

PHOTOGRAPHIC STORAGE SOLUTIONS IN COLLECTIONS MANAGEMENT
THE EDWARD BURTYNSKY ARCHIVE

by

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Abstract:

The paper, "The Edward Burtynsky Archive" is part of the thesis project submitted by Paul Sergeant in the partial fulfillment of the Master's Degree in Photographic Preservation and Collections Management at Ryerson University in Toronto, Ontario and George Eastman House International Museum of Photography and Film in Rochester, NY, in 2010. The author proposes the creation of a personal archive/repository of photographic prints for Canadian photographer Edward Burtynsky. This guide will describe archival methods for the storage of 1000-1500 large format colour photographs ranging in size from 27"x 34" to 60"x 70". The goal of this project is to produce a resource for present and future researchers concerned with the preservation of colour photography. Through research on the preservation of colour photography and archival storage standards, I will locate a viable space, design a model for storage, source materials, and construct the archive/repository by September 1, 2010.

There have been countless individuals who have helped me along the way. From friends to family, peers to professors I would like to say thank you.

I would like to personally thank Edward Burtynsky for his trust and belief in my vision and goal for this project. I would also like to thank Karen, Isabel, and Marcus for all their help and input along the way. To my family, none of this would have happened without your help, encouragement and love.

For Elizabeth Burket, me mum.

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Introduction

This paper aims to define both the problems and solutions related to the care and maintenance of a photographic repository, created for Canadian photographer, Edward Burtynsky. The majority of Burtynsky's photographs are large format mural sized chromogenic prints, which require specific handling and storage guidelines. The main purpose of this practical project is to solve storage and preservation issues that Burtynsky and increasingly many other contemporary artists, museums, and archives currently face. The goal of this project is not only to solve the specific problems of one photographer, but also to create a resource for other artists or institutions facing similar challenges. Throughout most of the last century the majority of photographs produced were on a smaller scale. This uniformity allowed for the creation of standard storage and management systems for photographic collections. Over the last 35 years the size of fine art photographs has increased dramatically to a scale similar to that of large paintings. Most collecting institutions and artists are attempting to adapt to this new reality and struggling with not only the size of these collections but also the complex preservation issues related to colour photography.

The opportunity to work on this project came about when I assisted Burtynsky over the summer of 2009, on a photographic project for National Geographic Magazine. During this time I had access to his current storage situation and observed that help was needed. I offered my support and knowledge over this period, to try and help where I could. Towards the end of my internship I discussed with Burtynsky plans for the creation of a new facility and he was interested in the ideas that I suggested. The practical project that I am proposing to design is the layout for a secure, stable location in which 1000-1500 photographs ranging in size from 27" x 34" to 60" x 70", can be stored and easily accessed when needed.

The photographic objects themselves have a variety of values associated with them. There is the cost related to print production, the value of the object within the art market, and the cultural and historical worth of the photograph. These characteristics of each photograph and the collection as a whole must be taken into account when planning for the preservation and storage. The proper storage of the objects is key to the longevity of any collection. The selection and use of appropriate materials and designs for storage must become a high priority if the collection is to be properly cared for. During the course of this project I undertook the necessary research prior to recommending and implementing a storage solution for the Burtynsky Archive.

The work that I conducted can be broken down into 4 parts:

- 1) Identifying the problem.
- 2) Researching a solution.
- 3) Proposing a solution and a plan for execution.
- 4) Executing the plan.

The problem that Burtynsky faced was in essence a simple one, he needed to create a new space to store a growing collection of colour photographs. The development of a repository was needed not only for new work that Burtynsky is constantly producing, but also for early career prints, Artist Proof (AP), and estate prints (this refers to work printed and stored for his estate). This problem was discussed and analyzed in the fall of 2009 with Burtynsky and his staff. The outcome of this meeting produced a deadline of September 2010, a rough budget, and the number of prints that needed to be stored. Now that the problem had been identified, I was able to begin research on the solution.

The research for this project was conducted from January 2010-May 2010, including visits, conversations and electronic correspondence with other institutions about how they store similar photographic objects. This research helped me begin to plan for the production of the physical space. There was also extensive research conducted into the history of colour photography and its current preservation issues. Through this research I was able to better understand the issues surrounding the colour photograph and what measures can be put into place to maximize the stability of this photographic object.

The information that I gathered about photographic archives and the storage of colour photographs allowed me to develop a plan for the execution of the repository. The development of the plan began in April 2010, and included the location of a suitable storage space, design and materials for the storage of photographic prints, the ordering of selected products and the budget of the project. I had planned that over the span of 3-4 weeks in June and July, the majority of the physical components could be ordered and installed.

The execution of the project was done over three weeks in June and July 2010. I did one week of work from June 14-22, which involved the set-up of half the components that made up the new repository. This included the shelves and worktables; also during this time I fabricated full-scale versions of the photographic folders that would hold the individual prints. After

waiting for ordered materials and furniture to arrive I returned for two more weeks (July 5-19) and focused on the completion of the physical space and the building of 100 photographic folders. The majority of the work was completed during these three weeks, but the production of the folders lagged due to shipping errors.

The remainder of this paper will not only discuss the specific needs and choices made for one particular artist, but also the best practices for other artists and institutions working with this type of material. This thesis project is intended to act as a future resource for professionals involved in collections of colour photography.

Literature Review

Although the photographic archive has existed since the creation of the medium (ca. 1839), photographic processes have been in constant flux and this has created challenges for collection managers. What was deemed the standard for excellence twenty, ten, or five years ago is, in some cases, now obsolete. Further, I discovered there are few published resources and/or guidelines available to professionals in the field – especially relating to the problems and issues of colour photography collections. The planning of an individual artist’s photographic archive must service the needs of the artist, but it also must be defined by museum standards of archival care. These aspects are most important to remember throughout the planning process. These parameters help the staging process by setting solid guidelines to follow with the goal of preserving the photographs for future generations. This involves both the physical and intellectual organization of the photographs in an effort to prevent damage and deterioration to the collection as well as making them accessible to the collection managers and staff working in Burtynsky’s studio. This literary survey has been divided into two sections to better illustrate each type of published research. The first pertains to the preventative conservation of the colour photograph, what exact parameters are needed to sustain the longevity of each print. The second section relates to the planning of an archive, and what steps need to be taken to ensure the best possible product.

The encyclopedic volume *The Permanence and Care of Colour Photographs*ⁱⁱⁱ (1993) by Henry Wilhelm, with well over 700 pages has been the main reference of my research so far. It begins with a discussion of historical and contemporary colour photography, Wilhelm states “there has never been a more exciting time in the history of colour imaging”^{iv}. This volume makes recommendations for particular types of colour prints and film. The book has been an invaluable resource to better understand colour photographs and the numerous ways they can be preserved, even though it was published almost 20 years ago. The website <http://www.wilhelm-research.com/index.html> is also a valuable research tool with more current information on the colour photograph. This website builds on the information laid out in the book, while being constantly updated with Wilhelm’s ongoing research into colour print stability.

Martin C. Jürgens *The Digital Print Identification and Preservation* provides a very good overview of the digital photograph in all its many forms. Published in 2009, it helps to demystify the complex, rapidly changing and mostly confusing world of digital printing. This book clearly explains printing technologies, materials, and print characteristics. This very comprehensive volume provides

invaluable help in facilitating the identification, acquisition, exhibition, and preservation of the digital photograph.

The book *Photographs: Archival Care and Management*^v by Mary Lynn Ritzenthaler, is one of the most in-depth and informative publications that I have found. This manual for the preservation of photographic heritage summarizes complex issues surrounding photographic identification, care and storage. This book was published in 2006 and seeks to improve the management of collections from the fine art museum to that of small publications and teaching collections. This is a very broad text that stretches well over 500 pages over very informative text, images and graphs. This comprehensive overview of photographic collections became a significant resource in the research and execution of this thesis project.

Photographs of the Past: Process and Preservation (2009) by Bertrand Lavédrine is a comprehensive introduction to the understanding and preservation of pre-digital photographs. Since the majority of the photographs that I will be archiving are digital chromomeric prints this book turned out to be a minor source of information. However, it was useful when dealing with some of Burtynsky's earlier Chromogenic prints, since they do require more attention than the newly produced photographs. This is the most up to date volume around issues relating to storage and housing. This publication also covers other important elements such as budgeting and planning. I found this information invaluable when beginning the planning process for the Burtynsky Archive.

One of the best-compiled introductions to photographic conservation is *Fundamentals of Photograph Conservation: A Study Guide*.^{vi} Printed in 1991 the purpose of this study guide is to summarize laboratory experiments and their theoretical foundations that are helpful in introducing students to the field of photographic conservation. The dense publication reflects on the combined experience of several workers in the fine art and photograph conservation department at the National Archives of Canada. The study guide is broken down into nine sections, with only two sections being of any real importance to my research, preservation and storage. Although this publication has an abundance of information relating to photograph conservation it turned out that only a small amount of the information pertained to my research topic.

Susan Carr's, *Caring for Collections*^{vii} is a relatively small publication at well under 100 pages, but what it lacks in size it makes up for in information. The book published in 2000 is well organized, first giving definitions of what constitutes a collection, museum, preservation, and a care policy. The remainder of the book is divided into four sections helping you understand the effects of environment, contents of a collection, managing, and the use of a conservator. This step-by-step

guide is very helpful when trying to find a starting point in the creation of an archive. The most useful section for my research was section 3: Managing the Collection. This chapter outlines simple yet effective preventive care that can be done on a regular basis to keep the collection in good order.

The role of managing conservation is presented in precise detail in Keene's *Managing Conservation in Museums*.^{viii} The 8-year-old book demonstrates the importance of conservation within museums, and gives practical advice on the latest issues in conservation management. The main focus of this book is on managing the preservation of collections although this is a unique reference; a majority of the information is focused on the larger museum. Thus some sections just didn't pertain to my practical project.

Collections Management^{ix} by Anne Fahy identifies the main issues relating to collecting and disposal of collections and discusses why museums should develop appropriate documentation systems. This book is a very practical introduction to the topic of collections management. The themes within the book follow the outline of the Collections Management Course at the University of Leicester. This book is paired with another from the Museum Studies Series entitled *Care of Collections*.^x I found this publication to be quite informative since it considers the museum environment, care and handling of collections, packing, storage, and disaster preparedness. The articles selected for this volume provide information of practical use to the student of collections management.

Preservation Management for libraries, archives, and museums, edited by G.E. Gorman, and Sydney J. Shep, is a multi-essay volume that charts the diversity of preservation management within the contemporary landscape. There are a variety of themes discussed in this book about the great number of issues facing the preservation world. Mirjam Foot's essay on *Preservation policy and planning* was informative and aided in my development of a thesis structure. Foot discusses the need for embedding preservation-led decision making, into the policy and planning of any institution. By having a standard that is set-up and followed it promotes institution-specific preservation programs. This 2006 publication's section on the changing nature of collection's management, in the 21st century was quite informative. It discussed the ever-changing environment of technology, storage and the archive.

There are a number of useful websites that offer a great deal of information on the preservation of the colour photograph.

<http://www.getty.edu/conservation/>

The Getty Conservation Institute is a great resource for information about the advancement of conservation in the visual arts. It describes current projects that are being completed at the institute and allows the visitor to ask questions about their individual conservation concerns.

http://notesonphotographs.eastmanhouse.org/index.php?title=Main_Page

Established by George Eastman House in 2006, Notes On Photographs is a tool for communication among students, historians, collectors, curators, conservators, archivists, practitioners, and the interested public. The site is an international forum for gathering information that enhances the communal understanding of the photographic print.

<http://www.imagepermanenceinstitute.org/>

The Image Permanence Institute (IPI) is a recognized world leader in the development and deployment of sustainable practices for the preservation of images and cultural property. This website has a variety of interactive resources to help aid in conservation planning and prevention.

<http://www.conservation-us.org/>

The American Institute for Conservation of Historic and Artistic Works (AIC) is the national membership organization of conservation professionals. Its members include conservators, educators, scientists, students, archivists, art historians, and other conservation enthusiasts in over twenty countries around the world

<http://www.loc.gov/preserv/care/photo.html>

This website set-up by the Library or Congress and has advice for the care of a variety of collections. It offers a great deal of information on the care of photographic collections and is a great reference tool.

The Photographer and the Archive

The artist is an individual who creates work that he/she has a personal connection too. The studio and/or archive of any artist established or emerging is usually just as equally unique, peculiar, and individualistic. The role of a collections manager is to try and understand the reasoning behind the decisions that have been made and incorporate them into any new plans that are created. The artist is concerned with their practice and the production of new art, thus the job of the collection manager is to facilitate their needs and help them to better understand the techniques to both organize and provide access to their collection.

The majority of Burtynsky's work has been produced from analog sources including, the camera, film, and resulting prints. Recently he has begun to shoot more and more born digital photographs, which has greatly changed the way in which he archives his work. There are a number of factors behind this evolution to 100% digital output. The major factor is the end of analog based films and paper. Burtynsky's original method of shooting involved the use of Kodak ready-load films, which is an individually packed 4x5 colour negative. This product was discontinued in late 2008. Around this time Burtynsky began to shift from his 4x5 camera to a medium format digital Hasselblad. This process was slow at first, but as of this year 90% of all the photographs he takes are now digital capture. There are three major advantages to this new photographic format; less equipment to transport, instantaneous results, and born digital images that are easy to archive.

Since all the photographs that Burtynsky produces are still printed on chromogenic colour paper, he feels that he must utilize this resource before it too is discontinued. This reason has spurred on Burtynsky to print the remaining editions of his work on a type of photographic paper that he is familiar with. If he waits too long then the material that the original prints were produced on will no longer be available creating inconsistencies within each body of work.

Introduction to Edward Burtynsky

Born Edward Taras Burtynsky in 1955, in St.Catharines's Ontario. His parents, Peter and Mary, were recent immigrants from the Ukraine, and he credits them with installing a strong work ethic in him from a young age. He acknowledges that his father piqued his twin interests in business and photography. At the age of eleven, Peter bought him his first camera, a Minolta A and the supplies to set up his first darkroom. Even though he gave him the necessary tools, Peter demanded that he fund his own photographic endeavors into the world. Burtynsky took advantage of the close-knit Ukrainian community and took photographs at get-togethers charging his subjects for the resulting photographs. This was Burtynsky's first attempt in the world of photography and business - he excelled at both.

Graduating from a vocational high school, Burtynsky entered Niagara College to study design, but his real passion was photography. In 1976 he enrolled at Ryerson University to study full-time. During his first three years of the program he focused on street scenes in and around Toronto using a 35mm camera. He soon became discouraged at how chaotic and incoherent his work felt. Burtynsky took two years off to work and explore his own interests related to photography. He returned with a new focus and an old technology. Using large format photography, he photographed the Welland Canal, focusing on how this once important trade route had fallen to the way side once society and commerce no longer needed it. Burtynsky enjoyed this technology because it slowed him down, and demanded that he think critically about each shot.

Burtynsky took his first quarry photograph in 1981, one year before graduating from Ryerson. He stumbled across the scene when he was looking for landscapes that reflected human interventions. This series was postponed when Burtynsky opened Toronto Image Works in 1985. This became a huge time commitment that dragged him away from photography at this critical point in his career. During this time Burtynsky could have gone in two opposite directions: either full-time businessman, or full-time photographer. Thanks to the patronage of Raphael Bernstein, Burtynsky was able to research photographing quarries.

The Quarries series was pivotal in establishing Burtynsky as a fine artist. They resulted in his first solo exhibition and his first overseas shooting trip in 1991. It was also the first of his work to be shown by Nicholas Metivier at the Mira Godard Gallery in 1993, a relationship that would become very important to Burtynsky's career. For the remainder of the decade Burtynsky focused on his art

photography with critical recognition soon following. Between 1993-2005 Burtynsky's exhibitions of work skyrocketed to 70 shows. He was picked up by more and more galleries and had a mid-career retrospective at the National Gallery of Canada in 2003. Over the next 6 years Burtynsky worked on numerous projects including Manufactured Landscapes, Shipbreaking, China, and Australian Minescapes. His most recent publication *Edward Burtynsky: Oil*, was the winner of the And/or Book Award for Photography. It was released in conjunction with the *Oil* exhibition (2009) at the Corcoran Gallery of Art in Washington D.C., a five-year international touring show. Other distinctions include The Outreach award at the Rencontres d'Arles, The Flying Elephant Fellowship, and in 2005, Burtynsky was nominated and won the inaugural TED prize, which was spurred on by his work Manufactured Landscapes. In 2006 he was awarded the title of Officer of the Order of Canada and given an honorary degree, Doctor of Laws, from Queen's University in Kingston, Ontario.

Description of Current Burtynsky Storage

Edward Burtynsky's studio is located at 80 Spadina Ave, in Toronto, Ontario.

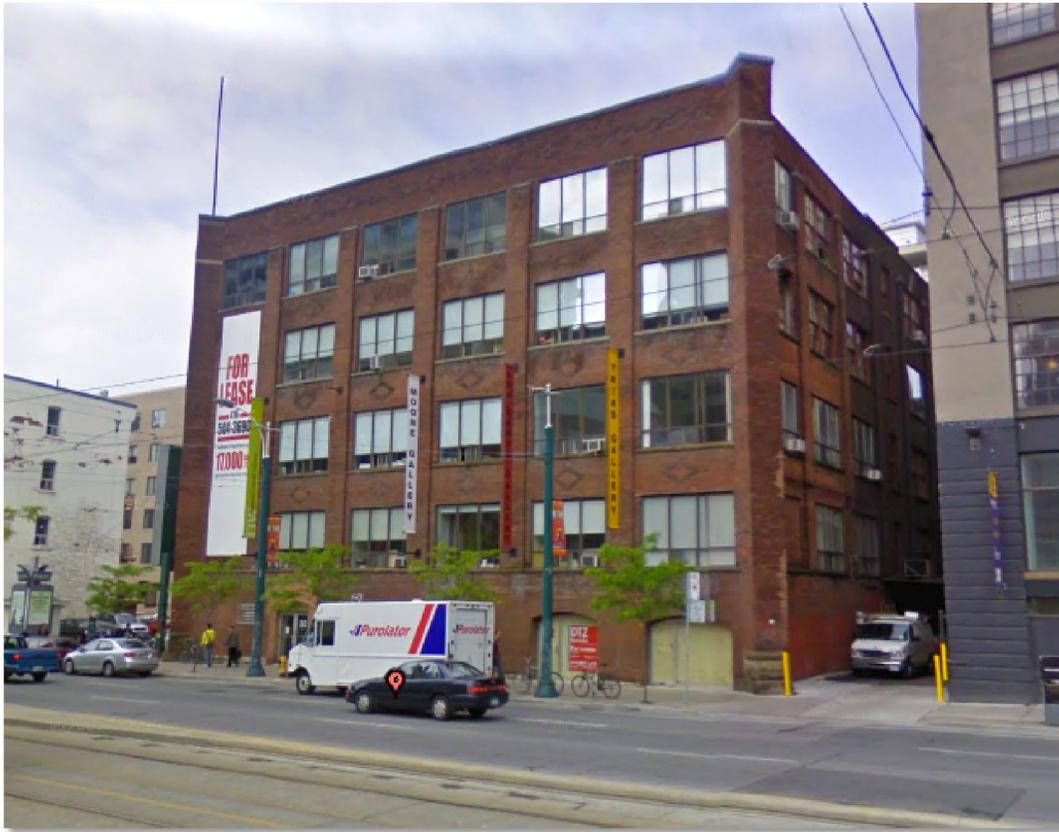


Fig. 1

The studio acts as the headquarters for the operations of his photographic practice. It houses his office and those of Karen Machtinger, Studio Manager & Arts Administrator, Marcus Schubert, Director of Media, Publications & Exhibits, and Isabel M. Martinez, Production & Inventory Manager. The space is roughly 1500-2000 square feet and it has been divided into three sections: 1) the offices, 2) print viewing, editing, packing, and shipping, 3) storage. Since Burtynsky has been utilizing the space for a number of years, it has reached a critical point in terms of a lack of available storage for new work. There are print drawers and smaller prints within Hollinger boxes throughout the print viewing space, but the majority of the photographs are housed in the storage section of the studio.



Fig.2

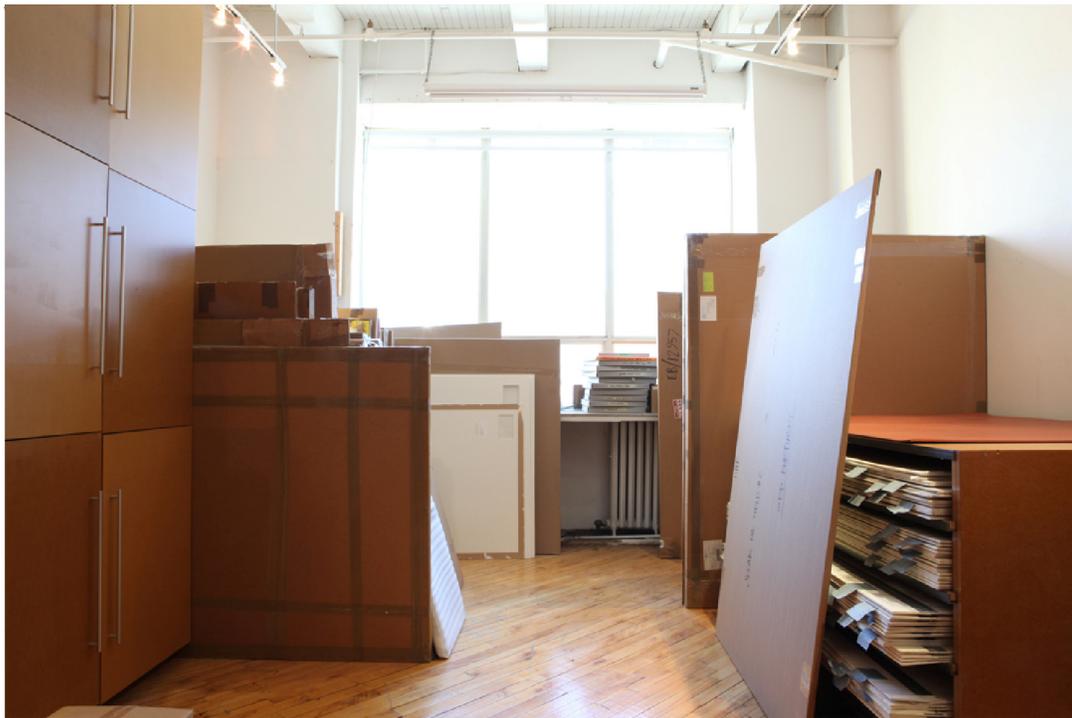


Fig.3

The storage area is comprised of a room 15.5' wide by 34' long. This room houses a variety of objects including framed photographs, unframed photographs, boxes of books, work prints from his early career as well as other objects from the studio. The framed photographs take up a majority

of the space and are stacked vertically, roughly 500 objects. These photographs are in a constant state of movement to and from galleries, museums, and collectors. The un-mounted photographs are stored in 3 horizontal open-faced cabinets, roughly 1000 objects.



Fig.4

These storage units are 4 feet high, 60 inches long, and 50 inches deep. There are five open trays that house roughly 8-10 folders per tray. The folders are constructed out of non-archival foam core that are hinged together with non-archival materials such as silver duct tape and clear packing tape. There is no standard around the number of prints per folder with some holding 20 or more. This lack of standards causes inconsistent distribution of weight with some folders requiring two or more people to move them. The cabinets do not have any cover on the front allowing light, dust, and debris to easily enter the folders of photographs.

The storage room also houses a large storage cabinet that holds 75-100 used photographic paper boxes that now double as storage for Burtynsky's older work prints. This cabinet does have doors, which limits that amount of light and debris that could harm the objects. There are also 40-50 boxes of Burtynsky's books (Oil, China, Quarries, etc) that are stacked in piles throughout the storage room. The room itself presents preservation issues as well. The building is well over 100

years old and the room has a wall-to-wall, floor to ceiling window that faces east. Temperature and RH measurements were collected over the span of five months from July 2009- December 2009.

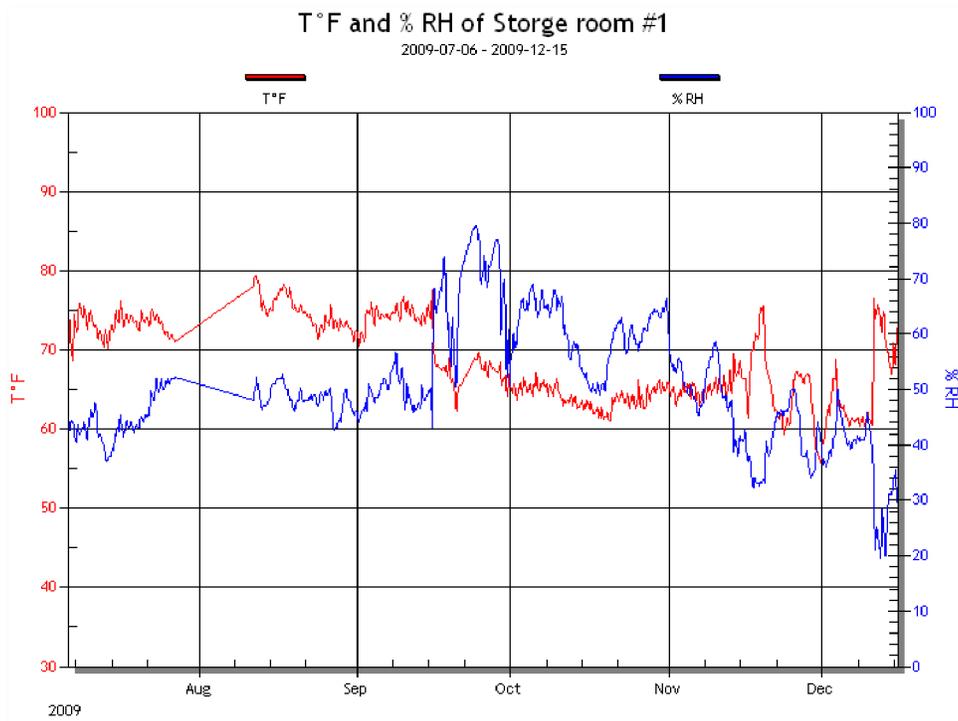


Fig.5

The temperature fluctuated from a low of 55°F(12°C) to a high of 80°F(27°C). The relative humidity also followed similar inconsistencies from a low of 19% to a dangerous high of 80%. The current storage facilities that Burtynsky is utilizing can only cause detrimental effects to the longevity of his photographic work. This includes dye fading, highlight staining, and physical damage to the structure of the photograph. The issue of space also presents itself as a problem with no room available for new prints or framed work. These are a couple reasons why Burtynsky has decided to allow for the creation of plan for a new photographic storage solution.

The negatives and digital files are stored in a different location than the photographic prints. The negatives are kept in archival sleeves and organized in binders. These binders are then housed within a large walk-in safe located down the hall from Burtynsky's studio in Toronto Image Works. Within the air-conditioned safe the negatives are held in a locked fridge that acts as another boundary against damage or theft. The majority of Burtynsky's "select" negatives have been scanned and are stored on the Studio/Image Works secure server that is backed up every month. Recently Burtynsky has purchased a digital asset management system (DAM) to store all of his scans and

contemporary digital files, since he is quickly migrating from analog to digital formats of image capture. These components of the Burtynsky archive will remain where they are and do not intersect with the plans formulated.

Preservation of Colour Photography

Colour Photography & the Chromogenic Process

The use of colour in photography has existed since its inception when photographer would apply colour to their monochrome images. The modern colour processes are the descendants of the helichrome process described by Louis du Hauron in 1869.^{xi} Chromogenic colour photography is an extension of black and white photography and was invented by Rudolph Fischer, a German chemist working just before the First World War.^{xii} To create a colour image, the developer first must form a black and white image.

“This process chemically alters the developer, preparing it to act as one of the components of the dye structure. Dye couplers react with the altered developer molecules. Together, the components form a dye around the black & white silver image. The black & white image must then be removed by bleaches that attack only the silver, not the newly formed dyes. After fixing and washing the result is a full-colour photographic image consisting only of organic dyes”.^{xiii}

Although Fischer was able to envision the chromogenic photograph, he was unable to create and sustain a successful colour process. He could not prevent the sensitizing dyes and dye couplers from wandering between the various emulsion layers and causing havoc in the final image.^{xiv} Kodak and Agfa continued researching chromogenic photography in the 1920s and 1930s and both would solve the problems that Fischer had faced. In 1936 Agfa released Agfacolour Neu, a chromogenic colour transparency. This process was finally commercialized in the 1940's as an outgrowth of chromogenic colour transparencies. Kodacolour was introduced in 1942 to the consumer public who preferred prints to the widely available Kodachrome transparency slides.^{xv}

The word chromogenic means ‘giving birth to colour’^{xvi} and refers to the fact that cyan, magenta, and yellow dyes in the final picture are formed during processing.^{xvii} Chromogenic is a photographic colour process that uses three silver images on a single support to create corresponding dye images in the subtractive primary colours. The three superimposed dye-images yield a full-colour image. Both films and prints are produced using this process. The most common type of colour photograph is printed from a colour negative. The print consists of dyes within gelatin layers on a plastic-coated paper base.

Process Identification

Over 90% of colour photographs are chromogenic prints.^{xviii} Prints made before 1968 were printed on fiber-based paper giving the back a papery, fibrous feel. Modern prints use resin-coated paper (RC) and are made by sandwiching the raw base between two layers of polyethylene^{xix}, which have a plastic feel. The surface of the print can be a variety of types including, glossy, matte, silk, and lustre.

Types of Deterioration

Early Chromogenic prints (ca. 1940-80) are more vulnerable to fading; their dyes lose their colour intensity not only as a result of light exposure but also during dark storage. After 30 years of dark storage, prints are found with reddish or bluish colour shifts due to the accelerated fading of one or another of the component image dyes. Why do these dyes fade? The main causes are heat energy, light energy, moisture, air pollutants, temperature and RH.^{xx} Products developed by Kodak and Fuji in the 1990's are much more stable than earlier papers with life expectancy that can range up to 100 years. These were created over the concern of the general instability of colour images of the day. More resources and new technology such as the computer-aided design of dye molecules were directed at the problem.^{xxi} There were also advances surrounding ultra violet coating that helped protect the photograph from sunlight.

Kodak continued to make improvements in coupler staining and dye stability, particularly balancing relative thermal and light fading rates to improve long-term appearance. New pyrazolotriazole magenta couplers virtually eliminated thermal yellowing and coupler printout by the late 1980s.^{xxii}

Chromogenic prints are composed of yellow, magenta, and cyan dyes and appear to be less sensitive to pollutants than traditional black and white silver images.^{xxiii} This does not mean that they are impervious to light. Light does have deleterious effects, such as the fading of dyes over time. The rate of fading depends on a variety of factors including light, temperature, relative humidity, and chemical structure of the dyes. The fading of dyes is the most prevalent and easiest to visually notice. Since the photograph is comprised of three dye layers with each fading at a different rate an imbalance occurs within the print. Even under dark storage conditions with a temperature-controlled environment, it is estimated that it takes 40 years before significant deterioration occurs in

contemporary chromogenic prints.^{xxiv} The most notable degradation found within the chromogenic print is highlight staining. This appears as a yellow stain that is most visible in the highlight or white areas of the photograph. It has been noted that the coupler for the magenta dye is to be largely responsible for this deterioration.^{xxv} The stains are the result of these couplers forming colour as they break down.

Physical Housing of Materials

There is no single ideal enclosure for a particular type of photograph. The most important characteristics of an enclosure are that it can physically perform the tasks desired and it meets archival standards. The enclosure that houses the object should protect the print from continuous exposure to light, since light will fade the dyes. One solution if the print is to be viewed frequently is using archival mat board as the base with the print being fixed with acid free photo corners. Another mat with a window cut can be t-hinged atop and then protective tissue can be layered between the print and top mat. This provides a rigid structure to support the print. Also Mylar can be used as a cover sheet in the place of another board. Prints should be stored flat in boxes or folders when possible. Only a small number of prints should be placed in single box to avoid too much pressure being placed on the bottom prints. This will also reduce the amount of weight, making it easier to handle and move each individual box, folder, or housing. According to Lavédrine there are three levels of protection:

Level 1-filing envelopes and boxes

Level 2-storage furniture

Level 3-storage area

Level 1

To avoid abrasion and inappropriate handling, one of the leading causes of physical degradation to a photograph, photographic sleeves and boxes provide a simple, yet effective protection barrier. There are numerous types of protective materials available and no specific type can be considered the best possible choice. This selection process depends on the individual needs of each collection and types of photographic objects to be stored. When storing prints it should be determined how they will be used. If they are to be exhibited or utilized frequently then they can be housed within a window mat. They can also be housed within a Mylar sleeve to protect them from abrasions. The simplest way to store a large number of photographs is to stack them in small

numbers, 10-15 with interleaving archival sheets between each print. Unbuffered tissue is an ideal product, since it is pH neutral, acid free, and has a smooth finish. It is designed to store materials that already have an acidic composition such as colour photographs. Once the first layer of protection has been decided to best way to store them is flat within some type of archival box, again making sure to limit the number of prints housed within each box. This will prevent the photograph on the bottom of the stack from receiving too much pressure, which in turn could lead to print damage.

Level 2

The materials selected for the storage furniture are just as important as the choices made for the previous section. Since components made from wood are inflammable, they can also produce emanations that can be detrimental for any photographic collection. Metal components are ideal for the storage furniture within an archive or repository. Selecting light-coloured paint enables earlier detection of microorganisms, insects, rust spots, and blistered paint.^{xxvi} Lavédrine also recommends avoiding materials with solvent-based paints; these coatings present no risk of harmful emanations. Since every collection, archive, or institution is unique one must make decisions based on the limitations of each project.

Level 3

The storage facility is the key to any successful archive or repository. Without a safe and secure location it does not matter how much prior preparation has gone into the preservation of the objects. The location of the facility is very important to the preservation of the objects within. There are numerous recommendations about the room design, height of ceiling, and maximum size of the space. These can all be taken into account when planning for any space, but since every project is unique one can only view these for what they are, recommendations. For this project there were a limited number of spaces that we deemed acceptable as locations. This made the process easier when finally deciding on the right location. The simple aspect of visiting a prospective space can be the best way to make a final decision. It is important to make sure there is enough room within the completed space for ease of movement and accessibility of the objects within.

Environmental Considerations

Environmental conditions are the most important aspect of storing colour photographs. The American National Standards Institute (ANSI) and the International Standards Organization (ISO) give recommended conditions for the storage of colour prints. For medium term storage (up to ten years) they recommended a maximum temperature of 25°C with a RH range of 20%-50%. For extended term storage (indefinite) the recommendation is a maximum temperature of 2°C to -3°C and a RH range of 30%-50%.^{xxvii} The costs of designing, constructing and maintaining an ideal facility can be extravagant. Since most major institutions spend millions of dollars to perfect the environment of their archives, what can an individual with a limited budget do? Simple and cost effective devices can be purchased, such as in room air conditioning and small dehumidifiers. This may not be as precise as the large environmental systems, but they are a simple way to keep control of a space.

Handling Guidelines

Handling photographic materials can be the most detrimental to any collection. Following simple and detailed guidelines is the best way to avoid damage to photographic prints. Always wear protective gloves when handling prints and look at one photograph at a time. When moving prints lift from opposite corners to reduce the chance of dents and creases. When handling large format prints try to have a partner since these prints are very susceptible to creasing, tears, and crescent dents. It is important to have clean and clear space when handling and viewing prints. Large worktables are ideal to accommodate large mural-sized photographs.

Exhibition Guidelines

Since chromogenic photographs are susceptible to light fading attention must be paid to the light levels within the exhibition. If the print is to be framed it should never come in contact with the glass of the frame. A simply overlay mat is adequate to prevent contact from occurring. When considering exposure to light the general rule of thumb for acceptable levels is between 54 and 160 lux, with a maximum of 12,000 lux hours per year.^{xxviii} The prints can also be protected by using a piece of UF-4 Plexiglas or museum glass with UV coatings, which can deflect damaging ultraviolet

light.^{xxx} Environmental temperature should also be taken into account since high temperatures will increase the rate of light fading.

Monitoring Collections

The simple task of monitoring collections can greatly affect the longevity of the objects being stored. This can be done with both visual and statistical observation. Simply looking over the space, housings and objects stored within can be a preventative measure to observe if any changes have occurred. The use of the PEM2 Monitor^{xxx} can record data on the temperature and relative humidity within a space. This data can then be downloaded and stored to give precise details on the environment within a space. Both small and large institutions use this device, which costs roughly \$300.00.

Institution Research

The Art Gallery of Ontario, Corcoran Gallery of Art, George Eastman House, The Getty, The National Gallery of Canada, and the Scotiabank Archives were contacted about how they store large format colour photography. Since each institution has its own guidelines and storage facilities, my research revealed there is no one standard method for the storage of large format un-mounted colour photographs, but there are some similarities. The majority of the institutions (except the Corcoran) I contacted and visited that have Burtynsky photographs in their collection are framed. The only institution that had unframed work was the A.G.O., but some these were mounted to a rigid material such as GatorBoard. The others within the collection that were not mounted were stored within a foamcore folder. J.P. McElhone, Conservator, Photographs at the National Gallery of Canada described how any photograph over 30" x 40" that enters the collection as a loose print is immediately framed or matted for easier storage and handling.^{xxxi}

The one common thread between the different institutions was the similar way in which they stored the objects. They followed similar guidelines of the 3-step protection process that was described by Lavérdrine in an earlier chapter. The photographs are housed in individual mattes, boxes or folders. These housings are then stored on open metal shelving or vertical racks, which are within a larger temperature and humidity controlled room or vault. The National Gallery of Canada has two storage facilities within its main vault. The first is a cold room designed to house the more fragile colour photographs produced during the mid to late 20th Century. This room is kept at

a temperature of 4°C and 40% RH. This cold room is within the main cool room that is kept at 16°C and 40% RH.^{xxxii}

Any other object that has not been framed by the National Gallery is either rolled and stored in a protective tube or in oversized map/print drawer. The A.G.O. also stores its larger prints in map drawers or custom made folders and boxes.^{xxxiii} This would be an ideal solution to house a large number of photographs, but the drawers they utilize are very large over 12 x6 feet and cost thousands of dollars. J.P. McElhone examines that each collection is local and peculiar to the institution it is housed in. Even though each institution is different they do however share some similarities and all meet standards of the best archival practices.^{xxxiv} In essence, every collection and the management of that collection are unique and require the use of a variety of tactics and decisions. There is no one right answer to how a collection is managed and stored; there are sometimes many answers to any particular question or problem.

For the purposes of the Burtynsky Archive certain restrictions were in place that influenced the decisions that were made. The issue of cost was a major factor, since the creation of this type of project could easily run into the tens of thousands. Even when confronted with restrictions it was the main priority that archival standards were observed and met. In an ideal world, one could simply copy the set-up of a large institution and scale it down to the size you need. There was talk of renovating the space currently used by Burtynsky, but this proved to a very expensive and timely venture. The timeframe for this project was roughly eight months, which would not have been enough time to build a space from scratch. Instead we opted for another location that is very close to Burtynsky's current studio.

Methodology/Summary of Work

Preservation Management

Preservation Strategy considers how the materials will be preserved; it needs to be planned like a military campaign.^{xxxv} Before considering a preservation strategy one should define what needs to be archived, any specific preservation problems, how they can be tackled, and in what order. This is a relatively easy exercise that will help to create a list of tasks that need to be performed. Assess what programs and resources you already have, how can you use them and how effective they are. Consider the life expectancy, both of the collections and the buildings that house them. Investigate what standards and guidelines exist and how they can be interpreted and applied.^{xxxvi}

It is important to know the documentation history as well as current information about collections, past life, housing etc. It is important to be aware of the significance, meaning and value of a collection, not only how much it would cost to replace the object, but its cultural or social value, research value, and rarity. Consider both the direct and indirect costs of instituting a monitoring plan for the collection as well as labour, materials, and consumables required to establish a storage facility. Indirect overheads, packing, transport, computer set-up, should also be contemplated.^{xxxvii} Risk assessment is a great way to plan for unforeseeable occurrences. Usually you start with very stable circumstances, a building with storage and monitoring, however, you need to consider what internal and external threats may be present. This is an important step to ensure that if an emergency arises, that there is a disaster plan in place that is easy to follow. Such as a fire, flood, insects, theft, or any number of other possible threats.

Description of New Storage Facility

The planning of the new storage facility includes 7 key sections of this practical project: 1: Photographs, 2: Preservation Concerns, 3: Storage locations, 4: Storage of objects, 5: Packing, handling and transfer policy, 6: Timeline, 7: Budget. Through this breakdown of specific tasks that need to be performed, it is easier to focus on each element in order to complete the final design.

Photographs

The photographs that are going to be stored in the new repository are traditional chromogenic photographs and also chromogenic photographs that have been created with a digital exposure system.^{xxxviii} The digital chromogenic photograph is identical to the traditional chromogenic print since they rely on light-sensitive emulsions that undergo chemical development after exposure. The only difference is the way the image is projected on the unexposed photographic paper. Instead of the traditional enlarger with its tungsten or halogen light sources, this process uses lasers or LED sources to transfer the digital source from computer to paper.

The photographs range in size from 20" x 30" to 60" x 70". The prints will be unmounted, which takes up less space in the storage facility, but in turn are more susceptible to damage due to the lack of rigid support. The photographs will be a combination of existing prints and newly printed ones. The existing prints will be mainly unique photographs such as AP and estate prints, while the new photographs will complete the editions that, up until this time, have remained incomplete.

Preservation Concerns

The chromogenic photograph has many preservation concerns and guidelines that should be followed in order to achieve the longevity of each photographic object. These recommendations have been outlined in the previous chapter of this thesis such as regulation of temperature, humidity, light, dust and debris and the proper housing. In an ideal situation all of the recommendations would be followed to create the best storage situation. Since every project has certain restraints, one can only try and follow the guidelines set in place by museums and other collecting institutions. The main restraints for this project are budget, time, and location.

Storage Locations

The selection process for the new location followed three important guidelines of location & accessibility, environment, and cost. The location was the main factor in the decision process. It had to be close to Burtynsky's current studio and easily accessible. After researching a number of possible businesses in the downtown Toronto area, we selected Apple Self Storage located at 530 Adelaide Street West in Toronto.



Fig.6

This facility is roughly 550m away from Burtynsky's studio, which is a 2min drive or a 7min walk. There is a covered loading dock to allow for easy and protected transfer of prints to and from the space. There are convenient access hours 7 days a week, individually alarmed units, 24-hour video surveillance, security lighting, steel constructed units and climate controlled interiors. Another benefit of the space is the freight elevators, which again allows for the easy transport of the large-scale photographic prints. The largest unit available is 200sq feet and is located on the top floor of the building. The following two pages show interior images of the unit and the proposed design for the layout of the space.



Fig.7



Fig.8

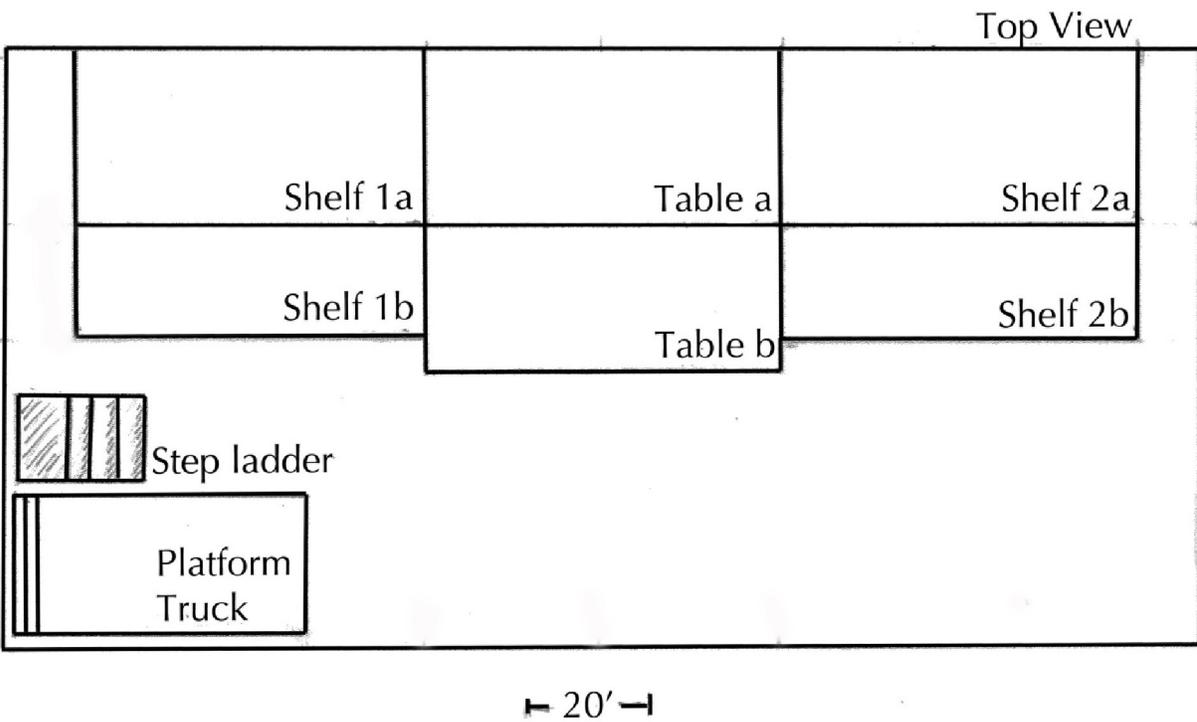
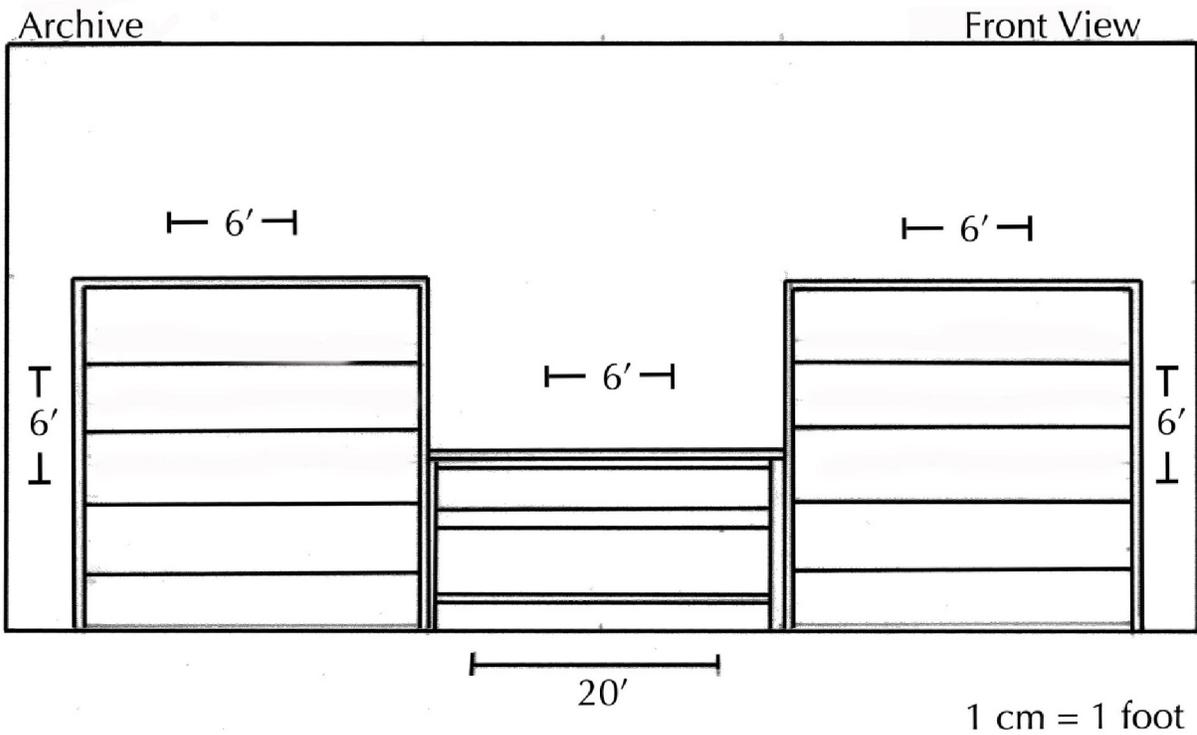


Fig.9

The environment of the space is as equally important to the preservation concerns of the photographic objects. The storage facility is climate controlled to a rough temperature of 20°C. There is no RH control in place, but levels were recorded over the span of 6 months and data revealed at first an ever changing percentage. Recently the RH has leveled off between 30%-50%.

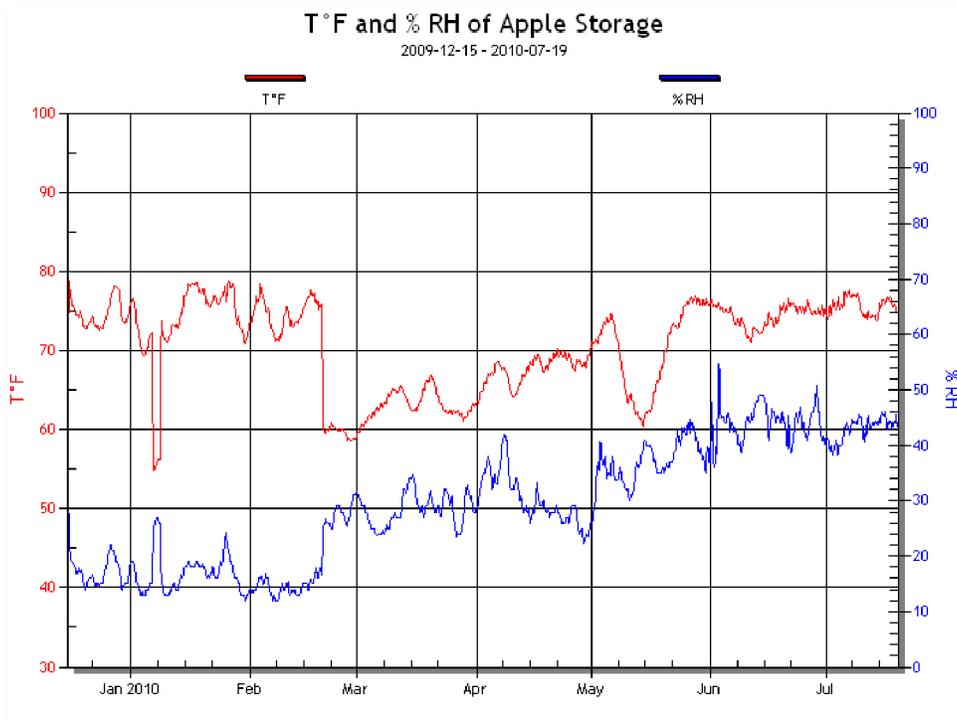


Fig.10

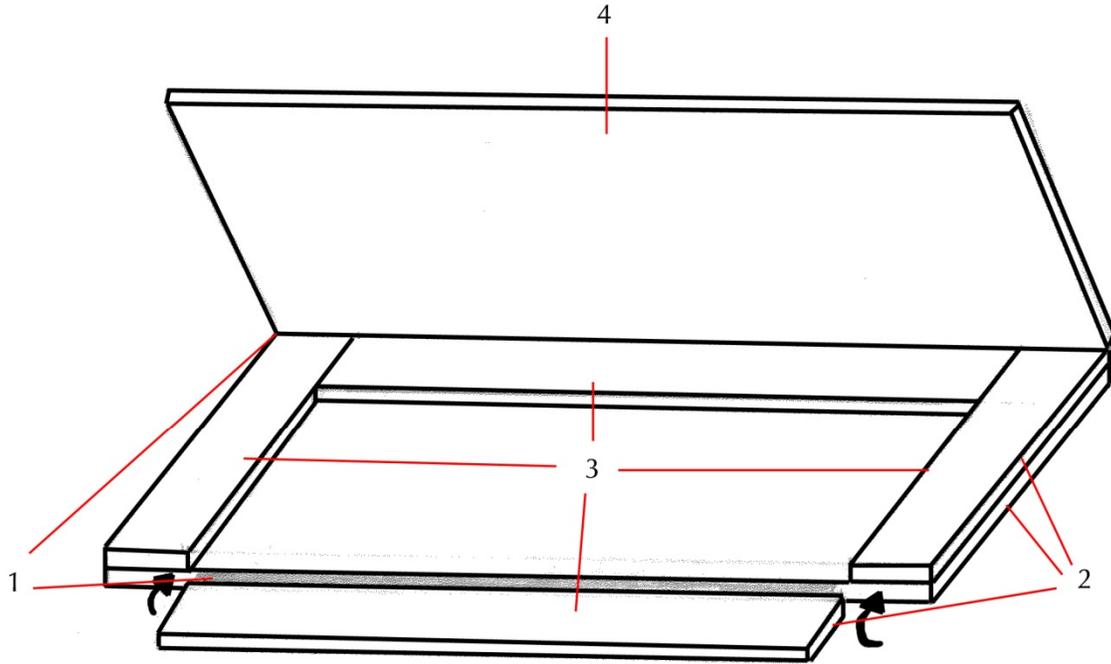
There is a flux of both the temperature and humidity, but it hasn't been as drastic as the current space that Burtynsky has been utilizing. As the graph depicts, the temperature never goes over 80°F and the humidity never higher than 55%. Although this is not as precise as an institution's environmental controls, it is by far the best climate that Burtynsky has ever stored his work in. This space is not 100% perfect, but it is the best compromise that has been made at this time.

There is a sprinkler system in place in case of any fires in the building. This could be a serious risk to the photographs being stored and preventative measure will be outlined in the next section. This location provides the best possible environment available to the project and is a great improvement over the current studio space being utilized by Burtynsky.

The cost of the space was also a factor in the selection process. Originally I had recommended that Burtynsky's current studio be renovated. This option turned out to be too costly and involved a much longer timeframe in order to complete. The space selected is roughly \$400 per month to rent.

Storage of Objects

The protection of the physical object is of the utmost importance to sustain the longevity of each object. There will be three levels of protection used to ensure that the photographic objects are stored safely and securely. The first will be the custom fabricated folders that house the individual photographs. The folders are constructed out of Hi-core, a 10mm thick, archival corrugated board. The folder will have an internal structure creating a recess within the folder to house the prints. The four rectangular sections that make up this recess have been wrapped in pieces of unbuffered tissue. This layer will protect the photographs from the rough and sometimes sharp edges that are produced when cutting the Hi-core. The sections of Hi-core that make up the base of the folder are adhered together with 3M Acid-Free Photographic double-sided tape. The cover board, which acts as the lid for each folder is a piece of acid free museum board. This board and the front flap have been attached to the folder with archival Cambric Linen tape. Each folder will hold a maximum of 15 prints, which will fill this recess to ensure an equal distribution of weight for each folder and protect the prints from the pressure of other folders atop. The use of the recess will allow for a microenvironment to be created restricting light and debris from coming in contact with the objects.



- 1-Cambric linen tape hinge
- 2-Hi-core archival board
- 3-Unbuffered tissue
- 4-Acid-free musuem board

Fig.11

Fig.12



Fig.13



The Second level of protection is the storage shelves and the stacked folders themselves. The shelves selected are a boltless steel frame construction with galvanized steel mesh decking. They are easy to assemble with the components locking into place with a tap of a mallet. Each shelf is 84" tall x 72" wide and 30" deep. In order to house the largest folders two units will be attached together to create one large stable storage space. There will be a total of four units creating two large shelves, each with five shelves per unit. These units will provide an archival storage unit for which the folders can be stacked. Each individual shelf can hold ten folders with 15 prints per folder, thus each unit can store 750 photographs. Through the simple element of stacking the folders one atop the next, the combined weight will help seal the folders from any unwanted contaminants.

The third level of protection will come in the form of Polyethylene film. This archival material can cover the outer structure of each shelving unit creating a protective membrane.



Fig.14



Fig.15

Not only will this generate another microenvironment to preserve and protect the photographs, but also help prevent the risk of water damage from sprinklers above. The membrane will shield the folders and prints from direct contact with water and allow for precious time to decide the best course of action in the unlikely event of this occurrence. It will also protect the folders from dust and debris, which is an inevitable occurrence in this type of facility.

Packing, Transfer, and Handling Policy

In order to ensure that photographs are transported and stored with preservation concerns in mind a simple policy has to be created, which can be easily followed by any individual working in the repository. The photographs should also be handled with clean hands or protective nitrile gloves in order to prevent any transfer of dirt, chemicals, or oils from the worker's hands. The photographs should be held by the opposite corners to avoid crescent dents or the occurrence of other physical damage. In the case of very large prints, which would be difficult to transport flat, rolling the prints

and using a protective box and/or tube can be utilized. Once safely transported to the new storage location the prints can be examined on the large worktable 72" x 60". Each print can then be stored in its corresponding folder, which will follow the organizational system already in place in Burtynsky's studio.

Timeline

This project has two deadlines:

- 1: the completion of this written thesis by July 31, 2010.
- 2: the completion of the physical repository by September 1, 2010.

Budget

The initial budget for the materials and construction of the repository was \$5000. This was the figure that Burtynsky proposed before any of the preliminary research had been completed. This did not cover the rental costs or folders, it focused solely on the materials needed to construct the space. The materials I have sourced did come in just under the proposed amount that Burtynsky wanted to spend. This however changed when additional items were sourced for the project.

Material Costs

1-Shelves-4 units + 8 additional shelves.	\$3200
2-Talas-heritage board, 60" ruler, polyethylene film, unbuffered tissue, cambric linen tape,	\$1000
3-Scissor lift table	\$1200
4-Uline-work table, extension cord, nitrile gloves, acid free adhesive, adhesive applicator, magnetic strips,	\$1250
5-Can-am- cd storage unit	\$1070
Total	\$7720

Rental Costs

Apple Self Storage	\$400/month
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Folder Costs

Hi-core -\$54/sheet of 60"x120"	\$2160
100 sheets of archival mat board (top of folder)	\$500-\$700
Total	\$3000

Execution & Conclusion of Practical Project

The intent of this practical project was to produce a guide to the creation of a personal photographic archive. The structure of this thesis was to illustrate the issues that were faced and the solutions that I decided upon. This thesis will give future researchers dealing with preservation concerns relating to colour photography a current resource guide. The intent of this project was not to describe the most ideal solution for all colour photography issues. It is instead a unique and personal attempt to create the best possible solution for an individual and their needs.

The research for this project was divided into two sections. The first pertained to the written thesis and involved research books, articles, journals, online sources, and first and second hand information from collecting institutions. The second section, applied the information gathered in the first section and put it to use sourcing material for the new archive. This involved online research, emailing, and calling companies to get information, specs, and other details pertaining to the products I had to order.

The construction process was initially planned in two phases, which consisted of three weeks of final research, planning, and implementation over the months of June and July. The first phase took place from June 14th to the 22nd, and involved the ordering of the folder material, shelves, and worktable. Shipping delays hampered this week, and it was not as productive as originally planned. Regardless of the delays I was able to install the worktable, receive the shelving units, and fabricate full-scale tests of the folders. The second phase was from July 5th to the 19th and focused on the ordering of any remaining materials and projects, while also setting up the archive in preparation for the intake of photographic materials. This phase went smoothly, but was still hindered by shipping delays putting production of the photographic folders behind schedule. During this time I was able to finish the installation of the shelving unit, wrap them in Polyethylene, and begin the construction of folders. I had originally planned that this three week time period would be enough to finish the majority of the work. Although I was able to finish the construction of the physical archive, I still have work to do on the fabrication of the folders. The folders, which I designed, are currently being fabricated by me. The final material selected, Hi-Core, is an inert plastic made of polyethylene similar to Coro-plast. This material was selected for its rigidity, affordable price, and archival properties.

As of August 31, 2010 the majority of my objectives have been completed. This includes the ordering and receiving of the archive materials and furniture. The set-up of the space was completed at the end of July and environmental monitoring was conducted over the span of a month within the polyethylene wrapped shelving units. The data collected shows a temperature between 70°-75°F and relative humidity between 40-50%. Although there is no way to control these two aspects of the archive I am very pleased with the results I have monitored so far. The only objective that has yet to be completed is the construction of the photographic folders. I was able to produce 10 of the 35" x 45" size in July, but I had underestimated the amount of time needed to produce each folder. I am currently in the process of completing this final aspect of the archive and should be done by the end of September. The creation of this archive went quite smoothly since I was giving almost total control of the planning, design and construction of the space. There were some delays mainly due to the shipping of materials, but other than having to wait an extra day or two there no major problems surfaced. In an ideal situation were budget and time did not factor into the production of the archive I would have changed only a few aspects of the archive. This would be the construction of space that would be solely dedicated to the purposes of a photographic archive. This contained room would have its own temperature and humidity control, and the space to take in an endless amount of photographic prints. I would also outsource the construction of the photographic folders, I do enjoy the process of making them myself since I can ensure that a level of quality is maintained. However if cost were not an issue then I would have then produced to speed up the process. Besides these two major alterations I feel that I was able to produce a quality space for the storage and preservation of photographic prints. Since Burtynsky does not need a full-time archive manager on staff the maintenance will be handed over to the print manager once the final folder has been completed.

This archive will ensure the stability and longevity not only of Burtynsky's photographic prints, but also his photographic legacy. By following these preventative preservation methods and storing his photographs within the constructed space, Burtynsky will not have to worry about what will happen to his work over the next 5, 10, or even 20 years. Although this archive will greatly improve the longevity of his work it does have a limit to the number of objects that can be stored. At the rate that Burtynsky currently produces work this space will quickly reach its capacity. This is an issue that he will face and hopefully this practical project can be utilized again when a new space is needed. The development of this project came about by chance, but was completed with hard

work and dedication. Through rigorous research and meticulous planning I have been able to produce an end product that fulfills the needs of the artist and his work.

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- ⁱ Image sourced from Google Maps.
- ⁱⁱ Image sourced from Google Maps.
- ⁱⁱⁱ Wilhelm, Henry, *The Permanence and Care of Color Photographs*, Grinnell: Preservation Publishing Company, 1993.
- ^{iv} Wilhelm, p.vi
- ^v Ritzenthaler, Mary Lynn and Diane Vogt-O'Connor, *Photographs: Archival Care and Management*, Chicago: Society of American Archivists, 2006.
- ^{vi} Hendriks, Klaus B, *Fundamentals of Photograph Conservation: A Study Guide*, Toronto: Lugus Publications, 1991
- ^{vii} Corr, Susan, *Caring for Collections: A Manual of Preventive Conservation*, Dublin: Heritage Council, 2000.
- ^{viii} Keene, Suzanne, *Managing Conservation in Museums*, Oxford: Butterworth-Heinemann, 2002.
- ^{ix} Fahy, Anne, "Collections Management", London: Routledge, 1995.
- ^x Knell, Simon, *Care of Collections*, London: Routledge, 1994.
- ^{xi} Bertrand Lavédrine, "Photographs of the Past: Process and Preservation" (2009): 198.
- ^{xii} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 6.
- ^{xiii} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 6-7.
- ^{xiv} Weaver, Gawain, and Zach Long, "Chromogenic Characterization: A Study of Kodak Color Prints, 1942-2008. Notes on Photographs, http://notesonphotographs.eastmanhouse.org/index.php?title=Weaver,_Gawain_and_Zach_Long._Chromogenic_Characterization:_A_Study_of_Kodak_Color_Prints,_1942-2008#History_and_Technology.
- ^{xv} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 3.
- ^{xvi} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 6.
- ^{xvii} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 6.
- ^{xviii} Henry Wilhelm, "The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures," http://www.wilhelm-research.com/pdf/HW_Book_01_of_20_HiRes_v1a.pdf (consulted in April 2010)
- ^{xix} Weaver, Gawain, and Zach Long, "Chromogenic Characterization: A Study of Kodak Color Prints, 1942-2008. Notes on Photographs, http://notesonphotographs.eastmanhouse.org/index.php?title=Weaver,_Gawain_and_Zach_Long._Chromogenic_Characterization:_A_Study_of_Kodak_Color_Prints,_1942-2008#History_and_Technology.
- ^{xx} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 10.
- ^{xxi} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 5.
- ^{xxii} Weaver, Gawain, and Zach Long, "Chromogenic Characterization: A Study of Kodak Color Prints, 1942-2008. Notes on Photographs, http://notesonphotographs.eastmanhouse.org/index.php?title=Weaver,_Gawain_and_Zach_Long._Chromogenic_Characterization:_A_Study_of_Kodak_Color_Prints,_1942-2008#History_and_Technology.
- ^{xxiii} Bertrand Lavédrine, "Photographs of the Past: Process and Preservation", (2009): 10.
- ^{xxiv} Bertrand Lavédrine, "Photographs of the Past: Process and Preservation", (2009): 12.

-
- ^{xxv} Bertrand Lavédrine, "Photographs of the Past: Process and Preservation", (2009): 12.
- ^{xxvi} Bertrand Lavédrine, "A Guide to the Preventive Conservation of Photograph Collections", (2009): 58.
- ^{xxvii} James M. Reilly, "Storage Guide for Color Photographic Material", (1998): 24-25.
- ^{xxviii} Bertrand Lavédrine, "A Guide to the Preventive Conservation of Photograph Collections", (2003): 162-163.
- ^{xxix} Bertrand Lavédrine, "A Guide to the Preventive Conservation of Photograph Collections", (2003): 174.
- ^{xxx} <http://www.imagepermanenceinstitute.org/shopping/shopexd.asp?id=16> (consulted June 2010)
- ^{xxxi} J.P. McElhone, email and phone conversations, May 17, 2010.
- ^{xxxii} J.P. McElhone, email and phone conversations, May 17, 2010.
- ^{xxxiii} Sophie Hackett, Tour of A.G.O. prints and drawings vault, April 29, 2010.
- ^{xxxiv} J.P. McElhone, email and phone conversations, May 17, 2010.
- ^{xxxv} Mirjam Foot, "Preservation Management for Libraries, Archives, and Museums", Chapter 2, *Preservation Policy and Planning*, (2006): 27.
- ^{xxxvi} Mirjam Foot, "Preservation Management for Libraries, Archives, and Museums", Chapter 2, *Preservation Policy and Planning*, (2006): 27.
- ^{xxxvii} Mirjam Foot, "Preservation Management for Libraries, Archives, and Museums", Chapter 2, *Preservation Policy and Planning*, (2006): 32.
- ^{xxxviii} Martin C Jürgens, "The Digital Print: Identification and Preservation", (2009): 121.

Bibliography

- American Association of Museums, *Caring for Collections: Strategies for Conservation Maintenance, and Documentation: A Report on an American Association of Museums Project*. Washington, D.C.: American Association of Museums. 1995.
- Batchen, Geoffrey. *Photography's Objects*. Albuquerque 1997.
- Burtynsky, Edward. *Australian Minescapes*. London: Empress Litho. 2009.
- , *China*. Göttingen: Steidl. 2005.
- , *Oil*. Göttingen: Steidl. 2009.
- , *Quarries*. Göttingen: Steidl. 2007.
- Clavir, Miriam. *Preserving what is Valued: Museums, Conservation, and First Nations*, Vancouver, B.C.: UBC Press. 2002.
- Carr, Susan. *Caring for Collections: A Manual of Preventive Conservation*. Dublin: Heritage Council. 2000.
- Daffner, Lee Ann. *Conservation issues in Contemporary Photography: 20th Century Color*. New York: Museum of Modern Art. 2008.
- Eastman Kodak. *Conservation of Photographs*. Rochester NY: Photographic Products Group. 1985.
- Edwards, Elizabeth. *Raw Histories: Photographs, Anthropology and Museums*. Oxford-New York. 2001.
- , Janice Hart. "On the Materiality of Images." In *Photographs Objects Histories*. New York: Routledge. 2004.
- Fahy, Anne. *Collections Management*. London: Routledge. 1995.
- Fopp, Michael. *Managing Museums and Galleries*. London: Routledge. 1997.
- Frey, Franziska and Martin Jürgens. *Contemporary Photography-Digital Prints-Collaborative workshop in photograph conservation*. New York. 2007.
- G.E. Gorman and Sydney J. Shep. *Preservation Management for Libraries, Archives and Museums*. London: Facet. 2006.
- Hendriks, Klaus B. *Fundamentals of Photograph Conservation: A Study Guide*. Toronto: Lugus Publications. 1991.

-
- Jay, Bill. *Sun in the Blood of the Cat*. Tucson: Nazraeli Press. 2001.
- Jürgens, Martin C. *The Digital Print: Identification and Preservation*. Los Angeles: Getty Conservation Institute. 2009.
- Keefe Jr, Laurence E and Dennis Inch. *The Life of a Photograph: Archival Processing, Matting, Framing, and Storage*. Boston: Focal Press. 1990.
- Keene, Suzanne. *Managing Conservation in Museums*. Oxford: Butterworth-Heinemann. 2002.
- Knell, Simon. *Care of Collections*. London: Routledge. 1994.
- Lavédrine, Bertrand. *Photographs of the Past: Process and Preservation*. Los Angeles: Getty Conservation Institute. 2009.
- . *A Guide to the Preventive Conservation of Photograph Collections*. Los Angeles: Getty Conservation Institute. 2003.
- Lord, Gail Dexter. *The Manual of Strategic Planning for Museums*. Toronto: Altamira Press. 2007.
- Matthews, Graham. *Disaster Management in Archives, Libraries and Museums*. Farnham, England: Ashgate. 2009.
- Pauli, Lori. *Manufactured Landscapes: The Photographs of Edward Burtynsky*. Ottawa: National Gallery of Canada. 2006.
- Ritzenthaler, Mary Lynn and Diane Vogt-O'Connor. *Photographs: Archival Care and Management*. Chicago: Society of American Archivists. 2006.
- Schaeffer, Terry T. *Effects of Light on Materials in Collections: Data on Photoflash and Related Sources*. Los Angeles: Getty Conservation Institute. 2001.
- "Standards in the Museum Care of Photographic Collections." *Museums & Galleries Commission*. London: Victoria & Albert Museum 1996.
- Pearce, Susan M. *Interpreting Objects and Collections*. London: Routledge. 1994.
- Wilhelm, Henry. *The Permanence and Care of Color Photographs*. Grinnell: Preservation Publishing Company. 1993.
- Willson, Nancy. *Museum and Archival Supplies Handbook*. Ontario: Ontario Museum Association. 1979.

Articles and Journals

Caraffa, Costanza. 2009. "Kunsthistorisches Institut in Florenz in Florence Declaration: Recommendations for the Preservation of Analogue Photo Archives." 1-20.

Manoff, Marlene. 2010. "Theories of the Archive from Across the Disciplines." *Libraries and the Academy*, vol 4, number 1: 9-25.
http://muse.jhu.edu/login?uri=/journals/portal_libraries_and_the_academy/v004/4.1manoff.html (Feb 2010)

-----, 2006. "The Materiality of Digital Collections: Theoretical and Historical Perspectives." *Libraries and the Academy*, vol 6, number 3: 311-325.
http://muse.jhu.edu/login?uri=/journals/portal_libraries_and_the_academy/v006/6.3manoff.html (Feb 2010)

Patkus, Beth. 2006. "Assessing Preservation Needs: A Self-Survey Guide." *Northeast Document Conservation Center*.
www.nedcc.org/resources/downloads/apnssg.pdf

Sassoon, Joanna. 2004. "Photographic Materiality in the Age of Digital Reproduction." in: Elizabeth Edwards, Janice Hart, *Photographs Objects Histories*, London-New York: 186-202.

Schwartz, Joan M. 1995. "We make our tools and our tools make us: Lessons from Photographs for the Practice, Politics, and Poetics of Diplomats." *Archivaria* 40: 40-74.

-----, 2000. "Records of Simple Truth and Precision: Photography, Archives, and the Illusion of Control." *Archivaria* 50: 1-40.

Wilder, Kelley. 2009. "Photography and the Archive." *Photography and Science*, London: 79-101.

Williamson, Ray A. 2001. "The Opportunities and Challenges of Preservation Technologies." *Archives and Museum Informatics*, no 13: 211-225.