expansion and contraction weakens organic fibers causing weak points that are susceptible to increased damage from handling. In addition, some of these chemical changes produce scents, indiscernible to the human nose, that attract certain pests, particularly insects.

Air Pollutants

Airborne pollutants can also hasten the deterioration of archaeological collections. Gaseous pollutants such as sulfur dioxide and nitrogen dioxide combine with moisture in the air to form acids that are deposited on objects and records. These acids can cause corrosion of metals or deterioration of organic materials. In records collections acidity, rust, and other contaminants can migrate to other documents. Solid particulates such as dirt and dust transported through the air cause damage through abrasive action as materials are handled. In addition, many pollutants can leave permanent stains on objects and records. Air filtration systems can be designed to control the pollution levels from both gaseous and solid pollutants, in addition to prohibiting mold growth.

Biological Agents

Biological agents such as rodents, insects, and mold can rapidly affect the condition of archaeological materials and associated documentation through the combination of physical deterioration and chemical interactions. The best defense against these agents is implementation of an integrated pest management program (IPM) that includes routine monitoring of conditions within the storage area, as well as examinations of object and record condition. Infestations or outbreaks can then be treated immediately, thereby reducing the amount of physical damage. Chemical treatments are to be avoided; only non-chemical treatments such as methods employing modified atmospheres are acceptable for RIDOT collections (see Chapter 5, Integrated Pest Management System).

From the Field to the Laboratory and the Center

Whether archaeological materials are being transported from the field to the laboratory or from one repository to another, proper handling and packing will determine the condition of the collection upon arrival at its final destination. Archival-quality material should be used at all times, beginning with packaging materials in the field, through processing and final curation. Non-acidic archival packaging materials shall be used when boxing or bagging materials, especially fragile objects. The containers for RIDOT archaeological collections will be Hollinger brand corrugated polyprolene acid free boxes (Table 2). Polyprolene boxes are required to protect collections from the danger of water should the sprinkler system discharge. There are two box sizes (type no.10769-15' x 12" x 10"; type no.30400-16.25" x 16.25" x 6") with detached lids that can be used for artifacts depending on the weight, volume and size of the collection. These box sizes use the shelf space in the Center most efficiently.

When preparing collections for transport perform the following.

1. Label everything.

It is vital to keep provenience information with the archaeological materials at all times, from the moment materials are removed or documents are created in the field until they reach the laboratory or repository where they can be permanently labeled. If an artifact is nested within several layers of padding, bag, and box, place a label inside the padding, on the bag, and on the box. The label should include

Table 2.
Materials for Packing Collections

Recommended	Avoid
Acid-free boxes, folders, and polypropylene storage boxes	Cigar boxes, grocery boxes, and manila folders
Polypropylene containers	Polyvinyl chloride or "plastic" containers
Metal containers, rust-free, and well sealed	Metal containers to contain moist objects
Glass containers (for samples that require clean glass environment), well padded, and placed within a rigid container	Glass containers without padding and rigid support
Acid-free conservation board or polyethylene foam to make rigid supports	Acidic cardboard or Styrofoam®
Polyethylene bags (minimum 4-mil thickness) with Ziploc® closure	Plastic sandwich bags
Polyethylene sheeting and chips	Plastic wrap, polyurethane chips
Acid-free tissue paper	Toilet paper, facial tissue, newspaper
Polyester batting	Cotton
Aluminum foil for ^{14}C	Paper envelopes
Spun-bonded olefin (Tyvek®) for making internal labels for containers with moist contents	Unprotected paper

sufficient information to relate the object to its original provenience (e.g., site number, unit or surface collection location, field specimen number, and date collected). Also note any special handling instructions. Polyester fabric (e.g., Tyvek®) can be used to make temporary water-resistant labels to accompany soil or midden that is being wet screened or has not completely dried. It can also be used to make permanent labels since it is an inorganic material that is resistant to mold and pest infestation but can be fed through laser printers.

For records, all file folders, video and audio cassettes, microformat reels or sheets, electronic disks and tapes, and all oversized materials should be labeled clearly with information regarding contents, formats, dates created, description or title, and creator. Photographic materials should be labeled with roll and/or exposure number and must be accompanied by a photograph log describing each image.

2. Keep handling to a minimum.

Handle the object or records only as much as is deemed necessary, as excessive handling may result in damage.

3. Artifacts should be kept in a storage environment that closely resembles their site conditions.

Label artifact containers clearly with special condition requirements, so that the artifact will be examined appropriately when it is unpacked at the repository. For example, if an item is removed in a dry condition, it should remain dry; likewise, wet or damp materials should remain wet until they can be stabilized professionally by a conservator.

4. Records should be packaged separately from objects.

Other than labels or special instructions, records and objects should not be packed together in the same container. This practice often results in crushed or lost documents once they arrive at their final destination. Packing records separately helps insure lessened damage to the records and the completeness of the document collection.

5. Isolate and place special samples in appropriate storage containers.

Check with the laboratory for recommendations on the proper excavation, handling, and packaging procedures. Each type of analysis is susceptible to particular contaminants (e.g., residues that will be analyzed using gas chromatography should neither be touched with the human hand nor enclosed in polyethylene bags). Organic materials that may be used for radiocarbon dating should be wrapped in aluminum foil, which in turn should be stored in rigid containers with a sealed lid and kept separate from the other excavated material.

6. Dry soil and radiocarbon samples thoroughly to prevent mold growth.

Small holes should be punctured into the top portion of the polyethylene bag to provide ventilation and prevent the formation of mold. Exercise care in the drying process so that contaminants are not introduced. All soils samples should begin to be dried within two days of collection. Drying of soil samples may take two to three weeks. Following drying, the soil should be put into 4- to 6-mil polyethylene bags.

7. Treat human remains with the utmost care and respect.

Separate human remains from other materials and store them by individual and by provenience. Funerary objects or grave goods should be clearly cross-referenced with the individual.

8. Use normal precautions in placing archaeological materials and associated records within boxes for transport.

Pack similar materials together. Place the heaviest items at the bottom of the box. Do not fold or force records into a box too small to contain them; find a larger, more appropriate box. Rolled maps should be transported in clearly labeled map tubes of archival construction.

9. Label the boxes.

In addition to provenience information, each box should be labeled to identify contents that are fragile, heavy, or require other special handling. Clear and informative labeling prevents unnecessary opening and handling when particular objects are being retrieved. Avoid reusing boxes that have previous labels "marked out" and new label information added. This creates confusion concerning the box's contents. If boxes are reused, ensure that new label information is clear and legible.

10. Create a packing list.

Prepare a general list of the contents of each box, duplicate the list, place one copy in the box, and collate the second set to serve as the inventory against which the collection can be checked upon arrival at the laboratory or repository.

11. Use normal precautions in transporting collections

Protect collections from abrasion, crushing, vibration, and harmful environmental conditions with a cushioning layer of padding on the floor of the transport vehicle. Place the heaviest boxes on the bottom layer, toward the front of the vehicle. Pack the boxes securely so that they do not slide around. If the vehicle is also carrying field equipment, set aside an area for the collection, distant from any cans of fuel or water, and segregated from heavy field equipment. Do not enclose collections in a vehicle all day, especially in high levels of heat and humidity. If storage at a site must be in a vehicle, ensure that there is good air circulation. In cold weather, the artifacts should not be stored close to a heating vent inside a vehicle. Once at the repository, the artifacts should be promptly removed from the vehicle.

Processing Artifacts and Samples

All artifacts should undergo seven processing steps: (1) accessioning, (2) assessment, (3) conservation treatment, (4) cleaning, (5) cataloging, (6) packaging, and (7) record keeping (Table 3). These are the basic foundations of good collections management and curation. Each step is designed to build upon the previous one whereby each establishes a chain of custody and each seeks to establish the optimal environment in which to preserve artifacts for future use and study (Table 3). Each of these procedures is discussed in detail in the following pages.

Accessioning

When a repository accessions a collection, it usually signifies that title (ownership) of the collection has been transferred to the museum; however, this is not the case for federal collections. Title remains with a federal agency, no matter where the collection is stored at any given time. The collection remains the responsibility of the federal agency.

A collection may consist of a single object or document, or many objects and documents. The collection may derive from a single site or from multiple sites. Decisions on how collections are defined and accessioned are the responsibility of the repository in consultation with the federal agency.

Accession numbers are repository specific. Any numbering system that assigns a unique number can be used to identify accessions, although there are

Table 3.
Basic Steps in Processing Archaeological Materials

Procedures	Comments
Accession collection	Prior to fieldwork obtain agreement to curate and, if necessary, conserve, the anticipated collection at a repository even though accessioning the collection itself occurs after the collection is physically transferred to RIDOT's Center for long-term care; include funding for curation in the project budget; obtain copies of repository procedures, e.g., required catalog number format
Assess collection	Segregate specimens that require special handling, e.g., for conservation treatment, submission for analytical testing, or "Do Not Clean."
Perform conservation treatments when required	Minimal conservation treatments, such as construction of supports or padding, should be performed for fragile specimens. These treatments should provide temporary stability so that a specimen can be transported to a professional conservator for consolidation, repair, or specialized cleaning.
Clean objects as necessary	Apply appropriate cleaning methods to specific material classes of objects.
Catalog and label specimens	Sort specimens by material class within each provenience; assign catalog numbers to individual objects and/or lots; label specimens; enter descriptive data into catalog.
Package specimens	Place specimens in artifact and storage containers that are appropriate for the material and for frequency of access (immediate or long-term storage); prepare contents lists for each box and an overall listing of the containers in a collection.
Pest treatment	Schedule pest treatment of collections (artifacts and documentation) with SPNEA. Transport collections to SPNEA for treatment. Upon completion of treatment, retrieve collections and transport from SPNEA directly to the Center.
Record keeping	Submit at least one acid-free hard copy of the catalog (as well as disk(s) if in electronic format) to the Center as part of the Associated Documentation.

several systems in wide use throughout the museum world. The Center uses the following format. Each accession number begins with "ACC" (Archaeological Collections Center). This is followed by four digits for the year in which the accession was received, to which is added a three-digit sequential accession number; each new accession is assigned the next sequential number. Thus, the first accession received in 2000 would be recorded as ACC-2000-001.

The purpose of the accession number is to match an object or collection with the original documentation that is maintained in an accession record. Since records and objects frequently are stored separately in a repository, the accession number maintains the link between the objects recovered and the associated records created during a single investigation. This goal is achieved by simply assigning a single accession number to the artifacts and associated records of a single collection.

The accession record typically consists of the accession number, the date the object or collection was accessioned, the nature of the accessioned material's acquisition (e.g., gift, purchase, excavation, etc.), the source (e.g., who donated the object) provenience (i.e., geographic or cultural origin or maker), a brief description of the accessioned material, the condition, the value, if applicable, and the staff member who accessioned the material. The accession record documents how the collection was made and how it came to be curated at a given repository.

The accession record is the central location of information concerning a collection's previous history, how the repository acquired it, and any conditions attached to the use of the collection. It is also the place where notes concerning objects or records within the collection can be maintained or cross-referenced with other repository records, such as conservation treatment records, loan documents, photograph collections, and citations of published references that include objects from the collection.

Assessment

Two objectives are addressed during the assessment of the collections. First, the inventory list submitted with the collection is compared to the boxes/specimens present to note any discrepancies and take remedial action. Second, individual specimens are examined by the curator, registrar, or researcher, in conjunction with a conservator, to segregate those

that (1) require some type of immediate stabilization before they can be further processed; (2) need special cleaning treatments; (3) need no cleaning; (4) will be submitted for analytical testing; or (5) will be set aside as unprocessed samples.

As specimens are segregated or removed from the collection for special processing, care must be taken to ensure that all provenience data remain with the objects. These objects should receive specimen numbers immediately (see Cataloging) so that their location and status can be tracked as they undergo special conservation treatment or analysis. Once these specimens have rejoined the collection or have been consumed during analytical tests, the collection catalog can be updated for each specimen to record the specific conservation treatments applied, the analytical results, or the specimen destruction during analysis.

A representative sample of each affected artifact type must always remain unaltered (36 CFR § 79.9(b)(5)iii). All other specimens can be cleaned and cataloged.

Conservation Treatment

Conservation treatments provided at this step in the processing should be restricted to minimal efforts designed to stabilize objects sufficiently so that they can be handled for cataloging and analysis. For many objects that require minimal stabilization, this will consist of the construction of a special acid-free support or box for the object (see discussion of preservation characteristics by material class). Any attempts to mend or consolidate the object or apply other chemical treatments should be referred to a conservator. All conservation efforts, no matter how minor, should be documented fully. Full documentation includes describing the materials and methods used for each affected specimen.

Objects that have been stabilized still require special handling and should be marked as such. By placing objects in boxes or supports, it becomes possible to continue processing the object by handling the container rather than the object. Again, care should be taken to ensure that the provenience data accompany the object at all times.

Cleaning

Artifacts are cleaned in order to permit analysis of the original surface and features of an object, to facilitate the application of a specimen number to the object, and to remove substances that might otherwise hasten the deterioration of an object (Table 4). In general, cleaning should be kept to a minimum to reduce the possibility of destroying fragile surface features of an object such as impressions or decorations, and to prevent compromise or loss of use-related evidence such as residues, polish, and scratches. A conservator should undertake professional cleaning of an object intended for display.

Artifacts can be cleaned by dry, wet, chemical, or ultrasonic methods. The entire artifact may be cleaned or only the specific area to which the specimen number will be applied. Regardless of which cleaning process is used, the conservation treatments should be halted immediately if any damage to the artifact is detected. Provenience information should be kept with the specimen at all times. Residues produced during the cleaning (e.g., pollen washes or DNA samples) may be retained and added to the catalog, noting the link between the original specimen and the residue.

Dry cleaning can take several forms including dry brushing or dry vacuuming. *Dry brushing* involves using a soft-bristled brush to remove the surficial soil from an artifact. Consolidated soils should be removed by a conservator. *Dry vacuuming* is particularly useful in cleaning porous objects. The vacuum should have low-powered suction and a small aperture nozzle. A rigid nylon or polyester screen may be attached over the nozzle to further reduce the suction and prevent damage to particularly fragile objects. Vacuums suitable for these tasks can be obtained from conservation suppliers or from medical/dental equipment suppliers.

Wet cleaning with water should never be used for artifacts that are unstable or contain residues that may be useful for chemical analyses. Examples of fragile or unstable materials include organic material such as bone, shell, hides, vegetative remains, either processed (e.g., basketry and textiles) or unprocessed, low-fired earthenware ceramics or ceramics with flaking or fugitive decorative surfaces, and metal objects. Residues found on ceramics,

Table 4.
Guidelines for Cleaning Archaeological Materials

Material Class	Recommended Cleaning Method
Bone	Dry brush.
Organics (e.g., macrofossils, wood)	Do not clean. If absolutely necessary, dry brush softly or use low powered vacuum through a screen. Retain the soil for possible constituent analysis. Consult a conservator.
Ceramics	Do not clean ceramics that have use residues.Spot clean area to be labeled. If complete cleaning is desired, stable ceramics can be washed in water, or swabbed (or surface cleaned) with damp cotton swabs. If washing is necessary, dry thoroughly before labeling or packing. Unstable or crackled ceramics may require consolidation before processing. Consult a conservator.For ceramics with salt encrustation, consult a conservator.
Ceramics	Do not clean ceramics that have use residues.Spot clean area to be labeled. If complete cleaning is desired, stable ceramics can be washed in water, or swabbed (or surface cleaned) with damp cotton swabs. If washing is necessary, dry thoroughly before labeling or packing. Unstable or crackled ceramics may require consolidation before processing. Consult a conservator.For ceramics with salt encrustation, consult a conservator.
Glass	Dry brush. Spot clean as necessary. Do not wash unstable, flaking glass. If washing is necessary, dry thoroughly before labeling or packing. Glass with thin films or iridescent glass corrosion should not be scrubbed or aggressively cleaned. Allow to dry.
Leather	Use preventive conservation including optimal storage conditions with a minimum of handling. Consult a conservator.
Metals (ferrous, nonferrous)	Do not wash. Do not use heat or commercial polishes or dips. Do not remove corrosion crusts.Consult a conservator.
Chipped stone	Do not clean chipped stone if use-wear studies are to be performed or if there is a possibility that mastic, cordage impressions, or other residues are present. Determine what portion of lot samples requires washing to prepare them for analysis. If washing is necessary, dry thoroughly before labeling or packing. Wash tools and flakes in water; use gentle brush to loosen soil if necessary, or use ultrasonic cleaning.
Paper	Do not wash. Consult a conservator.
Samples—Bulk (e.g., shell, soil—flotation, heavy/light fractions)	Decide what proportion of samples will be processed. Retain a portion of unprocessed for future analyses. Process as needed.
Samples for Special Analysis (e.g., archaeomagnetic, ^{14}C, phytolith, hydration, residue analyses)	Do not wash. Consult analytical laboratory for required processing techniques.
Shell	Do not wash.Dry brush, after specimen has been checked for possible residues (e.g., mastic, cordage impressions, food, paint) May need consolidation before processing. Consult a conservator.
Textiles (e.g., basketry, cordage, cloth)	Do not wash or dry brush.Low-powered vacuuming through a screen. Do not use home remedies for fabric cleaning (e.g., washing, spraying, steaming, lubricating, or waxing). May need special support and packaging. Consult a conservator.

chipped stone, and other artifacts can be useful for phytolith, blood serum, radiocarbon, elemental analysis, macrofossil identification, DNA analysis, etc.

Wet cleaning should be restricted to stable artifacts such as ceramics fired at high temperature, glass, and stone. Artifacts should be cleaned in a tub or wash basin rather than under running water to prevent accidental loss down the drain. Only one artifact at a time should be washed. Stone artifacts and debitage can be cleaned by placing specimens in a screen or mesh bag and gently swishing the bag back and forth in the wash basin.

Ideally, wet cleaned artifacts should be air-dried slowly and evenly. Under no circumstances should heat, either by direct sunlight or a drying oven, be employed to dry the artifacts. Trays with raised,

nonmetal screen bottoms should be used to air dry the artifacts, or artifacts can be placed on absorbent toweling and turned over to ensure thorough drying. If paper is used to dry artifacts, non-acidic sheets or rolls of paper should be used. Newspaper should not be used because of its high acid content.

Ultrasonic cleaning can be helpful in loosening stubborn deposits of soil or oxidation. Ultrasonic waves are sent through water in which the artifact is immersed to shake loose adhering dirt. This technique is restricted to stable objects that can withstand immersion and that fit within the ultrasonic cleaner. For example, ceramics and glass with microfractures may break apart from high-energy waves.

Although the ultrasonic cleaning process was not originally developed for archaeological purposes, it has proven to be effective at cleaning many items such as debitage, projectile points, and sherds. Approximately five minutes or less is needed to strip off stubborn oxidation deposits from artifacts, although more time may be necessary for some artifacts. The progress of the conservation treatment should be monitored regularly. When no further improvement is apparent, remove the artifact, rinse with water, and let dry thoroughly. Again, record in the catalog which objects were cleaned with this process.

Spot cleaning may be used in instances where it is preferable to clean only the spot on the artifact where the specimen number will be placed. Use a moistened, soft cotton-tipped stick to wash an area the size of the intended label. Let the artifact dry completely before the specimen number is applied.

Chemical cleaning should be performed or supervised by a professional conservator. Chemical cleaning may be necessary to remove encrustations or the corrosion layer on artifacts, particularly on metals, but also on basketry, bone, or ceramics. The chemicals used are usually acids, bases, chelating agents, or sometimes others, depending on the artifact being treated. These chemicals can cause irreversible damage to the artifact if not applied correctly. Also, the use of chemicals may require certain safety precautions and protective clothing. For example, some chemical cleaning should be performed only under a fume hood.

After the artifact is gently dry brushed, it may be immersed in water to wet it thoroughly, then suspended in the chemical solution for specified periods of time, rinsed thoroughly in changes of distilled or deionized water, and allowed to dry slowly. Artifacts that are chemically cleaned should be identified in the catalog, noting the chemical solution used, the time immersed, and the methods used to rinse and dry the object.

Cataloging

Cataloging is the process of assigning a unique identifying number to an object and recording a description of the object, its dimensions, and provenience data. The object also may be photographed as part of its documentation. For the purposes of these protocols, the actual placement of the unique number onto the object is the next step in processing.

Catalog number, sometimes also known as the speciman number, is the unique identifier that is assigned to each object within a collection during the cataloging process. It provides the link between the object and its associated documentation, including the accession record and any other information relevant to the collection or to the specific object. For the Center, catalog numbers are based on the accession number (e.g., 2002-034) and an individual object or lot number (e.g., 2000-001-000001).

A catalog is the listing of all specimen numbers relevant to a single collection. The catalog may be electronic and/or in a paper format. It lists the number assigned to each object, a physical description of the object, often a typological assignment, and any specific provenience information for each object. Catalogs can be used to note or cross-reference other records documenting changes in an artifact's status or condition (i.e., they can cite original condition, conservation treatments, use of an object for destructive analysis, and changes in condition). Copies of catalogs are generally filed with the repository's registrar in the accession record.

Some objects will undergo cataloging more than once. Some may be assigned temporary specimen numbers, sometimes referred to as catalog numbers, either in the field or during analysis, but then are assigned a final catalog number by the repository where the collection is ultimately stored. The final

catalog should cross-reference any previous catalog numbers assigned to an object, and it is recommended that previous catalog numbers not be removed from an object when adding the final catalog number.

A catalog number may be assigned to an individual object or to a group of similar objects collected from a single provenience. The latter strategy is used when cataloging faunal remains, debitage, glass fragments, or other fragmentary, non-diagnostic remains from a single provenience. Generally, if the object will be analyzed as a single specimen, it should be cataloged individually as well. Materials that are analyzed in bulk, such as shell or chipped stone, can be assigned a single lot number. At a minimum, a catalog should list the following classes of information for each object (Table 5).

No matter how the catalog data fields are organized, all data must be recorded in a consistent and uniform manner, particularly if catalog information is entered into an electronic data management system. Abbreviations should be avoided whenever possible, and if used, an abbreviation key must be kept as part of the catalog.

Labeling Artifacts

Once an artifact has been assigned a catalog number, a decision must be made on how best to associate the number with the object, whether to *label* the object directly or indirectly. Conservation principles dictate that any conservation treatment applied to an object, including the attachment of the identifying specimen number, should be noninvasive and reversible. Labels should be legible, neat, and unobtrusive. Extraneous writing on an object should be avoided.

Direct Labels on Artifacts

Directly labeled artifacts are less likely to lose their catalog number than artifacts that have separate specimen numbers on paper labels or labeled containers. Since the catalog number links the specimen with its provenience data, recorded in the collection catalog and/or accession record, it is crucial that this number not be separated from the specimen. For this reason, objects that can be safely labeled directly should be.

One possible exception to this admonition concerns human remains. Many Native American tribes consider it disrespectful to alter human remains

Table 5.
Sample Catalog Data

Data Field	Example
Accession number	ACC-2000-013
Catalog number	2000-013-4531
Object description	projectile point
Material class	chert
Form	side notched, basal fragment
Typological assignment	Woonsocket side notch
Analyst and date analyzed	Paul Robinson 9/5/89
Quantity	1
Measurements	Length: N/A Width: 15 mm Thickness: 5 mm (note any dimensions that are fragmentary)
Weight (when appropriate)	1.2 g
Geographic location (most commonly, the site number or name)	37Ke288
Associated features/artifacts	Hearth feature #4; adjacent to 2000-013-4530.
Chronological Data	C^{14}, corrected, 5000 B.P.
Collector	R. Funk
Date Collected	6/12/67
Comments on condition, form, conservation treatment	Fracture is not new.

in such a manner. Therefore, it is recommended that these are not directly labeled without prior consultation with the tribes or people who are most likely culturally affiliated with the remains.

A simple way to label human remains that satisfies tribal concerns is to print the catalog number on acid-free paper in a very small font with a laser printer, then affix the label to the bone with Rhoplex®. This water-soluble material does not alter bone and is easily removed, if necessary.

Careful consideration is necessary for the placement of the label. Labels should not be applied over diagnostic portions of an artifact. For example, a stone tool should be labeled on the unmodified portion, or cortex, of the tool if possible. If a tool has been bifacially worked, label the least photogenic side. Sherds should not be labeled on the broken edges because accurate reconstruction would be inhibited and would prevent observations of the ceramic body. Labels should not cover maker's marks or design elements, if possible.

A "sandwich" method is recommended for labeling artifacts directly. This involves placing the specimen number between a reversible, isolating base coat and a reversible, protective topcoat. Archival-quality solvents should be used, and information documenting the chemicals used should be recorded in the curation history (see Table 8). This will make it possible to safely remove the specimen number should it become necessary in the future. Take care to work in well-ventilated areas when using solvents (Table 6).

Table 6.
Steps for Direct Labeling of Artifacts

Procedure
Clean, if necessary, the area to be labeled on the artifact.
Place a barrier coat on the area to be labeled; a thin narrow coat of clear acrylic resin dissolved in acetone (e.g., Acryloid B-72®) or solvent-based acrylic varnish is recommended. Clear nail polish should be used only if neither of the archival-quality preparations is available or feasible. If the artifact is dark in color, white ink can be used. An alternative that results in legible labels and avoids the problem of finding a white background for a dark object is to type the label information into a computer, using an easily readable font, preferably at the smallest font size that is still readable. Print the labels out onto acid-free, high-cotton-rag content paper, using a xerographic process such as a laser printer or a photocopier. Cut the labels out of the paper and dip them briefly in a suitable quality adhesive (Rhoplex®, an Acryloid B-72® emulsion, or Acrysol®, a polyvinyl acetate emulsion). Remove excess adhesive or thin the emulsion with water if necessary, and allow to dry to a clear film. Mistakes then can be rectified by wiping the affected area with a wet cotton swab with acetone and a cotton swab after it has dried. This type of labeling is reversible with water using a swab.
Let the buffer layer dry thoroughly, overnight if necessary.
Write the label information including the specimen number and any additional information required by the Center. Water-based ink, such as black India ink, is recommended (see Pencil and Permanent Ink below). White ink may be necessary on dark colored artifacts.
After the ink has dried, apply another coat of acrylic resin dissolved in acetone (e.g., Acryloid B-72®) or solvent based acrylic varnish (e.g., Soluvar®) to protect the label.
Let the label dry thoroughly before placing the artifact into an artifact container.
Record in the curation history (see below) the methods and materials used to label the artifacts (chemicals, percentage solution, and solvent).

Indirect Attached Labels

Some artifacts cannot be labeled directly because they are too small (e.g., small beads can often be labeled with acid-free tags attached with string). Other specimens should not be labeled directly due to unstable surface conditions or fragility. Basketry, leather, textiles, wood, and deteriorating ceramics, glass, or metal should not be directly labeled, but should have an acid-free tag attached if possible, or the object should be enclosed in a container that is labeled (see Loose Labels below).

Attaching indirect labels and tags requires careful thought so that the least damaging method is used (Alten 1996:2). Tags and labels can be attached to an object by tying or sewing. A few basic rules apply when attaching them to an object (Table 7).

Table 7.
Basic Rules for Labels Attached with String or Thread

The string or sewing thread should be softer than the artifact's surface.
The string/thread should not cut through or into the object.
The label should be attached loosely so that it does not cause constriction of the object, but not so loosely that it will catch on other objects and result in a tear.
Colored string or thread treated with any substance should not be used.

The material used to attach the label or tag should be compatible with the artifact and its storage conditions. For example, the following materials are acceptable.

100% Cotton String, undyed. This is the most commonly preferred material, with the following exceptions: 100% cotton string should not be used on rubber or plastic artifacts because the aging byproducts used to manufacture the rubber and plastic can destroy the cotton thread.

Plastic tie tags (Zap-Straps®) and nylon monofilament (fishing line) in polyethylene tubing are two acceptable ties that can be used for attaching tags to industrial machinery and large artifacts or outdoor displays. The polyethylene tubing protects the artifact from being abraded by the nylon.

Teflon® monofilament is stable, smooth, non-fibrous, does not stretch, and is recommended for attaching tags to greasy or oily artifacts or artifacts with fragile surfaces. Check that the monofilament is not the version that stretches. It is equally important that the material used to make the tags or labels is archival-quality and of a material best suited to the object. Tags or labels with metal rims should not be used.

Acid-free 100% cotton rag paper is the recommended material type for most tags because it is pH neutral, lignin free, and inexpensive, though subject to damage if it comes into contact with moisture. Stationer's and jeweler's paper tags usually are not acid-free and will yellow, embrittle, become illegible over time, and can stain artifacts.

Japanese paper labels can be attached with wheat starch paste directly onto most baskets. The paste is reversible, the labels are not excessively intrusive, and the labels can be fitted to the surface texture of the basketry. Paraloid B-72® also can be used to attach these labels and to apply a protective topcoat over the paper label.

Tyvek® is a proprietary polyester fabric that is waterproof and inexpensive, and can be used to make labels or tags for small or large items. Tyvek® survives well in the outdoors and is appropriate for labeling material such as farm or industrial machinery. It can also be sewn onto textile fabrics. For example, Tyvek® #1422 is inert, soft, non-fibrous, and is recommended for attaching tags to plastic items, items stored or displayed outdoors, or oily objects with unstable surfaces.

Cotton twill tape, a soft inexpensive material, is recommended for textile objects. A length of the tape can be labeled with permanent laundry marking pen and sewn onto the textile using undyed cotton thread.

When labeling a tag or paper label, the writing medium must be easy to apply and able to survive light and water exposure. Felt-tip pens should not be used because these are usually composed of dyes that fade. Waterproof India ink is the preferred form of labeling tags. Black and blue ink are the only recommended colors; red should not be used because it is the least lightfast ink and some colorblind individuals cannot detect red (see below Pencil and Permanent Ink).

Loose Labels

When direct labeling or attaching a label/tag is not possible, an acid-free paper label should be placed in the artifact container, e.g., inside the polyethylene bag or acid-free box containing the artifact. Particularly fragile materials such as basketry fragments, textiles, or wood artifacts may be placed in acid-free boxes that contain inert polyethylene foam (Ethafoam®) that has been carved, shaped, or otherwise modified to support the specimen. These custom supports make it possible to match artifacts with their idiosyncratic supporting structure in addition to having the specimen number visible on the exterior of the box.

Pencil and Permanent Ink

Although the principle of reversibility applies to the conservation treatment of artifacts (except those designated for destructive analyses), it is important that artifact labels are inert, yet stable, and capable of withstanding normal use. Many inks and felt tip markers are labeled as being "permanent," but this often proves to be untrue given sufficient passage of time and/or exposure to ultraviolet radiation. Black India ink has been the standard medium used to label artifacts or artifact tags in many museums. However, not all black India inks are the same (see Clark 1989). Test inks before using them for long-term curation contexts. Ink is inexpensive; testing is inexpensive. However, the process of labeling specimens is extremely labor intensive and costly, and unstable labels may compromise the link between specimen and associated provenience documentation.

Ink can be applied using a variety of pens including Crow quill pens, mechanical drafting pens, or ceramic tipped pigma® pens. Crow quill pens are inexpensive and they can be inserted into a small block of Ethafoam® to keep the tip clean. Mechanical pens are favored for the ease with which the ink is applied to a surface. However, they are subject to frequent clogging and must be cleaned routinely by disassembling them and soaking them in cleaning solution, in an ultrasound cleaner, or in tap water. Pigma® pens are more expensive and each batch should be tested for ink quality before using them to label specimens.

It is recommended that any new procedures or materials be tested first before implementing or using them on a collection. It is important to document in a collection's curation history (see below) all procedures and materials applied generally to a collection. Special conservation treatment of specific objects should be noted in the object catalog.

Packaging Artifacts for Storage

Artifacts stored loose within a drawer are subject to much more damage than those placed inside some type of protective artifact container—a bag, box, or special support. These artifact containers, in turn, are often placed within a storage container (e.g., drawers for easy access to type collections or boxes on shelving for long-term curation). The intended use of the specimens and specimen condition will affect how each should be packaged after cataloging. In addition to protecting the artifact, all packaging should be labeled clearly to facilitate access to specific specimens within a collection and to reduce excessive handling of the object.

Artifact Container Guidelines

Determining which container is suitable is influenced by the following.

1. Determine the anticipated use of the material.

Determine the frequency of access to the artifact. Should it be stored with type collections materials that are frequently used and therefore placed in drawers or should it be stored in archival boxes that are located on shelving?

2. Segregate and store objects by their material class.

When placing specimens or samples in artifact containers, objects from only one material class should be placed in the artifact container. Each material class has a specific optimal storage environment. This environment is easier to create if similar materials are stored together and can be segregated from the rest of the collection. For example, all soil samples should be stored under similar conditions. However, the samples can be arranged by provenience (i.e., by site number, excavation unit, or level) within a soil sample storage area. The segregation by material class should extend to the final placement of artifact containers in storage containers. Fragile or lightweight materials should be kept separate from rugged, heavy artifacts.

3. Select the type and size of container appropriate for the type and size of the object, taking into consideration the frequency of object use.

Polyethylene resealable (Ziploc^{Ò}) bags. These have become the popular container for most small- to medium-sized artifacts and for larger samples of a single material class such as faunal remains, soil samples, etc. They are economical, easy to handle, lightweight and compact, and can be directly labeled. Nevertheless, there are some precautions that should be exercised if polyethylene bags are used.

a. *Select the bag size that is appropriate for the object*. Do not force an object into a bag. Instead, select the next larger size. Do not overfill a bag simply to maintain consistency of bag size when processing a collection.

b. *Select the most appropriate bag thickness*. At a minimum, use bags with a thickness of 4 mil or greater. These provide a measure of cushioning of the artifact and are stronger than thinner bags. Thicker bags should be used for heavier objects.

c. *Ventilate the bag*. Ventilation is recommended only for hygroscopic materials. Small holes should be placed at the top of the bag prior to placing the object inside. The holes will permit air circulation and thereby prevent mold or other organic fungi from developing inside a sealed bag. All

polyethylene bags, however, experience air exchanges over a period of time and none is airtight. Naturally, the holes should be smaller than the diameter of the contents. Generally, a hole punch can be used for most objects, although bamboo skewers are useful for making fine holes.

d. *Add padding when necessary*. Acid free tissue or polyethylene foam sheets may be used to provide an extra measure of cushioning for objects or to cover a sharp object that might otherwise tear the artifact container.

e. *Do not store fragile objects in a polyethylene bag*. Organic remains and fragile objects should be placed in rigid wall containers (see below).

f. *Purchase polyethylene from reputable vendor*. There are many grades of polyethylene. Some polyethylene sheeting is produced from recycled scraps of polyethylene with unknown formulations and composition. All contain plasticizers and anti-oxidizing agents that are susceptible to leaching and degradation. If the bags are purchased from a supplier of archival materials, there is likely to be greater attention to consistent quality and product guarantees.

Polypropylene rigid wall containers. More and more containers are being produced in a range of standard sizes from polypropylene film vials to large lidded boxes. These can be used as artifact containers for heavy, bulky objects, and they can be used to support a fragile object needing extra protection. Follow the same principles outlined above for polyethylene bags.

Corrugated polypropylene boxes. Although these are more expensive, polypropylene boxes come in a variety of styles, sizes, and strengths, and they do not require repackaging as frequently as polyethylene bags. The Center accepts only polypropylene boxes such as the types manufactured by the Hollinger Corporation. It is recommended that boxes with telescoping lids be used rather than folded flap lids. Telescoping lids allow easier access and prevent the container from becoming damaged with use as often happens with flap lids. Custom-designed boxes can also be made for unusually–shaped or–sized artifacts. These can be constructed using acid-free conservation board adjoined with linen tape, hot melt adhesive, or Ross® glue. Care must be taken to ensure that the box strength is sufficient to support the weight of the object without any flexure of the container walls. Some vendors will make large lots of odd-sized boxes as well.

Metal containers. The advantages of metal are its rigidity, strength, and potential to provide sterile storage for an artifact or sample. The disadvantage of some metals is that they are susceptible to oxidation that in turn is exacerbated by the presence of moisture and/or heat, particularly if the container has a tight-fitting lid. Some metals are susceptible to chemical interactions with other metals.

Carved polyethylene foam. Artifacts stored in drawers can also be protected by carving object specific shapes in a block of polyethylene foam (e.g., Ethafoam®) that has been cut to fit the drawer. Each object space can be labeled with the specimen number or any other special information regarding the object.

Unacceptable artifact containers. These include, but are not limited to, brown paper bags, sandwich baggies, lightweight food storage/freezer bags, non-polypropylene plastics, film vials or pill bottles, or glass containers for which no special provision has been made to store them securely to prevent breakage. Artifact containers should not be closed with tape, twist ties, rubber bands, string, staples, or heat sealing.

4. Construct special packaging or support when necessary, and label it as well.

As mentioned above, some containers may need to be custom designed to fit odd-sized objects. They also can be constructed to provide platforms for custom supports of fragile or broken objects that require special support in specific areas or to make portions of these objects visible without handling the objects themselves. Use archival-quality materials in constructing the support and consult a conservator if in doubt as to which portions of the object are strongest or most fragile and require special consideration. Labeling the packaging/support will reduce the amount of handling required to verify the object's specimen number.

5. Maintain provenience data at all times.

Label all artifact containers so that the contents can always be associated again should they become separated. All artifact containers should be labeled directly with permanent, indelible black ink, and they should have an acid-free label placed inside the container.

Storage Container Guidelines

After the artifact has been placed comfortably and securely in its artifact container, the artifact container is usually placed inside a storage container (e.g., inside a larger polyethylene bag, a box, or a storage unit drawer). Many of the same principles listed for the artifact container apply here as well.

1. Determine the anticipated use of the material.

Determine the frequency of access for the storage container. Will the container be accessed often or only intermittently? Intermittent access of artifacts will require that they be placed in a container that is designed for long-term preservation such as a standard archival box. More frequent access may require that they be stored in a drawer housing.

2. Segregate and store objects by their material class.

Heavy items such as brick, daub, groundstone, and fire cracked rock should be stored separately from lighter artifacts to prevent damage caused by shifting when boxes are moved from the shelves or when drawers are opened or closed in storage units. Use archival-quality padding or dividers to help stabilize heavy objects to prevent movement.

Ideally, artifact containers should not be stacked atop each other in a box or drawer, but placed in a single layer only. If this is not possible, then the heaviest items should be placed in the box first with lighter items on top of them, even if this means that the artifacts are no longer in sequential order. Each storage container must have a contents list that will assist in locating specific artifacts within that container.

3. Select the type and size of container that is appropriate for the type and size of the object.

The storage containers must not be overpacked, distorted by the contents, or made too heavy to handle easily. The maximum weight of a container should be between 20 and 30 pounds. Weights in excess of this range become unsafe to handle.

4. Construct special packaging or support when necessary, and label it as well.

Artifacts should not be wrapped in packaging material so that the item's identity and size cannot be determined unless it is unwrapped. Instead, place the artifact on a nest of acid-free tissue, then cover it with a protective layer of tissue that can be lifted off without handling the artifact. Segregate and cushion large heavy items that may cause damage if they shift position.

5. Maintain provenience data at all times.

The exterior of the storage container should list the provenience and the general contents or range of artifacts contained inside. Inside the storage container, place a packing list or box inventory printed on acid-free paper. This list should contain the specific specimen numbers stored in the container. It will facilitate locating and replacing objects in their correct storage container. The storage container can be labeled directly with pencil or indelible ink or with an acid-free paper label placed inside a sleeve on the exterior of the box or shelf.

Record Keeping

Throughout the procedures discussed above, the importance of documenting every action affecting an individual specimen and/or the collection as a whole has been emphasized. The Center's procedures and formats for documenting these data is by direct entry into the electronic collections management program, which serves as a centralized tracking system. Museums often refer to these data as *Museum Records*. The Center utilizes *Re: Discovery Software Program's* three modules (version 6.3) for tracking: Collections Management, Archaeology and Images.

Safety Copies

Additionally, 36 CFR § 79 mandates that museum and associated records be maintained in their original form and that a duplicate, or safety, copy be created and housed in a separate, fire safe, and secure location. Safety copies may be made on archival microfilm, acid-free paper, or other media if deemed appropriate. Generally, microfilm and archival paper are used due to their proven permanence. Electronic media provide many advantages (e.g., remote access, multiple simultaneous access, and manipulability) but they are neither stable nor permanent. For this reason, it is not recommended that museum records or data be created exclusively in electronic formats. The Center retains original records; safety copies are stored at Capital Records Management, 431 Harris Avenue, Providence, RI.

Material Safety Data Sheets

One method of documenting the materials, usually chemicals, used to process collections is by using Material Safety Data Sheets (MSDS). Federal law requires manufacturers to compile an MSDS for each product listing (1) the nonproprietary ingredients in a product; (2) basic handling, use, and storage guidelines; (3) potential chemical interactions; (4) fire hazard; (5) toxicity; and (6) spill cleanup procedures. These should be requested with each order and retained on file until the next batch is received.

It is also prudent to purchase materials from reputable vendors with long-term commitment to archival preservation. Even though the initial expenditure may be costly for archival materials, the highest cost is in the labor to process each object within a collection. Inferior materials will result in shorter "shelf life" and potentially may be damaging to the objects. This is particularly true for polyethylene bags. These materials are notorious for breaking down quickly, causing harm and resulting in enormous rehousing costs if not manufactured by a company that understands the importance of archival materials. Insist on the best archival-quality products.

Prior to using new products or new shipments of products routinely used in processing collections, test them. Even reputable manufacturers occasionally have bad "batches."

Curation History

The curation history of a collection informs future users of not only the original context or provenience from which an object came, but also notes the original condition and changes to the condition, conservation treatments performed and the specific chemical formulations used, the availability of photographs or analyses, the results of destructive analyses, and even the date an object was noted as broken or missing (Griset 1993). In short, it establishes and assists in maintaining intellectual control over the collection.

The curation history assists future users of the collection in identifying specimens suitable for specific research questions, for interpretation, or for educational uses. It can assist curators and conservators in monitoring changes in collection condition, and enables informed choices for future restorations or conservation treatments. It can even aid repositories in identifying curatorial practices that are advantageous versus those that are deleterious for the long-term curation of collections by documenting specific conservation treatments and practices.

The curation history should be collection specific (Table 8) and should include active documents that are routinely updated. As a matter of course, there should be a scheduled review (e.g., every two years) to ensure that they are current and that linkages between data management systems are operating in a consistent manner to track curation data.

Processing Associated Documentation

Associated documentation, by definition (36 CFR § 79), consists of the documentary materials generated as a result of an archaeological investigation conducted on federally owned or administered lands, no matter the scope of the investigation (e.g., archival, survey, or excavation) or the results. Whether or not artifacts are collected or archival materials are generated, each investigation results in a collection that consists, at a minimum, of the report of results. Even a "negative findings" letter provides information that may prevent future redundant investigations and waste of funds. If artifacts are recovered, the associated documentation preserves the context in which the collection was made as well

Table 8.
Curation History of a Collection

Procedures	Information Needed
Collection Acquisition	Date(s) that the collection was made, by whom, for what purpose, and other relevant details regarding the origin of the collection, such as a general description of the excavation/collection techniques. Date that the collection was accepted by (each) repository and any conditions pertinent to the ownership, access, or curation of the collection. Record the name of the individual who accessioned the collection and the accession number.
Processing Techniques	Date collection was processed and by whom. General procedures to clean or treat the collection (identified by material class). Specific procedures to treat individual specimens (record each individually). Products and/or formulations used to process the collection.
Collection Inventory	Field inventory (if present), and how produced. Final catalog (note specimens that received conservation treatments, analysis, or were lost or damaged in transit or elsewhere) and how produced. Periodic inventories by repository (note any changes from previous inventory).
Storage Conditions	General conditions for storing each material class in the collection. Special storage conditions for specific specimens. Type of pest management system used, name of inspector, and frequency of inspections; note any conservation treatments made. Record any changes in these procedures as they occur. Add them to the curation history. Do not remove previous procedures. Record any natural or human-induced crises that affect the storage conditions.
Conservation Treatments	Record for each specimen treated.Maintain a list of unique specimens to be monitored for special conditions.
Collection Use	Record types of use (loans, exhibit, research, etc.) and place copies of any publications, photographs, exhibit catalogs, etc. in the collection file. Note any destructive uses of artifacts. Include all documentation including original request for use, agency point of contact approval, methods used, and results. Note any restrictions on use (e.g., human remains).

as the context from which the artifacts were recovered. Without these contexts, the scientific and educational use of the artifacts and data is seriously curtailed.

The definition of associated records is independent of the investigating organization. The installation is responsible for any and all collections made by installation personnel or contractors. Upon completion of an archaeological project, the contractor should deliver to the installation the complete archaeological collection—artifacts, associated records, and the final report—as all of these are considered to be government property. Administrative records generated by contractors may be retained by them; installation administrative records for each project are subject to permanent curation. The retention, disposal, and preservation of agency records should be conducted according to agency directives. Individual Records Managers, or Records Management Officers, are responsible for these records and for ensuring that regulations are followed.

Archival processing of associated records has two primary objectives: (1) to stabilize the collection so that future deterioration is prevented or minimized, and (2) to arrange or organize the records in such a manner that they are easily accessible. Deterioration of paper and other archival media (e.g., photographic materials, audiovisual materials, maps, and ephemera) can never be completely halted. It is possible, however, to slow the deterioration to an indiscernible rate and therefore extend the life of valuable information contained in these collections. However, having the information is not enough; one must be able to find the information, preferably in an efficient and timely manner.

The techniques described below may be used to preserve or rehabilitate any type of documentation collection. They consist of general procedures common to all records collections as well as procedures for specific classes of records (e.g., photographs, cartographic data, paper records, or video tape) (Table 9), and are addressed in the following sections.

Table 9.
Basic Steps In Archival Processing

Procedures	Comments
Accession/Register associated documentation	Generally, associated documentation is assigned the same accession number as the accompanying artifacts. This ensures that the two elements of a collection, artifacts and documents, do not lose their association. In many cases the accession number is used as the collection number. Check with the repository prior to processing so that the documents may be properly numbered prior to submission.
Assess collection and perform minimal conservation treatments	Assess document condition, remove contaminants, and segregate documents that require special handling such as dry surface cleaning, humidification and flattening, mending, and encapsulation. Consult a document conservator if more than minor conservation treatment is required.
Arrange, refolder, rebox, and number documents	Archival processing consists mainly of the tasks of refoldering, reboxing, and arranging the documents in logical sequence (keeping in mind the principle of original order), and numbering appropriate elements (e.g., folders, documents, boxes) according to the specifications dictated by the curation repository.
Package documents	Place documents in containers appropriate to each media, and package according to repository's instructions for immediate access or long-term storage.
Create a finding aid for the associated documentation	The finding aid should enable users to quickly and accurately retrieve specific kinds of information from the associated documentation.
Keep records of all actions performed in processing the documentation.	Document any conservation treatments performed on associated documentation as well as any special information related to the documents. Submit copies (on acid-free paper) of conservation treatment reports, the finding aid, and registration documentation to the repository (see above).
Create an archival safety copy	An archival safety copy should be made of all the associated documentation, as well as the finding aid, conservation treatment forms, etc. This safety copy may be produced on acid-free paper or archival microfilm. Electronic media is discouraged because of questions concerning its survivability, stability, and technological obsolescence. The safety copy should be stored at a separate secure location. Safety copies of photographic materials should be made whenever possible.

Accessioning and Registering the Documentation

The process of accessioning is also referred to as "registering" the collection, and the paperwork generated from this process may also be referred to as registration or entry documentation. In these protocols, these terms are used interchangeably (refer to Accessioning). All associated documentation, regardless of the format, will be accessioned, or registered, when the Center accepts the collection. Bear in mind that these protocols define an archaeological collection as all materials (documents and/or artifacts) generated or compiled during the course of a single archaeological investigation. In many cases, a collection will consist entirely of associated documentation.

Generally, one accession number is assigned to a single collection, and it is used to identify all collection components: associated documentation, artifacts, and any documentation that is developed during curation of the collection. All of this information is recorded in the accession file. The accession file should include information concerning the receipt of the collection, an initial listing or inventory of the associated documentation files in the collection, and notes on any conservation treatments performed on the documents. The physical location of the records collection within the repository should also be noted in the accession file, along with any known requirements for preservation or conservation treatments. A curation history of the associated documentation should be created, if one has not been submitted with the collection.

Once the collection is accepted and the accession or registration is complete, the associated documentation must be archivally processed if this has not been done previously. The steps in processing associated documents for archival storage are discussed below.

Assessment and Conservation Treatment

Before any other measures can be taken to preserve the associated documentation, each type of documentation should be assessed for its current condition, necessary conservation treatments, and general completeness. Separate each document format, if this has not been done previously. Segregate items that require special treatments before they can be handled. Some of these conservation treatments may be performed by a professional archivist; others may require the attention of a professional document conservator. Any materials that are separated, for any reason, should have their original location noted to ensure that cross-indexing will be recorded in the finding aid.

Paper

Documents that require mending, removal of adhesives, humidification and flattening, cleaning, deacidification, or encapsulation should be set aside for treatment. Always note the original arrangement to maintain the original order.

Cartographic

Procedures and conservation treatments are generally the same as those for paper documents; however, the oversized format may require special support or handling to prevent additional tearing. Never force a tightly rolled document to lie flat without first humidifying and flattening it. Forcing the document open increases the chances of permanently damaging the item by tears and creases. For large format documents, always support the entire document when moving these items. These items should be stored flat. For extremely long documents (over six feet), cutting the document is unacceptable. Rolling may be necessary, although it will complicate access to the material. We recommend the following:

> Obtain two rigid, acid-free cardboard tubes or cylinders, one a minimum of three inches in diameter and the other at least two inches wider in diameter. The narrowest tube should be several inches longer than the document's shortest side, and the longer tube should be several inches longer than the first tube. Wrap the smaller cylinder with a sheet of polyester such as Mylar®, in order to keep the document from directly contacting the tube. Then, roll the document onto the tube in the direction of the document's longest dimension. Roll a second sheet of polyester over the document, making sure it covers the document completely, and that the leading edge overlaps the trailing edge. Tie the polyester sheet to the tube using cotton twill tape or a self-adhesive Velcro® coin under the leading edge. Finally, slide the smaller tube assemblage into the larger tube, ensuring that the twill tape or Velcro® coin is not under the document, as it can crease the document. The tube must be labeled either with the number of the document on the roll or with an index number that can be used to index the storage location of the rolled documents.

Photographic

Black-and-white negatives manufactured prior to 1947 require special assessment because they may be composed of cellulose nitrate, an unstable and highly combustible material. As the cellulose nitrate deteriorates naturally, it becomes increasingly unstable. If these negatives are stored in high temperatures, there is the potential for spontaneous combustion. Cellulose nitrate negatives often may be identified by their format, age, and visible deterioration. Any negatives dating prior to 1947 should be treated as potential nitrate negatives. Many nitrate negatives are larger (four by five inches and larger) and are often labeled on the edge as "NITRATE." When nitrate negatives begin to deteriorate they often have a silver or reflective sheen on the surface or they may appear iridescent. These materials should be copied, and the original nitrate negatives should be turned over to the local fire department for proper disposal. Cellulose acetate film, which replaced cellulose nitrate film, also deteriorates through time, although it is not flammable. Both nitrate and cellulose acetate film outgas, producing a vinegar smell that is readily apparent.

Audiovisual

Check for any signs of damage due to high temperature (warping, embrittlement) or due to conditions of low temperature and high moisture (mold, embrittlement). Segregate these specimens for examination by a conservator specializing in

audiovisual media. Note which items need immediate duplication in order to salvage the data. If a written transcript is not available, one should be created as soon as the material is stabilized.

Electronic

Identify the files on each disk and try to determine the software that created the files. After checking for potential viruses, open each file to insure that all are error free. Always ensure that a hard copy (paper copy) of each document is available to protect against irretrievable data loss.

Arrangement, Refoldering, Reboxing, and Numbering

Arrangement

Archival collections, like the artifacts they often accompany, are unique entities. Therefore, each document collection should be arranged according to its individual specifications. The principle of provenance is the key, but it often causes confusion to the untrained; "organization according to provenance precludes the uniformity of arrangement provided by library classification systems" (Miller 1990:26).

There is no one-size-fits-all arrangement that can be applied to all documentation collections. There are, however, certain principles and practices to help. The most common arrangements are chronological, topical, numerical, and alphabetical. Any or all of these systems may be used singly or combined, and should be suited to the type of document and the types of data present in each. Most often collections can be easily broken down into series and subseries.

> Series is defined as file units or documents arranged in accordance with a filing system or maintained as a unit because they result from the same accumulation or filing process, the same function, or the same activity; have a particular form; or because of some relationship arising out of their creation, receipt, or use (Bellardo and Bellardo 1992:32).

A *series* is a discrete unit of information that often can be further divided into subseries. "A *subseries* is a body of documents within a series readily identifiable in terms of filing arrangement, type, form, or content (Bellardo and Bellardo 1992:34)."

For example, one collection may contain the following series: administrative records, survey records, analysis records, and reports. The administrative records can be further arranged in the following subseries: correspondence, meeting notes, and Section 106 compliance documents. Each of these series and subseries should be arranged in the most logical manner—chronologically, alphabetically, topically, or any combination thereof. In another collection, it may be more appropriate to arrange data from several archaeological sites into series, with subseries for administrative records and survey records.

Once the files are physically arranged, the contents of each individual file must then be arranged. Standard archival practice dictates that each file's contents be arranged chronologically, from least recent to most recent (e.g., if a file contains documents dating from 1949 to 1970, the file, when opened, would begin with the 1949 data). Undated documents are placed last in the file. If, however, a more logical arrangement of the papers seems appropriate, it is permissible to supersede this practice.

Refoldering and Reboxing

As arrangement progresses, the materials are repackaged in archival-quality materials (i.e., acid-free folders and boxes). This is the refoldering and reboxing stage, and the document medium will dictate the best archival document container (see Packaging below for detailed discussion by documentary medium).

The label information or description of each document should be legibly transcribed to the new document containers (e.g., folders or sleeves). At this stage of archival processing, different formats (e.g., photographic, audiovisual, electronic, and cartographic materials) that have not been pulled previously should be separated from the rest of the collection and their removal noted and indexed in the new document container. Document format often dictates different storage requirements and thus indexing must be imposed and maintained to ensure that the materials are not intellectually separated from the collection (see Chapter 4 for more information on storage requirements).

Numbering

Unique identifying numbers should be assigned, both to a single investigation's associated documentation

and to individual document containers, so that (1) the documents can be easily sorted, searched, and managed, and (2) the associated documentation can be linked to the accompanying specimen collections, if present. Accession numbers are unique to each curating institution. Often in the case of associated documentation, an accession number is assigned to the collections of both artifacts and documents. The accession number is then used as a unique collection number for the associated documentation to preserve the link between the artifacts and documentation from a specific investigation. In some cases, the accession number may be used as a prefix to the numbering system applied to the associated documents. However, some repositories have specific requirements for numbering document collections. Some require that each document be indexed and numbered, but most require that documents be labeled/numbered at the folder level. Contact the repository for directions.

How these numbers are applied depends upon the format of the record. Some labels will be applied directly to the record; others will need to be applied to the document container. The repository may direct the preferred method of numbering and labeling.

Recommendations by Document Type

Paper Documents. It is imperative that all folders have clear label information. It must be legible and describe the contents of the file with clear, concise information. Folders should be of acid-free stock or as close to pH 7 as possible. Labels can be typed or computer generated on archival adhesive labels. If these labels are not used, it is permissible to write (i.e., print), legibly, on the file with indelible ink or #4 graphite (2H) pencil lead. When feasible, indelible ink is the preferred labeling medium. Basic information includes collection name and/or number, series, description of folder contents, and dates. Each folder should be assigned a unique number according to the numbering system used for the collection.

Cartographic/Oversized Documents. Oversized paper records, such as cartographic documents (maps), should be labeled the same as smaller-format paper records. Number and label each one. Both the map and the corresponding file from which it was originally separated should be labeled clearly with the cross-indexed information. This information should be noted in the file, on the cartographic document, and in the finding aid.

Photographic Materials. Photographic records consist of several different media: negatives, prints, and transparencies from either black and white or color film. Each poses particular conservation requirements that are discussed in greater detail in the section below entitled *Preventive Conservation*. Photographic collections or series should be arranged according to format and numbered according to image. Each image receives a unique number, and duplicate images are noted in the finding aid. For example, a single image may be represented in several formats (e.g., a print, a negative, and a slide), but it is assigned only a single unique number. When labeling and arranging this sample collection, the print, the negative, and the slide will each be labeled with the same number (referring to the same image), and each format will be packaged and stored according to its specific requirements. Each image should be recorded in the finding aid and the corresponding formats noted (Table 10). Photographic materials can be labeled either indirectly or directly.

Table 10.
General Rules for Processing Photographic Materials

Never handle photographic materials with your bare hands. Always wear white cotton gloves. Acids and oils present on human skin transfer to and eventually damage or destroy the image.
Each image should have a unique identifying number. Any corresponding duplicates, negatives, or slides should indicate this fact in the finding aid. It may also be appropriate to record this fact in the label information.
Each image should be labeled legibly, either directly or indirectly.

Indirect Labels may be used on all photographic media. Indirect labels can be written on and attached to the exteriors of photographic document containers such as polypropylene or polyethylene sleeves or acid-free or buffered envelopes. Negatives should always be labeled indirectly on their document container, never directly on the negative.

Direct Labels should be written in indelible ink on the reverse of photographic prints. When directly labeling photographic prints, it is recommended to record only the identifying number of the back of the print. More detailed label information should be

provided in a log or other descriptive scheme. Care should be taken to write with minimal pressure so that impressions do not crack the emulsion on prints, thus hastening deterioration. Transparencies in cardboard slide holders should be labeled directly on the cardboard holder in indelible ink. As with photographs, care should be taken not to apply too much pressure when labeling slides. Slides should be labeled only on the non-emulsion side. Foil back labels can be attached to the back of prints. These labels, available in a variety of sizes, prevent surface inks from penetrating the label and affecting the images and, conversely, the adhesive cannot penetrate the foil and attack the ink, causing excessive fading. They may also be removed, in the short term, if there is a mistake or if they need to be replaced. However, over time, they will be very difficult to remove without damaging the photograph.

The photographic log will provide the detailed information that can connect each image with its provenance or collection data, should the two become separated. All labels should be clear and in a consistent format throughout the collection (Table 11).

Table 11.
Sample Label for Photographic Materials

Field	Sample Data
Unique identifying #	434-P-1001
Date image was taken	5/30/77
Where image was taken	Site RI-103
Photographer	Larry Jones
Image Format	4-x-5 color print
Any corresponding images	8-x-10 color print; color slide; 35-mm color negative
Description of image	Overview of site facing northwest. Units 3 and 4 in foreground, at 0–20 cm level.

Audiovisual Materials. Audiovisual materials include a wide range of materials. Most common of these are audiocassette tapes, reel to reel tapes, phonographic disks, videotapes (including Beta, VHS, and ¾ inch), moving picture film (including 8-mm, 16-mm, 35-mm, and larger format films), and audio compact disks. Many audiovisual (AV) disks and tapes can be directly labeled with indelible ink. If this is not feasible, use a foil-backed label and attach it to the tape/disk. The very minimum of information recorded directly on the tape/disk should include the collection number and a unique identifying number for that item. Each storage container should be labeled with the above information and more detailed information to ensure that the original item is not permanently separated from its storage container. Detailed information should be provided in the finding aid, or in an AV log included with the finding aid (Table 12).

Table 12.
Sample Label for Audiovisual Materials

Field	Sample data
Unique identifying #	434-AV-101
Creation Date	5/30/77
AV Format	16-mm black-and-white film
General description of contents, including interviewer and interviewee if applicable	Suzanne Griset describing oral history concerning site RI-103. Interview conducted by Margaret Mead and filmed by Stephen Spielberg.
Location where tape/disk was created	Onsite at RI-103
Transcript	Transcript 434-TR-001, 15 minutes.

Whenever possible a transcript of the recorded material should be made. Audiovisual materials are easily damaged, so a transcript will ensure the survival of the basic informational content.

Electronic Media. Electronic records present a multitude of problems for long-term storage. Magnetic computer disks and tapes can be partially or totally erased by proximity to magnetic fields. This damage can be caused by something as simple as placing a disk too close to a telephone. Dust and humid conditions can also affect the accessibility of the information, causing lost sectors of information on the disk or tape. Technical obsolescence, however, creates the primary problem with curation of electronic media. Computer technology changes so fast that there is no guarantee that information recorded in electronic form this year will be retrievable on new generation computers. Added to the hardware difficulty is the problem of software. Changes in software virtually guarantee that information stored in electronic form will not be readable unless that software is still operable. Ultimately, long-term storage of electronic formats is

not particularly viable. Even in cases where "permanent" storage solutions such as scanning or digitizing have been used, there is no guarantee that the data will remain viable and accessible. Electronic format records should be viewed as access tools, but should not be used to "replace" the original documentation.

If electronic media are included with an associated documentation collection, every effort should be made to preserve the material (see Chapter 4 below). As with audiovisual media, each disk should be labeled directly with the collection number and a unique identifying number for each item. Detailed information should be provided in the finding aid, or in an electronic materials log included with the finding aid (Table 13).

Table 13.
Sample Label for Electronic Materials

Field	Sample data
Unique identifying #	434-E-007
Creation date	5/30/77
Format	5.25 inch floppy disk
Software used to create disk	Dbase III+, version 2.1—database tables and report formats
Creator	ARS, Larry Jones
General description of contents	RI-103 artifact catalog, obsidian hydration rims, and Final Report Tables
File name	RI103CAT.db
Size of file	356,789 bytes
Date last updated	10/9/77
Size of file	47,097 bytes
Date last updated	11/12/77

The best method of ensuring the survival of the data contained on electronic media is to provide hard copies of all electronic data printed on acid-free paper. Each printout should be labeled with the unique identifying number of its corresponding disk, as well as the file name and software name and version.

Packaging

Associated documentation should be packaged in archival-quality materials to prolong the life of these records. As with archaeological objects, associated documentation is packed first in a document container; these are then placed within storage containers; again, the choice of appropriate container is guided by the preservation requirements of the format (e.g., media), as well as the anticipated need to access each record format.

Document Containers

Document containers should be selected according to the preservation needs of each document format and to the particular size of the records. Do not place documents in containers too small for them. This causes folding and tearing. By the same token, however, placing documents in containers too large will also cause damage because it will allow shifting within the document container.

Paper Records. Paper records should be placed in acid-free or buffered files and folders of appropriate size. Polyethylene, polypropylene, and polyester (Mylar®) sleeves or enclosures are also acceptable document containers. Often collections will have varying paper sizes. A single collection may have documents that are letter sized (8.5 x 11 inches) and legal sized (8.5 x 14 inches). In this case, use legal-sized folders and boxes (document and storage containers) for both paper sizes so that all folders will fit snugly within the box without shifting from side to side as the storage container is moved.

Cartographic Materials and Oversized Drawings. Maps (cartographic materials) and drawings present storage problems related to space allocation. They tend to be nonstandard in size, often oversized, and require flat, horizontal storage. It is tempting to fold these and place them in legal- or letter-sized folders for storage. This practice, however, severely shortens the life span of these materials. Creases created by folding severely weaken the paper fibers and lead to tears or losses that are likely to obscure information. Even folded, these materials can be humidified and flattened for long-term storage, but the material has been weakened by creasing. Fragile and/or frequently used materials may require encapsulation in Mylar®.

The preferred storage method for these materials is to place each inside an acid-free folder. This can be quite costly in time and money. At the very minimum, separate each map with a sheet of acid-free tissue or blotter paper before placing it inside the storage container.

Photographic Documents. Every image (print, negative, or transparency) should be stored in its own document container such as a photographic envelope or sleeve. Multiple images improperly stored in a single envelope or sleeve can scratch the emulsion and irreparably damage the image. Envelopes and sleeves should be constructed of either acid-free paper or an inert plastic. Acid-free paper sleeves are available from reputable archival materials suppliers and are made in a variety of sizes to fit common photographic media formats.

Plastics that are considered archival-quality include polyester (Mylar®), polyethylene and polypropylene. Mylar® is commonly used to encapsulate very fragile documents, especially if they are handled frequently. Polypropylene sleeve pages come in a variety of sizes for single or multiple images as well as for slides or negatives and have become popular due to their low cost and ease of use. Glassine envelopes, vinyl, or other plasticized sheets containing polyvinyl chlorides (PVC), and acidic papers including Kraft® paper envelopes, are unacceptable.

Each photographic document container should have proper label information. Envelopes and sleeves can be labeled directly with indelible ink on the exteriors; metal slide containers will have log sheets inside the container that identify the contents, as well as a label applied to the exterior of the container (see the labeling discussion above for specific details).

Electronic and Audiovisual Records. Electronic disks can be stored within plastic containers made specifically for this purpose. These come in a range of sizes and can be selected to suit the size of the collection of disks per accession, or can be stored in sequence in a larger disk storage container. Video or audiotapes should be placed in acid-free boxes of appropriate size. A foil-backed label can be attached to the front of the box, and the spine can be labeled with the Collection and Identifying numbers. Electronic and audiovisual material should be kept in an area not only free from the hazards of nature, but also human-derived hazards such as electromagnetic fields that can potentially destroy them (see *Preventive Conservation* section for more detail) (Table 14).

Table 14.
Sample Document Container Label

Field	Sample data
Collection or Accession #	434
Unique identifying #s	434-AV-001 through 434-AV-010
Container contents	Cassette tape and 16mm black and white film
Site numbers (if relevant)	RI-103

Storage Containers

Once documents have been placed in material-appropriate document containers, they will need to be placed in storage containers that are suited to the anticipated level of use that will be required of each set of documents, while maintaining the requisite environmental conditions. For some materials that are rarely used, the document containers may be placed in acid-free boxes and stored in an off-site storage area or facility. Other document containers may be placed in metal storage furniture that permits easy and frequent access (i.e., archival boxes placed on baked enamel shelving units in an on-site storage area). Wooden shelving often produces gases that can detrimentally interact with materials that are stored on them.

Paper Records. Paper records should be stored in acid-free or archival boxes of appropriate size. They may also be stored in baked enamel metal file cabinets, but this practice is discouraged due to the warping of documents that occurs in hanging files or even regular file cabinet storage. This warping may also occur in archival boxes, but can be prevented by the use of archival spacer boards.

Maps and Oversized Materials. Flat storage in a baked enamel metal map case is preferred for these materials. These materials also may be stored in appropriately sized acid-free or alkaline-buffered boxes. However, check with a conservator first before using buffered storage materials because using buffered materials may be detrimental to oversized materials produced with early reproduction equipment.

Photographic Documents. Photographic images that have been placed in paper or archival plastic sleeves can next be placed in either acid-free boxes, archival photograph notebooks, or in baked enamel storage cabinets manufactured specifically for photographic media. Prints should be stored flat, in

either a horizontal or vertical position, as long as they are kept on a single plane and not permitted to warp. Slides can be placed directly into metal slide boxes if so desired, but should be stored upright. The important issue in storing photographic media is to keep them out of ultraviolet radiation (especially sunlight) in a clean and particulate-free environment, and to maintain a consistent environment as far below 68º F as your HVAC will permit and dependent on human comfort, and a constant relative humidity (RH) of 30% (National Information Standards Organization 1995:1). However, it is even more important to maintain constant temperature and relative humidity because drastic swings in either can be extremely stressful to photographic materials.

Electronic and Audiovisual Materials. These materials may be placed in appropriately sized boxes or in baked enamel metal cabinets. It is imperative that these materials be kept away from electromagnetic fields and dust. Lower temperature and lower relative humidity (RH) will help increase the life expectancy of these materials. It is important to note, however, that "electronic data, even when it is well cared for, may suffer major data loss for no apparent reason" (Balough et. al 1993:31).

Record Keeping

After the documentation has been physically arranged, labeled, and placed into document containers and these in turn have been placed in appropriate storage containers, a finding aid should be developed that explains the organization and arrangement of the collection. Also, the pertinent data concerning the contents of the associated documentation and processing techniques used for the collection should be placed in the accession file with the rest of the entry documentation.

Finding Aids

Finding aids are the tools archivists create to assure fast and accurate retrieval of information in document collections. Finding aids are also referred to as guides, registers, checklists, and indexes. An archival finding aid is an essential element in the preservation and research use of archaeological associated documentation. It may be simple or complex, depending upon the collection and the repository's policy (Table 15).

Not all finding aids will contain all of the above components. The finding aid should include as many components as are needed to present the most complete information. At the very least, a container listing should be provided. Often the curation repository will state the components that must be included in the finding aid prior to its acceptance of the collection.

Word processing programs are often used to create finding aids because they allow unique information to be easily searched by name. However, it may be very tedious to use this method to search through a large collection of materials such as photographs, particularly if the collection contains multiple images of similar objects or large numbers of images. Retrieval of information can become an extremely time-consuming task. Generally, databases work much better for large collections.

Table 15.
Components of an Archival Finding Aid

Field	Sample Data
Introduction	An overview of the contents, origins, and research strengths of the materials.
Scope and content note	A narrative description, usually written by the processing archivist, of the collection's characteristics, strengths and weaknesses, and any particular notes on information or format contained within.
Series description	A brief, precise overview of the files contained within the series; includes the series title, description, dates, and the size of the series being described.
Container listing	A detailed table of contents that provides specific information on the filing order and the contents of the collection. Generally it is a list of folder titles and their identifying number listed in the same order as the physical arrangement of the collection. Also known as a box or folder listing.
Index	A rearrangement of the finding aid into an alphabetical, subject, chronological, or other sequential order to facilitate retrieval of files. With electronic finding aids, indexing is generally done automatically or with the "find and search" commands.

Curation History

Like objects, associated documentation is subjected to a variety of treatments and uses that may affect the preservation and usability of the specimens in the future (see Figure 7). Each of these areas also should be addressed specifically for the various media in the associated documentation in the collection. This curation history may be maintained in the accession file or in a master list maintained by the repository.

Safety Copies

A duplicate, or safety, copy of the associated documentation should be created for each collection. It is preferable to use the duplicate copy and store the originals in fireproof and archival conditions in a separate building.

Safety copies may be made on archival microfilm, acid-free paper, or other media if deemed appropriate. Generally, microfilm and archival paper are used due to their proven permanence and low cost. Electronic media that incorporate digital images do not have comparable proven stability or permanence, but are more easily searched. They are also more costly to produce and require more frequent migration or replication.

Decisions as to the appropriate media for security copies should consider the anticipated frequency of requests to access the data, initial production cost, and maintenance costs (including routine migration if needed), as well as the stability of the media. Routine periodic inspections of the security copy should be made to ensure its accessibility and stability.

Conservation Criteria for Archaeological Materials

The following section provides basic information on the characteristics and consequent handling and storage requirements of object material classes commonly recovered during archaeological excavations in North America, as well as common associated documentation such as paper records, photographic materials, audio tape and video tape. This information is provided as a reference so informed decisions can be made on whether collections are being properly curated. The information also may assist in discriminating between signs of active deterioration versus inadvertent aging of a specific material class.

We have provided ranges of temperature and RH for storing various material classes. These ranges provide the optimal conditions; however, any materials recovered from conditions that vary greatly from these ranges should not be subjected to drastic condition changes just to reach these optimums. Objects may be slowly brought into the optimal range or they may have reached equilibrium under the current conditions and should not be changed. These assessments will require consultation between the federal agency point of contact and repository personnel and may require the assistance of a professional conservator.

Conservation treatments (e.g., repairing damaged objects or documents) should be performed by, or under the supervision of, a trained professional conservator. Some minimal stabilization efforts can be applied to prevent additional deterioration of a damaged item, but the best way to prevent deterioration of artifacts and documents is to employ the principle of *preventive care*. The information presented here can assist in planning the storage environment or selecting artifact containers suited to the particular needs of specific material classes. Archaeological materials are listed first, alphabetically. These are followed by an alphabetical listing of material classes within associated documentation.

Bone

All bone, whether human or animal, consists of both mineral (hydroxyapatite) and organic, or protein (collagen) components. These components combine to form different kinds of bone structure, depending on the part or function of the bone. Long bones, for example, consist of an external shell of dense, compact material called lamellar bone which surrounds an inner spongy material known as cancellous bone (Sease 1987:56; Cronyn 1990:275–277; White and Folkens 1991:14).

These materials are preserved in most environments, but the condition and the level of their preservation can vary according to the environmental conditions of their discovery context. The effects of these conditions are further complicated because the two components of bone, inorganic hydroxyapatite and organic collagen, are best preserved at opposite pH levels. In acidic deposits the inorganic hydroxyapatite dissolves, leaving the soft collagen,

which shrinks when it dries out. In alkaline environments, the organic collagen hydrolyzes (decomposes due to chemical reaction with water) and is attacked by bacteria, leaving the hydroxyapatite brittle and susceptible to crumbling when dried out. In less alkaline deposits there is a softening of the bone surface. Very dry environments or soils that contain high levels of calcium carbonate (e.g., in shell middens) at a moderate pH produce the best conditions for preservation (Cronyn 1990:277).

Processing of bone artifacts and faunal remains will depend upon the condition in which they are recovered archaeologically. Samples that are recovered in good condition and are stored in areas with appropriate controlled temperature and relative humidity levels may need little treatment beyond dry brushing, cataloging, and packing. Bone (and ivory) recovered from extremely dry or wet contexts may be stabilized by maintaining those conditions in the storage context. Bone that is in poor condition and actively deteriorating may require consolidation (the addition of chemicals to restore physical or structural strength) before it can be removed from the archaeological contexts. Other samples may require consolidation in the laboratory to permit handling of the specimens. Others may require treatments to stabilize and slow the degenerative process.

Consolidation should be undertaken upon the advice and supervision of a professional conservator. Many "simple" methods advocated in the archaeological conservation literature (e.g., saturating bone with water-based white glue (National Park Service 1990:P:16) have associated risks. White glues can crosslink (become less or completely insoluble) with the passing of time, and hence they are not considered to be satisfactory conservation treatments with full reversibility (Sease 1987). Some treatments involve the use of hazardous chemicals that require special handling and disposal. The best option is to consult a conservator, and be certain that any such treatment is fully documented and added to the curation history.

Antler

Antler is the outgrowth of the skull bones of deer, elk, moose, caribou and other animals, referred to as cervids. Because antler is an extension of bone it can be treated much the same way as animal bone. Unlike the hollow horns of other animals, antler consists of solid bone. Structurally, antler is very similar to long bones in that they consist of a hard outer layer surrounding a spongy central area. Unlike long bones, antlers do not have a central marrow cavity. For consolidation and preservation of antler see the recommendations above for faunal remains.

Ivory

True ivory comes from the upper incisors, more commonly referred to as the tusks, of elephants and mammoths. However, this term is frequently used to describe the teeth and tusks of other animals such as walrus, hippopotamus, and narwhal. Ivory is formed of successive layers of dentine that are hygroscopic. Deterioration usually occurs between the layers due to absorption or loss of water, or migration of salts from the interior to the exterior surface. Like bone, ivory swells and warps at high humidity, and shrinks and cracks at low humidity (<40% RH, Rose 1992:151). High humidity levels cause soluble salts in the ivory to re-hydrate and crystallize, and cause the layers of dentine to split (Lamb and Newsom 1983:30). Very dry environments or soils that contain high levels of calcium carbonate (e.g. in shell middens) at a moderate pH produce the best conditions for preservation (Cronyn 1990:277).

Human Remains

In general, human bone is compositionally similar to animal bone and can be treated in much the same way; however, greater care is necessitated by the nature of the material. Human remains typically offer a greater degree of information about the past lives of groups of people than faunal remains (White and Folkens 1991). This, coupled with the emotional and psychological aspect of dealing with deceased humans, requires great care when consolidating, stabilizing, and conserving these remains.

All human remains require respectful handling and storage procedures. Native American human remains must be treated according to the requirements of NAGPRA. This law stipulates that culturally affiliated federally recognized tribes and lineal descendants of Native Americans should be consulted regarding the disposition of the remains. Stabilization and preservation of Native American

remains should be undertaken only after consultation with affiliated peoples has been completed.

Botanicals (see also Textiles, Wood)

Botanicals (or flora remains) are collected from archaeological contexts in a variety of forms. They may have been processed as foodstuffs or used to manufacture tools, housing, or textiles. They also may appear as unprocessed samples of the flora extant at the time the site was used. Each of these forms poses unique requirements for processing and for long-term storage.

The one factor common to all botanicals is their fragility. They must be handled with great care and packaged so that they are not crushed or contaminated.

Flora food remains may consist of charred fragments of stems, seeds, or other portions of plants. These may be collected directly from the midden during excavation, from residues on other artifacts, or they may be floated from soil samples that are processed with water after the excavation has been completed. Care should be taken to keep these samples as free from contaminants as possible. Oils from hands and plasticizers from artifact containers can affect their future use as research specimens. If the botanical specimens have been processed with water (i.e., floated) they must be thoroughly air dried before they are placed into rigid walled, inert containers, and the containers must be vented to permit air circulation and prevent mold growth.

Some botanical remains may survive only as impressions cast in baked or sun dried clay, asphaltum, or some other medium. These, too, should be handled carefully and placed into rigid walled containers.

Pollen samples that have been processed for analysis have undergone extensive chemical manipulations. They must remain in liquid storage if they are to be preserved beyond their initial analysis. Often, these samples are stored in glass or polypropylene test tubes. Long-term storage should focus on maintaining the physical integrity of the sample by supporting the tubes in specially constructed trays or racks, and by routine periodic inspections to ensure that the wet medium has not evaporated. Data concerning the chemicals and techniques used to process the samples should be entered into the curation history.

Ceramics

In many archaeological sites, both Native American and historic ceramic sherds constitute a significant amount of the total volume of artifacts recovered. They have the potential to reveal a tremendous amount of data about a site and/or group of people. The term ‘ceramics’ refers to a wide variety of fired clay products, including pottery. Many types of pottery exist, from low-fired aboriginal earthenwares to higher-fired, often glazed, earthenwares, stonewares, and porcelains (Cordell 1983:63). The raw clays used to make pottery are basically aluminum silicates; however, the clays vary in chemical composition and in the nature and quality of impurities. Additionally, many clays are tempered with other materials such as ground shell, rock, and organics. Because of differences in composition and hardness, the reaction of pottery when buried will vary depending on the burial conditions, but generally speaking, well-fired ceramics will survive better in all types of soil conditions (Sease 1987:93). Soil conditions that can damage pottery are excessive acidity, alkalinity, and salinity.

Acidic soils exert a weakening effect on certain types of pottery, generally those that are low-fired ceramics and those with temper that is easily affected by the acidity, such as crushed limestone and shell tempers. Acids can react with these temper types and leave the pottery exceedingly porous (Cordell 1983:63).

Alkaline soil conditions will result in the deposit of carbonates, sulfates, or silicates of calcium on the surfaces of sherds. These compounds are referred to as insoluble or slightly soluble salts because they are not readily dissolved in water. Again, low-fired pottery is more susceptible to encrustation and penetration of these compounds. Calcium carbonate is the most frequently encountered insoluble salt that leaves a whitish encrustation on sherd surfaces. Ceramics located in semiarid environments or buried in shell middens also produce these encrustations (Cordell 1983:63–64; Cronyn 1990:146).

Soluble salts can saturate pottery in varying environments, particularly in areas located in marine environments, but soluble salts also can occur in

pottery buried in semiarid conditions and in tropical environments. The soluble salts impregnate ceramics and when the moisture evaporates, the salts crystallize and move to the surface of the sherds through capillaries in the clay bodies (Cordell 1983:64). This crystallization can exert tremendous force and may cause spalling or disintegration of the ceramic body. Most common soluble salts are chlorides, nitrates, phosphates, sulfates, and carbonates. The chlorides, nitrates, and phosphates are more readily dissolved in water while the sulfates and carbonates have slower dissolution in water and are thus referred to as insoluble salts (Paterakis 1987:67). Salts cause more damage to pottery than any other agent. If the salts are not removed, they promote loss of surface decoration and can eventually cause complete disintegration of the ceramic body.

Cleaning and repair are the two treatments commonly applied when processing ceramics. However, as more techniques are developed to analyze residues found on ceramic sherds, complete cleaning is giving way to spot cleaning of the area needed for labeling the specimen. The most common methods of cleaning are dry-brushing or washing with water. Ceramics with salt encrustations should be cleaned under the supervision of a professional conservator to ensure that the proper techniques are applied. All ceramics, especially the low-fired varieties, are porous, and any ceramics that are cleaned with water or another solution must be permitted to air dry thoroughly before any additional processing can proceed. They should not be enclosed in airtight bags until they are completely dry.

Some ceramics are friable or actively deteriorating and require special treatment and handling before cleaning can begin. If pottery needs to be consolidated or has already been consolidated, it should not be washed. Some consolidants may alter the physical and chemical properties of pottery, thereby altering their suitability for certain kinds of analyses. Consolidation should be undertaken only after consulting a professional conservator to verify the type of stains, salts, or other problems that may be affecting the ceramics. Be certain to document every specimen that receives some form of special cleaning, consolidation, or repair.

Large fragments or whole pots frequently require external support to provide structural reinforcement or protection during storage and handling. These supports can be made of Ethafoam®, padded cotton knit tubes, or other supports similar to those constructed for large baskets (see Clark 1988). The support will also provide a safer means of transporting or handling the specimen. When it is necessary to handle a whole pot directly, use both hands to lift it by the base, never by the rim or handles. Storage environments should provide stable temperature and humidity ranges of 55–75° F and 40–60% RH for low-fired ceramics, and 45–55° F and 45–55% RH for high-fired ceramics (National Park Service 1990:P:21).

Composite Materials

If artifacts are composed of two or more different materials that require dissimilar conservation techniques, a decision must be made as to which artifact component is more important and then the appropriate preservation method for that component should be employed (National Park Service 1995:17; Sease 1987:65; Cronyn 1990:94). Examples of some composite items include furniture, knives, pistols, rifles, and cutlery. It is recommended that the artifact not be disassembled for conservation.

Glass

Glass is composed of silica that is fused with other elements or modifiers such as potassium (potash), sodium (soda ash), lead, or calcium (National Park Service 1990:P:8; Sease 1987:72). These are referred to as fluxes. They lower the melting point of silica and allow it to fuse more readily. However, fluxes may compromise the stability of the final glass product (Cronyn 1990:128; Sease 1987:72). Additional materials such as lime, magnesia, or iron are also added to act as stabilizers. They, in turn, can influence the color of the glass, e.g., manganese gives glass a purple color whereas iron gives glass a green color (Cronyn 1990:128; Guldbeck and MacLeish 1990:187; National Park Service 1990:P:8).

Absorption of moisture is the primary cause of chemical and physical changes in glass, which result in weathering and/or decay. The kinds and rates of absorption are dependent upon the chemical composition of the glass, the firing history, the post-use deposition matrix, and the length of time that the glass has been deposited in the matrix. If the glass

contains insufficient quantities of silica, it is more susceptible to absorption of moisture and consequent weathering or decay. If there is more or less than the optimum 10% lime flux, the glass will also be unstable. Soda glass (glass containing soda ash) is almost twice as durable as potash glass. Glass will be reasonably well preserved in acidic soils. Alkaline soils will cause severe deterioration because under alkaline conditions the flux is leached preferentially to the silica, and will render the glass porous, pitted, and covered with layers of carbonates (Sease 1987:72; see also Shapiro 1983). Glass decays when its chemical composition is unstable and compounds leach from the glass body out to the surface of the glass. Iridescence, crizzling (surface cracking), weeping, efflorescence, and encrustation are all terms used to describe the effects of specific compounds (see Newton and Davison 1989, Cronyn 1990, and National Park Service 1990, Appendix P for detailed descriptions).

Glass decay is irreversible, but it can sometimes be stabilized. Guldbeck and MacLeish (1990:188) recommend maintaining an ideal relative humidity level between 45–47%, although a range of 40–55% is acceptable; Plenderleith and Werner (1976:346) recommend <42% RH; and Sease (1987:74) suggests <40%.

Handling precautions may also prevent additional glass decay. Bare hands can transfer moisture, oils, and acids onto the surfaces of the glass, and these can accelerate inherent deterioration. Snug-fitting latex gloves are recommended over cotton gloves because the glass surface might be slippery. Glass should never be handled by any knobs, rims, handles, or decorative motifs. Jewelry such as rings, bracelets, and long necklaces should also be removed from the person handling the glass so that scratches or chips do not accidentally occur (National Park Service 1990:P:19).

Leather and Other Animal Skin Products

Leather artifacts recovered from archaeological sites provide numerous preservation problems. Control of temperature, humidity, and ventilation is crucial to the preservation of leather. Extreme heat will harden and embrittle leather. Drying will cause leather to shrink, curl, crack, and become brittle and inflexible. Low relative humidity (<40%) will cause the leather to dry out; high humidity (>60%) promotes the growth of bacteria and fungi, increases the chances of infestation, and may also cause changes in dimension and flexibility. Leather may also provide a source of food for various pests including moths, beetles, and rodents. Once deteriorated by whatever cause, leather cannot be returned to its original condition. Therefore, the most important elements in conserving leather goods are optimum storage conditions and appropriate handling; in other words, preventive conservation (see Cronyn [1990], Guldbeck [1969]; Guldbeck and MacLeish [1990]; Sease [1987]).

If the leather is in a dry, stable condition, no treatment may be necessary. Leather dressings should not be applied to dry stable leather. Items that need to be cleaned, repaired, or reshaped should be referred to a professional conservator, preferably one specializing in leather care.

Moisture and heat cause the majority of problems for leather objects. Moist leather may mold or mildew and should be kept damp and refrigerated until it can be properly conserved; leather should never be allowed to freeze.

Red rot is the common term used to designate the deterioration of leather objects, particularly vegetable tanned skins, due to reaction with sulfuric pollutants (Rose 1992:148). It is not reversible though it may be slowed with the use of a potassium lactate buffer solution. Red rot is commonly found on leather book bindings made between 1850 and 1900.

Virtually all leather stabilization treatments will result in some shrinkage, though the degree will vary. For this reason, the size and shape of leather artifacts should be recorded prior to and following treatment. One method of stabilization is to replace the water in the leather with a more stable material, one that will coat the fibers and thereby prevent cross linking on drying (Cronyn 1990:273). Humectants (hygroscopic chemicals that bond to the organic material in question) such as glycerol or sorbitol can be used for this purpose since both contain oils and tannins that are vital for leather stabilization (Cronyn 1990:245, 273–274). Treatments should be performed by a professional conservator.

Special caution should be used when handling leather specimens. Many treatments of leather objects advocated and performed well into the 1970s

involved the use of arsenic and other hazardous chemicals. All older specimens should be assumed to contain potential skin absorbent toxins unless they have been analyzed by a professional conservator and are certified to be free of such chemicals. These specimens should never be handled without gloves, and the gloves should be disposed of properly after a single use (consult your local Hazardous Materials disposal guidelines; see also Carson and Mumford 1994).

Masonry

Masonry refers to stonework or brickwork used in building structures. Examples of stonework collected from Native American or historic sites should be treated according to the conditions discussed in stone; brickwork is a manufactured ceramic material and should be treated accordingly.

Metals

Metals are broadly classed as either ferrous or nonferrous. Ferrous metals contain iron; nonferrous metals do not. Ferrous objects will attract a magnet if there is sufficient sound metal (iron and steel) remaining; nonferrous metals, with the exception of nickel, will not attract a magnet (National Park Service 1995:19–20).

Ferrous metals (e.g., cast iron, wrought iron, and steel) generally comprise the majority of metal artifacts from historic sites. The major cause of ferrous metal deterioration is rust or oxidation. Metals such as copper, brass, lead, tin, pewter, and silver are examples of nonferrous metals commonly found at historic sites.

Metals are referred to as base or noble metals. Base metals corrode more easily than noble metals. The list below depicts reactivity of metals to chemical corrosion, from the most reactive base metals to the least reactive noble metals (Cronyn 1990:171).

(base) Zinc/Iron/Tin/Lead/Copper/Silver/Gold (noble)

most reactive ⇨ ⇨ ⇨ least reactive

Metal artifacts are generally affected by oxidation or corrosion in surface or subsurface environments. The degradation of the metal results from electrochemical reactions that form mineral encrustation. The rate of these reactions is dependent upon the nature of the metal and the microenvironment of the surrounding soil (e.g., soil pH, porosity, naturally occurring salts, moisture content) and components in the air (e.g., oxygen, carbon dioxide, salts) (Wilson 1983:39; National Park Service 1995:19; Hamilton 1976). Metal that is exposed to these chemicals forms corrosion products such as oxides, carbonates, and sulfates (Cronyn 1990:171). Once a metal object has been deposited, it will begin to corrode in order to achieve a state of equilibrium with its surroundings. When the item is excavated and placed into a new environment, the equilibrium is destroyed, allowing for further corrosion (Wilson 1983:40; Scott et al. 1991). Most metals will also tarnish in dry air, though the introduction of water will accelerate this process. Even more stringent requirements must be met for preserving metals that are excavated from wet contexts (Hamilton 1976). All metal storage environments should be dry.

Conservation of metal objects is difficult at best, and should be referred to or performed under the supervision of metal conservators. Before any treatment can be undertaken, the composition and stability of the metal or its alloys must be identified and assessed. The condition of the artifact and the type of metal will determine the process to be used to clean and stabilize the object. Corrosion products are extremely difficult to remove without causing damage to the object; in some instances the corrosion products are actually harder and stronger than the metal itself. Scraping dirt off with a metal tool or brush may scratch the object's surface. If little or no metal remains, cleaning by an inexperienced person may cause disintegration or irreparable damage to the object. One method that is used by conservators to identify and determine conservation treatment is X-ray radiography.

Because metal conservation is expensive and time consuming, only a select group of artifacts may undergo treatment beyond the initial cleaning stage. These should be chosen for their suitability to treatment and for their potential research or exhibit value. Wilson (1983) uses a tripartite classification of the stages of deterioration to evaluate potential specimens for their suitability for further treatment.

Metal objects with substantial metal cores and consolidated surfaces that are capable of withstanding any of the various conservation

treatments. Metal artifacts that are badly corroded but retain their shape. Little core metal remains and it is so weak that most treatments would damage the object; and artifacts that are so badly corroded the only treatment is consolidation, or in the case of encrusted objects, casting is the only means of preservation or recovery of the object.

Many metal objects are better left untreated, providing they can be placed in a stable storage environment. Preventive conservation may be the best option for the bulk of archaeological metal objects.

Because lead is toxic, a handling and storage caution is warranted for all lead artifacts. Handling should be kept to a minimum. The use of gloves is recommended to protect the artifact and the handler. Avoid breathing particles from the corrosion products. Prolonged exposure requires the use of a respirator or mask when handling lead objects. Lead artifacts should also be stored separately so that the acids and vapors from organic materials (e.g., paper, cardboard, wood, cotton) that can cause lead to corrode are not placed in or near the lead object's storage container (Sease 1987:83).

Plaster

Plaster is a combination of earth and other constituents applied in a wet state to structures; upon drying, it acts as a protective sealing coat or a smooth final surface that can be decorated. Plaster or "mud" as it is still referred to today, consists of a mixture of clay or earth, to which sand, animal blood, hair, grass, etc. are added to improve the workability and strength of the material, and to prevent shrinkage and cracking upon drying. Mud-lime, an even stronger combination, contains lime produced by burning shell or limestone.

In various regions of the United States, Native American structures were plastered to protect the construction and, in the case of ceremonial structures, to provide a smooth surface on interior walls to which ceremonial paintings could be applied. Walls constructed with techniques such as wattle and daub, rammed earth, and adobe brick all require the application of a protective plaster top coat to seal out moisture that would otherwise compromise the strength of the walls and hasten the deterioration of the construction materials.

Plaster was also used to provide a smooth coat on interior walls that could then be decorated with paint, paper, or cloth, as seen in Native American kiva paintings; colonial silk wall coverings; or the many layers of painted plaster found in historic American structures. Plaster can be used with any type of construction (e.g., wood, stone, or brick) by applying the mud to a wood lath, metal screen, or other roughened surface that facilitates the adherence of the mud and application of several layers to produce a final smooth surface. This technique has evolved into today's prefabricated plaster wallboard that receives a final coating of mud to fill in any seams or fissures to produce the desired smooth surface.

Up until the close of the nineteenth century, plaster was made primarily of calcined lime (calcium carbonate); this was gradually replaced by calcined gypsum (calcium sulfate) plaster (MacDonald 1989:3). "Historically, gypsum made a more rigid plaster and did not require a fibrous binder. However, it is difficult to tell the difference between lime and gypsum plaster once the plaster has cured" (MacDonald 1989:4).

Plaster was also used extensively to create decorative architectural elements that were appended to ceilings and walls. This technique fell out of favor during much of the twentieth century, although the preservation and rehabilitation movements of the 1970s have created a new interest in the use of plaster as a decorative technique.

Plaster will be retained in archaeological collections for a variety of reasons (e.g., as documentation of construction techniques, to record original paint colors used in historic structures, to preserve decorative architectural elements, or to preserve decorated wall panels that may have religious significance or potential for interpretive uses).

Because plaster is dried earth mixed with aggregates and other materials, moisture presents the greatest hazard to its preservation. Absorption of moisture in any form will weaken the original bond and cause swelling, distortion, decomposition, cracking upon redrying, and eventual loss. Depending upon the constituent materials and how well they were proportioned and mixed, whether multiple layers had similar shrinkage rates, or whether the plaster cured under optimum conditions (55–70° F), some

plaster may have inherent structural problems that lead to cracking or crumbling (MacDonald 1989:7).

Plaster reaches equilibrium with the water content in the environment; samples removed for study or storage should not be subjected to rapid desiccation, nor should they be enclosed in airtight containers that might promote mold growth. If polyethylene bags are used to transport the sample, they should be punctured to permit air exchanges.

Plaster is also very brittle and requires external support to maintain its original structure. Place samples in rigid walled containers, adding support with custom-fitted Ethafoam® if needed. Extremely brittle or crumbling plaster may require consolidation by a professional conservator. Plasters containing botanical or proteinaceous materials may attract infestation and should be monitored routinely.

Plastics

Plastic materials are manufactured from "complex organic compounds produced by polymerization, capable of being molded, extruded, cast into various shapes and films, or drawn into filaments used as textile fibers" (Riverside Publishing Company 1994:900). Natural plastic materials such as amber, horn, bone, tortoiseshell, shellac, lacquer, and latex have been used for many centuries to manufacture items by heat treating and shaping the original material into the desired shape.

In the early nineteenth century, the search for materials that were both flexible and moldable resulted in "semi synthetic" plastics manufactured from natural materials in combination with various chemicals. These included materials such as vulcanized rubber (vulcanite) and cellulose nitrate (known by various names such as Parkesine (1860s), celluloid (1870s onward), and cellophane) (Katz 1984:9). Nitrocellulose was widely used between 1870s–1920s to make common household items such as dresser sets (mirrors, combs, brushes), cutlery handles, toys, eyeglass frames, buttons, and other "plastic" items. Objects manufactured prior to 1920 that have the appearance of clear "plastic" are likely to be cellulose nitrate. The first true synthetic plastic, Bakelite®, was manufactured from phenol formaldehyde in the 1900s. The combinations since then have been limitless.

All plastics pose preservation problems because they are susceptible to rapid deterioration through oxidation. Depending upon their formulation, the gaseous byproducts of deterioration can be hazardous to other materials, especially metals, and to humans. The semi synthetics such as cellulose nitrate and cellulose acetate are inherently unstable and cellulose nitrate in particular is flammable, particularly if stored in conditions with poor air circulation (see Table 10). In general, the semi synthetics are more susceptible to deterioration, while many recent plastic materials include antioxidants as part of their formulation. Nevertheless, all plastics remain susceptible to rapid degradation and deterioration under adverse conditions. Deterioration can cause loss of flexibility and strength, shrinkage, cracking, color change, or changes to the surface composition.

The rate of deterioration by oxidation can be further affected by temperature and light levels. Another cause of deterioration is exposure to caustic chemicals such as sulfur dioxide and nitrogen dioxide, especially when coupled with high humidity. High humidity will also promote fungal growth on cellulose nitrate materials. Physical stress can also cause breakage that leads to additional deterioration.

Morgan (1991) identifies light, relative humidity, temperature, and ventilation as the prime factors to be considered in preserving plastics. He cautions, however, that ideal conditions are material specific (e.g., cellulose materials require low humidity (about 40%) whereas cellulose nitrate and nylon become brittle at low RH and require an optimum of 60%) (Morgan 1991:10). If humidity cannot be controlled, serious damage can be avoided if plastics are placed in minimal light, cool stable temperatures, and good ventilation. The latter is particularly important, as plastics tend to offgas as they undergo chemical reactions. Cellulose nitrate objects should be segregated from other materials and never enclosed or touching one another. These objects should be routinely monitored for any sign of active deterioration that would indicate unstable, dangerous conditions.

Other plastics or synthetic rubbers should also be kept in an environment that is dry and has low temperature and light levels. Do not place these materials in sealed polyethylene bags, as the offgassing vapors can accumulate and accelerate

the deterioration (see Dubois 1943; Roff et al. 1971; Johnson 1976; Katz 1984; CCI ICC Notes 1986; Selwitz 1988; Williams 1994).

Shell

Shell is composed of layers of calcium carbonate. Exposure to acids in surface and subsurface environments weakens and softens these layers causing exfoliation and crumbling. Worked shell (e.g., beads, buttons, gorgets), regardless of its appearance of stability, should be treated by a conservator. Many of these artifacts may require some form of consolidation before they can be processed further.

Examine all shell carefully before cleaning. Unmodified shell can be cleaned gently with a soft brush to remove surface dirt. Although dry brushing is the preferred method of cleaning, if shell is washed, it must be done so very gently as it is highly susceptible to damage from abrasion as well as exfoliation due to absorption of water. Some unmodified shells may have been used as containers for food or pigments and should not be cleaned. Shell should be thoroughly air dried before packaging and thus should never be stored in "air tight" containers.

Shell is susceptible to degradation by Byne's disease, an efflorescence that is triggered by storage environments with high levels of carbonyl pollutants (Grzywacz 1995:197). Large collections of shell will require well-ventilated storage areas and pollutant monitoring and filtration. Prevent rapid or frequent fluctuations in temperature and humidity.

Soil Samples

Soil samples from archaeological sites are collected so that one or more tests can be performed on the soil, each of which can reveal different things about the site or geographical location. Soil analysis of hearths, the contents of a vessel, or the remains on a floor of a structure can reveal what types of organic matter were utilized during the occupational period of the site. Soil analysis can also answer questions about the climate and environment during a particular period of time.

Various types of materials can be extracted from soil, such as pollen and phytoliths. Analyses that can be performed from materials in soil include radiocarbon (^{14}C) and thermoluminesence (TL) dating, particle size analysis (PSA), archeomagnetometic measurements, phosphate and acidity levels, and faunal and botanical contents (National Park Service 1995:9–10; Smith 1983:5–7). Each soil sample is treated differently in terms of the collection techniques and analysis, yet outside contamination can ruin any sample. It is recommended that the individual doing the analysis instruct the field archaeologist on how and from where to remove the soil samples. Ideally, if possible, the expert should personally remove the samples to ensure proper removal techniques and to minimize the possibility of contamination.

Given the cost of storing archaeological materials, there is a temptation to discard bulk soil samples that may not have been processed during the original investigation's analysis of the collection. Like all archaeological remains, once soils have been excavated they cannot be replaced in their original contexts or duplicated by samples from other locales within a given archaeological site. A representative minimum (1000 cm^3) should be retained of each soil sample collected in the field.

Soil samples should be stored in a dry environment (<65% RH) to prevent the growth of microorganisms that would cause deterioration of any organic content and contamination of the sample. They should be thoroughly air dried before being placed into a storage container. The storage container, be it polyethylene bagging or a rigid container, should contain a label on the inside as well as on the exterior. Tyvek® can be used to make interior labels that are moisture and grime resistant.

Stone

By definition, stone is concreted earthy or mineral matter. The formulation of the mineral content, the types of inclusions, the hardness, the porosity and consequent permeability, and the environmental conditions in which the stone is deposited all affect the durability of each specimen (National Park Service 1990:P:11; Shapiro 1983).

Moisture and temperature are the primary agents of stone deterioration. Atmospheric water and the chemicals it transports, combined with the permeability of stone (the ease with which fluids pass through) affect the rate of deterioration. The more

caustic the solution and the more permeable the rock, the greater the deterioration. Airborne pollutants such as carbon monoxide, nitrogen oxides, hydrogen oxides and sulfur oxides, as well as particulates of dust, coal, and soot are deposited directly or as part of atmospheric water. Temperature comes into play when fluid saturated stone is frozen or dried. Water increases approximately 9% in volume upon freezing, thus causing expansion pressure upon the stone material (National Park Service 1990:P:16). The greater the number of freeze/thaw cycles, the more likely the stone will undergo fissuring from this expansion, and ultimately segments of rock will spall from the parent rock. If the liquid contains soluble salts, the salts will crystallize upon drying and will appear as an efflorescence layer on the surface of the stone, or if they crystallize beneath the surface they will exert pressure that may cause delamination of the surface or fissures in the body of the stone. The hardness (resistance to scratches as measured with a Mohs scale) of the stone will also determine how susceptible it will be to abrasion from bioturbation or from windborne particles prior to its collection.

Stone that has been fragmented by any of these processes will be more susceptible to increased rates of deterioration as well as attack by algae, fungi, or botanical growth in the fissures. Although these forces should no longer be in effect in a controlled environment in a storage area, all archaeological specimens will have undergone weathering in situ prior to their excavation and collection. This will determine the amount of care or treatment required to stabilize them for long-term curation. Curated stone specimens remain susceptible to abrasion from poor storage conditions or mishandling, particularly when specimens are very large or heavy. Stone can also absorb oils from hands or stains from other materials used in storage, research, or exhibition.

Within the last ten years, cleaning stone artifacts has become the exception rather than the rule. This is due, in large part, to the increase in techniques to analyze microwear patterns and residues via techniques such as electron microscopy, pollen analysis, serum analysis, and gas chromatography. Unless the specimen must be cleaned for exhibit purposes or to enable special analyses, only the small area needed to label the specimen should be spot cleaned using a cotton-tipped swab and water. Distilled or deionized water is preferred, although tap water is acceptable. If stone is to be cleaned completely, the cleaning methods should be suited to the hardness and durability of the stone material. For example, soapstone, sandstone, and limestone are relatively soft and can be damaged if cleaned with a hard bristled brush. Polished alabaster should not be washed.

Mica tends to delaminate and may require consolidation by a professional conservator before attempting any further processing.

Porous granitics, fire affected rock, or vesicular basalt should be examined first for stability, before any cleaning is attempted.

Specimens with powdery white deposits on the surface probably contain salts. These should be referred to a conservator for consolidation (if necessary) and removal of the salts.

Native American ground stone objects requiring repair should be referred to a conservator who can determine the best adhesive or consolidant for the particular type and weight of stone prior to further processing.

Never use acidic cleaning solutions (found in most commercial stone cleaners).

Any stone that is cleaned with water should be permitted to air dry thoroughly before it is processed further. Artifact bags should be ventilated unless the specimen has been protectively wrapped to preserve its depositional matrix for special analyses. Large stone items such as metates should not be stored directly on the floor and should be protected from dust by using closed containers or sheets of polyethylene as covers over open storage.

Stable stone objects should be stored in environments having a temperature range of 55–75° F and RH of 40–60%. (National Park Service 1990:P16:21). Stone suspected to contain soluble salts should be stored in dry conditions (e.g., <35% RH).

All stone specimens should be protected from abrasion due to movement within the storage container. Each formed tool or artifact should be stored in an individual artifact container, padded as necessary. Debitage or rock samples may be stored in bulk lots.

Textiles

Textiles are made from animal and vegetable fibers, and in the twentieth century, from natural and synthetic polymers (National Park Service 1995:25; Keck 1974). The primary causes of the deterioration of textiles are the natural instability of the fibers, mechanical damage, detrimental environmental conditions, and attack by insects or microorganisms. Mechanical damage may result from internal stress, exposure to the elements, or handling and use. Damage that resulted from original use may be preserved as a record of the artifact's function and use. Damage from improper curation should be documented and stabilized until a professional textile conservator can evaluate the specimen and make any requisite repairs. Minor treatments should be restricted to providing support for weak or damaged areas until they can be professionally treated.

Environmental conditions such as light, heat, and pollution can damage textiles, particularly those made from organic materials that are more susceptible to aging. Insects and microorganisms may utilize textiles as habitation sites and/or as a food source. Organic textiles are also subject to attack by molds and bacteria, and if in subsurface contexts, they are also susceptible to deterioration by the chemical and physical conditions of the soil. Moisture can destroy vegetable fibers and excessive heat will cause desiccation and embrittlement of the fibers. Exposure to light will cause dyes to fade and the textile fibers to deteriorate.

Recommendations for optimum environmental conditions for textiles vary slightly; suggested relative humidity is 60–70°F, 35–50% RH according to Commoner (1992:88) and 55–68° F, 40–50% RH per Orlofsky (1992:80), but the important factor is to choose levels within these ranges and maintain them. Textiles should be stored in the dark when not in use. Light levels for examination or display should be 50 lux (5 footcandles), and for limited duration only (Orlofsky 1992:80).

When handling textiles, always wear gloves to protect the artifact from transfer of oils and acids from human skin. Cloth gloves are recommended unless the textile has frayed surfaces that might snag more easily on cotton gloves; in those instances, use polyethylene gloves.

A professional conservator should be consulted regarding any attempt to humidify, soften, unfold, or stabilize textiles, or to repair or strengthen weak or torn areas. If the textile is folded or crumpled, no attempt should be made by anyone other than a textile conservator to unfold or flatten the textile. Four contributing factors cause the deterioration of textile objects (National Park Service 1990:K:12; Florian et al. 1990).

1. The natural deterioration of fibers comprising the textile object. This includes chemical and physical instability of the material, interaction with other incompatible materials, and the degradation of by-products used in the manufacturing of the textile object.
2. Damage resulting from excessive handling, inadequate storage and display environments, natural disaster, and vandalism.
3. In-house environmental effects (e.g., pesticides, light, smoke, carbon dioxide).
4. Damage resulting from insects and microbiological infestation.

If cleaning of textiles is necessary, a gentle vacuuming with a low suction vacuum equipped with a rheostat to control the speed is the most effective and least harmful method of removing most dirt and microorganisms. Vacuum through a nylon screen or with a nozzle covered with cheesecloth, and use an up and down motion rather than back and forth. Avoid direct contact between the vacuum nozzle and the textile. Additional cleaning treatments should be undertaken only if absolutely necessary and only when under the supervision of a professional textile conservator. These include wet or dry cleaning methods that employ solvents, including water.

Any treatment used to clean and/or stabilize a textile artifact should be thoroughly documented on a treatment record that notes the materials and procedures used, the date of the treatment, and the name of the person performing the treatment. If the appearance of the artifact will be significantly altered by the treatment, before and after photographs should be taken to document the appearance and condition of the artifact.

Textiles should be placed in an acid-free environment as soon as possible. Textiles can be padded with unbuffered acid-free tissue to avoid any

undue stress on vulnerable areas and to prevent creasing or folds. Unbuffered acid-free tissue is best for protein-based textiles such as silk, wool, fur, or leather. Textiles should be stored in the dark when not in use. If exhibited or under study, light levels should be maintained at 50 lux or less, with the maximum acceptable UV level of 75 mW/lumen (a proportion of the visible light level).

Basketry and Cordage

Basketry and cordage are considered to be textile materials because they are manufactured from botanical materials. Both may be recovered from Native American as well as historic sites. They are usually very fragile, require special handling, and are extremely perishable. Basketry and cordage that survive in the archaeological record are generally found under very dry or very wet conditions. These factors will temporarily act as stabilizers for the materials while they are in situ. Materials removed from these environments must be packaged and stabilized according to their condition. In general, after treatment, optimal environmental conditions are the same as those for textiles and for botanicals, that is, RH of 50–55% and a temperature range between 55–70° F.

Dry basketry or cordage tends to be brittle and highly prone to breakage. Extra care must be taken when handling these materials. These materials benefit from custom designed supports or packing (Clark 1988). Supports provide both structural reinforcement and the means to handle the specimen container without coming into direct contact with the specimen. When handling specimens directly, whole baskets should never be lifted by the rim or any handles because of the risk of breaking them. They should be lifted by placing both hands beneath the basket if feasible, or one hand against the side of the basket for support.

Large fragments may be placed on a nest of acid-free tissue paper in an acid-free cardboard box deep enough to allow closure of the box without applying pressure to its contents. Do not place this box inside a bag. Tie the lid of the box with a piece of cotton twill tape, being careful not to tip or turn the box over. Label the exterior of the box with handling information such as “Fragile,” “Do Not Tip,” or a directional arrow indicating the top of the box. Small fragments of basketry or cordage may be placed in boxes with shape-specific padding or immobilized by encapsulation in two polyester sheets (e.g., Mylar®) closed with double-sided tape.

Wood

Relative humidity levels for wood and textile storage are dependent on the area of the country in which the repository is located. The National Park Service’s Museum Handbook (1990:N:31) states that the relative humidity level should be 50% ±5%. However, in a drier climate such as that of the desert Southwest, recommended relative humidity levels should be between 35–40%; along moist coastal zones, 55–60% is acceptable (1990:N:31). The most important thing to remember is to maintain a constant level of humidity and prevent excessive fluctuations.

Wood preservation at most archaeological sites is generally very poor. An exception is wood that has is preserved in arid caves, tombs, or in anaerobic conditions such as underwater or submerged in silt. Wood is vulnerable to damage from a host of agents, particularly moisture, light, fire, acids, alkalines, salts, infestation, and human reuse (Merrill 1974; National Park Service 1995:25–26).

Wood is hygroscopic, shrinking and swelling with variations in relative humidity. It is also anisotropic which means that the shrinkage and swelling are not dimensionally uniform. The combination of these two traits leads to cracking and distortion of the original shape of the wood (National Park Service 1990:N:9).

Wood that is dry should never be exposed to water. Cleaning should be limited to dry brushing, vacuuming, or careful cleaning with wooden tools (metal tools may damage wood artifacts). Moist wood should be kept moist immediately upon excavation until it can be treated by various methods for removing the water without causing the cells to collapse due to the lack of support. Wood and other organic material that is found in wet environments can be irreversibly damaged if allowed to dry out for even a short period of time. A conservator should be consulted for assistance with these methods. Large wooden artifacts can be packed in wet polyethylene sheeting until they can be treated. Small artifacts may be triple bagged in Ziploc® bags and then refrigerated. Objects that are discovered in fully wet environments should be moved directly to wet storage so that they never are allowed to dry.

Fungal activity is the single greatest cause of biodeterioration of wood. Fungi are found nearly everywhere, and various species are capable of staining or consuming wood. Fungal activity may be reduced or eliminated by controlling humidity and avoiding direct exposure to water.

Temperature is critical insofar as it affects relative humidity and should be maintained at the lowest comfort level to reduce agents of deterioration, such as mold and fungus (National Park Service 1990:N:31–32).

Light levels should not exceed 200 lux for exposed wooden objects that are finished and 300 lux for unfinished wooden objects National Park Service 1990:N:32). Hunt (1992:133) recommends an optimum of no more than 5 footcandles and 65° F or 18° C. Light can damage dyes, finishes, the natural color of heartwood (the center portion of a tree from which many wooden items are constructed), and any upholstery on the wooden item.

Handling and exposure to airborne contaminants should be kept to a minimum. Dust accumulations can be abrasive and cause scratching of the surface. Oils from hands can also be damaging.

Conservation Criteria for Associated Documentation

Audiovisual Materials

The most important thing to remember about audiovisual materials is that they must be kept free of dust. Dust and other particulates can abrade and scratch tapes. These scratches may distort sound or picture, or may result in blank areas on the tape. Disc recordings should be stored in a vertical position at all times; do not allow them to lean because of the possibility of warping. Inner sleeves should be replaced with archival-quality sleeves. Disk recordings should be handled on the edges and only when wearing cotton gloves. Reel-to-reel and cassette tapes should be stored away from stray magnetic fields, which can erase all or part of the recording. Vertical orientation on shelves is recommended. Cassette tapes are not considered a good medium for long-term storage and should be transferred to reel-to-reel tapes, if possible. Video tapes should be kept in an environment similar to reel-to-reel tapes. They should be stored in the played position and rewound only at the time of the next use.

Tapes, both audio and video, should always be rewound slowly. The use of “fast reverse” or “fast forward” speeds will create fluctuating tension in the tape and can be damaging. Tapes should be handled only by their housing, and bare hands should never touch the tape surfaces. Also remember that each time these materials are played, the playback heads, even if well maintained, will cause degradation to the tape (Ritzenthaler 1993:74).

Historic movie films may be 8 mm, 16 mm, 35 mm, or 72 mm. Films made prior to 1950 should not be excessively handled. Earlier films were made with nitrate negatives (see Table 10) and are extremely dangerous. These films deteriorate and form a highly combustible chemical coating. In extreme cases the spark from opening a film canister or friction from unrolling the film just to see what it depicts is enough to cause these materials to burst into flames. These materials should be opened only by trained individuals and in fire retardant areas. Do not discard these materials in a dumpster or with household trash. Nitrate film and negatives must be transferred to fire protection officials for proper disposal.

Because of the more stringent storage requirements for audiovisual materials, they should be removed from the collection and stored elsewhere (e.g., locking cabinets) in the repository. When these materials are removed from collections, indexing and cross-references must be provided for research use. This practice ensures that the materials are not permanently separated from the rest of the document collection and intellectual control is maintained.

Technical obsolescence (e.g., phonographs) or damage can render audio and visual recordings unusable. Transcripts ensure that the informational content is preserved. Thus, transcripts should be made of all audiovisual materials as soon as possible. The content is then preserved, even if a picture or voice inflection is lost.

Dust and particulate risk may be lessened by proper packaging and by installing filtering systems on environmental controls (i.e., HVAC systems). As with other archival materials, lower temperature and relative humidity (<68° F and <35% RH) will prolong the lifespan of these materials. Fluctuations in

temperature and relative humidity (greater than a rate of ± 3° and ± 5% RH per month) will hasten the deterioration of these materials (Ritzenthaler 1993:74).

Cartographic Materials/Oversized Drawings

Due to their size and the damage inherent to larger formats, these materials frequently require the most conservation. These items often are dirty, torn, and generally mishandled.

Dry cleaning can be performed with a soft bristled brush and a vinyl eraser used for gentle cleaning. These activities must ensure that no damage or residue is left on the document. Vigorous cleaning often does more damage than leaving the document soiled. Some documents can be safely washed in water or solution, but care should be taken that the inks on the document are not washed away. In cases of extreme acidity, the archivist may wish to deacidify the document. Wei T'o® deacidification solution comes as a liquid or as a spray. Again, as in wet washing, the inks on the document must be tested first to ensure that they will survive the deacidification process. Never fully submerge documents in liquid solution of any type unless you are positive that it will not result in permanent damage. Documents can be treated with Japanese tissue and wheat starch to mend rips and tears. Adhesives such as tape or glue can be removed through careful physical removal or the use of solvents.

Folded or rolled materials may be humidified and flattened prior to storage in order to lessen the damage made along creases. Humidification introduces small amounts of moisture into paper fibers through the use of an enclosed humidification chamber. The process relaxes the paper fibers and allows the gentle unrolling or unfolding of the document. The flattened document is then placed between two clean, dry sheets of alkaline-buffered blotter paper. This "sandwich" is then weighted down by evenly distributing weights on top of the "sandwich." The document is allowed to air dry slowly. Once dry, the flattened document can then be properly stored (Ritzenthaler 1993:184–185).

Fragile or frequently handled documents, regardless of their size, may be encapsulated in sheets of Mylar® film. The rigid Mylarâ provides extra support for these documents, prevents further transfer of acids from the user's hands, and provides a translucent surface through which both sides of the document can be viewed. Encapsulated documents should be handled very carefully. Encapsulation consists of cutting two sheets of Mylar®, 1.0 in larger than the dimensions of the document. Archival double-sided polyethylene tape is affixed to all four edges of one sheet, save for a small vent in one corner. The document is then placed atop the taped sheet and carefully centered so that 0.5 in of space is left between all edges of the document and the tape. The second sheet of Mylar® is placed on top of the document and gently pressed to adhere the two sheets of Mylar® and remove trapped air through the corner vent. Paperweights can also be used to remove the air, seal the tape, and prevent slippage of the document. Encapsulated materials should be periodically checked to make sure that the document has not slipped and is not in direct contact with the tape.

For further reading on the above techniques, see Appendix D in Ritzenthaler (1993). None of these treatments should be performed without consulting a qualified document conservator. Any and all treatments performed must be recorded in the curation history or documented in the accession file.

Even if no treatments are necessary, cartographic or oversized materials are usually separated from the rest of the collection so that they may be stored appropriately in large sized containers. Cross-indexed notes should be left in the original file and with the oversized material. This cross-index and separation must also be reflected in the finding aid.

Procedures for proper packaging and labeling of these materials were discussed earlier. Environmental storage issues and requirements are dependent upon the medium of the oversized material (e.g., paper, photographic). See the appropriate section in this chapter for specifics.

Electronic Media

Electronic records present unique problems for long-term storage. Electronic media may be classified into two general types—magnetic and optical. Magnetic media include materials such as diskettes or floppy disks, hard drives, DAT tapes, and conventional tape backups. Magnetic media can be partially or totally

erased by electromagnetic fields. This damage can be caused by something as simple as placing a disk too close to a telephone or stray static electricity from the user's clothes. Dust and humid conditions can corrupt the disk, causing lost sectors of information on the disk or tape much the same way as with audiovisual material.

Optical media are physically more stable than magnetic media and include CD ROM, WORM (Write Once, Read Many), magneto-optical disks, and phase change disks. These materials are not susceptible to destruction through dust, light, heat, or humidity (Balough 1993:36). While more stable than magnetic media, optical media are not considered archival or permanent.

Technical obsolescence, however, creates the primary problem with curation of electronic media. Computer technology changes so quickly there is no guarantee that information recorded in electronic form this year will be retrievable on the next generation of computers. Software poses an additional layer of difficulty; changes in software virtually guarantee information stored in electronic form will not be readable unless that software (in that particular version) is still operable. Even in the case of optical media, ten years is approximately the life span one can expect and there is no guarantee the new equipment can read older disks (Balough 1993). It is important to remember: "even if the media lasts, if the machine and all the software necessary to interpret it are not usable, the information may as well not exist because it will not be accessable [sic]" (Balough 1993:28).

Long-term storage of electronic formats is not viable. If electronic media are submitted, the following provisions must be made: (1) routine inspection of software to ensure readability, (2) duplication of all files in hard copy format and on disk, and (3) routine transfer of files into formats compatible with new software and hardware. Store magnetic tape in cool, dry environments of 40–70° F and 20–30% RH, with variations of no more than ± 3° F and ± 5% RH (Wheeler 1998).

Microform

"Microforms are photographic images that are 20 to 150 times smaller than the original" (Balough 1993:17). This reductive ratio enables a large number of images to be recorded onto a small space. Microform, like electronic media, is machine-readable but it is not machine-dependent; therefore, issues of technological obsolescence are not as critical. Archival microfilm has proven stability and too much has been invested in it to "switch over" to another medium easily. Finally, microfilm may be read with a microscope or strong magnifying glass, if all else fails.

Generally, microform is produced on film with a life expectancy (LE) of 500 years (Fox 1996:30–31). The procedures for microfilming and the materials used are standardized and accepted throughout the archival and library communities. When preservation microfilm is produced, three copies are made—a master negative, a printing master, and a service copy (Fox 1996:32). As long as the printing master and/or master copy are available, service copies may be made at a relatively low cost.

Microform is available in a variety of formats and sizes—35 mm, 16 mm, 105 mm, and microfiche—but 35 mm is the standard for preservation purposes (Fox 1996:31). Long-term storage areas should be kept dark, dust-free, protected from natural disasters, and temperature and relative humidity should not exceed

Table 16.
Temperature and Relative Humidity Requirements for the Storage of Microforms (Fox 1996:217)

Sensitive Layer	Medium Term Storage		Extended Term Storage	
	Maximum Temperature (°F)	Relative Humidity Range*	Maximum Temperature (°F)	Relative Humidity Range*
Silver gelatin, Vesicular, and Diazo	77°	20–50%	70°	20–30%
			59°	20–40%
			50°	20–50%
Color	77°	20–50%	70°	20–30%
			59°	20–40%
			50°	20–50%

*The moisture content of the film to be stored shall not be greater than film in moisture equilibrium with these relative humidities.

Table 17.
Classes of Paper Based on Acid Content
(Balough 1993:14)

Type	Acidity	Life Expectancy (LE)
One	pH 7.5–9.5	Several hundred years
Two	pH 6.5–7.5	50–100 years
Three	pH 5.5–6.5	About 50 years
Four	pH under 5.5	Under 50 years

accepted standards. Medium-term storage should have the same basic conditions, but the temperature and relative humidity standards are slightly less stringent (Table 16). For a full discussion on all stages of microfilming, see Fox (1996).

Paper

Paper, due to its organic nature and the manufacturing process used to produce it, is usually extremely acidic. Today's paper has a life expectancy of less than 50 years. Acidic paper turns yellow and brittle with age and eventually disintegrates. This natural degradation can never be completely halted, but it can be slowed to a much lower rate. This deterioration may be partially combated by photocopying the information onto acid-free paper or by applying a buffering agent to acidic paper. Acid-free paper has a pH close to neutral or may be slightly alkaline. It is more stable and lasts longer than acidic paper. Acid-free papers may be ordered with varying pH values (see Table 17, Balough 1993:14). Other paper types commonly encountered in archival collections include onionskin paper and newsprint. Of these two types, newsprint is the most unstable and acidic. It should be replaced immediately if found in the collection. Not only will newsprint deteriorate rapidly, but it will transfer its acidity to any other paper it touches. Onionskin paper should also be copied onto acid-free paper if at all possible.

Obviously the paper itself is of secondary importance to the data recorded upon it. Carbon ink, chinese ink, india ink, carbon ribbon inks, and most printing inks are permanent and pose fewer problems for long-term storage and preservation than colored inks. Colored inks and many of the inks used in felt tip pens are water soluble and very unstable. Even ballpoint ink is relatively unstable; it sits on the surface of the paper and is soluble in many solvents. There is always the danger that the ink will run and become illegible if it is exposed to liquids or extreme moisture levels.

Adhesives are a concern in preservation of paper for several reasons. First, they are often misapplied and cause damage to a wide variety of materials. Adhesives may break down over time, losing their tackiness; they also may permanently stain documents and initiate harmful chemical reactions that hasten the deterioration of paper. Deteriorating adhesives can also attract insects and other pests. Some common adhesives are tape, glue, and rubber cement.

Metal fasteners such as staples and paper clips can rust, leaving permanent stains; they also can function as cutting edges against which paper will break as it is flexed over a period of time. Rubber bands deteriorate, dry out, and attach to paper fibers, making them virtually impossible to remove without damaging the document. Alternative methods of attaching paper include zip staplers and archival paper clips.

The rate of paper deterioration is dependent upon the inherent chemical stability of the material, in combination with external influences such as the environment, storage conditions, and handling procedures. It is susceptible to embrittlement and deterioration by high temperature, humidity, and light levels, as well as chemical and physical attack by airborne pollution and biological agents.

Paper is hygroscopic; it readily absorbs and releases water vapor, and these fluctuations strain the organic fibers. Most chemical reactions that cause paper objects to deteriorate occur twice as fast with each 10° F increase in temperature (National Park Service 1990:J:7). When relative humidity is low (<40%) yet temperature is high (>70° F), paper becomes embrittled. Any adhesives on the paper will dry out, book bindings will crack, and paint will begin to flake. However, if the relative humidity is high (>60%) and the temperature is high, then the excessive dampness will result in cockling, paint loss, hydrolysis of adhesives and parchment, mold growth, and staining on paper products (Shelley n.d.:29).

In general, dark, dry and cool are the operative factors in preserving paper. If humans are also using the area where paper collections are stored, a constant temperature between 60–72º F is optimum;

if the area is for storage of paper only, then temperatures can be maintained at less than 60ºF and between 30–35 % RH (Van der Reyden 1995:332).

The fading and drying effects of light on paper objects are cumulative. Paper that is on exhibit should have no more than a maximum of 50 lux or 5 footcandles for not longer than a total of six months (National Park Service 1990:J:37–38). Black ink on white rag paper is less apt to fade than colored inks or colored paper. Ultraviolet radiation should be screened from windows or from storage and collection use areas at all times. Archival materials must be protected against ultraviolet (UV) radiation and active visible light, both of which have a damaging effect on paper and speed up chemical reactions. Direct sunlight can be very damaging. The easiest way to combat this threat is through fluorescent, non-UV light systems, or better yet incandescent lights, set up where documents are exposed.

Airborne pollutants can also hasten the deterioration of archival materials. Gaseous pollutants such as sulfur dioxide and nitrogen dioxide combine with moisture in the air to form acids, which then attack the fibers in paper. Solid pollutants such as dirt and dust transported through the air can damage archival materials through abrasive action. In addition to abrading paper and thereby obscuring information, many of these pollutants also permanently stain paper. Air filtration systems control the pollution levels from both gaseous and solid pollutants, in addition to prohibiting mold growth.

As an organic product, paper is a natural food source for a variety of pests. Adhesives on the paper often provide additional incentive for infestation. Preventive integrated pest management measures are essential in ensuring that paper is protected from this source of deterioration.

Finally, paper is also very susceptible to damage incurred during handling. Paper should be supported when transported (e.g., placed in a folder before moving from one location to another). Paper should not be creased or folded so that the fibers remain intact rather than bent or broken. This will preserve the original strength of the paper fabric. Duplicate or microfilm copies may be made for day-to-day use or exhibit, thus lessening the damage incurred from frequent handling. Paper conservation techniques such as cleaning, mending, deacidification, encapsulation, humidification, and flattening are discussed under Cartographic Materials/Oversized Documents above.

Photographic Materials, General

Photographic materials pose a unique set of difficulties for long-term storage. Twentieth-century photographic images include prints, negatives, slides (or transparencies), and digital images. Earlier images include materials such as daguerreotypes, ambrotypes, ferrotypes, cabinet cards, carte-de-visites, tintypes, and albumen prints, just to name a few. The discussion below addresses prints, slides, and negatives which may be black and white, color, or sepia toned. Should other nineteenth-century images be noted, contact a trained document/photograph conservator immediately. It should be noted, however, that all types of photographic materials are unstable and require more stringent handling and storage requirements.

The first rule of handling photographic materials is to always wear cotton gloves. Although the acid from human skin is invisible, it transfers to the image and will chemically attack the emulsion. Ideally, a copy of the print, negative, or slide should be created, and the original used only to make additional copies.

Every image (print, negative, or slide) should be stored in its own envelope or sleeve. Envelopes and sleeves should be constructed of either acid-free paper or an inert plastic. Plastics that are considered archival-quality include polyester (Mylar®), polyethylene, and polypropylene. If photographic materials are improperly stored in a single envelope or sleeve, the emulsion can become scratched or dented, thus irreparably damaging the image.

Photographs and slides should be indirectly labeled. Never write directly on an image; write on the backs of prints, on slide or negative sleeves, and on the cardboard borders of slides. Do not use ballpoint pens or pencils—the pressure used to write the label will make an irreversible impression on the front of the photograph. These impressions crack the emulsion on the photograph, thus hastening deterioration. This danger, however, does not mean that photographs should not be labeled. If label information is not recorded, valuable information will be lost and value of the photograph limited.

The storage environment is the second significant factor in determining the longevity of photographic materials. Issues that must be addressed include light, airborne pollutants, humidity, and temperature.

As with paper documentation, ultraviolet radiation hastens the fading and embrittlement of photographic prints. This issue is of particular concern when dealing with sepia tone or color images. These materials have an extremely short life span, and exposure to light only hastens the loss of color and definition in these images.

Air pollution can also be a source of print degradation as airborne acids attack the emulsion and particulates abrade photographic surfaces. Other types of pollutants may permanently stain images. These pollutants can also induce mold and mildew growth, which in turn may attract insects and rodents. Many of these pollutants may be eliminated from storage areas by placing appropriate filters on the environmental systems (e.g., HVAC Systems).

High relative humidity levels (>60%) will promote the growth of microorganisms such as mold. Fluctuating humidity levels will "impose considerable strain on the adhesion of the gelatin to the support as it expands and contracts" (Hendriks n.d.:41). Ideally, the optimum relative humidity level for processed photographic material is between 30–35% (Hendriks n.d.:42).

Temperature levels also play an important role in determining the longevity of photographic materials. High temperature levels combined with high humidity levels will accelerate the decomposition of photographs, although high temperature alone will play a factor in photograph decomposition. For glass plates and paper prints, temperature levels should range between 59–77° F, though excessive fluctuations should be prevented. For film, a temperature below 68° F is recommended (Hendriks n.d.:42). It is recommended that photographic experts be consulted for optimum ranges in specific locales.

Color Images

Color images are particularly susceptible to deterioration, losing their color over a relatively short period of time (<10 years). Preservation requires not only optimal conditions, but routine replication of the original image. Guldbeck and MacLeish (1990:223) note that some color film is now being stored in temperatures below freezing. If color images are kept in a refrigeration chamber or freezer, it is absolutely essential that these materials be allowed to slowly adapt to the outside temperature when they are removed for any reason. If this equilibrium in temperature is not achieved slowly, condensation will form on the image surface and hasten the deterioration of color images even more rapidly.

Nitrate Negatives and Film

Cellulose nitrate and cellulose acetate films deteriorate relatively quickly, and in the case of cellulose nitrate, pose a potential fire hazard. Negatives created prior to 1947 have a high probability of being cellulose nitrate negatives. Often these negatives are larger sizes (4 x 5 inches, 5 x 7 inches, and 8 x 10 inches), and are clearly labeled "NITRATE" on the border of the negative. As the cellulose nitrate deteriorates, it becomes increasingly unstable. If these negatives are stored in high temperatures, there is the potential for spontaneous combustion. These materials should be copied immediately and then turned over to the local fire department for proper disposal. Movie film (of varying sizes) from this time period was also created on nitrate negative stock, and is extremely hazardous. Any spark may ignite the negatives if they have suffered severe degradation (see Audiovisual Materials above).

Compliance Checklist

The following checklist is offered as a quick guide to curation requirements for cultural resources management personnel. More details are provided elsewhere in this manual.

1. The Center's physical plant meets Department of the Interior and RIHPHC requirements for implementing standards outlined in 36 CFR § 79 and RIGL 42-45. The building conforms to public health and safety standards, has an operational fire detection and suppression system and is free of insects and vermin.

2. The Center is under the supervision and management of a Director (professional curator/ collections manager) meeting the Secretary of the Interior's Historic Preservation Professional Qualification Standards.

3. The Center has written collections management policies in place: (1) collections registration procedures (including accessioning, assessment, cataloging, labeling, packaging for use/storage, and deacessioning) that permit intellectual control of the contents and storage location of all objects and associated documentation; (2) a records management policy; (3) collections access and use policies (including loans, duplication or photography, and destructive testing); (4) routine monitoring of collections and storage areas; (5) a physical inventory policy; and (6) a disaster policy. Without these policies in place, collections cannot be managed efficiently and cost effectively.

4. Archaeological materials and associated documentation are segregated by material class within a collection, and stored in environments appropriate to each material class. There is a data logger in each Collections Storage Room for monitoring relative humidity and temperature. Data loggers are checked daily on a weekday basis and relative humidity and temperature are adjusted accordingly as required.

5. Artifacts are stored in archival-quality corrugated polyprolene containers. Associated documentation is stored in archival-quality folders and boxes.

6. All storage areas have an appropriate, limited-access system for controlled ingress and egress and a burglar alarm system.

7. An archival-quality security copy of all associated documentation is stored in a separate facility, i.e. at Capital Records Management, 431 Harris Avenue, Providence, RI.

8. Center staff will make no decisions affecting the condition of archaeological materials or associated documentation without first consulting the RIHPHC.

9. The RIHPHC and the Department of Defense/ Army Corps of Engineers will conduct an annual on-site inspection of the Center to insure that the repository continues to meet the standards of 36 CFR § 800 and RIGL 42-45.

3

Organization, Staff Responsibilities, and Collections Center Description

Organization

The primary purpose of the Center is to ensure the long-term care of archaeological collections derived from RIDOT projects. A secondary purpose is to assist researchers using the collections.

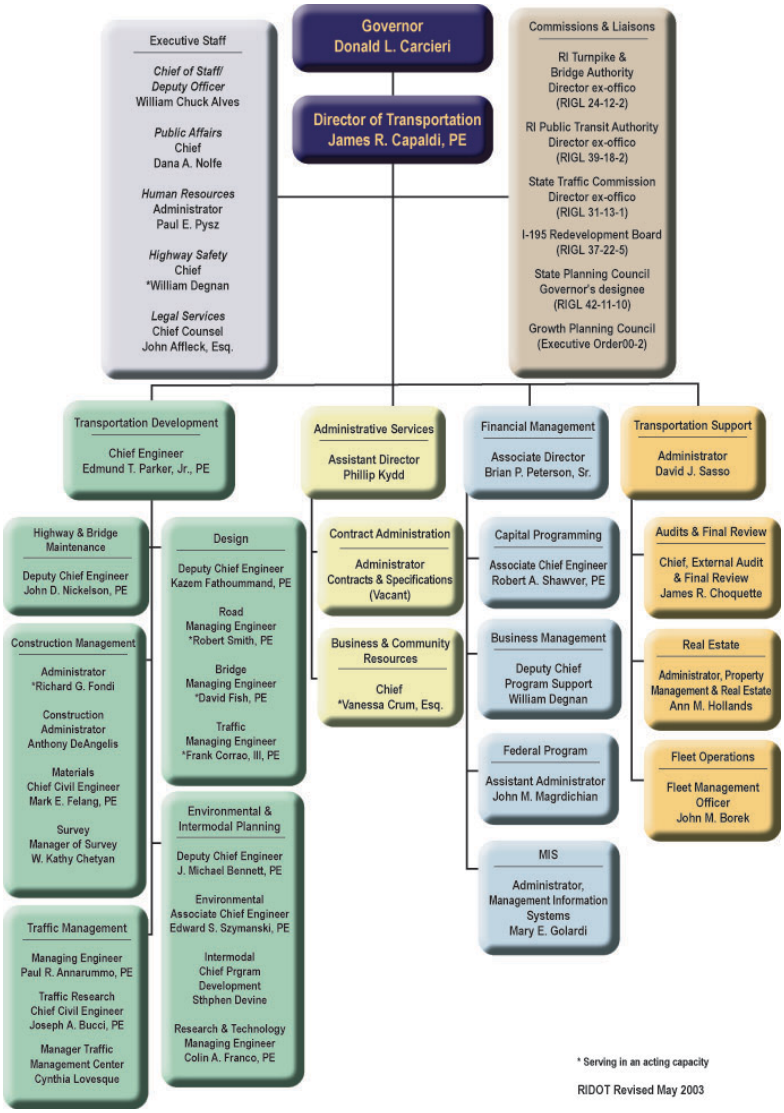

Figure 1. RIDOT Organizational Chart.

Staff Responsibilities

Director of the Center

The Director of the Center is an employee of the State of Rhode Island and is entirely responsible for the professional care and management of the Center's collections; the Director performs and/or directly supervises all curatorial activities occurring at the Center. In accordance with 36 CFR § 79, the Director is a professional meeting the Secretary of the Interior's Historic Preservation Professional Qualification Standards for curator by (1) possessing a graduate degree in museum studies, (2) having at least three years of experience in working with archaeological collections, and (3) having supervisory experience at the U.S. Office of Personnel Management's GS 11 level. The Director will also be CPR certified and participate in at least one NPS-sponsored or recommended collections care and management training session or workshop every two years in order to ensure that the Center meets current federal-level standards.

Note:
As additional staff members are identified a description for each position will be included here.

Collections Center - Floor Plan and Description

As with any building, certain activities are accommodated by different spaces (i.e., rooms or areas) within the repository. Below is the floor plan (Figure 2) for the Center; a brief description of the building, its site and each type of space in the Center is provided on the following page.

Woonsocket Depot

The Woonsocket Train Depot building was constructed in 1882 and is a contributing property of the Main Street Historic District, which is listed in the National and State Registers of Historic Places. The property was purchased by RIDOT in 1993 for intermodal use and renovated in 2003-2004. The building has load bearing interior and exterior brick walls and some exterior ornamental decoration. The structure is one-and-a-half stories tall and has a partial basement. The first and second levels are used as administrative offices by the John H. Chafee Blackstone River Valley National Heritage Corridor Commission, a division of the National Park Service. A majority of the basement is occupied by the RIDOT Archaeological Collections Center. A smaller portion of the basement level that is accessed from Main Street is leased to the Rhode Island Public Transit Authority (RIPTA) and serves as a passenger waiting station. The site is bordered on the south by High Street, on the east by Main Street, on the west by a parking area and on the north by the Providence and Worcester Railroad line. An accessible, brick lined tunnel extends from the Center and runs under the rail line to Railroad Avenue to the north. A second point of access to the Center at the basement level is via Main Street through the RIPTA office.

Corridor (Room 001)

The corridor is a non-public space that leads to two means of egress from the Collections Storage Rooms and the Office and Research Room. The walls are painted gypsum wall board, the ceiling is humidity-resistant acoustical ceiling tile, and the floor is sealed concrete. The main point of entry/egress for the Center is from the corridor's tunnel doorway entrance on Railroad Avenue. Both means of egress are secured by locked doors connected to a wireless electronic alarm system. The alarm system code is known only to the Center's Director and a staff person at RIDOT's Property Management Office; the Director and the staff person in the RIDOT Property Management Office are the only persons in possession of keys to the Center.

Mechanical Room (Room 002)

The Mechanical Room is approximately 90 SF and houses air conditioning units and a domestic hot water heater. The walls are painted gypsum wall board, the ceiling is exposed existing structure, and the floor is sealed concrete. Lighting is overhead fluorescent.

Office and Research Room (Room 004)

The Center's Office and Research Room is approximately 90 SF. The walls and ceiling are painted gypsum wall board with batt insulation and a polyethylene vapor retarder. The floor is sealed concrete. The room also contains one desk, two chairs, one table and one filing cabinet. Final Reports for archaeological investigations are also kept in this space. Associated office equipment includes a computer, scanner, printer, fax machine and an

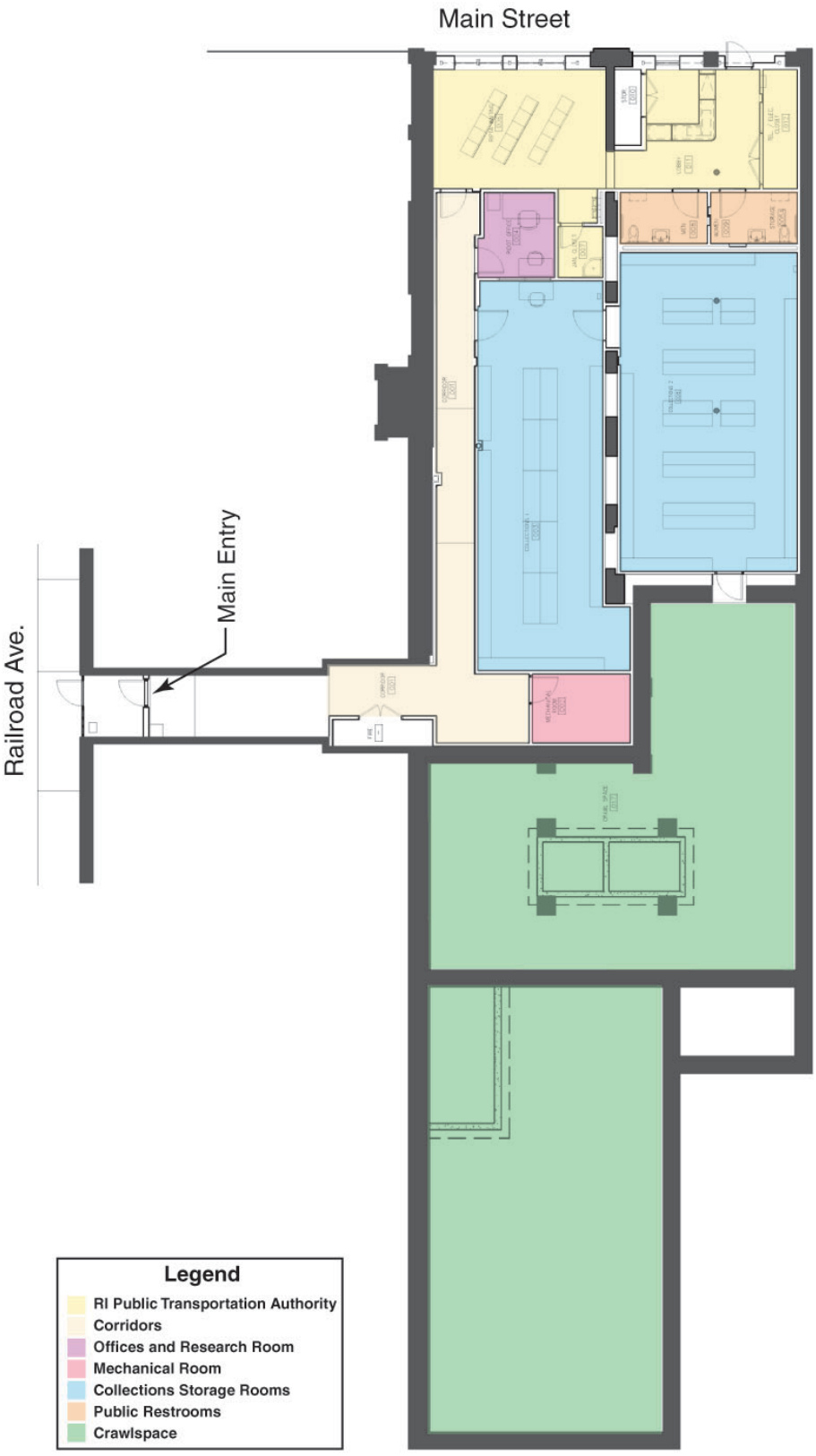

Figure 2. Collections CEnter floor plan.

illuminated optical magnifier for artifact examination. A six-foot long interior window allows views into Collections Storage Room 1 (Room 003). Lighting is overhead fluorescent. All collections are inventoried and made available for inspection or research in this room.

Collections Storage Room 1 (Room 003)

Collections Storage Room 1 is approximately 730 SF. The walls and ceiling are painted gypsum wall board with batt insulation and a polyethylene vapor retarder. The floor is sealed concrete. The room also contains one table and one chair and approximately 140 LF of open metal shelving. There is a fire extinguisher on the north wall and a data logger (measures temperature and humidity) on the south wall. A six-foot long interior window allows views into the RIDOT office and research room 004). Lighting is overhead fluorescent.

Collections Storage Room 2 (Room 005)

Collections Storage Room 2 is approximately 580 SF. The walls and ceiling are painted gypsum wall board with batt insulation and a polyethylene vapor retarder. The floor is sealed concrete. The room also contains approximately 170 LF of open metal shelving. There is a fire extinguisher on the north wall and a data logger on the south wall. Access to this room is through Collections Storage Room 1 (Room 003). Lighting is overhead fluorescent.

Men's and Women's Toilets (Rooms 008 and 009)

Each toilet room is approximately 60 SF and both are handicapped-accessible. The spaces are intended to serve as public toilet rooms for the RIPTA bus patrons; however, they are accessible to the RIDOT Center staff and visitors via a keypad-operated and alarmed private door from the Corridor (Room 001). A handicapped-accessible drinking fountain is also available in the public RIPTA area.

4

Collection Management Polices and Procedures

Minimum Standards for Acceptance

All archaeological collections recovered from state-owned lands are the property of the State of Rhode Island. Archaeological materials recovered from federal lands are the property of the federal government and will be maintained by the Center for public benefit on long-term loans from each federal and state agency (36 CFR § 79).

All collections/objects presented to the Center must adhere to certain standards, regardless of origin or ownership. The following pages outline the procedures and standards under which collections can be submitted to the Center. For additional discussion of this requirement, refer to 36 CFR § 79.

For archaeological consultants/CRM contractors who will deposit collections at the Center, prior to the start of fieldwork, a conservation plan that includes field procedures through final treatment shall be developed, reviewed, and approved by the Center, and then implemented.

Collections shall be properly conserved and curated using the guidelines contained in this manual (see Chapter 2, *Processing Archaeological Collections for Curation*). Improperly conserved and curated collections will not be accepted by the Center.

All collections (including associated paper records) will be non-chemically treated for insects and pests immediately prior to transfer to the Center. The treatment will consist of an infusion of carbon dioxide in a modified atmosphere. The SPNEA Conservation & Collections Center, 151 Essex St., Haverhill, MA will provide the treatment, which typically occurs within a six-week time frame. Advance reservation for treatment by SPNEA is required; the contact person is Ms. Julie Solz, Collections Manager & Associate Conservator at (978) 521-4788, ext. 736.

Objects are principally acquired from archaeological work associated with Rhode Island Department of Transportation projects. However, objects may also be acquired through gifts. Title to all acquired objects, except for federal collections, should be free and clear, without restrictions as to use or future disposition. No commitment will be made as to exhibition or placement of a gift. No guarantee shall be made that the gift or bequest shall be retained by the Center in perpetuity. If objects are accepted with restrictions or limitations, these conditions should be stated clearly in an instrument of conveyance, should be made a part of the accession records for the objects, and should be strictly observed by the Center. Prior to bringing collections to the Center for curation, collections shall follow the guidance provided in this manual.

Collection Registration

When the Center accepts a collection for curation a formal process, known as collection registration, must occur. Collection registration consists of accessioning a collection, transferring any title (i.e., ownership) to the collection to the Center, and entering pertinent collection data into an electronic collections-management software. The Center has adopted the software program Re: Discovery as its collections

management system. Basic data such as that concerning title, provenance, responsible parties for the investigation, collection content, and applicable restrictions (e.g., items available only to researchers after the appropriate Native American group has been consulted) is entered into *Re: Discovery* before the collection is integrated into the Center's holdings.

Loan Policy

The Center may lend or accept collections/individual objects to use in specific exhibitions, educational or research purposes, or for consideration of accession. A loan form (Appendix 4) must be signed by both the lender and receiver for all collections and objects on loan. The terms and length of the loan must be specifically indicated on the loan agreement. No loans for any indefinite periods shall be made or accepted.

Deaccessioning Policy

The Center is a state-owned, maintained and funded facility and holds archaeological collections in the public trust. Thus, any decision to deaccession (defined for the purposes of this manual as a removal from the Center for transfer to another facility or for disposal) a collection or individual objects must be in the public interest. Many reasons exist for why a collection or object should be deaccessioned. For example, a collection or object may become superfluous to the mission of the Center. Conversely, objects may deteriorate beyond repair, or another repository may be able to provide better care of a collection or object (e.g., fine art).

Should the Executive Director of the RIHPHC determine that deaccessioning may be necessary, a Deaccession Committee (committee) shall be formed consisting of the Director of the Center, the Rhode Island State Archaeologist, and a member of the Public Records Administration program designated by the Director of the Department of Administration. The committee's sole function is to consider any deaccession proposals and make recommendations to the Director of the Rhode Island Department of Transportation, who is responsible for making final deaccession determinations. The committee will not consider any Federally-owned collections curated at the Center for deaccession and then disposal.

The committee will use the following criteria to evaluate a collection or object for deaccession.

1. Does the object qualify for Native American Graves Protection and Repatriation Act repatriation?

2. Do any affiliated Native American tribes or ethnic groups approve or recommend deaccession?

3. Does the Center have unambiguous title or custody of the collection/object?

4. Were any restrictions placed on the collection/object at the time of accession?

5. Does a donor or any descendant of a donor express an objection to deaccession of the collection/object?

6. Is the collection/object made of a material that is hazardous to other objects or people?

7. Has the collection/object deteriorated beyond usefulness or repair?

8. Is the collection/object exorbitantly expensive to conserve or maintain?

9. Is this type of collection/object over-represented in the collection?

10. Is this type of collection/object still in keeping with the Center's collection policy?

If the Deaccession Committee determines that a collection/object should be deaccessioned, final disposition recommendations will be based on the following options.

1. Repatriate according to the Native American Graves Protection and Repatriation Act requirements.

2. Retire the collection/object to a teaching collection.

3. Return the collection/object to the donor.

4. Exchange or give the collection/object to another organization that can better preserve or exhibit the collection/object.

5. Destroy the collection/object in a manner that meets any local, state, and/or federal regulations for those materials.

A Deaccession Recommendation form will be completed for each collection/object deaccessioned, and the deaccessioned collection/object handled accordingly. The Deaccession Recommendation form will be forwarded to the Director of the Department of Transportation for approval or denial. Records shall be maintained documenting all decisions by the Director of the Department of Transportation and for the deaccessions themselves. These records will become part of the permanent deaccession file.

(Also refer to Rhode Island Laws, Title 38, Public Records, Chapter 38-1, Custody and Protection; Chapter 38-3, Public Records Administration, Inventory Policy)

Inventory Policy

The Inventory Policy is to assist in maintaining standards of curation and storage in the Center's storage facilities. Approximately every 4–6 months a random check of artifacts and archives boxes will be conducted. This is to ascertain any deterioration of artifacts as well as adequacy in packaging and storage. Any problems will be brought to the attention of the Director. Problems can include excessive corrosion of metal, deterioration of textiles, or breaks in ceramic or glass vessels, as well as deteriorations of the paper documentation. Some of these problems can be corrected by repackaging into sturdier containers or by moving items into a closed container with its own microenvironment. The Curator will instruct what steps need to be taken to rectify the situation after personally assessing the damage. An Inventory Log for each check shall be kept by the Center.

If there is evidence of rodent infestation within a collection, the Director and the RIDOT Property Management Office will be notified and a treatment plan developed and implemented. An ongoing log of pest checks and infestations will be kept in addition to the Inventory Log.

Environmental controls will be checked on a daily basis on weekdays. The temperature/relative humidity of the Collections Storage Rooms is recorded by Dickson Data Loggers. The Director of the Center is responsible for monitoring the readings and adjusting the temperature and relative humidity as needed. The record will also contain information about any unusual circumstances (e.g., inclement weather or increased room access) to explain any changes in daily readings. Daily recordings will be placed in a spreadsheet to monitor any trends. Temperature and relative humidity readings from the data loggers will remain with the Center permanently; a copy will be transmitted to the RIHPHC on a quarterly basis.

Every five years there will be a full inventory of the collections. Each box will be searched, and all artifacts and documents accounted for. Any missing items will be documented and filed in the accession file.

Annual Inspections

Center staff, under the supervision of the Director will perform an annual inspection of the collections and physical plant. The inspection will consist of a random sampling whereby box numbers and then catalog numbers are randomly chosen and objects are retrieved from a representative collection. Thus, objects can be cross-checked with a written/hard-copy inventory. The size of the sample and the number of individual objects selected should balance the time available and the nature of the materials to be examined. A similar sampling should be made of the associated documentation and its containers.

5

Preservation and Maintenance of Collections

Security for Collections

The Director of the Center is responsible for maintaining the security of the collections. Security itself is the responsibility of all staff members whether they are permanent, part-time, or volunteers. Access to keys and the code for the wireless alarm system is limited to the Director and a staff person at the RIDOT Property Management Office. An inventory of all keys will be performed at least once a year. The wireless intrusion and detection system will be maintained and in proper working order. Any problems with the intrusion and detection system should be immediately brought to the attention of the Director of the Center.

Environmental Monitoring

Environmental monitoring will be accomplished using Dickson digital data loggers. A data logger is located in each Collections Storage Room. Temperature and humidity information from the data loggers will be downloaded as needed and analyzed. Any corrective actions that are required will be implemented as soon as practical to protect the collections from damage or deterioration. The heating, ventilation, and air conditioning system should be in good working order at all times. During the summer, the Office and Research Room will be kept at 78°F and 50% relative humidity, whereas the two collections holding areas will be kept at 70°F and 50% relative humidity. Climate-sensitive areas will be kept at 70°F and 35% relative humidity. During the winter, the Office and Research Room will be kept at 70°F and 35% relative humidity, whereas the Collections Storage Rooms will be kept at 65°F and 35% relative humidity. Climate-sensitive areas will, again, be kept at 70°F and 35% relative humidity. Relative humidity levels should not vary by ±5%.

There are four zones in the Center consisting of the Office and Research Room, two Collections Storage Rooms; and the vault entry/corridor. The temperature can be controlled separately in each zone.

Emergency Management Plan

The Director of the Center administers all emergency planning. The goal of the Emergency Plan is to identify possible hazards, diminish the potential of emergency occurrence and to plan an organized response when an emergency does occur. The core of the plan is prevention. All Center staff are responsible for maintaining a safe workplace and should be familiar with the plan.

The plan is targeted at mitigating injury and damage and is focused on those emergencies that are most likely to occur, or that are the most likely to cause injury and damage such as fire, water, electrical failure, threat to personnel, and injury accidents. Consultation with Native Americans will determine how, if at all, emergency procedures might impact cultural material in the collections.

All Center staff will participate in emergency planning, training, and drills, and will be certified in CPR and fire extinguisher use. Employees must understand their duties and roles in an emergency.

The Center Director will maintain a telephone tree that is activated in an emergency. The tree will be readily available at the Center and in the homes of

the Center's permanent staff. The tree will include the names of and telephone numbers of the RIDOT Property Management Office staff person responsible for the building, all permanent Center staff, Native American and other ethnic groups, the Director of the Rhode Island Department of Transportation, the Center's insurance company, and a RIDOT attorney assigned to the Center. The tree will also include the telephone numbers of other services that may be needed in an emergency including the Woonsocket police, fire department, paramedics, utility companies, plumber, electrician, locksmith, and janitorial service. If it is impossible to use Center telephones during an emergency, an attempt will be made to locate a cell phone, pay phone, or two-way radio to activate the phone tree.

Fire

The location of fire alarms, telephones, fire extinguishers, and emergency equipment and supplies will be marked on fire escape route maps located throughout the Center. Emergency equipment and supplies will be inspected quarterly and replaced as needed. Emergency telephone numbers, address and cross street, and room numbers will be posted at each telephone. A sufficient number of fire extinguishers will be available. A sufficient number of flashlights attached to interior walls should be available. Material Safety Data Sheets will be maintained for all hazardous materials. First aid kits will be available. Emergency cleanup kits consisting of collapsible boxes, saw, hammer, nails, screwdrivers, utility knife, pliers, rope, plastic sheeting, scissors, duct tape, masking tape, plastic bags, paper masks, rubber gloves, disinfectants, broom, dust pan, mop, buckets, sponges, paper towels, and a "Do Not Enter" banner will be available.

The potential for fire in any building is always present. To prevent hazardous conditions from developing, staff should be trained and ready to deal with a fire. Fire preparedness should have a high priority because of the potential loss of life and serious injury, as well as the irreplaceable loss of the collections. For fire preparedness (1) maintain all emergency equipment; (2) conduct quarterly inspections of all fire extinguishers, alarms, and sprinkler systems; (3) do not store any combustible or flammable material in the Center; (4) regularly inspect electrical cords and plugs; (5) do not overload electrical circuits; (6) ensure that sufficient ventilation exists around electrical and computer equipment; (7) ensure that automatic shutoff switches exist for electrical appliances and office equipment; (8) know where gas, electric, and water main shutoff valves are located; and (9) identify a meeting place for all staff after a fire to obtain a head count.

If a fire is present (1) activate the fire alarms; (2) call 911; (3) warn and evacuate others; (4) attempt to extinguish a fire only when it involves people or is small enough for a fire extinguisher to handle; (5) isolate a fire by closing doors during evacuation; and (6) have all persons present in the building proceed to a designated meeting place.

Water

The potential from outside water damaging the collections is probably moderate. While some collections may not be seriously damaged by water, the containers they are stored in could be damaged, which can then lead to the collections becoming disorganized. To prepare for a water emergency (1) know where all the plumbing is located; (2) report small leaks or "sweating" immediately; (3) know where the water shutoff valves are located; (4) inspect the plumbing at least yearly and clean out any drains; and (5) inspect fire sprinklers quarterly for leaks.

If a water emergency exists (1) try to locate the source of the water; (2) attempt to shut off water at the valve; (3) attempt to divert the water away from storage areas or cover collections; (4) notify the appropriate parties; and (5) activate the emergency tree.

Electrical

There is minimal risk of an electrical failure at the Center. However, power may fail and could result in danger to personnel, equipment, and the collections. Failures could include (1) loss of lighting in interior rooms; (2) power surges that could damage equipment, and (3) the security system going out of service.

In preparing for an electrical failure: know where the main circuit board is located; know how many amps are allowed on each circuit; and know where flashlights are located.

If the electricity fails (1) avoid electrical injury; (2) attempt to turn the power off at the main circuit; (3) assure a safe evacuation of others; (4) turn off all electrically powered equipment to avoid surges in case the power is suddenly restored; (5) immediately replace damaged power cords, plugs, and switches; (6) notify the appropriate parties; and (7) activate the emergency telephone tree.

Threats to Personnel

The potential of threats to personnel are minimal, but could occur as a result of a bomb threat, civil disturbance, terrorist activity, or thermonuclear war. Probably a more significant potential threat would be "senseless" crimes that occur every day.

To prepare for threats against personnel (1) be security consciousness; (2) report suspicious activities and people to the appropriate security authorities; (3) use a "buddy system" when leaving the Center after dark; (4) do not leave collections or personal items unattended; and (5) be aware of potential problems such as demonstrations.

If a threat occurs (1) determine the nature of the threat; (2) avoid confrontation; (3) notify appropriate parties; (4) if the potential exists for injury, evacuate the Center if it is safe to do so; and (5) activate the emergency telephone tree.

Injury Accident Potential

Almost all injury accidents are preventable, but in any public place accidents may occur. All Center staff and volunteers are responsible for maintaining a safe workplace.

To prepare for injury accidents (1) maintain emergency equipment and supplies; (2) ensure that the Center staff is CPR trained; (3) know the locations of first aid kits; (4) eliminate unsafe conditions such as blocked hallways or slippery floors; (5) practice good housekeeping to avoid clutter; (6) use correct body mechanics when performing tasks; (7) supervise visitors; and (8) maintain and review Material Safety Data Sheets.

If an injury accident does occur (1) determine the nature of the injury; (2) assist the injured person, but do not move if this will worsen the injury; (3) notify the appropriate parties; (4) assist emergency personnel in locating the injured person; and (5) activate emergency telephone tree.

Disaster Plan

Natural Disasters

Due to the unexpectedness of most natural disasters (see inside front pocket for Emergency Management "Glancers"), it is important for all staff to review and be familiar with procedures for response and recovery before a disaster occurs.

Although it is understood that other natural disasters may possibly occur, this document only includes information about three: hurricanes, floods, and earthquakes. Additional information, as well as information dealing with other natural disasters, can be obtained at:

Rhode Island Emergency Management Agency
State House, Room 27
Providence, RI 02903
(401) 421-7333

and through Federal Emergency Management Agency (FEMA) offices:

National Office
State and Local Programs and Support Directorate
Office of Disaster Assistance Programs
Washington, D.C. 20472
(202) 646-3612

FEMA-Region I
J.W. McCormack Post Office
& Courthouse Building, Rm. 442
Boston, MA 02109
(617) 233-9540

Hurricanes

With the advancement of modern detection tracking devices, it is now possible for the National Weather Service to provide between 12 to 24 hours of advance warning before the hurricane hits the land. Even with this information, a hurricane can often take unexpected turns. Therefore, it is important to take the necessary precautions in advance.

A "hurricane watch" is issued whenever a hurricane becomes a threat to coastal areas. Precautionary actions should be taken as soon as a

"hurricane warning" is issued. This occurs when winds are 74 miles per hour or higher, or when a combination of rough seas and high water are expected. The following are precautionary measures to be taken in the event of a hurricane:

1. Listen to local radio or television reports for the latest information.

2. Check battery-powered equipment: radios, flashlights, emergency lighting, etc.

3. Check recovery kit (see chapter 5).

4. Where possible, remove books, papers, etc. from vulnerable areas near windows.

5. Board up windows or protect them with tape. Although tape may not keep a window from breaking, it can prevent flying glass.

6. Have phone trees available to notify staff if building is closed prior to event.

7. If advised to do so, evacuate area.

8. Be aware of tornado watches and warnings, as tornadoes are often spawned by hurricanes. During a tornado, stay away from windows. Go into a restroom with out windows or a basement or closet.

9. Remain indoors during the hurricane.

Floods

Warnings of flood may be issued by the National Oceanic and Atmospheric Administration when rainfall or snow melt is sufficient to cause rivers to over flow their banks. The following are precautionary measures to be taken in the event of a flood:

1. Know how many feet the building is above or below flood levels.

2. Listen to local radio or television reports for the latest information.

3. Check battery-powered equipment: radios, flashlights, emergency lighting, etc.

4. Check recovery kit (see chapter 5).

5. Remove books, papers, or other fragile objects from low areas if possible.

6. Disconnect electrical equipment. Do not touch equipment if it is standing in water or is wet.

7. Retreat to high areas of the building if necessary.

8. If advised to do so, evacuate area.

Earthquakes

Although earthquakes are unusual in the northeastern United States, the possibility does exist. Unfortunately, no warning is usually forthcoming for an earthquake. Therefore, precautionary procedures need to be part of the routine inspection of your facility. The following are suggestions:

1. Hold drills so staff know what to do in case of an earthquake.

2. Check battery-powered equipment: radios, flashlights, emergency lighting, etc.

3. Check recovery kit (see chapter 5).

4. Check for defective electrical wiring or leaking gas connections. Bolt down water heaters and gas appliances.

5. Overhead lighting fixtures should be made secure.

6. Deep cracks in the ceiling or foundation s should be investigated and repaired.

7. Brace or anchor shelving units.

8. If indoors, take cover either under a heavy desk or table; or in a supported doorway or along an inside wall. Stay away from glass or bookstacks. Do not use candles, matches, or any other open flame because of possible gas leaks.

9. Do not dash for exits since stairways may be broken. It may be necessary to have more than one evacuation route.

10. Never use elevators since power may fail.

11. Be aware that aftershocks are likely to occur.

Recovery Kit

Statement of Purpose

Most Institutions are plagued by minor disasters: a pipe that leaks or a drain that is backed up. "When this happens usually less than fifty books are damaged. It is a good idea to have a small store of recovery supplies available to handle these situations. A quick response will limit the amount of damage that

is caused. The supplies should be stored in an easily accessible area. The kit should contain the most frequently used supplies, e.g., paper towels. The kit should be inventoried on a regular basis. As an extra precaution, the container should be sealed so that the contents aren't taken. While this kit will not contain all the supplies that will ever be needed, it will give the staff the ability to respond to a problem in the moment it is discovered.

There are several advantages to storing the kit in a plastic garbage can. It is easily portable and will protect the supplies in the event of water. If the problem is a leak, the emptied garbage can can be positioned under the leak to collect the water. The garbage can will facilitate the clean-up of the area, as the debris that can be collected in the container and removed from the recovery area.

Suggested Contents

Blotting paper (white)	50 sheets
Chemical light sticks	6
Duct tape	2 roll
Extension Cords (water proof)	2
Flashlight with batteries	1
Freezer paper	1 roll
Paper towels (folded)	6 packages
Plastic garbage bags	1 box
Plastic sheeting	10 sheets
Rubber gloves	3 pair
Waterproof markers	4
Waxed paper	5 rolls

The amount of paper towels can be increased if there is enough room.

The following written information should be stored in the kit: the location of mops, buckets, fans, dehumidifiers, pumps, wet vacs, etc. and how to get to them.

All of the above should be stored in a plastic garbage can with lid. The lid should be secured with string and the ends should be sealed with wax, so that the contents are not misappropriated.

Integrated Pest Management System (Department of the Interior 1993a:Chapter 6)

Integrated Pest Management (IPM) is an ecosystem approach to the control of pests. In contrast to the traditional control measures, IPM uses a variety of approaches to prevent and solve pest problems in the most efficient and ecologically sound manner without compromising the safety of the collections or the staff. It is based on information about the pest, its habits and ecology, and the environment that supports it. IPM is site specific and adaptable to any repository environment. IPM also provides a structure in which responsible decisions concerning the treatment of pest problems can be made. The goal of IPM for the Center's collections is two-fold—to protect the Center from pests that could damage the collections and to reduce the amounts of pesticides used.

Pests that damage a repository can be divided into three categories: insects; microorganisms; and vertebrates (e.g., birds and mammals such as rats, mice, and bats). The three categories can be interrelated. They can support each other's survival and can contribute to the damage caused by each. The damage can range from surface soiling and spotting to complete destruction of an object. Organic materials (e.g., silk, skin, wool, hair, hide, paper, and wood) are most vulnerable to damage by biological agents.

Unfortunately, the optimum conditions for the care, storage, and exhibition of artifacts are also good for the survival of pests. Improper storage and exhibition conditions such as high temperatures, high relative humidity levels, dust, overcrowding, and clutter enhance pest survival.

The traditional method for controlling pests in repositories has been either the routine prophylactic treatment of collections with pesticides such as arsenic, thymol, mercury, DDT, ethylene oxide, Vapona® (DDVP), naphthalene, and paradichlorobenzene (PDB), or treatment with these chemicals once an infestation has been discovered. Recent studies have found that these chemicals can damage objects and pose health risks for staff. Furthermore, improper application of pesticides has increased insect tolerance to some of these

chemicals. Chemical treatments may provide a false sense of security.

Pesticides can damage objects and cause health problems for staff and visitors. In 1980 a Presidential memorandum directed all federal agencies to adopt IPM into their management policies. The extent of the work involved in an IPM program depends on the material nature and size of a museum property collection and on the facility space housing archaeological collections.

Establishing an IPM Program for Archaeological Collections—Preventive Program

The damage caused to collections by pests is almost always irreversible. Once an object becomes infested, the options for eliminating the infestation without further damaging or altering the object are limited. Many of the chemicals traditionally used to manage infestations have been found to damage or alter the material from which the object is made. This is contrary to one of the basic tenets of conservation—a treatment should be reversible and should not alter the materials of the object or specimen. Therefore, it is preferable to prevent pests from gaining access to or becoming established in the collections. Through an effective IPM program, those elements essential to pest survival (e.g., food, moisture, and habitat) are minimized. The basic components of any IPM program include monitoring and identification, inspection, habitat modification, good housekeeping, treatment action, evaluation, and education. These components are ongoing and cyclical in nature. For an archaeological collections IPM program, these components are used in six activities: (1) determination of biological activity; (2) prevention of pests from gaining access to and surviving in repository spaces; (3) establishment of thresholds for pest activity; (4) treatment actions to modify conditions that permit infestation; (5) pest access and survival; (6) action to take when an infestation is discovered.

IPM Program Activities—Determination of Biological Activity

Monitoring is the key to developing an effective IPM program. Monitoring provides baseline information on the biological activity and climatic conditions in the spaces housing archaeological collections such as where the pests are, how they came into the repository, and why they are surviving. It can also help to determine strategies to eliminate future access and survival of pests in the collections. Finally, monitoring can help evaluate the effectiveness of any treatment action taken.

For archaeological collections IPM there are two types of monitoring; (1) monitoring for pests in the collections; and (2) environmental monitoring. Environmental monitoring not only provides information critical to the protection of archaeological collections against climatic damage, but also provides information about the interior climatic conditions of the building that might be contributing to an infestation.

Monitoring for pests begins with documenting the biological populations present in the facility. Monitoring relies on direct observation, population sampling, routine inspection, and passive trapping. Techniques vary depending on the target pest. For example, the presence of wood-boring pests can be detected by placing a sheet of white paper beneath holes created by insects. If sawdust accumulates beneath the holes, the infestation is active. Since most insect pests in collections are small, avoid people, and are nocturnal, one of the easiest ways to document their populations in museums is to use traps placed throughout the area to be monitored. Passive traps are used to record the occurrence of pests when humans are not present. Traps are also useful because they can document the distribution of the insect population over time.

The most effective all-purpose insect trap currently available is a “sticky” trap. These come in two shapes, a box and a tent, and contain a food bait attractant. Both shapes consist of cardboard with an adhesive layer tacky enough to catch insects. For a wide variety of insects, the tent-shaped trap may be best.

Although not all insects cause damage to collections, it is important to identify every insect found in a facility housing archaeological collections to determine if it is a threat to the collections. Insect pests of archaeological collections can be divided into categories based on the primary type of materials on which they live or feed. The categories are mold

feeders, woodborers, cellulose feeders, protein feeders, and starch feeders.

Some insects (e.g., cockroaches and crickets) are omnivorous. Members of these groups can damage a wide variety of organic materials. Some insects do not feed on an object, but damage it by excreting, soiling, or burrowing to find a quiet place to develop into the next life stage. These category terms may have a different connotation outside of the museum field and should be used with care when talking with entomologists or pest control specialists not directly associated with managing the Center.

Structural pests (e.g., subterranean termites, carpenter bees, and carpenter ants) can also threaten collections. These pests should be identified and action should be taken to control them.

Microorganisms

Accurate identification of molds and other fungi requires the services of a trained mycologist. Evidence of molds and other microorganisms indicates that the environment is suitable for their growth, and that it may be inappropriate for the preservation of museum property. The spores of mold and fungi are omnipresent. They become active when the temperature and relative humidity (RH) are appropriate and when nutrients are available to support their growth. Mold has been found growing at temperatures between 32° F and 100° F, and when the RH exceeds 65%. Unfortunately, the materials in some collections (e.g., paper and sizing solutions in paper, animal glue, adhesives, and starch pastes) can provide nutrients for mold and fungi to flourish if environmental conditions permit the spores to germinate. All organic materials are prone to damage by mold. The damage can range from odor and staining to structural weakening and complete destruction of the object. In temperate climates, problems with mold and fungi can usually be solved by modifying the climatic conditions.

Vertebrates

Rodents, bats, and birds can cause both direct and indirect damage to the Center.

Rats and Mice

Rats and mice cause damage through chewing, nesting, excreting, and soiling collection objects with dirt and grease. The presence of mice and other rodents in a structure should serve as a warning that insects also may be present. Rodent nests provide habitats for carpet beetles and other insects that feed on fur and animal excreta. Insects can easily move from the rodent nests to collection materials. The traditional use of poisoned baits for rodent control can cause secondary problems. Although the poison bait will kill the rodent, it will not kill insects (certain carpet beetles and cellulose feeders) that may feed on it. When a rodent has consumed enough poison to kill it, it may die in an inaccessible location, becoming food for insects that feed on the carcass, then move to museum collection materials.

Bats

Bats rarely have caused direct damage to archaeological collections and they are generally considered beneficial animals because they eat mosquitoes and other insects. Like rodents and birds, however, bat roosts and droppings can provide food for insects that can damage collections.

Birds

Birds can cause damage to objects through their droppings, which can stain objects and become acidic in the presence of moisture. These acids can degrade acid-sensitive materials. Bird nests also provide habitats for carpet beetles and other insects that feed on their droppings and cast feathers. These insects can move from the bird nests to collection objects.

Steps for Establishing an Insect-Trapping Program

Obtain or draw a floor plan of the area to be monitored. Indicate the location of all doors, windows, water, and heat sources as well as floor drains. Furniture should be illustrated. In addition, if the area being monitored is a collection storage or exhibition area, notations should be made as to the type of collection material that is stored or exhibited. Number and date the traps. Place traps throughout the area to be monitored. Critical areas are perimeter walls, corners, near doors, under furniture, near water sources, near heat sources, and inside and outside exhibit and storage cabinets. Indicate the location of the traps on the floor plan. Inspect the traps on a regular schedule and record the following: (1) trap number, (2) location of the trap, (3) date inspected, (4) species of insects, and (5) the number

of individuals per species found in the trap. Also useful is a notation of the life stage of the species found, unusual conditions (e.g., leaky pipe or maintenance work), and the replacement date for a trap.

During the initial phase of the monitoring period—usually the first three to six months—inspect the traps weekly. As the trapping routine becomes more regular, refinements in trap placement and inspection periods can be made depending upon the structure and the evidence found in the traps. An understanding of the biology of the pest will assist in the placement and scheduling for the maintenance of the traps. It is important, however, not to leave the traps uninspected for too long because the dead insects caught in the trap can become attractive as food sources for other insects and rodents, which may feed on the dead insects in the trap without getting caught. Traps should be replaced at least every two months, when they become full, or when the adhesive loses its tackiness, whichever comes first.

Routine Inspections

Another important activity in monitoring for insects is making routine, thorough inspections for insect evidence of all the interior spaces of the structure, including the collections themselves. Gain a familiarity with the structural components of the Center. Windowsills and doorjambs will be checked for insects at least once a week.

Windowsills. Sills are a common resting place for insects that are attracted to light. This is especially important for determining if a carpet beetle problem exists, because the adults are attracted to light and attempt to go outside to feed on pollen and to breed.

Doorjambs. Look for evidence of spider webs. If there are gaps around the doors, insects are likely to enter the building through these gaps. Spiders are likely to spin their webs so they can trap any insects entering the building through the gaps. Inspect the archaeological collections at least every six months. Especially vulnerable materials, such as organic ethnographic materials and biological specimens, should be inspected more often. Look for holes in textiles and examine the bottoms of drawers and cabinets for cast larval skins of dermestid beetles, piles of woodborer frass developing beneath wooden material, and frass and hairs cut from animal skins. Monitoring is not effective unless it is properly documented. Document what was found, where it was found, and when it was found. If possible, identify the species of the insect. The identification of the insect and its life stage are critical to determining what is happening in the areas being monitored. Assistance with identifying insects may be obtained from entomologists through a Cooperative Extension Service, U.S. Forest Service, State Departments of Food and Agriculture, and museums of natural history. Repository staff may wish to establish an IPM pest reference collection to assist in identifying pests. If such a collection is established, store it properly to protect it from biological deterioration.

Monitoring for rodents uses a combination of techniques, including the use of traps. Sticky traps known as glue boards are available for rats and mice. These are usually shallow plastic trays filled with an adhesive onto which the rodent walks and gets stuck. Also effective for rodents are old fashioned snap traps which can be baited with cotton batting, an attractive nesting material that is preferable for use in a repository to a food bait, which can attract insects. A whole (unshelled) unroasted peanut is also an excellent bait that is unlikely to attract insects. All traps should be monitored daily. A dead mouse or rat constitutes a threat because it acts as an attractant to insects.

All staff should be trained in "pest awareness" and should immediately report any evidence of biological activity to their IPM coordinator. A logbook should be established and any evidence of pest biological activity should be noted. Include the location and description of the evidence, the material on which the evidence was found, the time of day, and the name of the finder. If actual insects are found, they should be collected and identified, and this information should be included in the logbook together with the time of day that the insect was found and whether it was found alive or dead. Regular analysis of the data collected from monitoring programs can guide curatorial staff in developing strategies for minimizing or eliminating pests. Monitoring provides critical information concerning the extent and source of the infestation.

The strategies can range from improving sanitation and dust control to making modifications to correct failures in the seals of the building that are not easily detected by humans, but allow insects or other pests to enter. Insects can come from a variety

of places. For example, by placing a trap near an emergency exit door leading from the storage or exhibition space directly outside, the tightness of the seal around the door can be determined. If the door is opened only in emergencies, and the trap shows that over a month's time many insects of different species are being caught, the seal around the edges of the door should be checked to determine if it is tight. The seal should be checked periodically as part of the housekeeping program. Once the repair to the seal of the door has been made, subsequent monitoring will indicate whether the repair was effective.

Preventing Pests from Gaining Access to and Surviving in Repository Spaces—The Structure as a Physical Barrier

All pests require food, water, and shelter for survival. Facilities with archaeological collections can provide all three. Restriction of pest access into the structure from the outside is therefore important. Adult mice, rats, and insects require only a small opening to enter a building. Insects are attracted into a structure at night and on cloudy days by light. Rodents are attracted by warmth during cool weather and by dryness during damp weather. Some pests are attracted by the smell of food. Consequently, all structural gaps should be closed to prevent access to the building. Actions that can be taken include installing weatherstripping around doors, caulking joints around windows and doors, installing screens on all operable windows, and installing screens on floor drains.

Minimize habitat for insects and rodents outside the structure. The larger the population of insects and rodents directly around the structure, the greater the potential for pest entry. Install a three-foot-wide, four-inch-deep gravel strip around the perimeter of the structure to prohibit vegetation growth around the structure. While this may not be acceptable for historic structures that require appropriate landscaping, it is useful for non-historic buildings.

Similarly, if not prohibited by historic landscaping requirements, remove ivy and other plants growing on the structure. They provide support for bird nests that make attractive habitats for pests. Since branches can be used by rats as access points to the roof of the structure, trees should be routinely trimmed to prevent them from touching the building. Other regular maintenance activities that help to reduce biological activity around the structure include periodic cleaning and repair of gutters, grading the soil around the foundation so that water drains away from the building, and removal of bird and wasp nests. Many of these recommendations prevent pests from gaining access to the structure and protect the structure itself from deterioration.

Establish a routine inspection program to maintain the exterior of the structure and surrounding vegetation. Inspections should document building changes, such as settling foundations, or evidence of biological activity around and on the structure.

Barriers Within the Structure

Inside the structure, enclosure of the collections in storage cabinets and exhibit cases is the first defense against pests. Cabinets and cases should be well sealed. Gaskets are useful for improving the seals around doors and drawers. Holes cut into cases for ventilation should be screened.

For exhibitions, enclose as much of the archaeological collections as possible. Limit the use of open displays. Weatherstripping installed around interior doors helps to prevent pests from moving from one section of the building to another. It is especially important to separate public spaces such as exhibit and office areas from the collection storage areas. All areas inside the structure should be routinely inspected for structural changes or failures.

Good Housekeeping and Sanitation

Most pests require only small amounts of food and water to survive. Dust found in cracks may provide enough nourishment for survival. The dust is usually hygroscopic and may increase humidity enough to favor pest survival. Moisture from condensation on plumbing or water in sinks can also provide enough moisture for an insect to survive. Rodents are nibblers. They feed on almost anything available, including dead insects.

Establish a good housekeeping and interior maintenance program to minimize food and moisture sources. Shelter for pests comes in many forms, including cracks and crevices in walls and floors, voids in walls, and clutter. To minimize shelter and areas in which nutrients such as dust build up, make the interior spaces of the building as seamless as

possible. Caulk all cracks and crevices with silicone caulk and close gaps around plumbing fixtures and pipe penetrations through walls, floors and ceilings. The use of steel wool to fill such gaps in structures can provide additional protection against rodent entry.

Eliminate clutter. Clutter provides excellent hiding places for insects and rodents. It can also become food for some pests. Clutter gathers dust, which can become a microenvironment-supporting mold, mold-feeding insects, and other insects. Dispose of all unnecessary materials and provide proper storage for equipment and supplies.

Minimize dust by building and cabinetry design and by proper sanitation. Cabinetry should be designed to permit easy access for cleaning the spaces beneath and behind. Use vacuum cleaners to clean floors and structures. All spaces should be vacuumed according to an established housekeeping schedule. A vacuum crack and crevice tool should be used to remove dust and debris from cracks and joints. The vacuum cleaner bag and its contents should be disposed of properly outside of the building to prevent redistribution of insects or eggs. After documentation, all evidence of rodents and insects should be removed and disposed of properly. Dead insects and rodent droppings can provide food for rodents and other insects. Dead rodents, birds, and bats also are food for insects and rodents.

Cultural Controls

Archaeological collections can become infested despite good housekeeping, sanitation, and tight barriers. This often happens when infested material is incorporated directly into a collection. Uninfested materials can go on loan to another repository and become infested, new material can be accepted into the collections without knowing that it is infested, scholars and visitors can bring materials from "home" for comparison with the repository's holdings, and an infestation can be established.

Establish an area outside of the collection storage and exhibition areas for the inspection of new objects and returned loans. Restrict the direct comparison of noncollection items against collection items. Do not incorporate any material into the collections until it has been judged to be pest free. Similarly, exhibit materials (e.g., props and new construction materials), equipment, and supplies may already be infested with insects when brought into spaces with archaeological collections. Set aside space near the repository's receiving area for thorough inspection of all material entering the building. If infested, do not bring this material into the building until it is pest free. As plants and flowers can be nutrient sources for the adults of some carpet beetle species, they should not be brought into spaces with archaeological collections. Restrict food and smoking in spaces with archaeological collections. Pests can enter the facility in smoking materials and food bags. If food and smoking is permitted in the building, designate special areas far away from the collections that can be thoroughly cleaned. Dispose of food and smoking wastes properly. Do not leave them accessible to insects and rodents. Take wastes outside of the museum and dispose of them in tight-fitting receptacles.

Establishment of Thresholds for Pest Activity

Thresholds are the points at which some action needs to be taken to correct the presence of a pest. With archaeological collections, the threshold is site specific in establishing the level at which action should be taken. The intensity of the action is determined by the proximity of the pest to the collection. For instance, a pest caught near the entrance door to a storage or exhibit space may not warrant extensive treatment, but its discovery should trigger an increase in vigilance against pests.

Summary of Preventive Actions

Monitoring programs provide information about biological activity within the storage and exhibit spaces and the collections. Data from monitoring identifies what pests are in the museum, in what quantities, where they are located. Data also may reveal how they came into the museum, and whether they can survive.

Monitoring helps to evaluate the building structure: Does it provide enough of a barrier against pests from the outside? Are there structural failures? What can be done to improve the seal? Monitoring also helps to evaluate the existing sanitation and housekeeping programs. From this information, improvements to the structure and modifications to the sanitation programs can be efficiently planned. Taking preventive actions to exclude pests from

museum spaces and exercising constant vigilance through monitoring and inspections are the keys to effectively controlling pest problems.

Actions to Take When an Infestation is Discovered

If an infestation is discovered in a storage or exhibit space, take immediate action. Actions should include steps to isolate and identify the infestation, develop a treatment strategy, and review the effectiveness of the existing IPM Program.

Isolating and Identifying the Problem

Isolate the infested material by using heavy polyethylene plastic (6 mil minimum). Small objects can be placed in resealable bags (e.g., Ziplock® bags). For larger objects, a polyethylene tent can be made using tape or heat sealing equipment. Make sure that the plastic is completely sealed. Identify the pest. Based on the habits of the pest, determine the extent of the infestation. Start at the site where the first infested object was found and inspect the archaeological materials and the space around the material in ever widening circles. Isolate infested material as it is found and document the findings. Sweep away any old wood dust and frass and place a sheet of white acid-free paper beneath the object. Monitor for new wood dust and frass accumulation to determine if the infestation is still active.

Determine the source of the problem. If the problem is structural, make structural repairs to the building. If infested material was brought into the collection, evaluate and modify the policies and procedures that permitted this to occur.

Developing a Treatment Strategy

Identify developmental stages of the pests that are found on the materials. Identify the media of the infested material (e.g., What is the material composition of the object or specimen?). Based on an understanding of the biology of the pest, its life stage when found, and the material of the object, answer the following questions: Can the infested material be disinfested by removing the pest? Are eggs present? What is the least damaging approach to treatment?

Treatment decisions should be based on evaluation of the identification of the pest, the infested materials, and the condition of the object. In consultation with a conservator, choose an effective treatment that will cause the least amount of damage to the object and to the environment. Treatment options range from simple cleaning to fumigation. A non-chemical option is preferred; if fumigation is determined by the Center's Director to be necessary, then the preferred method of treatment shall be to utilize the services of SPNEA's modified atmosphere (carbon dioxide fumigation). If chemical options are selected, follow manufacturer and state/local safety procedures carefully. A desirable alternative to use of chemicals is freezing. The success of this treatment, however, requires following very specific steps, including the careful bagging of objects and their exposure to repeated freeze-thaw cycles. Not all materials can be safely frozen. Freezing will stop pest activity, but may not kill all insects and eggs. Before using this treatment, consult a conservator.

Document any and all treatments made. After treatment, the objects should be cleaned, with all the removable evidence of the infestation documented and removed, and any pest damage documented and added to the museum records. File all treatment and/or damage documentation in the appropriate Accession File or Catalog Folder.

Evaluate the treatment to determine if it was effective. Following fumigation, the object should remain in isolation and should be monitored weekly or bimonthly for any signs of continuing infestation. The object should be returned to the collection only when it is free of pests.

Reviewing the Integrated Pest Management Program

Review the Center's IPM Program to determine how it can be modified to prevent a similar infestation from occurring in the future. Consult outside experts for assistance with the review. As necessary, modify the IPM procedures. Document any modifications.

Fumigation

The word "fumigation" is commonly used to identify any chemical treatment of infested material. Although fumigants may exist in three physical states (e.g., solid, liquid, and gas), they need to be converted to a gaseous or vapor state in order to effectively kill pests. Solid fumigants (e.g., paradichlorobenzene, naphthalene, and thymol) convert to a vapor state with heat and time. Liquid fumigants (e.g., dichlorvos

[Vapona®] and carbon disulfide) evaporate at room temperatures to a vapor state. Gaseous fumigants (e.g., ethylene oxide, methyl bromide, and sulfuryl fluoride [Vikane®]) are distributed in pressurized cylinders for specific use in fumigation chambers. If it is determined that a chemical approach is necessary to control the pest infestation, the Center's staff needs to adhere to the following guidance.

The Environmental Protection Agency (EPA) is required by law to determine whether a pesticide can perform its intended function without causing "unreasonable adverse affects" (sic) on human health or the environment while taking into account the potential benefits of the proposed use. Each product's label contains the EPA Registration Number. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972 (as amended) prohibits, with limited exceptions, the use of any pesticide product for any purpose or in any manner not specified on the label (see Section 2(ee) for exceptions). For example, the fumigant ethylene oxide (EtO) is not approved for use on books and archival materials. In addition, EtO may be used as a fumigant only in a chamber, and not as a contact pesticide or deterrent.

FIFRA classifies all pesticide products as either "general" or "restricted" use. General use pesticides are those that will not cause unreasonable adverse effects to the user or the environment when used in accordance with the label. These products are available to the public with no restrictions except those that are specified on the label. Repository pesticides and fumigants in this category include paradichlorobenzene (PDB), naphthalene, thymol, dichlorvos (e.g., Vapona®), and boric acid. Restricted use pesticides are those that cause adverse effects to the applicator or the environment and must be applied by persons who have received specific training in their use. Methyl bromide, hydrogen cyanide, and sulfuryl fluoride (e.g., Vikane®) are repository fumigants included in this category. The federal Environmental Protection Agency's list of restricted use pesticides is updated monthly. All staff must be certified to handle and apply restricted use pesticides.

The use of pesticides or fumigants (e.g., paradichlorobenzene, dichlorvos, naphthalene, and boric acid) is approved only in response to controlling a specific infestation. These materials are not approved for use as preventive repellents or deterrents.

Fumigation, a complex process, should be carried out by a trained and experienced person. The specific pest, the volume of space to be fumigated (e.g., chamber, room, or structure), and the type of archaeological material involved determine the type and amount of fumigant to be used and the length of exposure. During application, the proper and effective use of a fumigant requires the strict control of environmental conditions (e.g., temperature and relative humidity).

The Center shall utilize the services of SPNEA to provide fumigation services when needed. SPNEA's fumigation chamber or "bubble" employs an infusion of carbon dioxide to treat any infestation of collections. A chemical approach should be used only when preventive measures have failed to control an infestation. The fumigant applied brings the infestation under control and reduces the threat of damage to collections. Once the fumigation procedure is completed, the IPM program should be evaluated to determine how a future reoccurrence can be prevented. Objects that have been fumigated should be continually monitored to evaluate the success of this control method.

6

Use of and Access to Collections

Exhibits

The Center is committed to serving as an educational resource for the general public. Exhibits assist the public in appreciating the irreplaceable nature of archaeological collections. For any collections not owned by the Center, including federal collections, the owner must approve in writing any use of its collections in an exhibit.

An exhibit proposal must be written for each proposed exhibit whether internally developed or received from an outside source. All proposals should contain specific installation and deinstallation dates. Proposals should be appropriate to the mission of the Center, ensure collection/object security, and be feasible. For exhibits on Native Americans, consultation with Native Americans should be an integral part of exhibit planning. A proposal should present all the proposed text, labels, photographs, maps, and all other visual or auditory media. Proposals should avoid ethnocentrisms and cultural bias.

The proposals should be reviewed and evaluated by the Center in consultation with the RIHPHC. Funding for exhibits may be internally available or be the responsibility of outside sources for proposals received from outside parties.

Exhibits should be designed to balance feasibility, education potential, Native American or ethnic group concerns, Americans with Disabilities Act, sophistication of exhibit visitors, care and security of collections on exhibit, and ease of viewing. Native Americans may voice concerns over exhibit content, artifacts displayed, placement of artifacts, labeling, wall text, relationship between artifacts, and any other specifics they deem appropriate.

Artifacts that are displayed must be protected from breakage, light damage, dust, changes in relative humidity, mishandling, and theft. Artifacts must be mounted so that no permanent physical damage occurs.

All items used in an exhibit must be inventoried, including recording the individual catalog number, accession identification number, box location, and any other information, to insure that the artifact is returned to the correct collection.

Signs, labels, and wall text should be concisely and clearly written. In general, all text should be at least 16 points in size and be left justified. The placement of labels and wall text should consider the needs of seated visitors and children. The overall design of an exhibit should also consider the needs of persons with disabilities. For example, for visitors with visual impairments (1) wall text and labels are printed in large, easy to read font; (2) exhibits are well lit; (3) exhibit furniture does not prevent movement; (4) extra-large copies of photographs, maps, and artifacts are available; (5) staff are available to guide people through an exhibit; and (6) some exhibits are interactive. For visitors with hearing impairments (1) sign language tours can be prearranged when needed and (2) tour information is available in a written form. For mobility impaired visitors (1) clear access of at least 40 inches between pieces of exhibit furniture; (2) label and wall text located an appropriate height for seated visitors; (3) exhibit furniture so that the exhibit is visible for seated visitors; and (4) seating available at convenient locations. For developmentally impaired

visitors (1) signs, labels, and wall text are concisely and clearly written, and (2) special tours can be scheduled to meet special needs.

For traveling exhibits artifact reproductions should be considered. All objects leaving the Center must be documented on an outgoing loan form.

Research

Scientists should be encouraged to use the collections for research and be accommodated whenever possible. Prior to use of the collections, a written request must be must be submitted for review and approval. The written request must contain the descriptions of the activities that will be performed, a time line for these activities, and the intended final result of the use. The Center Director will approve or deny the request. Consultation with Native Americans or other ethnic groups should be performed as necessary prior to making a decision on the request. A written record of the action will be kept in the permanent files of the Center. If a scientist wants to work with a collection that is not owned by the Center, the owner must approve the request in writing to the Center.

Native American Use

Any items in the Center-owned collections should be made available, after a reasonable written request is received, to Native Americans affiliated with the collection for religious, spiritual, or teaching activities. For collections not owned by the Center, the owner must approve the request in writing to the Center.

Cultural Use

Any items in the Center-owned collections should be made available, after a reasonable written request is received, to ethnic groups affiliated with the collection for religious, spiritual, or teaching activities. For collections not owned by the Center, the owner must approve the request in writing to the Center.

Educational Use

A teaching collection should be created and added to give visitors a chance to touch history. The teaching collection consists of objects in the collection without a provenance, ecofacts, botanical specimens, and objects that retired to the teaching collection after they were deaccessioned. Teaching collections may be used for travelling exhibits, intern training, and other uses deemed appropriate. Prior to including any objects in the teaching collection, the Deaccession Committee should review which objects will be used and if those objects are appropriate to be included.

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Appendix 1

Rhode Island General Laws

Chapter 42-45: Antiquities Act of Rhode Island

§ 42-45.1-1

Short title. – This chapter shall be known, and may be cited, as the "Antiquities Act of Rhode Island."

§ 42-45.1-2

Purpose of chapter. – The general assembly of the state of Rhode Island and Providence Plantations hereby declares that the public has an interest in the identification, interpretation, preservation, and protection of the state's archaeological resources including underwater historic properties situated under the navigable waters and territorial seas of the state; that the public has a right to the knowledge to be derived and gained from a scientific study of these resources; and that therefore it is the purpose of this chapter to provide that activities for the identification, preservation, excavation, study, and exhibition of the state's archaeological resources be undertaken in a coordinated and organized manner, with due consideration given to other significant natural and man-made environmental assets, for the general welfare of the public as a whole.

§ 42-45.1-3

Definitions. – As used in this chapter:

(a) "Field investigations" shall mean the study of the traces of human culture at any land or water site by means of surveying, sampling, excavating, or removing surface or subsurface objects, or going on a site with that intent.

(b) "Site" shall mean any man-made landform, fort, earthwork, habitation area, burial ground, historic or prehistoric ruin, mine, cave, or other location, which is or may be the source of important archaeological data.

(c) "Specimen" shall mean all relics, artifacts, remains, objects, or any other archaeological evidence of a historical, prehistorical, or anthropological nature which may be found on or below the surface of the earth, and which have scientific or historical value as objects of antiquity or as archaeological samples.

(d) "Underwater historic property" means any shipwreck, vessel, cargo, tackle, or underwater archaeological specimen, or part thereof, including any found at refuse sites or submerged sites of former habitation, that has remained unclaimed for more than ten (10) years on the bottoms of any navigable waters and territorial seas of the state.

§ 42-45.1-4

Property and investigative rights of state. – (a) The state of Rhode Island and Providence Plantations reserves to itself the exclusive right and privilege of field investigation on sites owned or controlled by the state, its agencies, departments, or institutions, in order to protect and preserve archaeological and scientific

information, matter, and objects. All the information and objects derived from state lands shall remain the property of the state and be utilized for scientific or public educational purposes.

(b) Furthermore, subject to any local, state, or federal statute, the title to all bottoms of navigable waters within the state's jurisdiction in the territorial sea, and the title to any underwater historic properties lying on or under the bottoms of any other navigable waters of the state, is hereby declared to be in the state, and the bottoms and underwater historic properties shall be subject to the exclusive dominion and control of the state.

§ 42-45.1-5

Responsibility for administration of programs – Rules and regulations – Permission to conduct recovery operation – Title to recovered objects. – (1) The state historical preservation commission shall be the agency responsible for administering the archaeology and underwater archaeology programs. The commission is empowered to prescribe such rules and regulations as may be necessary to preserve, protect, recover, and display underwater historic properties and specimens derived from archaeological sites. The rules and regulations may include but are not limited to the following:

(a) Issuance of permits for the conduct of field investigations;

(b) Requirements for reporting on the results of field investigations;

(c) Provisions for the preservation and display of specimens; and

(d) Fair compensation to the permittee for underwater historic properties recovered.

(2) The rules and regulations, when approved by the governor of the state, shall be subject to the provisions of the Administrative Procedures Act, chapter 35 of this title.

(3) Any person conducting field investigations shall be responsible for obtaining permission of any federal or state agencies having jurisdiction prior to conducting any recovery operation. Title to all objects and specimens recovered from the field investigations shall be retained by the state.

§ 42-45.1-6

Survey of sites. – The state historical preservation commission shall conduct a survey of archaeological and anthropological sites and specimens located within the state. The results of the survey shall be made available to all agencies of the state government and its political subdivisions that, in the opinion of the commission, may conduct activities which affect the archaeological or anthropological sites and specimens.

§ 42-45.1-7

Cooperation by state and municipal agencies – Notice and investigation of possible adverse effects of state projects. – All state agencies, departments, institutions, and commissions, as well as all municipalities, shall cooperate fully with the historical preservation commission in the preservation, protection, excavation, and evaluation of specimens and sites and to that end:

(a) When any state or municipal agency finds or is made aware by an appropriate historical or archaeological authority that its operation in connection with any state, state assisted, state licensed, or contracted project, activity, or program adversely affects or may adversely affect scientific, historical, or archaeological data, the agency shall notify the state historical preservation commission and shall provide the commission with appropriate information concerning the project, program, or activity. The provisions of this chapter shall be made known to contractors by the state agencies doing the contracting.

(b) The state historical preservation commission, upon notification, shall, after reasonable notice to the responsible agency, conduct a field investigation.

(c) The state historical preservation commission shall initiate actions within thirty (30) days of notification under subdivision (a) or within such time as agreed upon by the parties involved. The responsible agency is authorized to expend agency funds for the purpose of assisting the commission with the field investigations.

§ 42-45.1-8

Conditions upon transfer of property by state. – When transferring real property under its jurisdiction that contains significant archaeological or other anthropological resources, the state, its agencies, departments, and institutions, may, upon the recommendation of the state historical preservation commission, condition the transfer upon such covenants, restrictions, or other contractual arrangements as will limit the future use of the property in such a way as will protect those resources.

§ 42-45.1-9

Reservation of lands from sale by state properties committee. – Upon written recommendation to the state properties committee by the state historical preservation commission, the state properties committee may reserve from sale any state lands, including lands forfeited to the state for nonpayment of taxes, on which sites or artifacts are located or may be found, as designated by the commission; provided, however, that the reservation of these lands from sale may be confined to the actual location of the site or artifacts. When the sites or artifacts have been explored, excavated, or otherwise examined to the extent desired by the commission, the commission shall then file with the committee a statement releasing the lands and permitting their sale.

§ 42-45.1-10

State archaeological landmarks. – The state historical preservation commission may publicly designate an archaeological site or underwater historic property as a "state archaeological landmark"; provided that no site shall be so designated without the express written consent of the owner if it is on privately owned land. Upon designation of an archaeological site, the owners and occupants of each designated state archaeological landmark shall be given written notification of the designation by the commission. Once so designated, no person may conduct field investigation activities, or exploration or recovery activities in the case of an underwater site, without first securing permission from the commission and the express written consent of the landowner. The commission may remove its designation of state archaeological landmark from any site if it deems the site no longer has significance.

§ 42-45.1-11

Field investigations on privately owned lands – Communication of knowledge of archeological sites. – It is the declared intention of the general assembly that field investigations on privately owned lands should be conducted in accordance with both the provisions and spirit of this chapter; and persons having knowledge of the location of archaeological sites are encouraged to communicate the information to the state historical preservation commission.

§ 42-45.1-12

Enforcement of chapter – Assistance by other agencies. – The attorney general of the state of Rhode Island and Providence Plantations shall have the power to bring an action in the name of the state of Rhode Island and Providence Plantations in any court of competent jurisdiction for restraining orders and injunctive relief to restrain and enjoin violations or threatened violations of this chapter, and for the return of items taken in violation of the provisions hereof. The chief administrative officers of all state agencies are authorized and directed to cooperate and assist the state historical preservation commission and the attorney general in carrying out the intent of this chapter. All law enforcement agencies and officers, state and local, are authorized and directed to assist in enforcing this chapter and in carrying out the intent hereof.

§ 42-45.1-13

Severability. – The sections of this chapter and each provision and part thereof are hereby declared to be severable and independent of each other, and the holding of a section, or part thereof, or the application thereof to any person or circumstance, to be invalid, ineffective, or unconstitutional shall not affect any other section, or provision or part thereof, or the application of any section, or provision or part thereof, to any other person and circumstance.

Appendix 2

Rhode Island Historical Preservation and Heritage Commission's Performance Standards and Guidelines for Archaeological Projects

(Standards for Archaeological Survey) Sections 6 and 7

Section 6. Standards for the Conservation and Curation of Archaeological Collections

A. Project proposals/scopes of work shall provide for proper conservation and curatorial services as a direct project cost (see 36 CFR 66.4).

B. A conservation plan that includes in-field procedures through final treatment shall be developed, reviewed and approved by the Historical Preservation Commission, and implemented.

C. Collections shall be properly conserved and curated. Improperly conserved and curated collections will not be accepted by the Historical Preservation Commission. A collection is defined as all artifacts, ecofacts, analytical samples, field notes, laboratory forms, color slides, B & W contact sheets, and project reports.

1. Artifacts shall be:
    a. lightly cleaned with brushes to remove soil unless samples have been retained for specific analytical purposes. Water cleaning should be done only if necessary. Detergent cleaning is strongly discouraged.
    b. labeled with site number and artifact number (e.g., 925-1) and artifact catalogue submitted with collection. White-out should not be used. Use tie tag label whenever possible.
    c. bagged in heavy duty clear zip-loc plastic bags with outside label and acid-free label inside bag.
    d. packed in acid-free boxes 12½" x 16" x 10" (e.g., Hollinger record storage boxes) with inert packing material. Like classes of artifacts will be boxed together.
2. Each box shall have a packing slip listing contents attached to inside cover of box; a master list of packing slips will be provided.
3. Any special conservation/curatorial problems shall be separately noted on both the inside cover of box and on the artifact catalogue list. The conservator's report shall be attached to the catalogue list with recommendations for future curation and any specific curatorial problems.

D. All collections shall be boxed in standard-size acid-free storage containers and delivered to the Historical Preservation and Heritage Commission within two years of fieldwork end date unless other arrangements have been made with the RIHPHC.

E. A fee of $25.00 per box shall accompany the collection.

Section 7. Standards for Storage and Custody of Archaeological Collections

Authority: The Rhode Island Historic Preservation Act (R.I.G.L. 42-45) directs the Historical Preservation and Heritage Commission "to advise the departments and agencies of state government of the appropriateness, suitability, proper procedures, and other safeguards which should be observed in preserving, displaying, or using items… of historic, architectural, or archaeological interest." These Standards are the Commission's general advisory on the subject and should be applied to all archaeological collections in State ownership or custody.

A. These Standards are the minimum acceptable level treatment for storage and custody of archaeological collections. All collections should be properly conserved and curated in accordance with RIHPHC *Standards for Archaeological Survey, Curation of Archaeological Materials* prior to storage or custody. Because the majority of the State's archaeological collections consist of relatively stable materials, these minimum standards apply to most cases. Refer to number 3 below for exceptions.

B. Storage areas must provide safe, secure, clean, dry conditions that protect against reasonably foreseeable dangers to the collection. Specific requirements for storage areas include:

1. Maintain relative humidity level of 40 to 60 percent.
2. Maintain temperature between 60 and 75 degrees Fahrenheit.
3. Be monitored frequently by professional staff.
4. Be locked and secure from unauthorized entry.
5. Block or filter sunlight entering storage and work areas. Fluorescent lights with UV filters are recommended.
6. Provided a dry carbon dioxide manual fire extinguisher.
7. Be free of insects and rodents.
8. Provide strong, stable shelving—preferably without a wooden surface.

C. Special Conditions may be required when:

1. Special Conditions may be required when the collection includes fragile or perishable items such as ethnographic artifacts, paper, hair, animal hide, basketry, fabric, etc. Special Conditions may specify maintenance or particular environmental conditions, limited use of archaeological materials, supervision by specially qualified personnel, conservation and curation measures, or other requirements;
2. Collections that have not been conserved and curated in accordance with RIHPHC Standards will be subject to Special Conditions requiring that the conservation and curation standards be met.

D. Collections in State ownership or custody must be accessible for study by qualified researchers and for public examination or display if appropriate. Reasonable hours for use may be established in consultation with the RIHPHC. The storage facility must provide safe and adequate workspace for use of the collection.

E. While the RIHPHC encourages the use of archaeological collections for educational purposes, extensive use of collections for classroom study or by students may result in damage or loss to collections. Classroom or student use of collections is permitted only under the careful supervision of a qualified archaeologist or conservator.

F. Public display of exhibition of collections is permitted as an educational activity; however, plans for exhibits must be approved in advance by the RIHPHC. Storage requirements generally apply to exhibits also.

G. Maintenance of these Standards for Storage and use shall be documented in an annual report filed with the RIHPHC. The annual report shall provide an inventory of collections, describe any changes to the collections and designate a collection custodian responsible for overseeing storage and use of the collections. The RIHPHC will summarize these reports and make them available to interested persons. Any loss, damage or other material changes in the collection shall be reported to the RIHPHC immediately. Collections shall be reviewed completely every five years to assure their safety and completeness. Problems in meeting these standards should be corrected in a timely way. Failure to maintain these Standards may result in removal of a collection to a place where these Standards can be more fully met.

H. Verification that these Standards are met will be a requirement of any loan agreement for archaeological collections.

Appendix 3

Glossary

Accessioning: The process of formally accepting and establishing permanent legal title (ownership/custody) for incoming artifacts and/or associated records. This process involves the agency assigning a unique "accession number" to the item(s).

Acid: In chemistry, acid is a substance capable of forming hydrogen ions when dissolved in water. Acids can weaken cellulose in paper, board, and cloth, leading to embrittlement. Acids may be introduced in the manufacture of library materials and may be left in intentionally (as in certain sizings) or incidentally. Acids may also be introduced by migration from other materials or from atmospheric pollutants.

Acid-free: In chemistry, materials that have a pH of 7.0 or higher are said to be acid-free; sometimes used incorrectly as a synonym for alkaline or buffered. Such materials may be produced from virtually any cellulose fiber source (cotton and wood, among others), if measures are taken during manufacture eliminate active acid from the pulp. However free of acid a paper or board may be immediately after manufacture, to over time the presence of residual chlorine from bleaching, aluminum sulfate from sizing, or pollutants in the atmosphere may lead to the formation of acid unless the paper or board has been buffered with an alkaline substance.

Acrylic: A plastic noted for transparency, light weight, weather resistance, color fastness, and rigidity. In addition to these qualities, acrylics are important in preservation because of their stability, or resistance to chemical change over time, a characteristic not common to all plastics. Acrylics are available in sheets, films, and resin adhesives. Some common trade names for sheet form include Perspex, Lucite, and Plexiglas.

Alkaline: Substances that have a pH over 7.0. They may be added to a material to neutralize acids or as an alkaline reserve or buffer for the purpose of counteracting acids that may form in the future. A buffer may be added during manufacture or during the process of deacidification. While a number of chemicals may be used as buffers, the most common are magnesium carbonate and calcium carbonate.

Archival or archivally sound: Non-technical terms that suggest that a material or product is permanent, durable or chemically stable, and that it can therefore safely be used for preservation purposes. The phrase is not quantifiable; no standards exist that describe how long "archival" or "archivally sound" material will last.

Archival-quality: Materials that have been manufactured of inert materials specifically designed to extend the life of artifacts and records by protecting them from agents of deterioration.

Arrangement: The process and result of organizing archives, records, and manuscripts in accordance with accepted archival principle, particularly provenance, at as many of the following levels as necessary: repository, record group, subgroup, series, file unit, and document.

Associated records/associated documentation: All original records (or copies thereof) that have been prepared and/or assembled in the efforts to locate, evaluate, record, study, preserve, or recover prehistoric or historic resources.

Cartographic records: Archival records that contain information in graphic or photogrammetric form of a portion of a linear surface (e.g., maps).

Cataloging: The process of assigning and applying a unique identifying number to an object or group of objects and completing the written documentation of this process.

Chemical stability: indicates a material that is not easily decomposed or otherwise modified chemically. This is a desirable characteristic for materials used in preservation, since it suggests an ability to resist chemical degradation (such as embrittlement of paper), over time and/or upon exposure to various conditions during use or storage. Other terms used loosely as synonyms: inert, stable, chemically inert.

Collections: Material remains that have been excavated or removed during a survey, excavation, or other study of prehistoric or historic resources. Collections also include associated records that are prepared or assembled during the survey, excavation, or other study.

Conservation: The treatment of library or archive materials, works of art, or museum objects to stabilize them chemically or strengthen them physically, sustaining their survival as long as possible in their original form.

Copy: A reproduction of the contents of an original document.

Cross-indexing: The process of accessing information from several different points.

Curation: The long-term, professional management and care of all objects, materials, and records recovered as the result of a Federal or non-Federal archaeological undertaking.

Curatorial services: The management and preservation of collections according to professional museum and archival practices.

Deaccession: The formal procedure whereby objects or records are permanently removed from a repository's holdings.

Deacidification: A common term for a chemical treatment that neutralizes acid in materials such as paper, and deposits an alkaline buffer to counteract future acid attack. Deacidification technically refers to only the neutralization of acids at the time of treatment, not to the deposit of a buffer. For this reason, the term is slowly being replaced with the more accurate phrase "neutralization and alkalization." While deacidification increases the chemical stability of paper, it does not restore strength or flexibility to brittle materials.

Field-curation guidelines: The set of formal procedures and protocols that outline how artifacts and records are to be treated following field excavation.

Finding aids: The descriptive media, published and unpublished, created by an originating office, an archival agency, or manuscript repository to establish physical or administrative and intellectual control over records and other holdings.

Holdings: The total accessions and deposits of a repository.

Integrated pest management: The selection, integration, and implementation of pest management methods based on predicted economic, ecological, and sociological variables. IPM can also be defined as a decision-making process that helps one decide if a treatment is necessary and appropriate, where the treatment should be administered, when treatment should be applied, and what strategies should be integrated for immediate and long-term results.

Inventory: The process of creating and maintaining a contemporaneous record of all objects for which a repository is responsible. An inventory is also an itemized listing of objects.

Loan: The temporary transfer of objects from a repository to a museum or other repository. These transfers do not involve a change in ownership.

Material remains: Artifacts, objects, specimens, and other physical evidence excavated or removed in connection with efforts to locate, evaluate, document, study, preserve, or recover prehistoric or historic resources.

Minimum standards for acceptance: A set of formal procedures and protocols that outline what basic stabilization steps must be performed before a repository will accept an archaeological collection for curation.

Permanence: A term that refers to the ability of a material to resist chemical deterioration, but is not a quantifiable term. Permanent paper usually refers to a durable alkaline paper that is manufactured according to ANSI Standard Z39.48-1984 *Permanence of Paper for Printed Library Materials.* Even so-called permanent materials depend upon proper storage conditions for their longevity.

Pests: Organisms that can cause damage to collections or interfere with human objectives for a controlled environment.

pH: In chemistry, pH is a measure of the concentration of hydrogen ions in a solution, which is a measure of acidity or alkalinity. The pH scale runs from 0 to 14, and each number indicates a ten-fold increase. Seven is pH neutral; numbers below 7 indicate increasing acidity, with 1 being most acid. Numbers above 7 indicate increasing alkalinity, with 14 being most alkaline. Paper with a pH below 5 is considered highly acidic. Buffered storage materials typically have a pH between 7 and 9.

Polyester: A common name for plastic polyethylene terephthalate. Its characteristics include transparency, colorlessness, and high tensile strength. In addition, it is useful in preservation because it is very chemically stable. It is commonly used in sheet or film form to make folders, encapsulations and book jackets. Common trade names are Mylar® by DuPont and Mellinex® by International Chemical Company.

Polyethylene: A chemically stable, highly flexible, transparent or translucent plastic. Used in preservation to make sleeves for photographic materials, among other uses.

Polypropylene: A stiff, heat resistant, chemically stable plastic. Common uses in preservation: sleeves for 35 mm slides or films, containers.

Polyvinyl Acetate: A plastic that is usually abbreviated as PVA. A colorless transparent solid, it is usually used in adhesives, which are themselves also referred to as PVA or PVA adhesive. There are dozens of PVA adhesives; some are "internally plasticized" and are suitable for use in conservation, due to greater chemical stability among other qualities.

Polyvinyl Chloride: Another plastic that is often abbreviated as PVC. It is not as chemically stable as some other plastics, since it can emit hydrochloric acid (which in turn can damage library and museum materials) as it deteriorates, and therefore has limited application in the preservation of books, paper, and artifacts.

Preservation: The basic responsibility to provide adequate facilities for the protection, care, and maintenance of records and artifacts.

Processing: In archival work, processing is the act of arranging, describing, and preserving a collection of documentation.

Provenance: The information of successive transfers of ownership and custody of a particular manuscript or document collection.

Provenience: The specific location, in either two-dimensional or three-dimensional space, where an object was originally collected, where a site is located, or where an archaeological collection was made.

Records management: That area of general administrative management concerned with achieving economy and efficiency in the creation, use and maintenance, and disposition of records.

Registration: The overall procedures for officially recording and monitoring object transaction—e.g., acquisition, accession, loan, movement, care, shipment, and deaccession.

Relative humidity: The relation between the air's water content and its temperature. Stated as a percentage, relative humidity (or RH) relates the moisture content of the air being measured to the amount of water vapor it could hold at saturation, assuming that there is no change in temperature.

Repository: A facility such as a museum, archaeological center, laboratory, or storage facility that is managed by a university, college, museum, other educational or scientific institution, a federal, state, or local government agency, or Indian tribe that can provide long term professional, systematic, and accountable curatorial services.

Retention/disposition schedule: A document that governs the continuing retention and disposition of the recurring records series of an organization or agency.

Reversibility: The ability to undo a process or treatment with no change to the object. Reversibility is an important goal of conservation treatment, but it must be balanced with other treatment goals and options.

Sizings: Chemicals added to paper that make it less absorbent, so that inks applied will not bleed. Acidic sizings can be harmful and can cause paper to deteriorate, but some are not acidic and are expected to more chemically stable.

Sticky traps: Passive insect or rodent traps that consist of cardboard with an adhesive layer.

Telescoping lids: Box lids that are separate pieces of cardboard and are not attached to the box in any manner. These lids may be removed by lifting them off of the box.

UV filter: A material used to filter the ultraviolet (UV) rays out of visible light. Ultraviolet radiation is potentially damaging to library, archival, and museum objects and more is present in sunlight and fluorescent light than in incandescent light. Removing UV radiation from storage, use, and exhibition spaces can reduce the rate of deterioration of materials stored there. Usually a UV filtering material is placed over windows or fluorescent light tubes, or over glass used in framing, or in exhibition cases. Certain acrylic sheet materials have UV filtering properties built in.

Vinyl: A word imprecisely used to refer to any of a number of plastics, many of which are not appropriate for preservation use. For specific safe plastics, see polyester, polypropylene, polyvinyl acetate, and acrylic.

Appendix 4

Incoming/Outgoing Loan Form

(Department of the Interior 1993b: Chapter 5)

Loan number _____

Loan type _____

Short-term or Long-term loan _____

Purpose of Loan _____

Exhibit	Exhibit Preparation
Study	Curation
Conservation	Storage
Other	

Lender (incoming loans only)

Lender name (individual) or Lender name (institution)_____

_____

Lender address _____

Box or street _____

City _____ State _____ Zip _____

Country if other than the United States _____

Telephone number _____

Responsible official _____

Transactions dates

Date of loan agreement _____

Termination date of loan agreement _____

Initiation date of loan _____

Return date of loan _____

_____ _____

Signature and Title of Lender Signature and Title of Borrower

Objects and/or specimens in loan _____

Catalog number(s) _____

Item count _____

Object or specimen name _____

Description _____

Condition _____

Value _____

Credit line for lender _____

Insurance _____

Waived
To be carried by lender
To be carried by the Center
Certificate of insurance
Waiver of subrogation

Packing and shipping _____

_____

Incoming loan return status (partial or complete) _____

The following data categories for each transaction should be entered in the loan book or loan tracking system.

Incoming/outgoing loan number

Incoming/outgoing loan type

Lending unit name

Receiving unit name

Purpose of loan

Total number of objects and/or specimens in loan

Brief description of objects and/or specimens on loan

Initiation date of incoming loan

Termination date of loan

Loan return status (partial or complete)

Loan Data Definitions

Credit Line for Lender

Record the credit line exactly as it is to appear in exhibit graphics, publications, or other media identified in the loan agreement.

Date of Loan Agreement

The date on which the agreement was signed.

Loan Number

The incoming loan number is the unique number given to the transaction for accountability and tracking purposes. The loan transaction may be numbered sequentially by year and incoming loan transaction [e.g., 1992.5. breaks down into: 1992 (year).5 (transaction number)]. The object and/or specimen may be tracked individually by the year, transaction number and number within the transaction (e.g., 1992.5.2). Bureaus or units may want to add a transaction type indicator such as IL for incoming loan before the number (e.g., IL 1992.5).

Incoming Loan Return Status (Partial or Complete)

A partial return of the incoming loan should be indicated with the date and the catalog number(s) of objects and/or specimens returned listed. If the entire loan is returned, indicate the complete return of all archaeological collections to the Center.

Loan Type

The type indicates the agreed-upon duration and purpose of the loan, either short-term incoming loan or long-term loan transaction.

Initiation Date of Loan

Date on which the agreement went into effect.

Insurance

Indicate insurance coverage: to be waived, to be carried by lender with a certificate of insurance required either naming the Center as an additional insured or attaching a waiver of subrogation, or to be carried by the Center.

Lender Address

Include the box or street, city, state, zip, country if other than the United States, and telephone number for contact purposes.

Lender Name

Include the name of the individual, institution, or unit lending the archaeological material.

Objects and/or Specimens in Loan

Enter or attach a listing of objects and/or specimens in the loan, giving for each the lender's catalog number, item count [or other quantification (e.g., weight or linear feet)], object and/or specimen name, description, condition, and insurance value, if appropriate. Note: As an alternative to using the lender's catalog number, an incoming loan object or specimen number may be assigned. For example, the object or specimen may be tracked individually by the year, transaction number, and number within the transaction (e.g., IL 1992.5.2).

Packing and Shipping

Provide information on the shipper and packer, including addresses and special packing and shipping arrangements.

Purpose of Loan

Indicate the purpose of the loan (e.g., exhibit, study, conservation, exhibit preparation, curation, storage, or other).

Receiving Repository Address

Include the box or street, city, state, zip, and telephone number for contact purposes.

Receiving Repository Name

Enter the name of the individual, institution, or unit receiving archaeological material.

Responsible Official (Borrowing Institution)

Enter the name of the responsible individual or agent of the borrowing institution.

Responsible Center Official

Include the name of the responsible individual of the Center.

Return Date of Loan

Enter the date the loan was returned to the lender or the Center.

Termination Date of Incoming Loan

Enter the termination date of the loan or enter "indefinite."