Care & Storage of Works of Art on Paper

CHARLES A.E. BRANDT
Chief Conservator
Artistic and Historic Works on Paper
Provincial Archives of Manitoba

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We are here because we are concerned about the materials of our civilization. We wish to preserve them. Museums, galleries, and to a certain degree archives, exhibit these materials. All of us house them. Our great concern is that they be preserved. This concern to preserve the materials of our civilization places a grave responsibility on us – a responsibility for the future of humanity.

I work at an archives. An archives is a form of museum. At the Provincial Archives of Manitoba we house priceless materials: The Hudson's Bay Company Archives with materials dating back to 1670; the Mss letters of Louis Riel; some of the Walter Phillips coloured woodcut prints; works of art by Musgrove, Lynn and Rindisbacher; the Hime Photographs; Public Records of the Government; and film and audio-visual material. Sometimes we exhibit. Usually our clients want to observe and study particular paper artifacts at their leisure. It is frightening to know that all of these materials are subject to deterioration.

At a 1969 conference, sponsored by the Graduate School of the University of Chicago, on the subject "Deterioration and Preservation of Library Materials", Edwin Williams of Harvard stated, "Everything in library collections was deteriorating yesterday, is deteriorating today, and will continue to deteriorate tomorrow."[1] This is true of the materials we house in our institutions. We can slow this process down, however, we can never totally halt it (unless we put everything into a deep freeze in total darkness). The forces which destroy these materials of our civilization to a great extent leave our houses and buildings intact. However, they seem to have a very keen appetite for the more important products of modern civilization.

A conservator has a very unique vocation: to slow down this process of deterioration as much as possible. Without question, the most important function of our profession is to practice preventative conservation–something we can all share. As Chief Conservator, Artistic and Historic Works on Paper, Provincial Archives of Manitoba, I am currently setting up a paper conservation laboratory to care for archival materials, books, works of art on paper, and eventually film and audio-visual materials. My principle work is to prevent, as far as I am able, these forces of destruction from gradually destroying these materials of our civilization which are contained in the Archives. Hopefully, in the not too distant future, the Manitoba Heritage Conservation Centre will be established in our province. With Federal and Provincial assistance, this Centre will reach out to all of the museums, galleries, archives, and libraries in the province to assist them in the work of preservation and conservation of their important materials.

This spring I did a study-tour of various archives, museums, galleries, and conservation laboratories in the Philadelphia and Washington areas. This tour was funded in part by a grant from the Canadian Museums Association and by assistance from the Provincial Archives of Manitoba. At the Library of Congress, Peter Waters, the Restoration Officer, spoke of a conference in December 1976 at his institution. The purpose of the conference was to assess and evaluate the most pressing needs of the preservation community. The conference was primarily concerned with the preservation of paper materials. Materials printed prior to the 19th century are generally in reasonably good condition. Those materials published since 1800 (especially printed books) are now reaching advanced stages of embrittlement and deterioration. Materials published today, as well as in the foreseeable future, are being produced on paper which is no better than the book paper of the past century, and in some cases, worse. The collections of the Library of Congress now include ap-

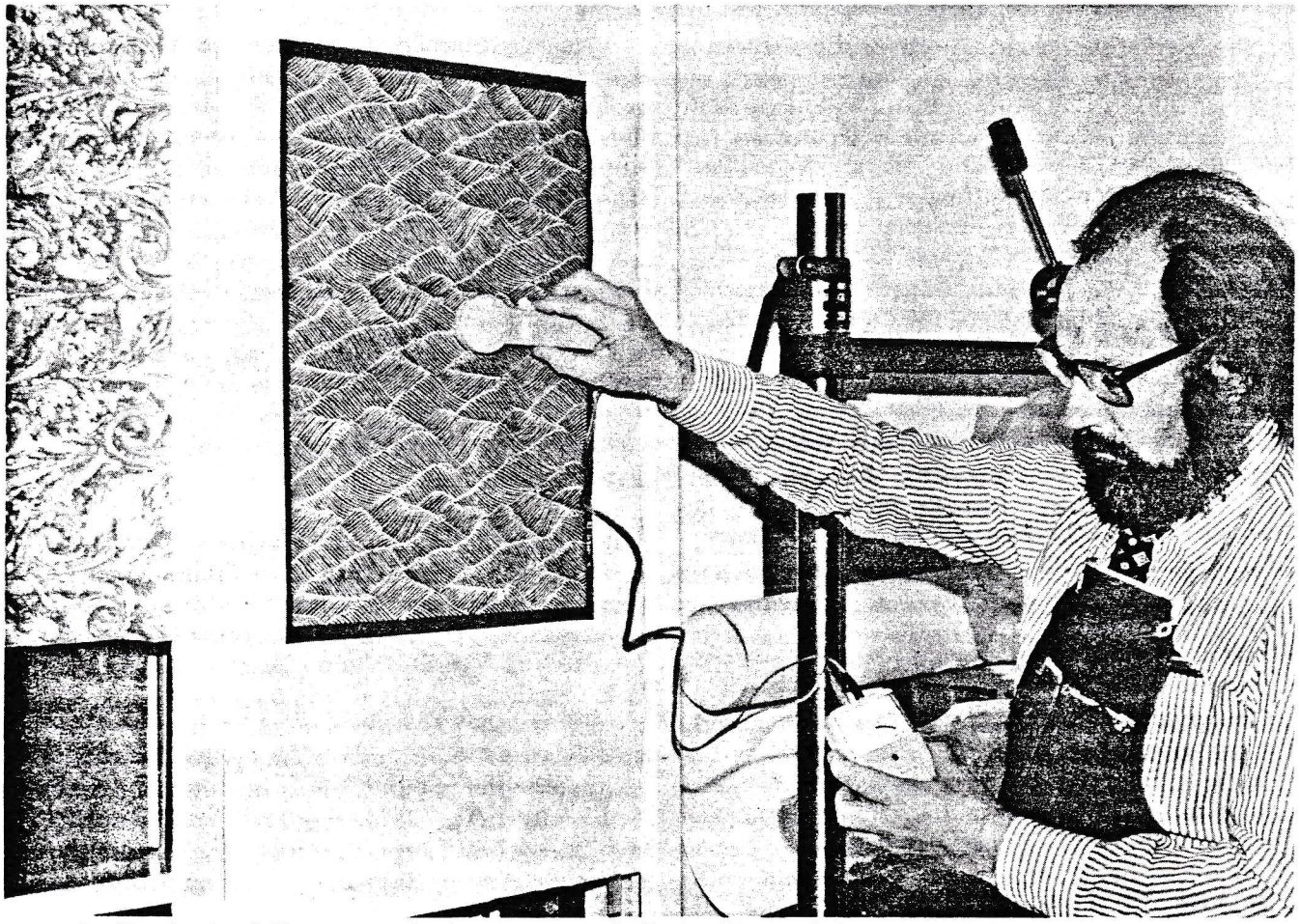
proximately six million volumes which are so brittle they can only be preserved through microfilming. Because of their brittleness, they cannot be distributed for use. Some 60,000 of these have been specifically identified and are being filmed at the rate of 20,000 volumes per year. Mr. Waters stated that they are not able to keep up to the demand. While they are filming the 20,000 volumes, more are reaching the brittle, critical stage. At the present time, there is no fully-tested, feasible method for mass conservation treatment (deacidification and alkaline buffering) of such materials. Even if such a process did exist, it would benefit no more than 65% of the brittle books in library collections, since deacidification does not restore strength to paper already embrittled. There appears to be only two feasible preservation procedures for such brittle documents: 1) low temperature storage, and 2) microfilming to preserve the intellectual content.

Low Temperature Storage

This procedure refers to storage at low temperatures in warehouse-type structures or in underground caves where optimum temperature and humidity can be maintained. Paper scientists generally agree that for every 10 degrees Celsius the storage temperature is reduced, the life of the paper can be approximately doubled.

Microfilming to Preserve the Intellectual Content

Microfilming is far less expensive than restoring a book. In 1976, it cost $25 to microfilm the average 300-page volume. Microfilming is more expensive than low-temperature storage. There is, as I shall discuss later, some question of the life expectancy of microfilm. Our experience with microfilm is limited to some 50 years or less, while our experience with paper goes back nearly 2,000 years. Ideally, the solution to the problem of preserving brittle and deteriorating books and documents would be to provide low temperature storage for all such materials. The Newberry Research Library's new storage facility will be at a temperature between 55-60° F. The Provincial Archives of Manitoba is considering a temperature of 60° F (±3°) for archival storage in its present renovation planning. The Library of Congress is emphasizing microfilming of the brittle materials published during the last



Measuring illumination falling on a work of art by means of a Panlux Electronic Luxmeter *Provincial Archives of Manitoba*

century, with storage of the master microfilm negatives under ideal environmental conditions. The Library of Congress also proposes that low temperature storage facilities be provided for books.

During this study tour, I also visited the National Archives of the United States. The National Archives is greatly concerned about the lasting quality (permanency) of microfilm. In 1981, a press release[3] was issued that stated that under the direction of Dr. Robert M. Warner, Archivist of the United States, the National Archives and Records Service has undertaken a comprehensive reassessment of microfilming as a preservation technique. An 18-member Archives' Committee on Preservation, headed by Dr. Norbert Baer of the New York Institute of Fine Arts, has established a sub-committee to study alternative forms of copying and their durability. Under a National Archives contract, Coulter Systems of Bedford, Mass., is surveying transparent electro-photography (TEP) as an archival storage medium. A National Archives periodic inspection of a representative sample of its vast microfilm holdings of 750,000 rolls is underway. A small but significant amount was found to have reduction and oxidation blemishes (also known as "redoc" blemishes or "measles"). These spots, microscopic in size, are sometimes found on microfilm stored in less-than-ideal environments. Dr. Warner points out that the bulk of our most historically-significant documentation has survived under conditions that would jeopardize the life of microfilm. Before placing full reliance on microfilm, or any other non-paper medium, Dr. Warner feels that we need to be certain that it will save money and more important, that it will outlast the paper.[4] It is clear from this that archivists will ponder a long time before they recommend destruction of original records.

To understand why this deterioration is taking place we must understand something about the nature of paper itself. There are many examples of brittle paper, paper so degraded that one cannot turn a corner of a page without it breaking off. If it is a book, it cannot be rebound. It can no longer be distributed for research or study purposes. Such paper is no longer permanent or durable. "Permanence is the degree to which a paper resists chemical action which may result from impurities in the paper itself or agents from the surrounding site. Durability is the degree to which paper retains its original qualities under continual usage."[5]

Paper, as far as we can determine, was invented by Ts'ai Lun at the Court of the Chinese Emperor in the year 105 A.D. He is said to have made it from macerated tree bark, hemp waste, old rags and fishnets.[6] Most of the older papers were made from plant fibres. Modern papers are made almost exclusively from wood fibres. Since paper fibres are organic materials, they are subject to deterioration. Paper made from such fibres can last for hundreds of years if properly stored in the right environmental climate. We think of the 12th to the 19th centuries as the period of good paper. I have examined paper from the 13th century in Germany and found it to be in almost perfect condition. During this period the paper was strong and durable. It was not until the late 17th century that Alum (which breaks down to form acid) was introduced into the making of paper to harden the sizing. Modern paper, with the exception of some of the permanent/durable acid-free papers which are being manufactured, have an expected useful life of less than 50 years (not that long if improperly stored). Later in this article we will be speaking about storage and its supreme importance.

CAUSES OF PAPER DETERIORATION

Acidity

This is primarily due to the alum-rosin sizing used in paper making. The alum is introduced to precipitate the rosin size. The size prevents the inks from feathering. Alum, however, eventually breaks down and one of its side products is sulphuric acid. The formation of this acid is accelerated by high temperatures and high relative humidity. Most papers manufactured today contain this alum-rosin sizing. The acid in paper acts as a catalyst to bring about the hydrolysis of the cellulose fibre and leads to a decrease in the length of the polymeric chain molecule through random scisson of the chains. The strength of the fibre is decreased so that the fibre becomes weak and brittle and is finally reduced to a powder.

Use of Unpurified Wood Fibres (Groundwood)

One way of producing woodpulp paper is to grind the wood timbers down by the use of large grinding wheels. The fibres are consequently weaker (shorter) and lignin (a kind of glue that holds the fibres together) is left in the pulp and in the paper. Lignin degrades to form acid which brings about the acid-catalysed hydrolysis of the paper fibre. Lignin also makes the paper more susceptible to deterioration by light. The period from 1850-on is considered the "Era of Bad Paper", principally because during this time alum-rosin sizing and groundwood came into common use.

Pollutants

There are many harmful gases in the atmosphere such as sulphur dioxide, nitrogen dioxide, ozone, hydrogen sulphide, etc. Sulphur dioxide first forms sulphur trioxide which in turn reacts with moisture to form sulphuric acid. This reaction can occur within your paper artifact.

Invisible Ultraviolet Radiation

This light energy with its very short wave lengths can create havoc in paper. It can excite molecules, divide them, cause bleaching, and be altogether destructive. Natural sunlight entering your home or institution has a high content of this harmful radiation. Also, many fluorescent tubes emit ultraviolet radiation. In addition, it is not the UV emission alone that is harmful, but also the quantity of light that can be damaging. We will speak of this later when we discuss "Lux levels".

Microorganisms (Mould and Bacteria)

Every room is full of tiny fungal spores that could develop into mould (mildew) if humidity is roughly 65% and the temperature 75-80°F. Fungi feed on the nutrients in paper, causing it to weaken and discolour.

Insects and Rodents

Most of us probably have seen a book that has been gnawed by a mouse or rat, and are acquainted with the damage caused by certain insects that penetrate and feed on paper materials.

Human Beings

Many paper artifacts have deteriorated through careless usage. How often have you observed someone xeroxing a book, pressing down on the spine to get a good impression thereby damaging the structure of the book at the same time?

Having examined some of the causes of paper deterioration, we are in a better position to understand what we mean by **Preventative Conservation** and the steps that we can take to slow down the deterioration that is taking place. I think that it goes without saying that acid-catalysed hydrolysis of cellulose is our main concern. If we can use paper that has no acid in its initial construction (paper that is permanent and durable), and if we can control the temperature and humidity of our institutions and safeguard them against harmful light radiation, the acid-hydrolysis of paper (breakdown of the cellulose fibre) will occur at a much slower rate. This brings us to the **Arrhenius Equation**: *scientists agree that for every 10°C decrease in temperature the useful life of paper is approximately doubled.*[7] If the temperature of our storage or exhibit area is 31°C and we reduce it to 21°C, we will have increased the life expectancy of our paper by 100%. This is the best type of conservation that we can all practice – preventative! Research libraries today are considering lower temperatures for their storage areas. At the Newberry Library in Chicago, their new storage area has been designed with provision for temperatures ranging from 55 to 60°F. As mentioned, the Provincial Archives of Manitoba is considering a temperature of 60°F (±3°) for its storage areas. Along with temperature, relative humidity must be considered. Too high an RH hastens acid deterioration and leads to damage caused by mould and bacteria attacks. On the other hand, if the relative humidity is too low, paper artifacts become dry and will warp. A relative humidity of 40-50% is best for books; 45-55% for leather bindings; and 50-60% for vellum bindings.[8]

The ultimate means of providing proper temperature and relative humidity is through a well-designed central air conditioning system in which both temperature and relative humidity are rigidly controlled day and night, winter and summer, 24 hours a day, 365 days a year. Only the more fortunate museums will be able to achieve full environmental control. Smaller museums may be able to install portable humidifiers to increase the low indoor relative humidity during the dry months of winter. Dehumidifiers are extremely useful during the summer months. The most harmful aspect of relative humidity and temperature is what we call cycling: marked changes in temperature and relative humidity over a short length of time (during the day and night) or for extended periods. These changes result in internal stresses set up in the paper as it attempts to adjust to the changes. The best way to guard against this cycling is to first of all recognize when it is taking place, and then take steps to prevent it. This can be determined through monitoring devices that register the temperature and relative humidity. Some units are quite expensive; while others are very inexpensive but will give you a general indication.

To protect a collection against atmospheric pollutants requires some form of central air purification in which activated charcoal filters are utilized. Again, most small museums cannot afford such a system. Museums in rural areas have less pollutants to contend with. Care should be taken to keep windows closed. If possible, collections should be stored in containers that protect against the entrance of harmful pollutants. Dust particles carry with them the absorbed pollutants and therefore should be excluded from the building.

We have already mentioned the harm that light

can cause. Ultraviolet rays in sunlight and fluorescent lights promote the oxidation of cellulose and cause deterioration. Paper will last longer in the dark than in the light. Paper should be stored out of direct sunlight. Ultraviolet filters should be applied to fluorescent tubes and UV protective films can be applied to windows. Heavy draperies over windows will cut out harmful radiation.

Raymond H. Lafontaine is the author of **Technical Bulletin No. 5**, entitled *Environmental Norms for Canadian Museums, Art Galleries and Archives*[9], issued by the Canadian Conservation Institute. These norms are extremely useful and, reprinted with permission from **Technical Bulletin No. 5**, are as follows:

SECTION 1 — Temperature Requirements

1.1 The optimum temperature for exhibition and storage areas is 21°C, maintained year round with a daily fluctuation not to exceed ± 1.5°C.

1.2 The minimum acceptable temperature condition is a set point varying from 20°C to 25°C with a changeover rate of 1°C per month. The maximum permissible daily fluctuation is ± 1.5°C about the set point.

1.3 In many instances, the deterioration rate would be decreased at lower temperatures, however, the human comfort factor necessitates temperatures not lower than 20°C and not above 25°C.

1.4 Consideration must be given to those materials having special temperature requirements. For example, fur garments, animal skins and similar artifacts are best stored in a cold storage kept at 4°C ± 1°C, at the proper RH (see section 2) and with sufficient air circulation.

SECTION 2 — Relative Humidity Requirements

2.1 The optimum relative humidity condition for exhibitions and storage is a constant condition year round with a set point between 47% and 53% RH and with a daily fluctuation not to exceed ± 2%.

2.2 The minimum acceptable relative humidity set point for winter months is 38% and the maximum acceptable summer set point is 55%. Daily fluctuations should not exceed ± 3%. Occasional variations of as much as 5% are tolerable if these are the exception and not the rule. The set point changeover rate from winter to summer should be no faster than 5% a month.

SECTION 4 — Air Cleaning Requirements

4.1 The level of dust removal should be 95% of particles, 1 μm in diameter or larger and 50% particles between 0.5 and 1 μm in diameter.

4.2 If unusually high levels of gaseous pollutants such as sulphur dioxide, nitrogen dioxide, ozone and hydrogen sulphide exist where the institution is located, some form of central air purification should be considered. Alternately, portable activated charcoal filters can be installed in problem areas. Electrostatic air purifiers and precipitators should not be used since they can produce ozone.

SECTION 6 — Lighting Requirements

6.1 Light levels should not exceed 50 lux (5 foot-candles) on sensitive objects such as works of art on paper, parchment, textiles, watercolours, felt pen drawings and not exceed 150 lux (15 foot-candles) on paintings and polychromes. As much as 300 lux (30 foot-candles) is acceptable on insensitive objects such as most stone and bare metals. Areas other than the exhibition area can be illuminated at the discretion of the designer; however, it should be remembered that the public requires a gradual decrease in lighting in order to adjust to lower levels.

6.2 Both incandescent and fluorescent lighting systems can be used. The ultraviolet radiation emitted by fluorescent lamps should not exceed 75 μ watts/lumen; otherwise a U.V. filter sleeve or a U.V. absorbing diffuser will be required. In order to minimize colour distortion, fluorescent lamps should have a colour distortion, fluorescent lamps should have a colour-rendering index of at least 85.

6.3 High pressure mercury and sodium lamps should not be used in exhibition and storage areas of museums, art galleries and archives because of poor colour-rendering properties and/or high ultra-violet radiation emission.[10]

It has taken me some time to get to my principle topic: The Care and Storage of Works of Art on Paper. Actually we have been discussing preventative care and there now remains the discussion of storage of works on paper. Several years ago I participated, along with Ian Hodgkinson of Queen's University, in a lecture/workshop for artists/printmakers at the Nova Scotia School of Arts and Design in Halifax. I was extremely edified to see how concerned the printmakers were to execute their prints on permanent-durable paper and how susceptive they were to good principles concerning the care and storage of their prints. Later I spent a number of days at St. Michael's printmaking studio south of St. John's, Newfoundland. The printmakers there also were conscious of the need for printmaking papers of high quality.

Winnipeg has a long tradition of printmaking and printmakers. Brigdens employed well-known artists such as Bergman. Other artists taught and worked in such schools as the Western Academy of Art, Winnipeg School of Art, and St. John's Technical School where Walter J. Phillips taught and worked[11]. Musgrove and Fitzgerald worked in the city. Some of their works come through my small atelier at home where I do private conservation work on selective works of art on paper. I am always amazed when removing the acid backing from a Walter Phillips' coloured woodcut print to find that the oriental paper (often mistakenly called rice paper) on which he printed his works of art is still in remarkably sound condition. I attribute this mainly to the permanent durable qualities of this paper which has a long, strong fibre, no alum-rosin sizing, and has not been weakened through excessive bleaching. Bergman also used oriental paper for his coloured woodcut prints, but not exclusively. There is a noticeable difference in the condition of his prints which have been printed on oriental and non-oriental papers.

Which brings me to my first point on the care and storage of works of art on paper. If we want our works of art to last they must be executed on paper that is permanent and durable, and stored in folders and containers that are acid-free.

A number of companies today are supplying acid-free, permanent-durable papers. Buntin Gillies of Ottawa supplies Harumi museum mounting board[12], designed according to the specification of the National Gallery. This comes in various plys. I have been told that Alex Colville uses this paper in ¼ ply to do some of his art work. Some of the standard artists' and printmakers' paper from Europe are definitely on the acidic side (pH of 5 to 5.5), while some of the English and North American papers are neutral and even on the alkaline side. I have tested some of these in my lab and know this to be true. We also want to select a paper with a high Alpha-cellulose content. Such papers need not necessarily be rag or cotton inasmuch as some of the sulphite papers produced today meet this specification.

There are some properties that should be considered in selecting a good print or watercolour paper: there should be an absence of groundwood fibres, alum-rosin sizing, concentrations of iron/copper minerals, residual bleaching chemicals, and any acidic components that would produce a non-alkaline paper. For you to discover good permanent-durable papers it will be necessary to consult with chemists, manufacturers and paper conservators. Once you have selected your paper and executed a work of art on it, then it is necessary to exhibit and store the paper so that the permanent and durable properties are not diminished.

The purpose of matting a work of art is not just to provide an attractive border, but it is a means of providing proper protection, support and storage for the artifact. It is clear that the work of art should not be in contact with cardboard that is acidic, but rather acid-free. All materials within the mat should be acid-free, and this includes the materials that provide the hangers that attach the work of art to the back mat. If you are not doing your own matting, then it is essential that you discover exactly what materials your framer is using in his matting procedures. How often do we see a priceless print with a brown inner layer of the mat showing along the edge were the window has been cut and the brownish contamination on the print itself resulting from this acid core. It is unbelievable the materials and techniques that some matters and framers use: Filmoplast, pressure sensitive tape, masking tape, gluing the work of art directly to the window mat, and backing the work of art with acidic cardboard. In the Winnipeg area, I have especially noticed that a residual, yellowish type of cement (rubber?) was used in the past to secure a work of art. This adhesive is almost impossible to remove. Paper scientists at the Library of Congress are emphatic that Filmoplast should not be used to hang in any works of art on paper.

Little can be added to **The Care of Prints and Drawings with Notes on Matting, Framing and Storage** produced by the Restoration and Conservation Laboratory, National Gallery of Canada[13]. I quote parts of this pamphlet verbatim:

I MATTING A WORK OF ART ON PAPER

1) The print or drawing should be hinged to the back sheet (as shown in Figure 1) and not to the overthrow or "window" portion.

2) *The work can be secured to the back sheet of the mat by "T" or "pendant" hinges (as shown in Figure 2). Use two hinges at the top edge, cut from Japanese tissue, affixed with starch paste as the adhesive. In this way, the work is allowed to hang freely. Otherwise, wrinkles or cockling can result due to expansion or contraction of the work changes in relative humidity. Gummed cloth tape ¾" (1.9 cm) wide can be used for hinging very large works.* Never *use scotch tape or masking tape, as these deteriorate, cause permanent discolouration, and cannot be removed safely if required later.*

3) *When it is necessary to display the full paper support on which the print or drawing is executed, the floating method is used. The hinges, made of Japanese tissue or gummed cloth tape, are attached to the back of the work of art and then folded and attached to the back mat. To make it stronger the hinge can be reinforced with a strip of paper or cloth tape (Figure 3).*

4) *Another method for securing works of art to the back mat, is to use commercially-available photo corners. For larger works of art or works on a secondary support, heavier corners can be made out of the ¾" (1.9 cm) gummed cloth tape (Figure 4) or any acid-free paper, and cut to fit the work, thus avoiding future damage.*

5) *Dry-mount tissue must be avoided for hinging, because a high temperature is required for its application (dangerous to the work), and it is non-reversible.*

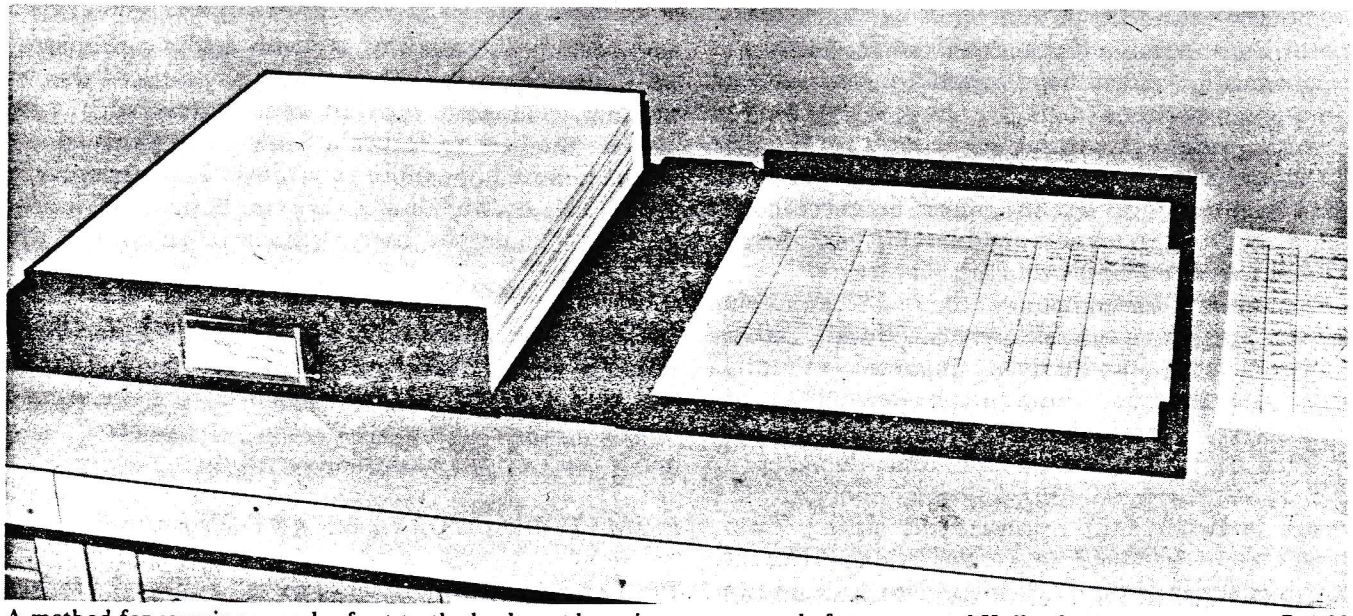
6) *The overthrow mat should be attached to the back sheet using 1" (2.5 cm) gummed cloth tape along the left margin (resembling a book, as shown in Figure 1).*

II STORING WORKS OF ART ON PAPER

1) *When storing a matted print, drawing or watercolour, insert a protective sheet of tissue paper cut to the full size of the mat, unless a Mylar "sandwich", mentioned in 1-6, is used. As an alternative, a sheet of clear uncoated 5 mil Mylar can be used as a protecting film. Round off each corner of the Mylar with scissors, as sharp corners can damage the surface of a work. Make sure only uncoated Mylar is used since some types of Mylar have a coating on one side for heat-sealing purposes.*

2) *Mylar or Plexiglas must not be used to protect charcoal drawings or pastels (fixed or unfixed) because pigment particles are drawn off the paper by the electrostatic charge continually present in plastic.*

3) *Store the matted works in heavy cardboard Solander boxes with hinged covers (Figure 5). When purchasing the Solander boxes, get assurances from the manufacturer that only neutral materials are used and that the interiors are lined with white acid-free paper. Storage in Solander boxes ensures that the works are kept from light, free of dust and scuffing. Acid-free cardboard folders can be used also for this purpose.*



A method for securing a work of art to the back mat by using corners made from gummed Holland tape *P.A.M.*

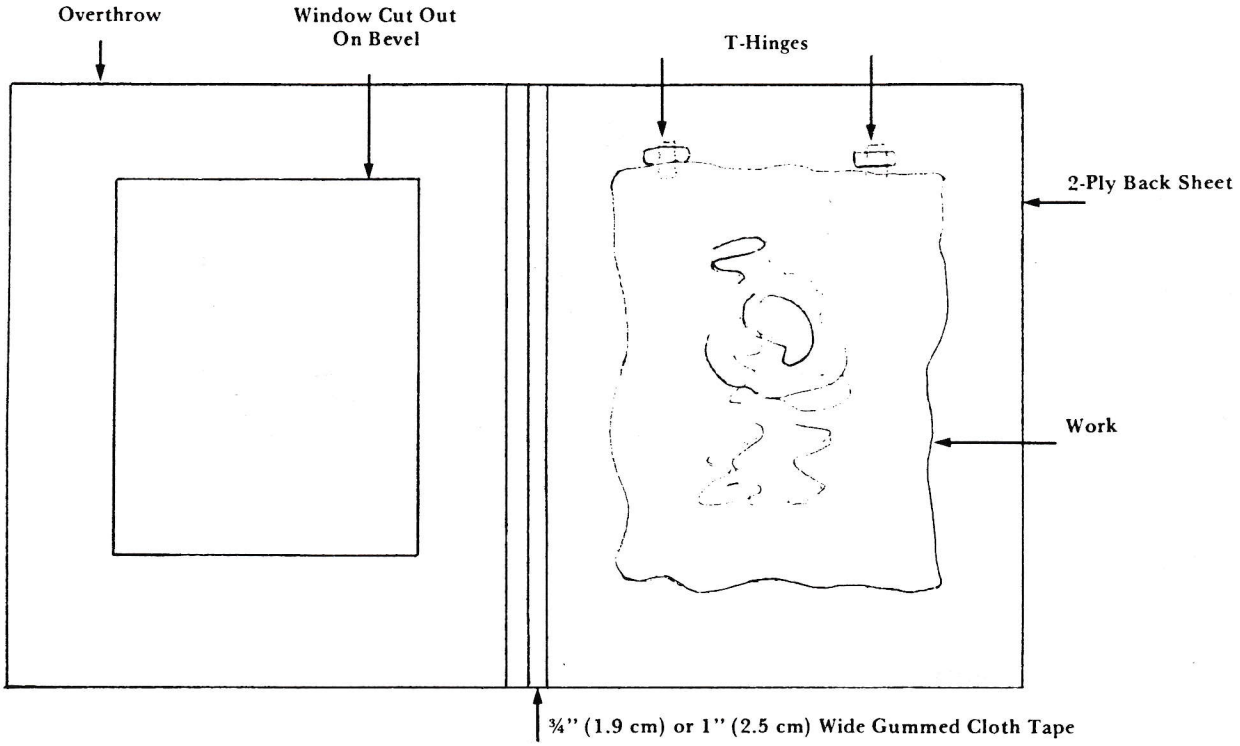


FIGURE 1 STANDARD MAT

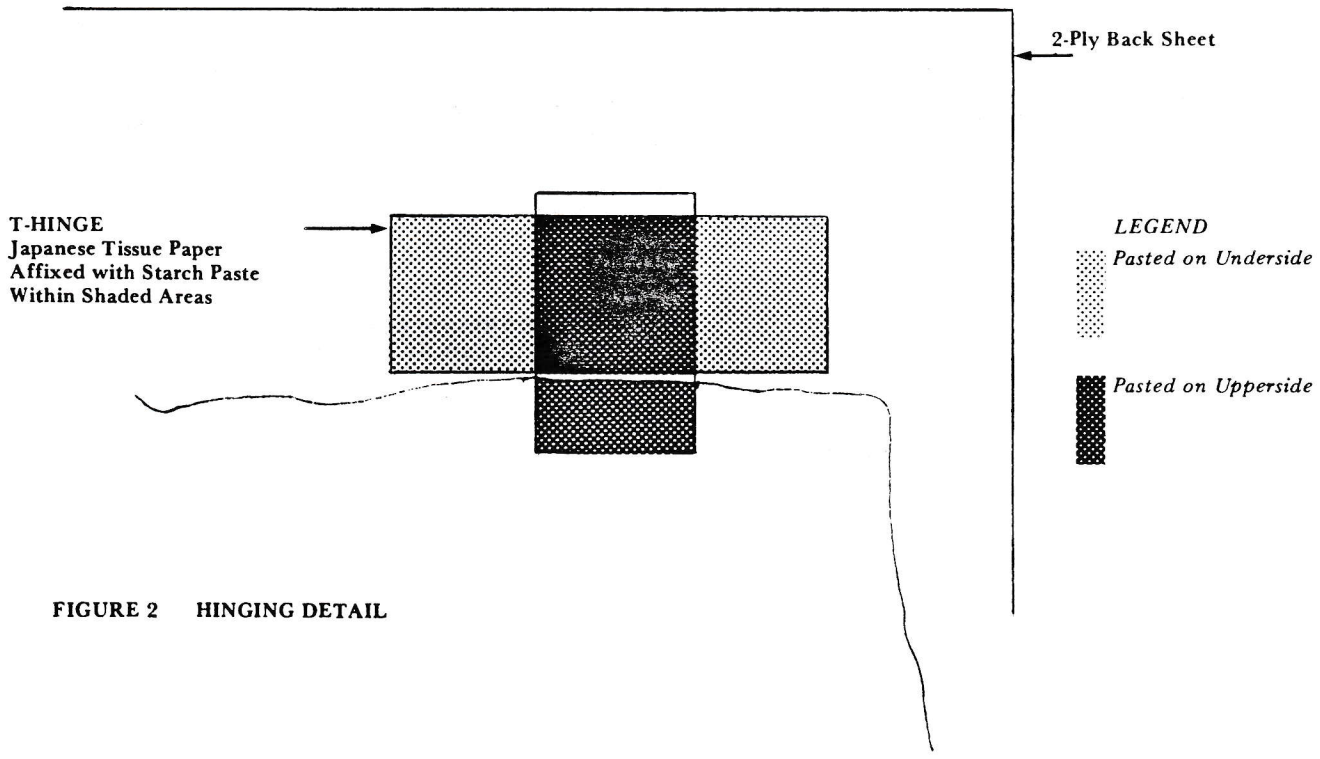


FIGURE 2 HINGING DETAIL

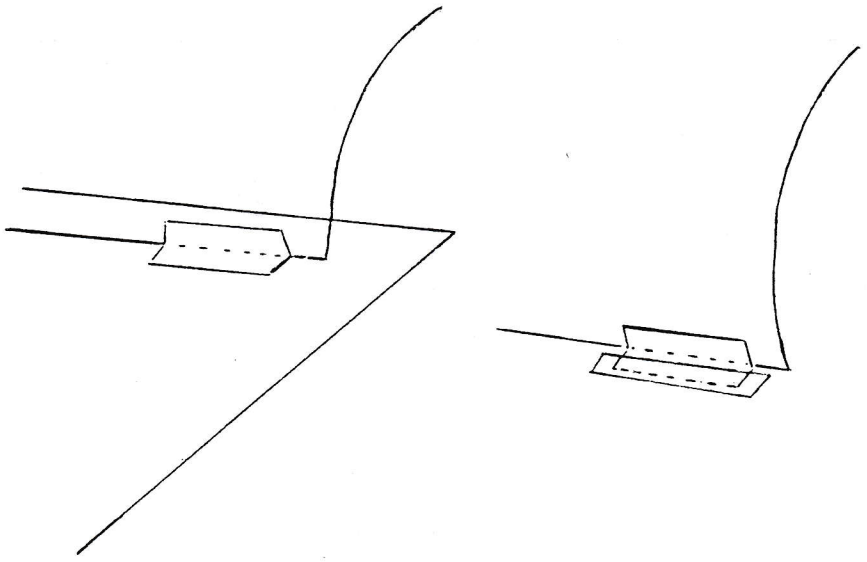
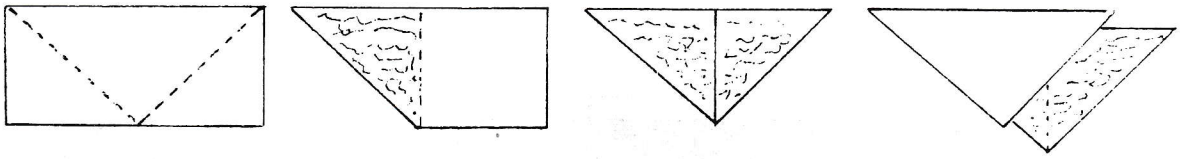


FIGURE 3 FOLDED HINGES



ADD TRIANGLE TO COVER
ONE GUMMED SIDE

FIGURE 4 CORNERS

III FRAMING

1) *Frame matted works under ultraviolet-filtering Plexiglas which helps to reduce the deteriorating effects of ultraviolet rays although it* **does not** *eliminate them completely.*

2) *Ultraviolet-filtering Plexiglas, because of its electrostatic effect, (as mentioned in II-2), must not be used over charcoal drawings or pastels. They should be framed under glass.*

3) *When shipping works of art framed under glass, make sure masking tape is placed over the glass in a grid pattern spaced not more than an inch apart horizontally and vertically. The tape will hold the glass in place, usually without damage to the work, if accidentally broken. (Plexiglas does not require masking tape nor should it be used, since it is difficult to remove).*

4) *As a backing, use a stiff, good-quality mounting board or corrugated plastic sheet. Corrugated cardboard, plywood or a wood panel should be avoided as a backing, since discolouration of the mat or work can occur.*

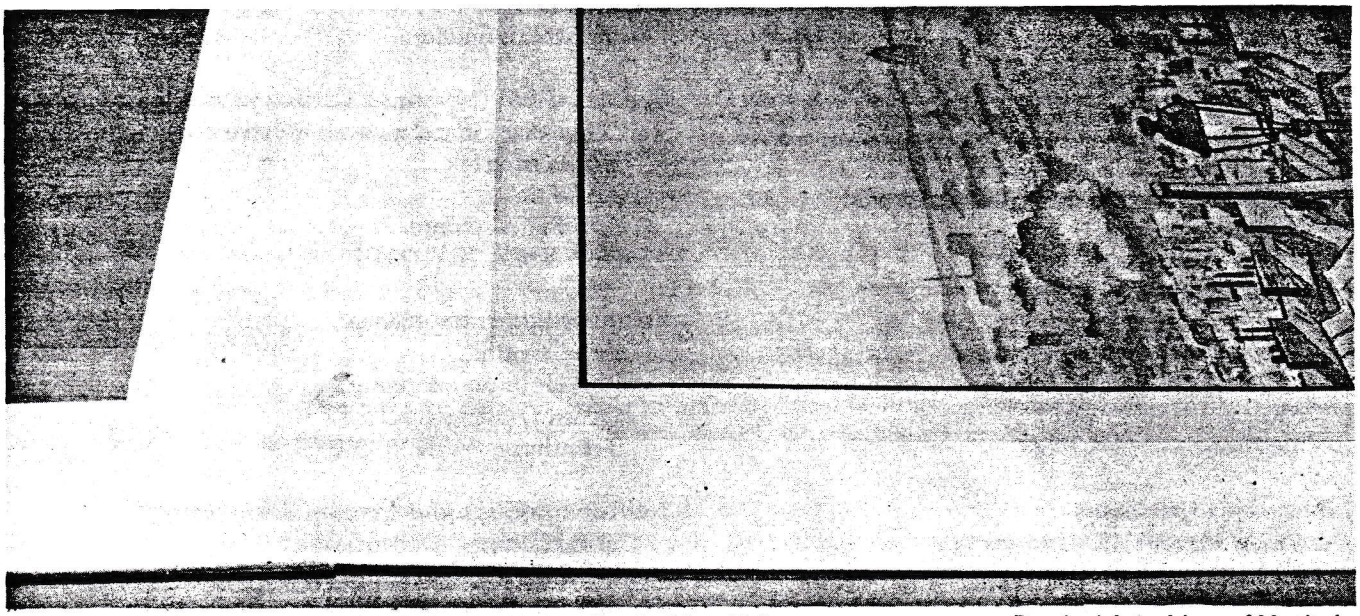
5) *Matted works having one dimension greater than 28 inches (71 cm) should not utilize metal frames for travelling. This type of frame is not sturdy enough to offer protection for larger works. Strong wood frames are recommended for larger sizes.*

IV THE ADVANTAGES OF STANDARD DIMENSIONS FOR MATTING AND FRAMING

1) *Works of art on paper in the National Gallery collections are matted in four standard sizes:*

Size One:
35.6 cm x 45.7 cm (14" x 18")
Size Two:
40.6 cm x 54.6 cm (16" x 21½")
Size Three:
55.9 cm x 71.1 cm (22" x 28")
Size Four:
71.1 cm x 91.4 cm (28" x 36")

These dimensions are standard for print and drawing departments throughout North America and England (with occasional deviation in Size Two). These matted works are stored in Solander boxes or folders which are made to conform to these four sizes. Once installed in reusable standard size frames, these matted works can be shipped in reusable slot crates. Oversized works requiring special mats are usually kept permanently framed for safe handling and storage.



Matted works of art properly stored in a Solander box lined with acid-free paper *Provincial Archives of Manitoba*

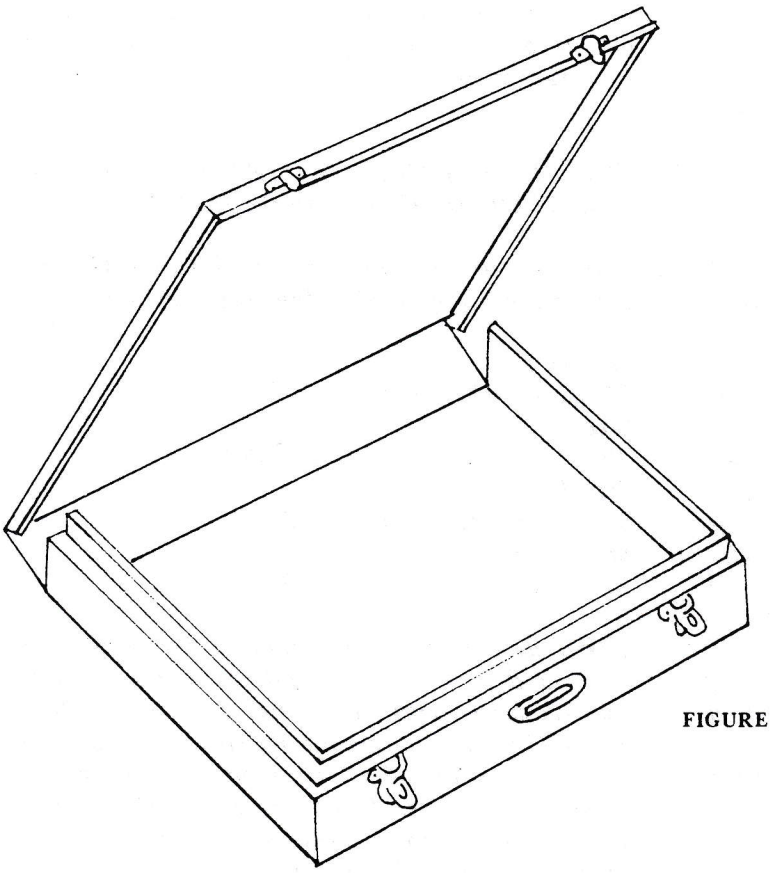


FIGURE 5 SOLANDER BOX

MATERIALS AND SUPPLIES

Cloth gummed tape for hinging*
1 inch (2.5 cm) widths in 100 yd. (91.4m) rolls
TALAS
130 Fifth Avenue
New York, N.Y. 10011

Recent tests have shown that this tape becomes more acidic with age and that the adhesive is subject to discolouration. It does, however, remain the most acceptable of commercially-available products.

Japanese paper and other useful materials
TALAS
130 Fifth Avenue
New York, N.Y. 10011

Aiko's Art Materials Import
714 North Wabash Avenue
Chicago, Illinois 60611
Telephone – 943-0745

Interleaving tissue paper
Process Materials Corporation
329 Veterans Boulevard
Carlstadt, New Jersey 07072

Mylar
5 mil (0.13 mm), type D, super clear, uncoated
Dupont of Canada Ltd.
Films Department
P.O. Box 660
Montreal, Quebec

Cellofas B-3500 (Sodium Carboxymethyl Cellulose)
(This can be used as an adhesive for hanging in works of art)
TALAS
130 Fifth Avenue
New York, N.Y. 10011

Solander boxes for storage
Perry Coodin
264 Holmwood Avenue
Ottawa, Ontario K1S 2P9
Telephone – (613) 235-0131

Acid-free folders and envelopes for storage
The Hollinger Corporation
3810 South Four Mile Run Drive
Arlington, Virginia 22206

Ultraviolet filtering plexiglas UF1
1/8 inch (3.18 mm) thick
Canus Plastics Ltd.
340 Gladstone Avenue
Ottawa, Ontario
Telephone – (613) 232-2657

Anti-static cleaner for plexiglas–"Rez-N clean"
Plastics of Ottawa
216 Pretoria Avenue
Ottawa, Ontario
Telephone – (613) 235-1465

Corrugated plastic backing sheets used in framing (Coroplast) – 48" x 60" (1.22 m x 1.52 m) and 48" x 96" (1.22 m x 2.44 m)
Crystaplex Plastics Ltd.
1825 Dundas Street East
Mississauga, Ontario L4X 1L6
Telephone – (416) 625-4200

Temperature and relative humidity recorders
Belfort Hygrothermograph Model 5-594-2. One month chart drive. Battery-operated. Chart Number 15677 (range -12°C to 43°C and 0%)
Carleton Industries Ltd.
2414 Holly Lane
Ottawa, Ontario K1V 7P1
Telephone – (613) 731-4703

Crawford UV Monitor Type 760
Littlemore Scientific Engineering Co.
Railway Lane
Littlemore, Oxford OX4 4P2
England

Acid-free corrugated backing sheets, CD-158-BD called Archivart
Process Materials Corporation
329 Veterans Boulevard
Carlstadt, New Jersey 07072

Ultraviolet filtering sleeves for fluorescent tubes
Comco Filter-Ray Sleeves in lengths 48" x 96"
Commercial Plastics and Supply Corporation
1127 Newmarket Street
Ottawa, Ontario K1B 4N4
Telephone – (613) 745-7043

Illumination measuring instrument – Gossen Panlux Meter Model N
Hall Photographic Supplies Ltd.
1018 Wellington Street
Ottawa, Ontario
Telephone – (613) 725-3368

FOOTNOTES:

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2. Poole, Frazer G., *Objectives of the Conference,* A National Preservation Program, Proceedings of the Planning Conference, p. 14. Library of Congress, Washington, 1980.

3. General Services Administration, National Archives and Records Service, Washington, *National Archives Reviewing Microfilming Program,* 3-23-81, p. 1.

4. Ibid. p. 3.

5. Stephenson, J. Newell, Editor-in-Chief, *Pulp and Paper Manufacture,* Volume 3, p. 645, Manufacture and Testing of Paper and Board (New York: McGraw-Hill, 1953).

6. Browning, B.L., *The Nature of Paper,* The Library Quarterly, Vol. 40, January 1970, Number 1. The University of Chicago Press, p. 18.

7. Environmental Protection of Books and Related Materials, Preservation Leaflet No. 2, p. 1. Library of Congress, Washington, February 1975.

8. Ibid. p. 2.

9. Lafontaine, Raymond H., *Environmental Norms for Canadian Museums, Art Galleries, and Archives,* Technical Bulletin No. 5, pp. 2-4. Canadian Conservation Institute, National Museums of Canada, Ottawa, Ont., November 1979.

10. Ibid. pp. 9-10.

11. Harper, J.Russell, *Painting in Canada: A History,* Chapter 25, Transformation in the West, p. 315. University of Toronto Press, Toronto, 2nd Edition, 1978.

12. Harumi Museum Mounting Board: supplied by Buntin Gillies, 560 Ferguson Avenue, N., PO Box 240, Station A, Hamilton, Ontario.

13. The Care of Prints and Drawings with Notes on Matting, Framing and Storage, Restoration and Conservation Laboratory, National Gallery of Canada, Ottawa, Ontario. Revised April 1981, pp. 1-14.

14. Ibid. pp. 1-14.