

Disaster Recovery

Salvaging Photograph Collections



Photograph collections are susceptible to damage from catastrophic disasters of all types, including floods, fires, hurricanes, and tornadoes. In most such disasters, as well as in smaller emergencies, water damage is widespread—whether from leaking or burst pipes, flooding, or

firefighters' hoses—and photographs may be permanently disfigured. This technical bulletin focuses on procedures for responding to water emergencies. In all such emergencies, it is essential to first seek the advice of a photograph conservator with experience in salvaging water-damaged materials.

DISASTER PREPAREDNESS

The wide variety of ways to process photographs, as well as differing methods of mounting and presenting them, make prompt and informed attention crucial in the wake of a disaster. To minimize loss and destruction, a well-organized and efficient disaster recovery program must be in place.

A coordinated disaster planning effort that is reviewed and updated regularly is a



Collodion print portrait (c. 1900) adhered to glass following a flood.

first step in helping to protect an institution's staff, visitors, and the collections themselves. Disaster planning requires considerable staff time, as well as support from the administration. An emergency organizational chart specifying staff roles and responsibilities must be prepared and understood by all employees. Emergency supplies must be collected; necessary services and expertise must be identified and their availability confirmed; emergency mitigation procedures must be outlined; and cleanup materials such as plastic to cover collection materials, brooms, mops, soft brushes, squeegees, blotting papers, and paper toweling should be purchased and stored in centralized locations throughout the collections.

Photograph collections should be properly housed in individual enclosures and protective boxes or cabinetry and separated according to type (negatives should be separated from prints, glass plates from film base, etc.). Proper housing makes these materials less vulnerable to damage and can also facilitate salvage efforts. Storing similar materials together can save time and further help to define recovery priorities. The careful use of individual polyester, polypropylene, polyethylene, and paper enclosures will protect photographs from bleeding inks, severe staining, soot, and other damaging particulates. At all times, photographic materials must be housed at least 12 inches off the floor to help guard against unnecessary damage and destruction.

FLOODS, HURRICANES, TORNADOES, STORMS, AND LEAKING PIPES

RECOVERY OPTIONS

Water damage presents complicated challenges and often requires an immediate response. Damp or saturated photographic materials must be attended to within 48–72 hours. Mold grows after 48 hours in environmental conditions above 65% relative humidity and 70°F. During this time, photographic emulsions and binder layers may also soften and dissolve, and stacked photographs and/or photographs in albums may permanently adhere to each other.

A variety of recovery procedures, including air-drying, freezing, and vacuum freeze-drying, may be considered. An understanding of these techniques and their effect on photographic materials is essential.

Air-drying is most suitable for small numbers of damp or slightly damp materials. The air-drying method is the most gentle and potentially least damaging of all drying methods. However, air-drying of water-damaged photographic materials is extremely labor-intensive, can occupy substantial space, and, most important, requires considerable care and expertise.

Freezing to help retard further deterioration by water or mold may be necessary if the materials cannot be treated immediately. Storage at low temperatures buys time in which to safely plan and organize the many steps needed to dry the affected materials and to prepare a rehabilitation site. Collections should be packed into boxes and transported in refrigerated trucks to freezer facilities. Small quantities of materials may be successfully frozen in commercial freezer units.

Vacuum freeze-drying may be a preferable alternative in some situations. In this method, photographic materials—either wet or frozen—are placed in a vacuum chamber. As the vacuum is pulled, a low heat source is introduced and the photographs are carefully dried at temperatures below freezing. Completion of the drying process may take two weeks or

more. Rehumidification of affected material following drying is required to prevent embrittlement.

Freeze-drying may irreversibly alter a photograph's surface character, creating a mottled and imperfect surface. Therefore, freeze-drying is not appropriate for photograph collections of high aesthetic or artifactual value. Surface damage from freeze-drying, however, typically will not affect a negative's ability to be duplicated or copied successfully. Vacuum freeze-drying techniques may thus be especially useful for recovering large collections of sheet-film negatives. *Never freeze-dry wet collodion processes (including glass negatives, ambrotypes, and tintypes), as they may be destroyed.*

In all cases, vacuum thermal drying, in which photographic materials are dried in cycles of freezing and thawing or at temperatures slightly above freezing, must be strictly avoided.

Vacuum thermal drying carries a much greater risk of expansion, distortion, adhesion of print surfaces, and staining.

SPECIAL CONSIDERATIONS AND SALVAGE PRIORITIES

Resistance of photographic materials to water damage depends upon the type of photograph and its physical condition, the extent of handling during recovery operations, total immersion time, and water temperature and pH.

In general, black-and-white photographic prints appear more resistant to water damage than contemporary color materials. Photographic film-base negatives in good condition are less likely to deteriorate than print materials. Some photographic materials (such as salted paper, albumen, platinum, cyanotype, and most photomechanical processes) can survive water immersion for 48 hours or more, whereas others are irrecoverable. All things being equal (this is rarely the case), it may be advisable to salvage prints prior to negatives and color materials prior to black-and-white.

Deteriorated nitrate and safety films are extremely susceptible to water damage, and in many situations will not survive immersion of any duration. The image-bearing gelatin binders on deteriorated nitrate films, for example, may be immediately dissolved, leaving the discolored nitrate film support intact. Acetate films will become further distorted, in some

cases trapping water within the film's layered structure.

Following immersion, antihalation dyes in both nitrate and acetate sheet film may bleed severely, and may irreparably stain adjacent and absorbent print materials. These dyes, which are incorporated into the gelatin layer on the reverse side of the film base and are often blue or pink in color, may significantly intensify following prolonged immersion. Regeneration of these dyes appears to be directly influenced by the water's acidity level.

Contemporary dye imbibition (absorption) color processes such as dye transfer; wet collodion processes including ambrotypes and tintypes; and early additive color processes including autochromes will also be irreversibly damaged following immersion and are best protected by eliminating the threat of water damage. These materials should be stored in rigid polypropylene containers, polyethylene bags, or watertight cabinetry.

Similarly, stabilized black-and-white prints must be protected from water damage. Stabilization processing, introduced in the 1940s, shortens processing time for contemporary black-and-white print materials by eliminating the fixing and washing stages of conventional processing. Rapid-access processing has been used for industrial, military, and scientific applications, as well as in advertising, document reproduction, and newspaper production. Stabilized or rapid-access prints are likely to be found in newspaper or business archives and may be identified by a faded silver image, often appearing brown or brown-black in color with discolored and degraded highlights and a characteristic brown staining at the reverse outer edge.

Following prolonged immersion in water, stabilized or rapid-access prints may begin to print out (turning pink in color) as they are air-dried and exposed to ambient light.

INITIAL STEPS

Before beginning any salvage operation, appropriate staff members should be alerted and a recovery team coordinator appointed. **Throughout the salvage effort, team members should be acutely aware of personal safety; respirators, protective gloves, boots, and hard hats should be worn when necessary.** Team members should be explicitly trained in the care and handling of water-soaked photographic materials; improper handling of wet, sodden, and/or soot-covered materials can result in extensive damage. Moreover, personnel should be instructed to always emphasize care over speed. As stated earlier, professional conservation advice should be sought before any recovery action is undertaken.

While awaiting permission to reenter the affected building, supplies must be assembled, a work site established, and service vendors contacted. Following reentry, an initial assessment of damage should identify the size, type, and condition of the photographic collections affected.

Once the damage has been assessed, specific plans and priorities for salvage should be developed as quickly as possible. Avoid devoting too much time initially to a small group of items at the expense of the photograph collection as a whole. In addition, incomplete appraisal of damage can result in the destruction of photographic materials as well as in unnecessary confusion

during recovery operations. Careful planning must be directed to ensuring the most appropriate, safe, and efficient recovery procedures.

During this assessment, collections should be removed from shelves and examined. Affected collection materials must be carefully relocated to a controlled and clean environment. Clear all entrances and aisles of collection materials first. Attempts should be made to recover the maximum number of materials in a manner that will minimize the need for further conservation treatment.

Documentation procedures should be followed for accurately recording the extent of damage, especially for destroyed materials. A detailed written and photographic record should be made for insurance purposes.

In the event of widespread damage, salvage priorities must be identified based on media type, value, and extent of damage (see previous section on "Special Considerations and Salvage Priorities"). It is vital that such priorities be established during the disaster planning process. Informed and proper decisions about the relative value and importance of collection materials should not be made in haste. **The importance of careful planning cannot be overemphasized.**

Where possible, the relative humidity within the affected space should be reduced and air circulation increased. Constant air flow is necessary to reduce the threat of mold. Turn off the heat, open windows and doors, and use dehumidifiers and fans. It may be necessary to install portable generators.

Materials to be air-dried should be systematically packed in numbered and reinforced cardboard boxes or plastic crates (indicating type or condition of contents) and transported to a clean, uncluttered work space. "Human chains" can be used to efficiently move affected materials. To avoid unnecessary damage, do not remove wet materials in large batches.

Materials to be frozen should be wrapped in or interleaved with wax paper, carefully packed into sturdy boxes, and removed to refrigerator trucks or directly to freezers. Rare or unusually valuable materials should be prepared for freezing separately, so that they can be readily located and identified prior to drying. Wet photographic materials must not be packed too tightly or distortion may result.



Conservation Center staff triaging the emergency treatment of a photographic archives collection damaged in a basement flood.

AIR-DRYING: GENERAL RECOMMENDATIONS

If possible, damp or water-soaked historic and contemporary photographic materials should be air-dried. In air-drying, the following precautions and guidelines must be followed:

- To minimize the effects of water damage, keep immersion time to an absolute minimum. Some photographic materials will not survive immersion of any kind.
- Treat least-stable items first. If possible, color and black-and-white photographic prints should be salvaged first. In the case of mixed collections, this may not be practical. Important exceptions include deteriorated nitrate and acetate films. These materials are extremely susceptible to water damage and, in many situations, will not survive unless recovered immediately.
- Keep identifying information (labeled enclosures and sleeves) in close association with materials being salvaged. Maintain strict control over the collection to ensure that important information is not lost.
- Keep photographic materials wet until they have been separated from filing enclosures and from each other. Never allow photographic materials to dry in contact with another surface, as they may stick permanently. To maintain wetness until the drying process takes place, pack photographs inside plastic garbage pails or boxes lined with garbage bags filled with cold, clean water. Do not allow photographic materials to remain immersed in water for longer than 48 hours. **If photographs are stuck together, do not pull them apart. Freeze these materials until they can be examined by a photograph conservator.**
- Gently rinse photographs in a tray of cool, clean water if they are covered with dirt and grime. A soft brush or dampened cotton balls may be used to assist with the cleaning process. Carefully monitor the condition of the photographs to ensure that binder layers and original ink notations are not being damaged. Do not wash or expose glass plate negatives to further moisture. Special care must be taken with swollen gelatin binder layers and photographs that exhibit separating or flaking of the layers. These surfaces



Water stains on
an albumen print
(c. 1850).

must not be touched or handled in any way. Similarly, some processes, including collodion chloride, platinum, and glossy silver-dye bleach papers, are very susceptible to damage from abrasion. In these situations, it may be possible to locally reduce embedded dirt and grime with dampened cotton swabs after the water-damaged artifacts have dried completely. **This work is not time sensitive and should be conducted by a photograph conservator after the initial recovery effort is complete.**

- Drain excess moisture off photographic prints. Be extremely careful, as severely swollen binder layers (image-bearing layers) can be seriously damaged. Water-soaked gelatin binder layers must never be blotted directly with blotters, paper toweling, or newsprint. Rather, wherever possible, polyester web should be placed gently on the water-soaked surface between the photograph and the absorbent paper. Modern black-and-white and color prints may be carefully squeegeed to remove excess moisture. In so doing, the photograph's binder layer should be placed in contact with a clear, clean acrylic sheet. Blotting and squeegeeing should be avoided if the photograph's binder layer is severely swollen or tacky.
- Place photographs emulsion side up on clean blotting paper, paper toweling, unprinted newsprint, or nylon mesh screening. A polyester web interlayer should be used between the photograph and absorbent materials whenever possible.
- Dry print materials horizontally in small sections (16 x 20 inches) so that the drying supports may be easily changed when necessary. Arrangement and organization are essential to ensure that damp items do not drip on those that are almost dry.

- Replace drying supports as they become damp. Photographs can be stacked once their surfaces are semi-dry and no longer tacky, swollen, or soft.
- Unframe photographs immediately. Carefully lift off the glazing away from the photograph's surface. Check to be sure the photograph is not adhered to the glass. If the photograph appears to be stuck to the glass, do not attempt to remove it from the frame. Instead, dry it intact with the glass side down, and contact a photograph conservator for further assistance as soon as possible.
- Unmounted and mounted photographic prints may curl, cockle, and/or warp severely following air-drying. Distorted resin-coated papers, for example, may be especially difficult to flatten successfully. In some cases, these materials can be gently rehumidified and flattened between polyester web and blotters and under glass and weights. **This work is not time sensitive and can be successfully conducted later in the recovery process. The supervision of a photograph conservator is required.**

AIR-DRYING: RECOMMENDATIONS FOR SELECTED MATERIALS

- Gently open cased objects, including daguerreotypes, ambrotypes, and tintypes, and place face up on an absorbent surface. Do not attempt to disassemble the components, remove debris, or wash these photographs. If the affected object has water or dirt trapped within the assemblage, contact a conservator for proper disassembly. Do not freeze or freeze-dry these materials.

- Albumen prints can be safely air-dried following immersion in water. However, the albumen binder layer may crack or craze upon drying. It may be possible to mitigate against cracking and crazing through slow and carefully supervised drying techniques—an uncommon luxury in any disaster situation. Chocolate mounts, a highly calendered, burgundy-colored paper mount popularly used with double-weight albumen prints in the mid-1880s, will immediately bleed red following immersion. Unmounted albumen prints will curl dramatically as they dry, and will subsequently require humidification and flattening. Ideally, these materials should be lightly restrained during drying to prevent excessive planar distortion. A dampened albumen binder is unlikely to adhere to adjacent surfaces, but precautions must always be taken (using polyester web interlayer) to prevent damage.
- Carefully unbind and open water-soaked lantern slides by removing paper tapes at the outer edges and lifting the cover glass away from the image glass. Keep labels and identifying materials in close association with the positive transparency. Place these materials on absorbent paper and dry emulsion side up. Identifying the emulsion side may be difficult when the lantern slide is wet (when dry, the emulsion side is dull, whereas the base or glass side is reflective). In such situations, these images, like gelatin dry plates, should be propped up on their long edge to increase air flow and ensure that they are not damaged by accidental adhesion to the drying supports. Owing to their vulnerability, these materials must be carefully guarded from potential physical damage caused by careless handling. If moisture is not trapped within the lantern slide, immediate unbinding may not be necessary.
- Positive color transparencies may be air-dried in their cardboard and plastic mounts. The adhesives and colored papers in many cardboard slide mounts, however, may swell and dissolve with prolonged water immersion, staining adjacent materials. Warped mounts should be replaced following drying. Color transparencies that have been separated from their mounts may be air-dried by hanging them vertically on a plastic or rope line, suspended with an elongated and noncorrosive paper clip. Glass-mounted slides must be disassembled prior to air-drying. If it is not possible to air-dry these materials immediately, they can be placed in tightly sealed polyethylene bags filled with clean, cold water (ideally, distilled or deionized). Prolonged immersion may have a direct impact on cyan dye stability. Some color transparencies may require a poststabilization treatment following recovery. Consult a photograph conservator for specific recommendations. Large collections of damaged positive color transparencies should be frozen or freeze-dried.
- Collodion-chloride prints from the turn of the 20th century will survive air-drying in relatively good condition. Collodion does not swell in water, and these print materials can therefore withstand prolonged immersion. As with many water-soaked materials, however, disfiguring staining on the mount and/or on the photograph's primary support may result. Collodion surfaces may be abraded by direct contact with particulates in flood waters. Fissuring in the collodion binder may allow water to migrate into the paper, causing staining and further damage.
- Sheet-film negatives should be dried vertically on a plastic or rope line. Plastic clips should be placed at the outer edges of the film, taking care not to use binder clips or other clips that will leave indentation marks. Vertical drying ensures that the negatives will not adhere to drying supports and also maximizes space. All films should be oriented in the same direction. Orientation of the notch code differentiates the base and emulsion—the notch code is located at the upper right when the emulsion is facing the viewer. A system should be devised for keeping track of important identifying information often found on the negatives' enclosures.

objects, and gelatin dry plate negatives on glass supports, cannot be safely frozen.

If possible, prior to freezing, gently rinse materials in clean, cold water to remove surface dirt and grime. Once rinsed, collection materials should be placed in tightly sealed polyethylene bags. Where possible, photographic materials should be interleaved with wax paper to prevent sticking during future recovery operations.

As time permits, frozen photographs can be systematically thawed and air-dried following the precautions and guidelines outlined previously in this bulletin. Alternatively, these materials may be freeze-dried in a vacuum chamber at or below 0°C.

SUMMARY OF RECOVERY METHODS FOR WATER-DAMAGED PHOTOGRAPHIC MATERIALS

Cased photographs

Do not disassemble case. Open case and air-dry. Do not freeze.

Photographic prints

Separate photographs from enclosures and keep them in order. Rinse in cool, clean water if dirty. Air-dry, face up, on absorbent surfaces. Do not touch surfaces with hands. Large collections can be frozen by placing them in polyethylene bags interleaved with wax paper.

Photographic negatives and positives on glass

Separate from enclosures and air-dry immediately. Do not freeze any collodion-based processes. Lantern slides must be separated prior to air-drying.

Photographic negatives on film

If time and personnel are available, separate negatives and air-dry. Dry negatives vertically. Place clips at margins. Do not allow these emulsions to come in contact with other materials unless the negatives are being frozen.

Film-based negatives and positives

Air-dry, freeze, or freeze-dry. Glass-mounted slides must be disassembled prior to air-drying. Some processes may require poststabilization treatment. Consult a photograph conservator.

FREEZING: RECOMMENDATIONS AND PRECAUTIONS

Freezing of water-soaked photographic materials retards deterioration and allows time to prepare for further salvage efforts. **Some photographic materials, including wet collodion processes, cased**

FIRE, EXPLOSIONS, AND SOOT

SMOKE AND SOOT DAMAGE

The intense heat of a fire can seriously damage photographic materials. Plastic supports become deformed, emulsion becomes embrittled, and paper supports are stained by soot and smoke. Charred photographic materials should be carefully sleeved and boxed prior to evaluation by a photograph conservator.

It is very difficult to safely remove smoke and soot deposits from photographic surfaces. **All cleaning procedures must be developed and carefully supervised by a photograph conservator.** In so doing, it may be possible to reduce soot and dirt and to locally minimize discoloration and staining.

PROFESSIONAL EDUCATION

TRAINING AND PROFESSIONAL DEVELOPMENT

Knowledge and familiarity with disaster recovery techniques can be gained through training and educational seminars. Photograph conservators and allied professionals—those who are ultimately responsible for disaster response and recovery operations—are encouraged to compile and share anecdotal and firsthand experience, to organize and participate in salvage workshops, and to promote scientific research into recovery methodologies.

RECOVERY METHODS FOR WATER-DAMAGED PHOTOGRAPHS

Cased Photographs

Daguerreotypes	●	
Ambrotypes	●	
Tintypes	●	

Silver Prints

Salt Prints	●	■
Albumen	●	■
Collodion	●	■
Gelatin POP ^a	●	■
Gelatin DOP ^b	●	■
Resin-coated	●	■

Nonsilver Prints

Platinum	●	■
Cyanotype	●	■
Gum bichromate	●	■

Color Prints

Chromogenic	●	■
Silver dye-bleach	●	■
Dye diffusion-transfer	●	■
Dye-imbibition	●	■

Glass-based negatives and positives

Collodion wet plates	●	
Gelatin dry plates	●	
Autochromes	●	
Lantern slides	●	

Film-based negatives and positives

Nitrate	●	■	▲
Acetate	●	■	▲
Polyester	●	■	▲
Transparencies	●	■	▲

● **Air-dry.**

■ **Freeze, follow by air-dry.**

▲ **Vacuum freeze-dry.**

Note: Chart ranks drying methods left to right from preferred (●) to acceptable (▲). Blank spaces indicate method is not acceptable.

a. POP, printing-out process.

b. DOP, developed-out process.

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These general recommendations are intended to provide practical guidance in the recovery of water-damaged objects. The recommendations are intended as guidance only, and CCAHA does not assume responsibility or liability for any resulting treatment of water-damaged objects.