2012

Stained Glass at the Woodlands Cemetery

Lauren M. Szeber
University of Pennsylvania

Follow this and additional works at: http://repository.upenn.edu/hp_theses

Part of the Historic Preservation and Conservation Commons

http://repository.upenn.edu/hp_theses/199

Suggested Citation:

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/hp_theses/199
For more information, please contact libraryrepository@pobox.upenn.edu.
Stained Glass at the Woodlands Cemetery

Abstract
In 1855, the Woodlands Cemetery Company of Philadelphia, Pennsylvania incorporated stained glass windows in the southern façade of the Hamilton Mansion. Designed by John Gibson, the windows transformed the interior space by creating a chapel-like experience, reflecting larger social movements such as the concept of a rural cemetery, religious symbolism in the domestic residence, and the way these trends came to bear on the nascent idea of the early funeral home industry. This thesis is a study into the Woodlands Cemetery windows as a rare example of surviving mid 19th century stained glass. Documentation and exploration into the windows history, construction techniques, and deterioration mechanisms shed light on future conservation opportunities in a largely unrecognized field of artistry in America.

Keywords
stained glass, funeral home, conservation, manufacturing, rural cemetery

Disciplines
Historic Preservation and Conservation

Comments
Suggested Citation:
STAINED GLASS AT THE WOODLANDS CEMETERY

Lauren M. Szeber

A THESIS

in

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in
Partial Fulfillment of the Requirements of the Degree of

MASTERS OF SCIENCE IN HISTORIC PRESERVATION

2012

Advisor
Aaron Wunsch
Lecturer in Architectural History

Program Chair
Randall F. Mason
Associate Professor
To my family with love for their enduring support, patience, and words of wisdom.
Acknowledgements

The completion of this thesis would not have been possible without the advice and encouragement of the following individuals:

Alberto De Tagle  
Randy Mason  
Victoria P. Alvarez  
Jennifer Mass  
Benedict Brown  
The Woodlands’ Staff  
Julie Sloan  
Daniel Castele  
Irene Berkowitz  
Tisha Allen

I would like to thank Jessica Baumert, Executive Director of the Woodlands Cemetery, for her continuous commitment and support. It has been an honor to work with her and her assistance is truly appreciated.

Jean Farnsworth has served as an instrumental guide throughout my research process and her invaluable instruction and expertise has been an integral component to the success of this project.

I would also like to express my gratitude to my advisors Aaron Wunsch and Frank Matero for their professional suggestions, knowledge, and direction.

Thank you for all the love from my family and friends. I could not have done it without you.
# Table of Contents

Introduction: ..........................................................................................................................1

Chapter 1: The History of Stained Glass & Victorian Gothic Revival .................................5

Chapter 2: The History of the Woodlands & the Significance of Stained Glass .................22
  Section 2.1 History of the Mansion 1600 – 1840 .................................................................22
  Section 2.2 The Rural Cemetery Movement ....................................................................28
  2.3 The Woodlands Cemetery Company .........................................................................40
  Section 2.3 The Funeral Home .........................................................................................46

Chapter 3: Stained Glass in America and at the Woodlands ..............................................52
  3.1 History of Stained Glass in America ...........................................................................52
  3.2 The Gibsons ..............................................................................................................55
  3.3 John Gibson at the Woodlands .................................................................................59

PART 2: Overview of Methodology and Objectives ..................................................................73

Chapter 4: Construction Techniques .....................................................................................79

Chapter 5: Deterioration Conditions .....................................................................................98
  5.1 Documentation and Conditions Assessment: ...............................................................98
  5.2 Glass Deterioration .....................................................................................................101
  5.3 Deterioration of Paint: ...............................................................................................106
  5.4 Decay of the Supporting Structure: .............................................................................110

Chapter 6: Methods of Conservation .....................................................................................117
  6.1 Cleaning: ....................................................................................................................118
  6.2 Repair to Glass: .........................................................................................................119
  6.3 Repairs to Paint: .......................................................................................................122
  6.4 Conservation of Came and Support Bars: .................................................................125
  6.4 Sealant Replacement: ...............................................................................................127
  6.5 Protective Glazing: ..................................................................................................128
  6.6 Conservation in Practice – American Glass Case Studies: .........................................129

Future Recommendations and Concluding Remarks: .......................................................133

Bibliography ..........................................................................................................................138

Appendix ................................................................................................................................146
List of Figures:

Figure 1: Stained glass designed by AWN Pugin for the Cathedral in Armoire, 1841. Published in *The Stained Glass of A.W.N Pugin* ................................................................. 10

Figure 2: Church of Saint James the Less 1846–1848. Photographed by Robert Newell for the Library Company of Philadelphia. .......................................................... 13

Figure 3: A Villa in the Pointed Style as designed by Andrew Jackson Downing in *Cottage Residences* ........................................................................................................ 16

Figure 4 Drawing by Davis of the Paulding House with the additions made after its purchase by George Merritt in 1865. ................................................................. 19

Figure 5: Few of the original panes by William Gibson remain. These windows were designed by Henry Sharpe in the 1860s. Photograph courtesy of Lyndhurst National Trust Historic Site ................................................................. 19

Figure 6: Early lithograph of the Woodlands Mansion ................................................................. 24

Figure 7: Engraved view of Mount Auburn Cemetery 1847. .......................................................... 33

Figure 8: View of Bigelow Chapel, Mount Auburn Cemetery 1886. Photographed by George Kendall Warren at the Cambridge Historical Society .................................................................... 34

Figure 9: Rose window detail in the Bigelow Chapel. Photographed by Julie Sloan. 35

Figure 10: Chapel, North Laurel hill ca. 1880. Photograph from the Laurel Hill Cemetery ................................................................................................................................. 40

Figure 11: Lithograph of the Woodlands Cemetery main entrance ca. 1860 by P.S. Dural & Son, Philadelphia. ........................................................................................................ 42

Figure 12: Detail of the Woodlands stained glass installed in the south façade. Photograph from the Historic American Buildings Survey ca. 1900. ................................. 44

Figure 13: Enamel painted stained glass at the Capitol. Photograph from *The Capitol Dome Second Edition* ........................................................................................................ 57

Figure 14: Stained glass skylight by Gibson, west side staircase. Photograph from *The Capitol Dome Second Edition* ........................................................................................................ 58

Figure 15: North façade, Historic American Building Survey ................................................................................. 61

Figure 16: South façade, Historic American Buildings Survey ................................................................................................. 62

Figure 17: Three exterior doors leading to the southern porch. Historic American Buildings Survey ................................................................................................................................. 63

Figure 18: Two of the intact Gibson door windows. Photographed by author. ................................. 64

Figure 19: Floor plan of the Woodlands. Note the “ballroom” is the space that would later be converted for the chapel ........................................................................................................ 66

Figure 20: Image of the saloon looking west. Historic American Buildings Survey ................................................................. 67

Figure 21: Interior fanlight after being removed and placed in the basement. Photograph by author ......................................................................................................................... 72

Figure 22: Removal of the fanlight over the northern entrance, 1994. Photograph from the Woodlands Cemetery ......................................................................................................................... 72

Figure 23: Broken stained glass pieces as found in the basement. Photograph by author ......................................................................................................................... 76

Figure 24: Pieces laid out to be organized and catalogued. Photograph by author ......................................................................................................................... 76

Figure 25: Cleaning of the windows. Photograph by author ......................................................................................................................... 77

Figure 26: Light table construction. Photograph by author ......................................................................................................................... 77

Figure 27: Window prior to cleaning. Photograph by author ......................................................................................................................... 78
Figure 28: Window after first cleaning. Photograph by author. ........................................78
Figure 29: 18th century glass house. Published in Conservation of Glass. 80
Figure 30: Green pot metal arch with matte paint detailing. ..........................87
Figure 31: Hourglass motif at the window’s base.................................................89
Figure 32: Diamond ruby detail. ........................................................................91
Figure 33: Lead came profile. ..............................................................................96
Figure 34: Evidence of severe glass cracks and separation of the glass from the lead matrix. .......................................................................................106
Figure 35: Loss and fading of the matte paint..................................................108
Figure 36: Cracking in the lead matrix..............................................................113
Figure 37: The face of Faith before and after conservation. Published in The Art of Collaboration: Stained Glass Conservation in the Twenty-First Century. 131
Figure 38: Woodlands Cemetery Company receipt to John Gibson 1855. Archived at the Historical Society of Pennsylvania.............................................146
Figure 39: Detail of the northern entrance fan light from 1907 postcard. Archived at the Philadelphia Historic Commission..................................................146
Introduction:

Since the Middle Ages, the art of stained glass has been a topic of study for architects, carpenters, painters, and scholars alike. With its ever-changing play on color and light, stained glass bridges the gap between architecture and art serving as a functional as well as decorative element. Like any great work of art, glass is reflective of history, religious and social values. Its design and symbolism connect viewers with the past while at the same time, transforming a space by shaping the interior experience.

In 1855, Philadelphia’s Woodlands Cemetery Company completed renovations to the grandest room of an historic mansion, on their grounds creating a “chapel” to serve their new mission. Outfitted with seven stained glass windows, the room was transformed from a bright open space to an intimate interior, arousing feelings of reflection and solemnity through the beauty of colored light. The Trustees’ decision to commission Philadelphia stained glass artisan John Gibson was not without well-planned intention. Applying the craft to buildings in a rural cemetery was in keeping with various movements that were taking place in the city as well as throughout the country. The 19th century was a period of great change for America. The industrial revolution set off an explosion of productivity, population growth, and economic opportunities. At the same time, changing social values created a cloud of confusion over the traditional family, further muddled by new ideas of taste, nostalgia, and modernity.
This thesis is an exploration into the Woodlands Cemetery stained glass windows that until recently were undervalued for their historical significance and masterful craftsmanship. The story begins with the history of stained glass and its introduction into American architecture during the rise of the Gothic Revival in the 19th century. The implications of stained glass at the Woodlands Cemetery are extensive, tied to larger social movements, such as the concept of a rural cemetery, religious symbolism in the domestic residence, and the way these trends came to bear on the nascent idea of the early funeral home industry, an institution that arguably took root in the city of Philadelphia. The Woodlands Mansion is of architectural importance in its own right. Known as one of the most significant domestic architectural accomplishments of the mid-18th century, the incorporation of the windows back into the public eye will add a temporal dynamic to the building that has been previously ignored and guide the building towards a more enriched and nuanced representation of the various phases of its history.

The second aspect of this thesis focuses on the windows’ design, technology, and conservation opportunities. American stained glass is relatively uncharted territory. Glassmaking did not gain broad recognition until the late 19th century with the establishment of renowned studios by Louis Comfort Tiffany and John La Farge. The high demand for their opalescent glass extended all the way until the 1930s and these firms are still household names today. This study in contrast aims to shine light on the lesser-known early years of American stained glass and its glassmakers. Characteristic of this experimental period, the Woodlands windows unite painting practices that range from the earliest days of the art to later 16th and
19th century developments. Not only does historical research provide a context for John Gibson’s methods, but close examination of the Woodlands’s windows has allowed for the study and clarification of the artist’s techniques. The identification of these skills and procedures adds to a broader understanding of American stained glass manufacture during this period.

One of the most important factors in verifying the significance of the craft tradition is through documentation of the windows themselves. Recent ventures like the Census of Stained Glass in America has catalogued America’s stained glass heritage for the past twenty years, bringing to light the extraordinary contributions that America has made to the craft. Virginia Ragun of the Census of Stained Glass Windows in America states:

Painted or “stained glass” constitutes a dominant form of architectural decoration in almost every nineteenth century place of worship and in many homes and public buildings at the turn of the century. Yet it has been relatively little studied...It is essential, if architecture is to be preserved with any sense of fidelity to its context, that we begin to value the architectural arts.¹

Making the link between aesthetics and function is a crucial part of understanding such windows’ construction techniques, deterioration mechanisms, and appropriate conservation practices. Unfortunately, American stained glass is being lost at an alarming rate. The observations and conditions survey of this paper focuses on two representative windows for their level of intactness and visible signs of decay. The

documentation of the Woodlands’ windows intends to add to the critical awareness of deterioration and the importance of preserving these historic treasures.

The harmony of different elements that comprise a window adds to its wonder but also contributes to its susceptibility to a complicated array of deterioration mechanisms. Deterioration is a natural aspect of any building component. Neglect, fire, vandalism, pollution, water infiltration, and misguided restoration are all reasons for damage, and only by acknowledging windows as complex, architectural artistic objects can problems be properly treated. A comprehensive conditions survey of the windows identifies the range of possible types of decay and records the various conditions that are currently evinced at the windows at the Woodlands. In addition, it strives to diagnose the cause of these issues for future prevention.

The final segment of this study addresses current conservation practices. Unlike European windows, architectural stained glass in the United States has gone largely neglected in the United States due to relative lack of age and low degree of restoration necessary aside from ordinary repair. Moreover, American stained glass has all too often been considered poor reproductions of medieval works, and thus unworthy of preservation. Over the proceeding chapters, the author aims to help change this misguided perception by discussing appropriate conservation methods for both the Woodlands’ windows and for similar works. The suggestions that follow will hopefully serve as a guide to future treatments that will return John Gibson’s glass to its former brilliance.
Chapter 1: The History of Stained Glass & Victorian Gothic Revival

The presence of stained glass windows at the Woodlands is the convergence of multiple trends that were taking place both locally and at a national level. In order to appreciate the stained glass at the Woodlands, it is important to first understand the larger movements that were rapidly changing both the art of colored glass, architectural styles, and their implications for society. The history of decorative stained glass has its roots in the mosaic art perfected in the Eastern Roman Empire. Fusing stones and clay into intricate patterns, the Byzantines later advanced to inlaying glass. It was in the East that stained glass became associated with the Church and eventually spread to Western European cathedral architecture, serving as both celebratory decoration, and as a biblical instruction to worshippers. Flourishing through the Middle Ages, stained glass was prized for its ‘translucent splendour’ and in the Romanesque Period was accepted as an integral element of a Christian structure. The blending of the emotional art form and the religious connotations of the period reached the height of craftsmanship during the twelfth and thirteenth centuries known as the Golden Age of stained glass. The medieval techniques used to fabricate stained glass windows were fully recorded by the German monk Theophilus in *De Diversis Artium*. This document established stained glass as an artistic medium and became the reference of choice for future craftsmen.²

By the fourteenth century, heraldic signs and portraits of donors became popular subject matter in both churches and private residences. Medieval hall windows would often display patron saints or coat of arms, exhibiting the history or social standing of an important family. However within the next century, the quality of the craft began to decline as Renaissance practitioners began to favor the artist-painter, who was thus elevated to a much higher position than the ordinary craftsman. The painter-artist substituted the natural properties of colored glass in for paint. It is during

Figure 1: The prophet Daniel from Augsburg Cathedral (c. 1065)
this period that some scholars believe that the true art of stained glass with its luminosity and brilliance was lost to the thick painted pictures that obscured it.  

For the next 200 years, the demand for the art form largely diminished and was nearly forgotten until the 18th century revival of the Gothic style. French architect and historian, Eugene Emmanuel Viollet-le-Duc (1814-1879) developed an interest in the middle ages, which eventually led to his personal restoration of numerous Gothic Cathedrals. His study of medieval stained glass resulted in an essay entitled "Vitrail" published in 1868 and later in a ten volume treatise entitled Dictionnaire raisonne de l'architecture francaise du XI au XVI siecle published in 1875. The book reveals Viollet-le-Duc’s complete knowledge and understanding of the medieval stained-glass techniques used in French Gothic Cathedrals. British followers, including John Ruskin (1819 – 1900) and Augustus Welby Northmore Pugin (1812 – 1852) who advocated the return of twelfth and thirteenth century architecture and by mid-century Gothic was considered by some to be England’s national style.  

For England, the revival of this architectural style and art form was closely entwined with the re-awakening of the high church and the concern for the increase in religious nonconformism. However, Gothic had long been established as a style influenced by literature and the arts. Eighteenth century writers, painters, and

architects voiced a longing for and romanticized the Middle Ages in the dawning of the Industrial Revolution. Again, key advocates including A.G.N. Pugin and Scottish writer Thomas Carlyle (1795 – 1881) directed their followers to study the golden age of medieval society as they fought against industrial “progress,” machine production, and factories that were corrupting the traditional, wholesome way of life. In many ways it is Pugin who can be credited with forming contemporary theories surrounding the Gothic aesthetic. Although a professional architect by trade, he was also well known as an eloquent Catholic polemicist and talented author. His two books for the cause, *Contrasts or a Parallel between the Noble Edifices of the Middle Ages, and Corresponding Buildings of the Present Day* and *The True Principles of Pointed or Christian Architecture*, are noted among the major 19th century architecture works in which he reasons for Gothic as the single most “true” Christian style. Gothic architecture with its high arches, stained glass windows, and cross symbolism, was infused with the Christian values that had been supplanted by the paganism of classicism and furthermore, destroyed by industrialization.⁶

Two concepts introduced in Pugin’s publications became particularly influential to Victorian design. In *Contrasts*, the author states that it is in Gothic (or ‘Pointed’) architecture that “we find the faith of Christianity embodied and its practices illustrated.”⁷ Specifically, the three great doctrines of Christianity – redemption through Crucifixion, the Trinity, and the Resurrection – are the basis of Gothic architecture. These doctrines manifest themselves in the cruciform plan of

---

⁷A.W.N Pugin, *Contrasts, or a Parallel between the Noble Edifices of the Middle Ages, and Corresponding Buildings of the Present Day* (London: 1836), 3.
churches, triangular groupings of structure and ornament, and the upward movement of Gothic form. Also important was the idea of the “honesty” of revealed construction. Pugin advocated that it was deceitful to conceal the construction and the exposed structure, like flying buttresses and vaults, provided Christian morals and truth. *True Principles* further details these points, stating that first “that there should be no features about a building that are not necessary for convenience, construction, or propriety,” and second, that “all ornament should consist of the enrichment of the essential construction of the building.”

Even such mundane objects, like locks, hinges, and nails could be “rich and beautiful decoration” if they were treated as “the decoration of construction,” which could be accomplished through the study of medieval craftsmen.

*True Principles* expanded on structural integrity in the correct application of materials in artistic production. His major design philosophies are set forth in his text:

All ornament should consist of enrichment of the essential construction of the building (1)
In pure architecture the smallest details should have a meaning of serve a purpose (1)
Construction should vary with the material employed (1)
The external and internal appearance of an edifice should be illustrative of, and in accordance with, the purpose for which it is destined (42)

The principle of designing in harmony with the natural properties of a material meant that the perceived essential properties employed should dictate how it was
used. Pugin exhibited the design of medieval metalwork in agreement with its essential properties, and soon after the same theories were applied to the crafting of stained glass.

![Image of stained glass window]

**Figure 1:** Stained glass designed by AWN Pugin for the Cathedral in Armoire, 1841. Published in *The Stained Glass of A.W.N Pugin.*

In response, it was the ecclesiological movement that transferred these ideas into the physical manifestation of churches. The Cambridge Camden Society (CCS) formed in 1839 to “promote the study of Ecclesiastical Architecture and Antiquities.” Within this realm and extensively discussed in their journal, *The

---

Ecclesiologist, was the topic of stained glassed. The Ecclesiologist became a prime publication for the various debates on stained glass between the quality and truth of medieval craftsman in comparison to their contemporary counterparts. By 1845, several crucial books were published; James Ballantine’s A Treatise on Painted Glass, Charles Winston’s An Inquiry into the Difference of Style Observable in Ancient Glass Paintings and William Warrington’s The History of Stained Glass. These books proved to be extremely influential to the stained glass movement both in Europe and in the United States, arguing that stained glass was applicable to every style of architecture. Ballantine’s “true principles” were based on the concept of good design, and if these principles were followed, stained glass could be employed in a variety of styles and contexts. This proved particularly evocative in the case of the Woodlands. John Gibson would not only be producing windows in a non-sectarian space but it was also Ballantine’s work that would serve as John Gibson’s guide in the early years of his practice.

Stained glass and its Catholic associations were not always met with open arms. Anti-Catholicism was prevalent in the 1820s, largely due to increasing growth of the Catholic population which reached its peak by midcentury. Anti-Catholic concerns included the loss of jobs to Catholic immigrants, fears among city leaders that impoverished newcomers would strain public relief efforts, and the threat that Catholic block voting would subvert the political process. However, at the same time, across the nation Protestant congregations were embracing the Gothic and beginning to add entirely new elements derived from Roman Catholic architecture.

13 Chesire, Stained Glass and the Victorian Gothic Revival, 17.
In addition, these congregations broke with their Puritan traditions and started to employ symbolic crosses, decorate with flowers and candles, robed choirs, and of course, stained glass.\textsuperscript{14}

From 1820 to 1850, the Catholic Church grew from less than 4% of practicing Christians, to 1.75 million, making it the largest religious sect in the United States. In Philadelphia, nearly one third of the city’s inhabitants were believed to be of the Catholic faith.\textsuperscript{15} Prompted by the mass Catholic immigration, new schools and parishes introduced the faith into communities for the first time. This rapid growth challenged the traditional strong standing of Protestant churches in these areas and fueled fears of losing ground in Rome.\textsuperscript{16} In the spring and summer of 1844, the tension and animosities exploded in one of the worst riots that Philadelphia had ever seen. In addition to the destruction of thirty Catholic homes, the city’s St. Michael's Church and rectory as well as St. Augustine’s Church were set ablaze.\textsuperscript{17} In an ironic effort, Protestant denominations chose to combat the situation by adopting the physical features that were emblematic of its competitor. Newly built churches were suddenly investing in Gothic atmospheres, sanctifying their alters with flowers, and celebrating with festivals and feasts in the hopes of defusing some of the appeal in the Roman Catholic Church. By the end of the 19\textsuperscript{th} century, these

\begin{flushleft}
\textsuperscript{14}Ryan K. Smith, \textit{Gothic Arches, Latin Crosses; Anti-Catholicism and American Church Designs in the Nineteenth Century} (Chapel Hill: The University of North Carolina Press, 2006), 5.
\textsuperscript{16}Smith, \textit{Gothic Arches, Latin Crosses}, 10.
\textsuperscript{17}Stained Glass in Catholic Philadelphia, 29.
\end{flushleft}
signature features of stained glass, high arches, and other Catholic associations were synonymous with church worship in America.\textsuperscript{18}

Figure 2: Church of Saint James the Less 1846 – 1848. Photographed by Robert Newell for the Library Company of Philadelphia.

Although variations of the Gothic Revival had been built since the early 1800s, in many ways Philadelphia was one of the first cities to embrace the movement towards the construction of true Gothic Cathedrals. St. James the Less was the first church in the United States to be erected under the direct supervision of the English Cambridge Camden Society. Built between 1846 and 1848, the design was copied from several churches in England, the 16\textsuperscript{th} century St. Mary’s in Arnold, Nottingham and St. Michael’s, Longstanton, Cambridge for their range of Gothic styles.\textsuperscript{19} In the end thirty thousand dollars were spent on the construction of St.

\textsuperscript{18}Smith, \textit{Gothic Arches}, 10.
James the Less. Granite was used for the stonework from Pennsylvania quarries and rich stained glass was installed in the aisle windows produced by Powell’s Whitefriars Glass Works, London. By 1849, the church had been become so distinguished that the vestry commissioned renowned artisan Henry Gerente of Paris to make a new glass window for the eastern façade.

By the mid-nineteenth century, the Gothic Revival and its stained glass was becoming integrated into both religious and domestic structures. Driven by the Gothic Revival from England and the movement towards the Picturesque, neoclassical structures were replaced by cottages and Italianate villas distinguished by pointed arches, vertical board-and-batten siding, and stained glass that represented the symbolic transference of ecclesiastical imagery from the church into the family home.20 Andrew Jackson Downing (1815-1852) advanced the movement by publishing his work Treatise on the Theory and Practice of Landscape Gardening (New York, 1841) and Cottage Residences (New York, 1842). These two publications, with illustrations from Alexander Jackson Davis (1803 – 1892) would become the foundation for a new aesthetic theory that sought “the improvement of the domestic architecture and the rural taste of our country.” In his last publication, The Architecture of Country Houses (1850), Downing included Richard Upjohn’s “A Villa in the Italian Style” and Gervase Wheeler’s (ca.1815-ca. 1872) “An American Country House of the First Class,” both specifying stained glass in which Wheeler recommends that “stained glass, of that quiet tone of color which true artists are just

beginning to find suitable to domestic purposes, and of simple design should fill the windows if not all certainly those of the halls, staircase, and library....”\textsuperscript{21} For the next thirty years, examples and patterns of appropriate houses could be found in over 58 different editions of builder’s guides. The gothic residence was described by one contemporary as “a building, the character of whose architecture is distinguished by the upward direction of its leading lines, and by such curves as may be introduced meeting, or having a tendency to meet in a point.”\textsuperscript{22} References made to stained glass were contributed by several architects including Philadelphia architect John Notman (1810-1870). The Cottage, Mount Holly, New Jersey, built for merchant Nathan Dunn, Esq., of Philadelphia, in 1837-38, had a library “In a rich Gothic style.... [with a cottage-oriel window] ... glazed with fine examples of landscapes painted on glass.” The description of Bishop George Washington Doane’s Riverside Villa (demolished), Burlington, New Jersey, again included stained-glass windows in the library, where the bay window was “a prominent feature ..., admitting through its coloured panes a pleasing, subdued light, in keeping with the character of the apartment.”\textsuperscript{23}

\textsuperscript{22} Clark, \textit{Material Life in America 1600 – 1860}, 536.
\textsuperscript{23} Farnsworth, “Stained Glass Windows at Lyndhurst,” 12.
This continuity between the sacred and the domestic transplanted the Christian form in a private dwelling. In 1847, Hartford minister, Horace Bushnell, published his book, *Christian Nurture,* in which he argued that the true approach to Christianity was that a child should “grow up a Christian, and never know himself as being otherwise.” This could be accomplished by simply raising a child in a Christian home and surround it with Christian parents who would set the proper example.”  

Bushnell preached that the child “breathes the atmosphere of the house. He sees the world through his parent’s eyes. Their objects become his. Their life and spirit mold him.” Housing reform quickly adopted this religious ideology to suit their needs. It was the home that was the key element in shaping the religion of the child,

---

24 Clark, 540.
25 Ibid., 540.
and housing reformers quickly sought to market a home that was as Christian as possible. The home became designed to incorporated church-like elements fabricated by the Gothic Revival, based on a cross plan with decorative gables and accented with stained glass. Ground plans were adapted to absorb irregularities necessitated by the bay windows and towers. Oval rooms were substituted for circular and hexagonal halls with vaulted and groined ceilings. Even small pump organs could be purchased for the front parlor so that family could play their favorite hymns together. In such a perfect Gothic rural home, in harmony with its natural setting and far away from the vices of the city, the Christian family could worship God.

Designed in 1838 in the Hudson Valley, Lyndhurst was one of the first and grandest Gothic Revival mansions to be built in the United States. Leading Gothic architect Andrew Jackson Davis (1826-1910) and owner William Paulding (1770 - 1854) conceived the structure as a country villa, reflecting the romantic emphasis on nature, imagination, and emotion that had become integrated into the Hudson River Valley. The home named the “Knoll,” became famous for its fanciful turrets and asymmetrical form that were complemented by picturesque grounds of sweeping lawns and with shrubs and carefully selected trees. Davis had a long history with the Gothic Revival, commissioned as an illustrator for Andrew Downing’s Rural Residences (1838) and Cottage Residences and designing the Gilmor house near Baltimore just a few years prior.26 As one visitor described it, “In the

---

course of our drive we went to see Mr. William Paulding’s magnificent house, yet unfinished, on the bank below Tarrytown. It is an immense edifice of white or gray marble, resembling a baronial castle, or rather a Gothic monastery with towers, turrets, and trellises; minarets, mosaics, and mouse-holes; archways, armories, and air holes; peaked window and pinnacled roofs.”27

In 1864 Davis doubled the size of the mansion its second owner, adding a four-story tower, a new porte-cochere, dining room, bedrooms, and servants quarters. Keeping true to form, Davis incorporated stained glass into the design first appearing in his records on June 12, 1841 in which he writes;

12 June 1841, “West window rectified from ... drawing for pendants [$]10” and “Front door alterations and additions; section of big window, and studies for stained glass [$] 5.”

19 August 1841, “Door top, Big Window. Stained glass design [$] 5.”

11 November 1841, “Extra drawing for window [$]5” and “Large Window [$]10.” 28
Figure 4: Drawing by Davis of the Paulding House with the additions made after its purchase by George Merritt in 1865.

Figure 5: Few of the original panes by William Gibson remain. These windows were designed by Henry Sharpe in the 1860s. Photograph courtesy of Lyndhurst National Trust Historic Site.
William Gibson (brother of John Gibson) was awarded the commission composing windows largely of leaded quarry glass (diamond shaped) with a spotting of colored and stenciled glass infills. Little of this work survives, however 1843, a New York weekly praised Gibson’s “gorgeous windows of enameled glass,” for the Paulding’s’ Gothic villa Knoll.29 The following year, on completion of George Washington Carpenter’s Greek Revival residence Phil-Ellena in Germantown, Pennsylvania, William Gibson was acclaimed for his execution of the stained-glass windows throughout the house as well as his decorative painting, in which he was assisted by his brother John. Glass stainers have also been identified for two of Davis’ villas designed in the 1850s: Loudoun House, in Lexington, Kentucky, for which John Bolton painted quarried door panels to resemble a grape arbor in 1852; and Grace Hill/Litchfield Villa, Brooklyn, for which a variety of stained glass was fabricated by William Gibson, William Hannington and Owen Doremus, ca.1854-57.30

Glass in the private home became so popular that by the end of the century advertisements could be found in almost every newspaper or furnishing magazine. One article from 1884 writes:

“With rooms more luxuriously furnished, and even the simplest accessories studiously artistic, vitrified colored transparencies in broad windows or narrow lancets, or windows divided by mullions, or as an upper light over white panes, or as mosaic or leaf borders afford an additional richness to apartments, softening too the bright light of summer suns and conveying a sense of warmth in winter, so far as artistic impressions are concerned.”31

29Ibid., pp 14.
30Ibid., 12.
As colored glass became more and more present in domestic spaces, Davis and Downing were the first in America to promote the use of colored glass and their work helped popularize the new taste in architecture to architects and homeowners alike.
Chapter 2: The History of the Woodlands & the Significance of Stained Glass

Section 2.1 History of the Mansion 1600 – 1840

Extending over nearly three hundred years, the full history of the Woodlands is by no means possible to cover in this chapter alone, not is it the subject of this research. Instead, this section is intended to provide a general historical background on the building and its architectural development. A comprehensive history of the estate can be found in Timothy Long’s 1991 thesis, “The Woodlands: a Matchless Place” as well as “The Woodlands: Documentation of an American Interior” written by Catherine Ann Carosino in 1997. Both of these works are the results of heavy archival research taking more than two years to compile. These documents are currently unprocessed at the Historic Society of Pennsylvania. Thus, the following abridged history of the Woodlands is a combination of information compiled from both of the listed theses. Also particularly useful were various historic structures reports conducted by John Milner Associates as well as James Jacobs’s “Addendum to the Woodlands” report for the Historic American Building Survey.

2.1 History of the Woodlands: The Hamilton Era

The history of the Woodlands began as a province of Pennsylvania in the late 1600s. Tracts of land around the city of Philadelphia were granted to settlers directly by the founder of the colony William Penn. Originally located on a 545 tract
of land, the Woodlands went through three owners before Andrew Hamilton I (1710 – 1734) came into 250 acres of the property on January 29, 1734. Architectural investigations undertaken between 1981 and 1994 suggest that major campaigns of modifications occurred around 1745 by Andrew Hamilton II, father of William Hamilton., however later evaluation indicates that the earliest construction was actually ca. 1770. The original house consisted of a simple two-story rectangular structure, which would be significantly altered following the War for Independence. William Hamilton (1745 – 1813) inherited the Woodlands at the age of two after the death of his father in 1747. Graduating from the College of Philadelphia, Hamilton began work on the home, possibly as early as the mid 1760s. A correspondence with George Washington, almost twenty years later, indicates that an addition of a south portico may have been constructed during this period.

---

Although financially secure, the Revolutionary War brought other misfortunes to the Hamilton family. William did not favor complete severance of ties with Britain, and his indifference to the cause resulted in two attempts to be prosecuted for high treason. Although acquitted, he chose to exile himself to his home throughout the war, during which he made significant improvements to the Woodlands. The household accounts from 1782 – 1785 show a vast amount of building activity with receipts for lumber, bricks, and plaster materials, indicating the laying of hearths for additional fireplaces and chimneys.\(^\text{36}\)

\(^{36}\) Catherine Ann Carosino, "The Woodlands: Documentation of an American Interior,"
The death of William’s brother Andrew Hamilton III in 1784 left him the sole heir to the ample Hamilton real estate holdings that were concentrated in Philadelphia and Lancaster County. However, his brother’s death also left William responsible for raising his four nieces and three nephews. Historians speculate that it was this addition to his family as well as his interest in the latest English architectural trends that prompted the later improvements made to the Woodlands.\(^\text{37}\) The largest building campaign at the Woodlands occurred one year after Hamilton returned from England in 1786. It is still unclear how much of the Woodlands was designed by Hamilton himself, but it is clear that master carpenter Thomas Nevell was hired to measure and draw plans of the existing house. In his article “The Woodlands,” Richard Betts suggests that the designer of the Woodlands was most likely a lesser-known individual who was acquainted with the works of more famous architects such as Robert Adam and Sir John Soane.\(^\text{38}\) Almost everything that is known about the current form of the structure derives from the voluminous correspondence between William Hamilton and his secretary, Benjamin Hays Smith, and between Hamilton and his Lancaster agent, Jasper Yeates. The Hamilton letters, included in the collection stored at the Historical Society of Pennsylvania, provide insight into the progress of the work.

Despite frequent delays, the finished Woodlands became a tourist attraction for many visiting Philadelphia in the late eighteenth century. In 1806 Dr. Charles

\(^{37}\) Ibid., 12.
Drayton of South Carolina described the Mansion as follows:

Dined at Mr. Hamilton's, at his elegant seat about 3 miles from Philadelphia. The house extends more than 70 feet. It is of rough Stone, coated over with lime. One ascends to the principal Stage by 3 steps of hewn Stone, about 40 feet long, & land on an area of the same Stone & of the same length & about 6 broad. On this 4 Doric pilasters of Stone support a pediment. [Drayton's footnote: the earth must have been raised to the steps, for] the garden front has a portico 2 stories & 12’ wide with 4 doric pillars of wood from which 6 or 7 steps descend at the ends, the principal floor is 14 feet high; & the Attic, 9. the Entrance is a Vestibule, circular 15 feet in diameter, with 8 3/4 columns, 4 doors, & 4 niches between them. It is lighted by the uppermost panels, of glass, in the folding doors. NB, the dining room & 2 small cabinets or parlors are papered. [Drayton's footnote: these are well furnished, with really good paintings.] there is but one principal door in each - the others for convenience, are not apparent, having no architraves of wood or paper to be seen. Whereby the walls seem spacious and unbroken by many doors, the attic contains 8 bedchambers of which 3 small ones are over the Salloon. The following plan may be sufficient to comprehend the position of the appartiments more clearly, the oval room on the right is a dining room - & its correspondent, not yet finished is for a drawing room <upon> the domestic offices are below. & the Stables at a distance. Upon the whole, it is an elegant convenient edifice. [Paragraph followed by a sketch of the floor plan]

The dining room may be said to be a square, with a cemicircle at two opposite ends. In one, are 3 windows, extending near to the floor; & the narrow piers, on each side that in the centre, are fitted with mirrors, from near the floor to more than a man's height, so that the whole cemicircle seems light. In the opposite one, in the centre is a handsome door, & on each side a large flat niche, occupied by a large picture in each. Opposite the chimney is a recess, formed by a square Venetian window, in which, is a sideboard: at each end of which is a lofty pedestal, supporting a Vase, the former is a conservatory for wine, plates & required to be at hand: - the Vase latter, a case for spoons, this room being papered, the door leading to the garden parlour is not Seen, this was the occasion of great surprise to a formal pompous gentleman, who finding the company
about to withdraw, stalked slowly to open the principal door. & when he
turned, nobody was to be seen, the company having passed thro the
concealed door.

In the two small parlours, the chimneys project; having shallow
closets at their sides, for wine, books, china, & ca. these being papered,
the doors are not seen, this position of closets is frequent in Philadelphia,
& <as> is very convenient, while they do not disfigure. In one of these Mr.
H has books. I saw no room appropriated as a Library.

The Salloon is not finished, the stucco walls being yet to be
apportioned into parts, by pilasters I believe, & bass relief figues in clear
obscure, one pannel over a door is so done with Lions. The 2 semi-circles
contain 4 niches: in one, is a concealed stove, behind the other, is a closet,
entered from the west cabinet. The chains & curtains for this
apartment, are from the plunder from the 2 of France’s house at St.
Cloud. I saw them deposited in a bed-chamber for the present.

In the unfinished Drawing room, which has a charming view of the
Schuykill. & part of the city. I saw two knacks [mechanical devices], one for
drying plants: the other an extensive measure, fit for the pocket... 39

William Hamilton died in June of 1813, leading to the slow decline of the
Woodlands.40 With no immediate family to tend to it, the property and all other real
estate was transferred to Hamilton’s oldest nephew, James. While James inherited
the substantial fortune of his uncle, it was his older sister Mary that took control of
the daily management of the Mansion and surrounding property. James only
enjoyed his new wealth for a few years before he died unexpectedly while traveling

---

in New York. Since James left no instructions for the future of his holdings, his
deceased sister’s husband, James Lyle, and Richard Milne and John Newman,
merchants, were appointed to administer the estate. Ownership of the Woodlands
passed out of the hands of the Hamiltos to Henry and Mary Lyle Beckett and then
to Thomas Flemming for thirty thousand dollars in the year of 1827. The house
and grounds continued to fall into decline that began in the last years of Mary
Hamilton’s ownership as maintenance and the family’s money dwindled.

**Section 2.2 The Rural Cemetery Movement:**

Just as it looked like the estate would be lost, the mansion and the
accompanying landscape were revived in correspondence to national and
international developments. Beginning in Europe, the idea of a cemetery in a
country environment was quickly taking root in the United States, starting in Boston
and spreading throughout the country to New York, Philadelphia, Maine, and
Maryland to name a few. These landscaped gardens served as much more than just
cemeteries; they were intended to serve as civic institutions that were promoted as
an answer to the confusion and complexity of urban life. The intricate meshing of
social values, architecture, landscape, and function created a multifaceted space.

---

41 Letters of Administration dated August 2, 1817. Administration #189, 1817, Book M, pg.
40 at Philadelphia Register of Wills. Originally cited in Catherine Ann Carosino, University of

42 The Woodlands in account with Henry Beckett,” Folder “Beckett 1816 – 1830,”
Hancock/Hannay” box, Hamilton MSS. Originally cited in Catherine Ann Carosino, University
Transitioning to a rural cemetery forced the Woodlands mansion to provide for its visitors in new ways, thus altering the interior with elements that reflected the cemetery’s need and the changing cultural norms.

**The Beginning of the Rural Cemetery:**

On April 14, 1840, the Woodlands Cemetery Company purchased the land with the intention of developing a rural cemetery. Hamilton had long before recognized the Schuylkill River estates association with “healthful refuge and pleasurable resort.”

From their beginning, country retreats were used by the Philadelphia elite to escape the discomforts of the city during the sweltering summer months. During the last decade of the 18th century, wealthy families fled to their rural plantations to escape the yellow fever epidemics that plagued the city. By the time of the Woodlands Cemetery Company purchase, West Philadelphia itself was in the process of growing as a community for merchants, workers, tradesman, and other members of the working class.

As a whole, the population of Philadelphia was dramatically increasing due to the expansion of commercial and manufacturing enterprises that took the place of traditional agrarian economy. The resulting swell in population placed immense physical strain on the city. As one Philadelphia wrote in 1835, “the living population has multiplied beyond the means of accommodation for the dead.” The urban

---

44 Ibid., 3.  
45 John Jay Smith, Laurel Hill Cemetery, Memoranda kept by Jno. J. Smith, Jr., Drayton Smith
graveyard model was becoming increasingly overcrowded to the point that exhumations were taking place to free the land for economic growth.\textsuperscript{46} Even more alarming to the public was the concern posed by the noxious gases believed to be escaping from graves. At the time, the miasma theory of diseases – that pestilence was spread through foul odors produced by rotting organic material – was still held by most of the nation’s medical elite. It was commonly believed that gasses from graveyards were both harmful to ones health and also the source of the extreme epidemics that were devastating urban centers in America during the early 19\textsuperscript{th} century.\textsuperscript{47}

This problem had been addressed earlier in Europe fifty years earlier, when burials were banished from cities in the early 19\textsuperscript{th} century. In Paris, the Cemetery of Pere Lachaise established on the outskirts of the city became one of the most famous “funerary gardens.”\textsuperscript{48} Parisians frequently visited the garden for recreation enjoying its “beauty as well as its fine prospects of the city and the countryside.”\textsuperscript{49} The cemetery became a symbol for changes in burial in conjunction with the picturesque gardens of the English. One American visitor reported, “it is impossible to visit this vast sanctuary of the dead, where the rose and the cypress encircle each tomb, and the arborvitae and eglantine shade the marble obelisk, without feeling a

\textsuperscript{47} Ibid., 183.
\textsuperscript{48} Ibid., 183.
solemn yet sweet and soothing emotion steal over the senses.”\textsuperscript{50} By 1825, the Parisian cemetery was cited on both sides of the Atlantic as a model for future developments. This advancement resolved both the stress of urban growth and new concerns of public hygiene.

Using Paris as a model, Americans decided to take on their own rural cemetery starting in Boston, Massachusetts. Mount Auburn was designed largely by Henry Alexander Scammell Dearborn with help from Dr, Jacob Bigelow and Alexander Wadsworth. Bigelow had dreamt of the idea of Mount Auburn as early 1825. As a medical doctor, Bigelow was one of the specialists concerned with the health hazards posed by the location of city graveyards as well as the quickly diminishing amount of space available for burials. With help from the Massachusetts Horticultural Society, Mount Auburn Cemetery was founded on 70 acres of land just outside of Cambridge on what was originally known as Stone’s Farm. Bigelow hoped to create a landscape that was not only functional, but would also fill other cultural needs – honoring the deceased, cultivating the civilizing melancholy, teaching moralistic lessons, and fostering a sense of incorporating the past with the present and future.\textsuperscript{51}

This type of elevated cemetery was intended to unify society, on a private and public, personal, and national level.\textsuperscript{52} By emphasizing the compatibility of the cemetery and an experimental garden, Dearborn and Bigelow intended “to plant and

\textsuperscript{51}Blanche Linden-Ward, \textit{Silent City on a Hill; Landscapes of Memory and Boston’s Mount Auburn Cemetery} (Columbus; Ohio State University Press 1989), 172.
\textsuperscript{52}Linden, \textit{Silent City}, 183.
embellish the same with shrubbery, flowers, trees, walks, and other rural
ornaments, and to enclose and divide the same with proper walls and enclosures as
a perpetual dedication."\textsuperscript{53} Avenues curved to fit the site’s remarkably varied
topography, allowing the natural features to position avenues and paths. Dearborn
also formed “sheets of water”\textsuperscript{54} and shallow ponds to provide the appropriate setting
for aquatic plants and the calming presence of a body of water. Extensive
ornamental plantations were laid out and richly filled with forest trees, shrubs, and
flowers.\textsuperscript{54} Despite Americans ambivalence towards the concept, in its first year
Mount Auburn proved more popular than Pere Lachaise was in its first two decades.
Famous figures and other publicity in visitors’ guides and newspapers quickly
earned Mount Auburn an international reputation. Visitors could seek lessons of
moral philosophy, transcendentalism, or just the appreciation of nature. The spatial
segregation of the living and the dead also paralleled other types of spatial
differentiation in America’s middle class. The cemetery served as an analogue for
the suburb, which “removed the place of residence from the place of work.”\textsuperscript{55} Non-
urban locations were considered well suited to rural retreats and various forms of
middle class leisure. Cemeteries centered in these locations both featured the
natural scenery and winding roads that contrasted the pre-engineered, industrial
aspects of the city. Founders observed that the cemetery was used “in a manner
very different from what they had expected,” not as a place of solemnity, but as a

\textsuperscript{53} Ibid., 184.
\textsuperscript{54} Ibid., 200.
\textsuperscript{55} James J. Farrell, \textit{Inventing the American Way of Death 1830 – 1920} (Philadelphia: Temple
University, 1980), 110.
place where the Victorian middleclass could find and confirm a place in society and within themselves.  

![Figure 7: Engraved view of Mount Auburn Cemetery 1847.](image)

Bigelow’s decision to use the Gothic in the cemetery was bolstered by the growing popularity of the style in America. Once disassociated from anti-Catholic sentiment, the style appealed even to Unitarians. Development of mortuary chapels in cemeteries produced a new building type akin to architectural follies in English gardens and provided opportunities for use of the Gothic. John Notman had designed a miniature collegiate Gothic chapel for Laurel Hill around 1837. However, some proprietors saw no need for a chapel at Mount Auburn, claiming that it would revert the site back to a churchyard. At the time, funerals were still conducted in the home and given the nature of the cemetery, services would be held outside at the

---

Linden, *Silent City*, 245.
open grave. Bigelow urged construction of a chapel before any other public structures to provide shelter for these services during poor weather.  

Figure 8: View of Bigelow Chapel, Mount Auburn Cemetery 1886. Photographed by George Kendall Warren at the Cambridge Historical Society.

Proprietors designated that the new building be “chaste in style and taste and of the most durable materials, and upon a plan which will admit of great additions and enlargements at a future period without symmetry and proportions of the original building when the religious services and the erection of monuments inside would necessitate expansion.”  

Bigelow’s design is sometimes considered “Protestant Gothic.” With a simple nave, it was lit only by the small, circular

---

57 Ibid., 273.
58 Ibid., 276.
clerestory windows and high rose windows inlaid with color glass at each end.

Figure 9: Rose window detail in the Bigelow Chapel. Photographed by Julie Sloan.

Bigelow’s romantic interpretation of the Gothic style in the Chapel suited the picturesque quality of the landscape as a whole. Mount Auburn's founders believed that the beauty of the natural setting when commemorating the dead would also educate the visitor about the ideals and achievements of those buried within its grounds. The stained glass in Bigelow chapel exemplified the founder's conviction that a sublime unity of art and nature could transform the soul. The effect of the natural light filtered through colored glass was meant to elicit thoughts of mortality
and reflection on the eternal.\textsuperscript{59}

In 1845, Scottish glass artisans James Ballantine and Allan were chosen to create the windows. James Ballantine (1808 – 1877) was one of the pioneers of the British Gothic Revival in stained glass. Opening his own studio, Ballantine & Allan in 1837, he was the author of one of the first books to discuss the craft in the revival context (as mentioned in Chapter 1), \textit{A Treatise on Painted Glass}. The artisan was famous for criticizing the copying of medieval windows, a practice that involved the creation of a faux deterioration. Their proposal called for ornamental grisaille lancets in a 13\textsuperscript{th} century style, surmounted by tracery filled with foliated ornament and ground of positive color. Ballantine prided himself on producing windows in the same way as the ancient artists, composing the Rose window of upwards of one thousand separate pieces. Bigelow was sure in his vision for the windows and what he wanted them to convey. Four tall lancets were surmounted by a large rose, followed by two smaller roses, and five tracery lights. For the large rose, he requested an image copied from \textit{Night} by Bertel Thorvaldesen; a winged female cradling two infants, who he professed to be, “the most beautiful and appropriate thing I have seen.”\textsuperscript{60} The finished windows were installed in 1846. In the words of Mount Auburn Curator Meg Winslow, the windows are what unify the architectural space with the Cemetery’s surrounding landscape - “the lasting significance of this


\textsuperscript{60} Julie L. Sloan and Meg Winslow, “The Restoration of an Early Scottish Window in America,” 226.
beautiful window is its connection with the building and with the Cemetery as expressed through the ideals of Mount Auburn’s founders.\textsuperscript{61} Mount Auburn would serve as the principal example for the Woodlands Trustees, taking into account both the landscape and architectural elements as they worked to fulfill the appropriate setting for their mission.

Philadelphia quickly followed in Boston’s footsteps with the establishment of Laurel Hill Cemetery in 1836. Located on 74 acres in the northwest portion of the city, the site’s picturesque setting is accentuated by its striking views overlooking the Schuylkill River. A system of winding roads allows access throughout the cemetery’s 51 sections with hundred of decorative mausoleums and monuments displaying styles ranging from Egyptian iconography to the early twentieth taste for L’Art Nouveau. John Jay Smith (1798 – 1881) is credited with launching interest in the project not only out of his sense of civic duty but also because of his own personal disgust for the state of Philadelphia graveyards. Like Mount Auburn, Philadelphia was quickly growing and causing severe overcrowding in city burial grounds, not to mention the concern for noxious gases that were presumably contributing to the spread of disease. Originally, Smith had set his hopes on purchasing the Woodlands for his cemetery venture. Finding the property unavailable for purchase, he and his fellow investors settled upon the estate of Joseph Sims, a “country” mansion with the perfect combination of natural setting but still accessible to the city’s population. At the time of its purchase in 1836, John

\textsuperscript{61}Ibid., 228.
Jay Smith felt that the estate combined “every requisite for improvement by means of landscaped gardening, being unrivaled for beauty and romantic scenery.”

Smith and his investors were pleased in their choice, commenting that their new establishment was where “the visitor could leave behind some of the cares of urban life, revel in the natural beauty of the scenery, and learn the moral lessons of the landscape and its monuments.” This type of estate as well as the other Schuylkill mansions were also appealing for the opportunity to display the highest levels of architecture, botany, and landscape design. Interest in botany had been sparked by John Bartram in his internationally renowned garden in which he “attempted to stimulate the natural habitats of his plants.” The Woodlands Estate had equally brought botany to new heights, where William Hamilton created an impressive collection and one of the most prominent examples of “controlled naturalism” in America. In the 19th century new republic, gardening began to appeal to middle and upper class citizens for its association with republican virtue and moral rectitude.

Officials were also beginning to recognize the problems surrounding the church owned graveyards that were the norm for the time period. Families of persons who did not belong to a religious congregation often found it difficult to find
a place to bury their loved ones as graveyards were owned and affiliated to a religious institution.\(^{67}\) John Jay Smith made a point of breaking from this trend by making Laurel Hill non-sectarian. This would allow for people of all backgrounds to benefit from the healthful and enlightening landscape while simultaneously improving burial conditions in the city.

After holding a national competition, Scottish émigré architect John Notman (1810 – 1865) beat out better-known architects such as Walter Ustich and William Strickland to design the cemetery’s buildings. Among his designs, a grand Roman Doric gatehouse, complete with grand porticoes and a balustrade encircled roof. Investors were hesitant to incorporate a chapel into the layout, insisting that a religious structure was unnecessary as mourners could hold services outside surrounded by the natural landscape. Instead, Smith again turned to the model of Mount Auburn and requested for Notman to design a one-story stone chapel that was rectangular in plan and symmetrical in elevation. The structure is a testament to the Gothic Revival with a central door and four tall windows, capped by ogival arches and divided by octagonal tower. The latter pierced a foliated parapet, emerging above as crenellated spires. Its one large room was lit from the east by a stained glass window.\(^{68}\) The chapel was demolished in 1880, however its initial presence illustrates the religious aesthetic that rural cemeteries were trying to incorporate into their institutional image.

2.3 The Woodlands Cemetery Company

Less than five years after the establishment of Laurel Hill, Eli K Price (1797 – 1884) presented his ideas for the Woodlands Cemetery to the current property owner Thomas Mitchell in the early months of 1840. By July of that year, nearly 100 acres of the estate had been transferred to the ownership of the Trustees of the Woodlands Cemetery, Garrick Mallery, Samuel Edwards, Thomas Mitchell, and Eli K. Price. The intent of their mission is described in their initial “Acts of Incorporate,”

Whereas the practice of crowding the dead within small spaces in populous cities is repugnant to the feelings and prejudicial to the health of the living and is becoming yearly more inconvenient, expensive, and dangerous. And whereas, a number of citizens of the Commonwealth hereinafter named have associated for the purpose of establishing a rural cemetery at The Woodlands in the neighborhood of Philadelphia, intending to appropriate the greater
portion thereof for the purpose of interments, whereby the beautiful landscape and scenery of that situation may ne perpetually preserved, and its ample space for free circulation of air, and groves of trees afford a security against encroachments upon the dead, and health and solace to the living; and whereas, The said associators have petitioned to be incorporated with the necessary powers for effecting the important objects aforesaid. Therefore, be it enacted.\textsuperscript{69}

In 1845, the cemetery officially prepared for interments and erected its first funerary monument that April. After witnessing the first funerary processions, Eli K. Price wrote, "on one such occasion the long procession of carriages slowly winding beneath the groves of trees to the last resting place of the deceased was peculiarly solemn and impressive."\textsuperscript{70} As argued by Timothy Long, the Woodlands was the premier manifestation of the evolvement of a private picturesque pleasure ground into the sacred landscape retreat of the rural cemetery.\textsuperscript{71}

\textsuperscript{70}Ibid., 227.
Despite a heavy economic depression, the Trustees spent most of the first few years making substantial alterations and the mansion as they strived to design a cemetery that could stand up to grandness of both Mount Auburn and Laurel Hill. The most immediate actions were devoted to restoring the overgrown grounds from the decades of neglect and laying out plots and winding pathways. The mansion received critical maintenance to prevent the further decay and to make it usable by the Cemetery Company. After a decade of improvements and stabilization, the Trustees could turn their attention to the interior spaces and their uses. Company records indicate that the largest reception room in the mansion, the Saloon, was to be redecorated to serve as a chapel. In an unidentified printed clipping from the Samuel Castner collection, one writes;

During a recent funeral service held in the parlor of the old country house of
the Hamilton family, now inclosed in The Woodlands Cemetery, its parlor is used as needs be as a chapel by the Cemetery Company, I was struck with the size of the spacious oval-shaped room, with its high ceiling and beautiful stained glass windows-remnants of former splendor. Time was when this old house and room saw many a stately minuet and echoed many a silvery laugh from the fair women, attended by the brave men, of old time Philadelphia.\textsuperscript{72}

The room is mentioned again in a poem dated from 1860:

A chapel now, that princely hall, where echoed tread and voice of mirth, receives the dead with funeral pall, and witnesses “the last of earth.”\textsuperscript{73}

As described in the clipping, receipts show that besides the additional furniture and appropriate wallpaper, stained glass was substituted in the doors and lunettes for the original iron and gilt fanlights.\textsuperscript{74}


\textsuperscript{73}“The Woodlands Cemetery,” for \textit{The North American and United States Gazette}, Henry Paul Beck, 30 September 1860.

Figure 12: Detail of the Woodlands stained glass installed in the south façade. Photograph from the Historic American Buildings Survey ca. 1900.
It was in this respect that the Woodlands Cemetery successfully united both the religious and domestic sides of the Gothic Revival in one space. Designed as a private estate, the Woodlands Cemetery Directors had the difficult task of readapting the space to serve as a dual institutional and religious venue. We have already discussed the transition of stained glass and its Cathedral implications into the family home. By designating the ballroom as a Chapel, Eli K. Price understood that he would similarly need to create a space with religious connotations in the secular envelope. This was no small feat as it was highly uncommon, if not looked down upon, to combine a non-sectarian but still religious establishment within a civic institution. In 1841, a writer of the *New York Review* asserted that churches should not be in the same style as town halls and exchanges. Civic architecture could be classical; ecclesiastical architecture called for Gothic. A symbol of the growth of Christianity, Gothic could be adapted for churches large and small, it was “susceptible of ornament, chaste in its simplicity-admitting of a great variety of form, so that it does not weary by its sameness-and complete and perfect as a whole.” In conclusion the writer recommended Gothic unconditionally as possessing “claims superior to that of any other style” and “preferable for its fitness.” This article is important because it insists that churches should be gothic and that rural settings are appropriate for them. Perhaps the Trustees took this into account, opting to harmonize the beauty of their rural setting, the height of the Gothic Revival aesthetic, and the religious connotations that accompany the funeral

---

process. By installing stained glass, the Trustees had created an all-encompassing space of domesticity and religion that could be enjoyed and accepted by visitors of all denominations.

Section 2.3 The Funeral Home

The dynamic of all these different movements - the “rural” cemetery, Gothic Revival in the private home, the merging of religious morals in the family setting, also while not directly correlated, ran parallel to a similar phenomenon, the introduction of the funeral home industry. While this custom did not truly take off until the late 19th and early 20th century, the rural cemetery essentially led the way for what has now become the norm for American funeral practice.

The Woodlands as an Early Prototype:

Since the first settlement in America, burials were almost always held in the home. The typical burial would span over three days, the body of the deceased would remain in a designated room, often a front room or parlor marked by black crepe or cloth covering the mirrors. The primary duties of those involved in the wake consisted of watching or sitting up with the corpse, while visitors would often engage in various activities, including somber reflection, scripture reading, and socializing over refreshments. As argued by historian Gary Laderman, this strong communal bond and sense of togetherness helped combat the harsh emotional
impact of the death of a community member. After the service, the family and other mourners were called on to transport the body to the place of burial, typically a local burying ground or graveyard.

This all began to change with several transformations that took place during the mid to latter part of the 19th century. Living quarters of families began to change, which affected the available suitable space for the dead in the home. The parlor, the center of domestic identity and significant life rituals was adjusted to accommodate changing tastes in home design, new practical considerations in planning domestic space and shifting attitudes about family life. However, the most revolutionary development toward the common concept of the contemporary funeral home first began in the mid 19th century with the practice of embalming. Although preservation of human remains has been in practice throughout history in various different cultures, the concept of arterial embalming was a radical and new innovation. The study of the body was actively pursued in the late 18th and 19th century, and the demand for the preservation of animal specimens and cadavers arose for further investigation. French chemist, Jean Nicholas Gannal is credited with developing the chemical composition that could be arterially injected, thus allowing for the safe keeping of specimens or human bodies. Although safer and better embalming methods were developed soon after, there was little market for

---

77 Laderman, Sacred Remains, 30 – 33.
them outside of medicine until the Civil War.\textsuperscript{79}

With 600,000 deaths over the course of the War, both the North and South employed embalming to treat the dead before shipping the bodies back to their families to see for the last time. Yet its use was still considered uncommon and rejected by the American population until Abraham Lincoln’s death, which is widely considered to be the birth of the modern American funeral industry. After he was assassinated, Secretary of War Edwin Stanton, saw the opportunity to encourage unity in the country, which was still in a delicate state from the Civil War. A funeral train was organized to travel across thirteen cities throughout the North over the course of two weeks. By the time Lincoln was finally buried, it is estimated that over seven million people, one fifth of the population, had been able to view his corpse. The American public was hesitant to accept the invasive practice of embalming into their personal lives, however Abrahams Lincoln’s funeral tour legitimized embalming as a hygienic method and not the barbaric and disrespectful procedure it was thought to be.\textsuperscript{80}

As embalming became a standard practice by the late 19\textsuperscript{th} century, mourning families began to see the value of the entire “package” of what would be considered the modern funeral. The preserved body could be presented in a neutral setting where the family could both receive guests and hold services. The Woodlands and


other “rural” cemeteries had the benefit of being able to not only perform the necessary services but also bury the dead in one institution. As “rural” cemeteries grew in popularity, the private institutions that owned these spaces gradually appropriated the power to regulate the burial of the dead. During this period, the majority of funeral homes operated from private residences or commercial buildings, which had been adapted to suit the needs of the undertaker. The attendance at the average funeral had become too large for the ordinary living room and too small for a church, thus the funeral parlor was developed at the turn of the century to provide not only the devotional atmosphere of a church, but also the convenience and feeling of a private residence. These parlors (chapels) were the first step in the eventual evolution of funeral establishments from adapted buildings to structures that were design specifically for the care and deposition of the dead.

Death mentalities also propagated the intermingling of cemeteries and funeral homes. The 19th century brought about attitudinal shifts in the way people perceived the importance of death, its rituals and spaces. As the historian Richard Morris has suggested, colonial gravescapes, their iconography, inscriptions and locations close to the living urged “an awareness of the fragility of life and the prospect of judgment.”81 These new rural cemeteries – derived from the Greek for “place for sleeping”- rejected the finite division between life and death and the living and the dead. The Woodlands emphasized this concept of the temporary nature of

death while designing a space that physically engaged the living. Feelings of Romanticism were induced while strolling through natural landscapes and pining over the dead through melancholy commemorations. At the same time, the sculptural tombs and design elements instructed viewers in the harmonious balance of nature and civilization.

The ideal ambiance of the funeral home was characterized as reverential, church-like, and sacred. As a domestic space of death, the funeral home disrupted conventional boundaries between the “religious and profane, commerce and spirit, private and public.”82 Funeral homes were designed strategically to help create a home-like atmosphere that could respond to a mourner’s desire for closeness with the body. Certain spaces, designated “slumber rooms,” were set up to resemble a bedroom so that they could serve as the traditional component of a death in the private home as well as have the ability to be integrated into funeral rituals. Understanding the association between death and sleep, directors modified the spaces of their establishments to accommodate the deeply rooted concept of death as sleep.83

Equally important to the “slumber room” was the incorporation of the “chapel” to encourage the funeral home as an all-purpose institution. This architectural innovation typically did not occur until the first few decades of the 20th century with the chapel replacement for the church funeral. The design of these chapels inspired a combination of religious emotion and domestic nurture. As one

---

82 Laderman, Rest in Peace, 25.
83 Ibid., 26.
writer commented, “atmosphere of reverence is the predominating note which is popularized the chapel...a better word than reverence would probably be churchly, though reverence is the desired end...on the other hand, however, there is a slight tendency in chapel architecture to evolve a home atmosphere, meeting the demand of those who formerly desired funeral services in the home.”\textsuperscript{84} Although is was a confused and complicated space fusing religion and domesticity, the chapel became a significant source of meaning for the mourners as a place to experience the sacred, respect the dead, and their leave of the body.

As evidenced by the foregoing history, the concept of the funeral home did not take off until after the Civil War, almost ten years after the Woodlands Cemetery Company chose to repurpose the ballroom as a chapel for funeral services. The Woodlands Cemetery chapel can thus be seen as an early prototype for an industry that wouldn’t begin until the end of the century. Its intimate form as a private home comforted the American psyche that was attached to the traditional Puritan burial while its stained glass windows imitated that of a cathedral fulfilling the need for the godly connection with the afterlife. Not one element redefined the space of the saloon as purely as the colored light filtered through the glass windows to create the ambiance true to its sacred aspirations. Like its fellow rural cemeteries, the Woodlands ideology, design, and services facilitated the “one-stop shop” that would become the major selling point of a funeral home in later years.

\textsuperscript{84} Ibid., 26.
Chapter 3: Stained Glass in America and at the Woodlands

3.1 History of Stained Glass in America

Despite the dearth of information on early stained glass in America, glass manufacturing was one of the first industries to come to the new world. As early as 1535, a glassworks was in operation at the Pueblo de Los Angeles in Mexico although no records exist to show the extent of its production. On the opposite coast, the first settlers took advantage of the abundant amounts of sand and forests they discovered in Virginia. The primarily commercial objective of the venture suggests that these resources laid the groundwork for glass making in Jamestown’s early years. In 1608, the second shipment of colonists to Virginia included eight Dutch and Polish glassmakers. A glasshouse was immediately constructed and samples of bottles and several dark green windows were sent back to London. More than a decade later, Venetian glassmakers arrived in the New World and continued the trade, which survived until 1631.  

Farther north, Obadiah Holmes and Lawrence Southwick formed the first glass manufacturer in Salem, Massachusetts, with the help of trained glassworker Ananias Conklin with limited success. While the trade floundered in the two English colonies, the craft got its true start on the island of Manhattan beginning with the Dutch. In 1637, Evert Duyckingh came from Borken, a Dutch-German border town, to New Amsterdam. His skills were listed as “painter of portraits, painter and

---

stainer of glass, a glazier, and a glass burner. Duyckingh’s work are evident in many Dutch paintings, showing small round, square, or oval panels set in a background of clear glass quarries. The subjects, often a family coat of arms, were applied with enamels and silver stain. The works of Duyckingh, his son Gerrit, and several apprentices that carried on the business were commissioned through the churches of the colonies and can still be seen preserved at the New York Historical Society.

The first century of European settlement in America was a period of pioneering and settlement. Although churches were among the first permanent buildings, they did not an advocate of the craft in any way that might be expected. Many pioneers were of Protestant sects and preferred simple, unadorned spaces in which to worship and therefore uninterested in the luxury of painted glass. These buildings often shared the dual purpose as town meeting house and reflected this in their “rugged austerity.” As English political and social influence gradually spread throughout the colonies, so did the architectural building styles exemplified by classical designs. Builders often constructed their churches after great European designs including Christ Church in Boston and Saint Peter’s in Philadelphia. Even by the time these impressive structures were building in the mid 18th century, painted glass was more likely to be imported from English studios than local shops.

---

86 Lloyd, 37.
87 Ibid., 41.
88 Ibid., 42.
The Revolutionary War brought with it economic depression as well as disruption and confusion within the American industry. However, without the limitations of the British Trade Act, glass production began to thrive under a new local demand. In 1787 Albert Gallatin started the first glass works west of the mountains in close proximity to Pittsburgh, Pennsylvania. Ten years later Revolutionary War heroes, General James O'Hara and Major Isaac Craig, established a second, beginning a movement that would make Pittsburgh the center of the American glass industry. East coast production also grew with the opening of the Pitkin Glass Works in Connecticut and Boston Crown Glass Company in 1792.89

The number of glass manufactures continued to grow, reaching 35 in 1830 in the New York area alone. Philadelphia saw its own rise in glass studios with eight domestic stained glass firms listed by mid-century. In 1827, judge at Philadelphia’s Exhibition for Domestic Manufactures awarded the New England Glass Company of Boston the silver medal for their stained glass window. The window, declared to be the first of its kind ever produced in this country, is considered by some to mark the beginning of the revival of the craft in the America.90 Despite this progress, very little stained glass was actually produced in America until the 1840s. Rather most glass artisans imported their glass from Europe. Where the Gibsons’ glass was manufactured has not been documented. However by 1856, the Gibsons were

---

89 Ibid., 43.
“buying most of their materials in New York,” which is highly likely to have included imported glass.\textsuperscript{91}

\subsection{3.2 The Gibsons}

As argued by historian Jean Farnsworth, one of the most successful Philadelphia firms was operated by John and George Gibson, who in 1857 – 59 made the still extant stained glass for the United States Capitol.\textsuperscript{92} Although commonly overlooked, the work of the Gibsons was “considered quite equal to that of European manufacture.”\textsuperscript{93} Their advertisements appeared frequently in the \textit{Catholic Herald and Visitor} during the 1860s and it is possible that the two fabricated the windows for the Church of Annunciataion in 1860 as well as for the Blessed Virgin Sodality to the Church of St. James the Greater in 1861.\textsuperscript{94} At the time American stained glass was typically viewed unfavorably in comparison to European work. However, several British stained-glass scholars recently assessed examples of the Gibsons’ stained glass as “Truly spectacular” and “Splendid.”\textsuperscript{95} John Gibson and his

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{91} Ibid., ??.
\item \textsuperscript{92}Ibid., 130.
\item \textsuperscript{94}Jean Farnsworth, “Reflections of Faith and Culture Stained Glass” in Catholic Philadelphia,130.
\item \textsuperscript{95}Jeans Farnworth, Excerpt from a report for the National Trust for Historic Preservation in “Stained glass windows at Lyndhurst: Three Generations of American Craftsmanship,” 2007. These comments were acquired after Farnsworth forwarded photographs of the windows in search of comparables in England and Scotland. Three British stained-glass authorities spontaneously commented on the quality of these panels including Stephen Clare, ACR, President of Holly Well Glass, an advisor to both the National Trust (Great Britain) and English Heritage, remarked on receiving the photos, “These are extraordinary
\end{itemize}
\end{footnotesize}
two brothers William (1809 - 84) and George (1822 – 77) were the sons of John
Gibson Senior and Margaret Petrie Gibson of Edinburgh, Scotland. John Senior was a
decorative painter by trade and it was most likely this influence that pushed all
three brothers into the craft. At sixteen, John began an apprenticeship with David
Ramsay Hay (1798 – 1866), one of Scotland’s most renowned decorative painters.
Hay was particularly famous for his accurate renditions of natural plants, having
published one of the 19th century’s most popular books on decorative painting, *The
Laws of Harmonious Colouring Adapted to House Painting* (1828). John followed his
brother William to American where he had established his own studio in New York
City during 1833. After working at his brother’s firm, he moved to Philadelphia to
start his own practice that became well known for his decorative wall finishes. John
had not been professionally trained in the art of stained glass, and with limited
apprentice opportunities in America, he presumably turned to his extensive library
for guidance. William and John’s younger brother George also worked with his

---

siblings, having the benefit of traveling to England where he was taught the art of
stained glass before returning to the States. George joined John’s glass staining
business around 1855. 98

![Floral Pattern](image)

**Figure 13:** Enamel painted stained glass at the Capitol. Photograph from *The Capitol Dome Second Edition.*

---

98 Ibid., 15.
Figure 14: Stained glass skylight by Gibson, west side staircase. Photograph from The Capitol Dome Second Edition.

The three brothers installed numerous windows throughout the United States, some as far away as Alabama. The brothers often collaborated on their work, one of the first projects completed at George Washington Carpenter’s Greek Revival residence in Germantown, Pennsylvania. Stained glass and decorative painting was executed throughout the house by both William and John, described as:

A Franklin Window, with stained glass, executed by Mr. [William] Gibson of New York, who is entitled to great credit for the superiority and beauty of his work... The principal subject in this window is the picture of Aurora, by Guido [Reni]. The side lights of this window, as well as the side and top lights of the front and back doors, are filled with trophies of game and fish, fruit and flowers; the whole of the colours of the richest and most permanent kind are burnt in the glass, and renders them almost as enduring as time.99

John was also the producer of the windows at All Saints’ Episcopal Church, Briarcliff Manor, New York, designed by Richard Upjohn. Unfortunately, evidence of the Gibson’s artistic talent rarely survives. The existing Gibson windows at the Woodlands are an extraordinary example of the art and its techniques during the pioneering years of the craft.

3.3 John Gibson at the Woodlands

John Gibson’s involvement at the Woodlands began first as a decorative painter. In fact, Gibson first listed himself as a “painter, glazier, and glass stainer,” a common classification of craftsmen during the period. Even five years after the windows were created, the 1860 U.S. Census lists him as “Master Ornamental Painter.” Stained glass craftsmen often practiced a closely related trade to decorative painting and John trained specifically under the Scottish decorative painter Davis Ramsey Hay. Decorative painted took place in the early years of the Cemetery, when maintenance conducted on the mansion included new floorboards, shingles, and painting executed by none other than Gibson. The Mansion was not always seen as an asset to the Trustees. Much of the company’s business took place from their downtown office, however they eventually recognized the potential of the mansion house. Included in the Executive Committee meeting minutes from 1847 are suggestions from James Leslie proposing to take the following steps:

---

Improve the Old Mansion Still retaining its Anteaque appearance, coteing the walls with Roughcasting Mastick or Paint outside And paint the wood work And fit up the large room for a Chapell, and build such lodges at the Entrance Equal if not Superior to those at Laurell Hill or Monument Cemeterys and remove Old buildings, sheeds fences and dead trees, which only mar and obstruct the unsurpassed natural buties of the grounds.\textsuperscript{102}

It appears that Leslie took these improvements upon himself, installing both the new shingles on the mansion roof and replacing the steps on the south portico.\textsuperscript{103} The largest of these changes that occurred during these first renovations was the removal of the two “pavilions” projecting north from the dining room and drawing room. These elements, which were uncovered during contemporary surveys, were never documented in paintings or engravings and thus their prominence has been lost in the early years of the mansion’s history. By 1850, the Managers of the Woodlands reported to the Trustees the completion of a variety improvements including:

...The Mansion which was dilapidated to an extent [illegible word] almost ruinous when the Cemetery Co. began their improvements was a few years since well roofed with cedar; the north projections were removed and the portico repaired. Since and chiefly during the past year, the exterior of the walls was yellow washed, the woodwork painted on the outside, the sashes of the old windows replaced with new and freshly glazed. The whole exterior is now in good order, proof against the weather and of creditable appearance.\textsuperscript{104}

\textsuperscript{103}Executive Committee Minute Book 1843-1852.” Woodlands Cemetery, Historic Society of Pennsylvania MSS.
\textsuperscript{104}Report of the Managers of the Woodlands Cemetery 1850,” Woodlands Cemetery
As discussed in the previous chapter, the company records indicate that the largest reception room in the mansion, the Saloon, would be repurposed to serve as a chapel. The Oval Drawing room was designated for use as a meeting room by the Board of Managers in 1857 and it was redecorated appropriately. The Southeast parlor at this time was also readapted for the use as the company office.

Figure 15: North façade, Historic American Building Survey.

---

Receipts from this period indicate that purchases were made for new wallpaper and furnishings indicative to the new direction the Trustees were hoping to take the Mansion. A receipt from October 1855 shows that the Woodlands Cemetery Company commissioned John Gibson for “Rich ornamentation stained glass in metal sash put in 3 windows, two transoms, and the door 86 ½ feet @ $225.”

The purchase is confirmed from minute books on November 6, 1855 writing, “the Bill of John Gibson for $194.62 was passed and ordered to be paid.”

Gibson created seven windows for the “chapel” – two panels per door for the two

---

side doors along the south façade and accompanying fanlights. In addition, a larger fanlight was created for the northern front entrance. It took Gibson nine months to complete the job, delivering the windows in June of 1855. No descriptions of the windows at the time of their installation are currently known to exist. However, one can only imagine the exquisite jewel toned effect that the windows had on the room with the pieces that have survived.

Figure 17: Three exterior doors leading to the southern porch. Historic American Buildings Survey.
The most intact windows consist of two upper rectangular glass panels 41.5 inches
long and 14 inches wide that fit into the east bi-fold door on the south façade.\textsuperscript{107} The design is the same for both panels, consisting of a rounded arch design with quarried panels running down the center and crowned with a small rose roundel surrounded by painted floral spandrels to its right and left. The painted decorations on the spandrels appear to represent poppies, a common symbol of death signifying eternal sleep. The surround of the arc is a repeat foliate leaf pattern of dark green glass detailed in matte black paint. The quarry panes have a shaded grey quadripartite design foliated with a central rosette and bordered with a repetitive decorative purple pattern of beads and triangular lozenges. The remaining space within the quarries contains arcs of a circular roundel with yellow and orange rims and with rosette infill patterns. Finally, the half-diamond pane at the base of the window is adorned with a painted winged hourglass motif. Gibson clearly understood the intent and aura of the cemetery, playing with natural foliage and funerary symbolism. The beauty of the glass and play on colored light added a dynamic to the space that restructured both its beauty and the emotional movement that it bestowed on its inhabitants.

The windows also reveal Gibson’s talent as both artist and tradesman. His design skillfully wove together solemnity of the grey hush tones of the floral plants with the vivid brilliance of the rich colors and refracted light. The naturalism of his subjects mirrored the embodied of the Woodlands by bringing the landscape into

\textsuperscript{107} The doors in which the windows were contained were determined by a note taped on the back of window B labeling them as the “east” windows. The validity of this statement is uncertain.
the interior, however in a much different manner. While Hamilton tried to create one continuous space with the landscape and the home, the Gibson windows incorporated the organic nature of the rural cemetery while forming an intimate enclosed area suited for the mourning process. Stained glass at the Woodlands exemplified the conviction that a sublime unity of art and nature could transform the soul. In addition, natural light filtered through a craftsman’s art prompted thoughts of mortality and reflection on the everlasting.

Figure 19: Floor plan of the Woodlands. Note the “ballroom” is the space that would later be converted for the chapel.

The “chapel” in which the windows were placed also played an important role in how the windows were experienced. The overall form of the room remained unchanged since its construction in the late 18th century. Rectangular in plan, it features semicircular extensions east and west with two semicircular niches and a
double door in the center. The double door in the center of the north wall connects to the reception hall, in addition to the three additional doors on the south that lead to the porch. The saloon has a high flat plaster ceiling and floorboards that span north to south. Each apse is trimmed with simple pilasters, which are capped by stylistic Roman Doric capitals at the spring of each arch around the front face of the apse. This also occurs around the horizontal molding along the rear wall of the apse at the spring of the elliptical half-dome ceiling. There are six door openings into the saloon; one into each of the small flanking parlors on the east and west; one into the vestibule to the north, and three on the south elevation leading onto the portico. All of these doors except for the middle are double and able to fold into the recesses built into the surrounds.

![Image of the saloon looking west. Historic American Buildings Survey.](image-url)
Reference is made to the windows in a newspaper article from 1899 in which they are mentioned, “Directly opposite the main entrance is the doorway leading to the ballroom, a lofty rectangular apartment running parallel with the river front of the house and communicating with the portico by three arched doorways, in which can still be seen fragments of panels of richly-colored glass.”\textsuperscript{108} Restorations conducted at this time focused on the repair of the outer walls, the author’s choice of the word “fragments,” suggests that this may have been the period when the windows were reglazed.\textsuperscript{109} There is no known additional documentation of the stained glass windows until 1981 when a historic structures report was funded by Architect John Dickey to document the structural history of the saloon and its current condition. Written by historical architect Reed Engle, the report describes the room as it appeared in 1981 as a precursor to future alterations to restore the saloon back to its Hamilton era appearance. The decorative wall finishes at the time consisted of a series of three horizontal bands: an upper band 21” below form the second floor joists covered with grey wallpaper embellished with a blue and white motif; a middle band 17” high or patched plaster; and the lowest area that extends to the floor of whitewashed, finished plaster.\textsuperscript{110} It is doubtful that these were the original finishes that embellished the walls during the mid-19\textsuperscript{th} century, however

\begin{footnote}{108}{Anonymous, “Hamilton Mansion Has Been Restored,” The Philadelphia Press, 15 January 1899.}

\begin{footnote}{109}{X-Ray fluorescent testing on the lead came of the windows shows two different types of metal composition, insinuating that the windows were reglazed at some point before they were removed. For greater discussion see chapter four.}

\begin{footnote}{110}{Reed L. Engle and John M. Dickey, “Historic Structure Report, the Saloon of the Woodlands: Woodlands Cemetery, Philadelphia, Pennsylvania,” written for the University City Historical Society, 1981, 21.}


they still worked in harmony with the windows to create the overall appearance of the room.

All the doors in the room were double with the exception of the center door, which had been replaced by a single modern door. Scorings on the marble threshold and photographs indicate that it was also a double door until the 1930s. The existing double doors measure 26” in width and all of the doors openings have arched heads. Finally, the report mentions the presence of the stained glass windows in the northern and three southern doors and fanlights.\textsuperscript{111} Examination of the doors in the room revealed that four (although altered) were original including the east and west doors and side doors on the south elevation. The two side exterior doors had Gibson’s upper stained glass panels over a vertical beaded board recessed panel below. The existing fanlights and the two flanking exterior door had their stained glass in the original sash.\textsuperscript{112} This configuration is important as it offers evidence about the presence of the windows in their original doors and overhead sashes, indicating that the windows had remained in place until the 1980s.

In his concluding remarks, Reed Engle suggests that “the importance of the saloon mandates that it be restored to the design and finish first created by William Hamilton. This will require the removal of certain late nineteenth and early

\textsuperscript{111} It should be noted that the fanlight over the interior door leading into the entrance hall is much different in appearance than its counterparts. Instead of the darker tones of mixed colored glass, this window is solely clear glass with vividly painted flowers. The botanically correct plants show Gibson’s first talent as a painter. Similarities can be observed between this window and bright floral and fruit arrangements that can be seen in his work at the U.S. Capitol. Reed Engle suggests that this window was installed in the 1930s, however this is highly unlikely due to the thinness of the glass pane.

twentieth century additions which have some merits in their own right, but which seriously detract from Hamilton’s original design. The quality of the original creation requires. Its complete restoration.” Reed continues that the most important task facing the Historical Society is the restoration of the six doors in the room. Hamilton specifically designed the doors with intent of bringing the landscape into the house and reflecting it from all directions. The addition of the stained glass windows and the modification of the doors had to be reversed by removing the colored glass and rebuilding the doors to conform to their original sash pattern. In addition, the center exterior door was removed and replaced with a copy of the Hamilton era double doors and interior shutters. Engle and Dickey recommended that all of the doors be scraped, sanded, and painted the original off-white interior color.

Taking Engle’s report into account, the Woodlands Director Mike Hardy and the University City Historical Society that was currently housed at the mansion, undertook a massive restoration of the saloon, returning it back to its late 18th century English architecture that Hamilton strove to achieve. In 1987, the stained glass windows were removed from the doors and fanlights, including the interior window in the northern wall and replaced with wood muntin moldings and historic reproduction glass panes. The windows were later placed in the basement for storage.

---

113 Ibid., 53.
114 Ibid., 57.
While this thesis does not focus on the northern front entrance fanlight, it is significant to note that it remained in situ until a later construction campaign in 1992. After consideration, Director Mike Hardy decided that he would complete the clean up of the original fanlight and hire Philadelphia stained glass artisan Hope Yaffe to repair the broken colored glass panes in hopes of using it in “the exhibition on the rural cemetery.”\textsuperscript{116} The stained glass was replaced by old clear glass with replicated coming and cast lead florets mirroring the original. The window was removed in 1994.\textsuperscript{117} Cleaning was performed, however it was never used in an exhibit before being placed in the basement.

In September of 2011, the author began work on what remained of the original stained glass windows. Already in a delicate state due to their age, the windows were further subject to the poor conditions of the basement atmosphere and lack of proper storage. As a result, only two door panels and two fanlights have survived relatively intact. The remaining windows and fanlights have been reduced to 196 individual pieces of colored glass, found unorganized and dirty in three unmarked cardboard boxes. These pieces ranged in size from ten inches wide to tiny slivers. Further study of the windows focuses on their documentation, current conditions, and future possibilities.

\textsuperscript{116}Hope Yaffe is a Philadelphia based stained art conservator. There is no documentation of her work and was unavailable for comment.

\textsuperscript{117}John Milner Associates, Inc, “An Architectural/Historical Assessment and Space Planning Study of The Woodlands. The Hamilton Residence.” dated September 1992, University City Historical Society, Philadelphia. This study presents a series of floor plans illustrating the evolution of the mansion as determined by architectural investigations performed at the site.
Figure 21: Interior fanlight after being removed and placed in the basement. Photograph by author.

Figure 22: Removal of the fanlight over the northern entrance, 1994. Photograph from the Woodlands Cemetery.
PART 2: Overview of Methodology and Objectives

The study of archival records, physical investigations and material analysis aims to identify conservation suggestions appropriate for the care and restoration of the stained glass at the Woodlands. From the beginning, it was clear that the first challenge would be to determine the amount of existing material. The windows were presented in three cardboard boxes in the basement room located the floor below the saloon (labeled Basement 1 by author). By observing the initial condition and positioning of the fragments, it was inferred that the windows had been broken into multiple pieces, whether intentionally or from deterioration processes, before being placed in their containers. The intact bi-fold window and its matching counterpart had been wrapped in bubble wrap and cardboard envelope a few months prior. Several larger pieces were also laid out on crates.

The first box contained 70 pieces of colored glass all matching the patterns of the long door windows, indicating that there was a reasonable effort to organize the pieces according to their original location and form. This is also evident by two sets of identifiable elements like the two floral roundels as well as two of the winged hourglasses. The second box held 84 pieces that were associated with the original fanlights by their distinct shapes similar to that of northern entrance window. In the second room, two full fanlights were stored on top of a table, the northern entrance window that had been cleaned in the 1990s and the glass that was in the interior vestibule. This window had a large piece missing that was located in the first box. The third box contained circular glass and metal pieces that were not
connected with the chapel glass, but instead speculated to be the surviving remnants of a piece of furniture that incorporated a glass front. This glass was not included in the Gibson inventory and requires further research to understand its origin.

After laying out the glass, each piece was given an identification number based on date, room location, box number, and item number i.e. 2011. B1. 001.001. Fragments were photographed individually with an artifact tag and placed in plastic bags. Each fragment is documented in a database using Filemaker Pro.

For the purpose of this study, the focus was aimed at the two door windows for their level of intactness and range of visible conditions. Prior to photography of the windows, they first had to be removed from the basement and cleaned. An area was reserved on the first floor of the mansion where the windows could be laid on tables and washed using distilled water and cotton-tipped swabs. For certain crusted-on residues, a small amount of mild detergent (Ivory liquid soap) and isopropyl alcohol was added to the water and allowed to briefly soak into the soiled areas to loosen the particles. Due to the position of the support bars on the outside of the windows, the windows had to be braced in order to clean the interior side. Acoustical ceiling tiles and foam padding were placed in between each support bar. The windows were then sandwiched between two flat, stiff surfaces, turned over, and the other side cleaned using the same methods.

To view the windows the way they were intended, a light table was created by using a display table on loan from the University of Pennsylvania. This served as the base of the table, in which nine 23" fluorescent bulbs were fastened lengthwise.
Everything Plastic in Philadelphia supplied a measured clear plastic pane that fit on top of the wood base and then covered with white paper to create an opaque layer. The windows were photographed using a Canon XTI digital camera and adjusted in Adobe Creative Suite-Photoshop. Unfortunately, the delicate condition of the windows made it impossible to take photographs of the front without the appropriate support, and thus all assessments were based on the back painted side of the glass. A conditions assessment was completed using both survey forms as well as rectified photographs in which conditions were recorded. These patterns were later traced in Auto CAD 2011 to determine patterns and areas that needed urgent attention. Several pieces of loose glass from the collection were selected and removed from the site for further examination and testing. The remainder of this document discusses the windows’ building assembly, prevalent deterioration mechanisms, and conservation methods. Recommendations for conservation are based on the analysis of the survey, material composition and review of restoration techniques.
Figure 23: Broken stained glass pieces as found in the basement. Photograph by author.

Figure 24: Pieces laid out to be organized and catalogued. Photograph by author.
Figure 25: Cleaning of the windows. Photograph by author.

Figure 26: Light table construction. Photograph by author.
Figure 27: Window prior to cleaning. Photograph by author.

Figure 28: Window after first cleaning. Photograph by author.
Chapter 4: Construction Techniques

The traditional process of stained glass construction has remained almost true to form for centuries. Essentially, stained glass is a compilation of colored glass pieces. Molten glass is blown, shaped into sheets, cut into a predetermined design and painted. The painted glass is then fired to fuse the paint to the glass and soldered together in a continuous panel by lead camees. This chapter sets out to explain the construction of stained glass as an insight into John Gibson’s methodology in the context of the greater scope of the craft. By studying the windows and their assembly, the fabrication of the window as a whole can come to light, painting a picture of each step to the final product. Moreover, understanding construction techniques is the first part in diagnosing damage and determining preservation methods.

The principal component of any stained glass window is clearly the glass itself. By definition, glass is considered “a congealed liquid formed through the fusion of several chemical elements under intense heat.”¹¹⁸ This process occurs naturally in nature, resulting in hard, glassy material found throughout the world and used by humans since the Stone Age. Fundamentally, glass is composed of silica sand mixed with smaller amounts of other oxides to aid in the melting (flux) and combining process. This includes lime, soda, potash, salt, scrap glass, and varying amounts of other ingredients like arsenic, magnesia, alumina, etc to aid in

---

¹¹⁸ Lloyd, Stained Glass in America, 112.
workability, durability, and color.\textsuperscript{119}

By the 19\textsuperscript{th} century when the Woodlands windows were created, the manufacturing of the ingredients in glass were much more refined and thus resulted in purer constituents.\textsuperscript{120} This also resulted in the addition of colorizing and decolorizing components like manganese and iron oxides that were unnecessary in the Middle Ages because they were found naturally in the ingredients. Consequently, nineteenth century recipes include many more ingredients than those found in Medieval formulas. In terms of deterioration, the use of soda-lime glass in America makes it generally less susceptible to atmospheric attack.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{glass_house.png}
\caption{18\textsuperscript{th} century glass house. Published in Conservation of Glass.}
\end{figure}


Like the majority of stained glass artisans in America during the early years of the craft, John Gibson did not manufacture his own glass preferring to import it from Europe or purchased from a supplier. Americans imported most European-made pot metal glass, with import duties as high as 30% in 1842.\textsuperscript{121} Flashed (or coated) pot metal was included among the imported glass items, and American craftsmen often etched and painted it with enamels and/or silver stain. In the case of the Woodlands, it is probable that Gibson purchased imported clear and pot metal glass and then painted and assembled the window at his studio in Philadelphia.

The basic manufacture of glass first involves the measurement and mixing of the essential ingredients including silica, soda, and lime with the addition of other components for various affects. Once thoroughly combined, the mixture is transferred into a preheated clay pot where it melts together or fuses at a heat of around 2600 degrees Fahrenheit until molten glass has formed. The plastic liquid is then drawn off to be poured, blown, or pressed into molds to create the desired form. After shaping the glass, it is slowly cooled or annealed. This process is important to prevent the formation of crystals or stresses within the sheet known as devitrification.\textsuperscript{122}

The color of the glass is acquired through the addition of different chemicals and minerals depending on the desired hue. Colored glass is often referred to as \emph{pot-metal} glass, a term used to describe glass that was colored when molten, or in

\textsuperscript{121} Farnsworth, “Stained-Glass Windows at Lyndhurst,” 6.
\textsuperscript{122} Davison and Newton, \textit{Conservation of Glass}, 4.
the “pot.” Pot-metal glass is colored throughout the entire body using metallic oxides that exist as colloids in suspension. Introduced by the Egyptians, copper was used to produce bluish-green glass and cobalt for blue or violet. Often mixtures of copper and manganese were employed for variations on blue and lead oxides with copper oxides for green. John Gibson incorporated two colors of pot metal glass in his windows for the Woodlands; the green foliate arched border and the narrow violet lozenges that outlined the quarried panels. X-ray fluorescence analysis of the glass conducted at Winterthur conservation labs make it clear that this was the formula used for the green arch borders with high levels of copper with the addition of lead oxides and arsenic as a flux. The high levels of manganese in the purple pot metal glass is also characteristic for producing vibrant purples, found commonly in Venetian glassware during the period. However, coloring glass was highly experimental. The color produced was dependent on the composition of the glass, the amount of oxygen present in the furnace, temperature, and the duration of the firing period. For example, both iron and copper can color glass either red or green depending on the conditions.

123Sloan, Conservation of Stained Glass in America, 79.
124Davison and Newton, Conservation of Glass, 58.
125XRF is a non-invasive technique that is widely used for chemical analysis of materials. A sample is irradiated with a primary x-ray, which in turn emits secondary x-rays characteristic of the elements that make up the material. These elements appear on a monitor in heights that measure their concentrations. This technique is popular for its quick and accurate results as well as its portability. See Norman H. Tennant, The Conservation of Glass and Ceramics (London: James & James (Science Publishers) Ltd, 1999), 27.
126Davison and Newton, Conservation of Glass, 59.
The coloring of glass was experimental and often left to change. The glass worker could not be certain of the impurities that might have infiltrated the melt. Early American glazers found that glass was liable to darken after several years in the sun. Later, when paint was applied to create shading and drapery, the additional firing that fuses the two paint layers might also change the shades in the process. By the nineteenth century, glass recipes and color formulas were recorded in handbooks. However, repetition of a particular color required numerous trials and errors and even when a glazier had determined the standard recipe, it was still difficult to maintain a consistent tint. This process is further described by C.J. Phillips in his book Glass: The Miracle of Maker about which he writes:

“The manufacture of coloured glass involves many problems of glass chemistry, some of them complicated and perplexing. Therefore the story of coloured glass cannot be made wholly simple and straightforward. Briefly, the colouring agent may be one of three types: (1) The colour is produced by absorption of certain characteristic frequencies of the incident of light by substances in solution in the glass; or (2) the colour is produced by particles of submicroscopic size precipitated within an originally colourless glass by appropriate heat treatment or (3) the colour may be produced by larger particles, which may be either coloured themselves as in aventurine glasses.”\(^\text{127}\)

Both of pot metal elements on Gibson’s windows were adorned with repeating black patterns painted on using a black glass paint. Since the Medieval ages, outlines and details with drawn out using brown or black lines, called trace lines, and a shape modeled with the use of washes or mattes for shadow. When only this type of paint

is used the window depends on the color of the glass to portray the image and the amount of light to form the pattern.\textsuperscript{128} Gibson added a particularly unique touch by double plating the glass for the green arch border, placing a plain piece of green colored glass on top of a painted one to create a richer hue.

Colored glass was formed in a variety of ways. Mouth blown techniques have been known since the first century AD, most commonly referred to as \textit{antique} glass. Antique glass is created by blowing the plastic melt into long, tubular bubbles between 3 inches and 5 inches long. The bubble is left open at the top and bottom to create a cylinder, which is then split lengthwise and pleased in an annealing oven. The glass is reheated, opened up, and relaxed into a flat sheet. The pot metal glass in Gibson’s windows exhibit small bubbles and has a slight wavy quality, a characteristic often left as a result of mouth blown glass. Another less popular mouth-blown process produces a \textit{crown} or a \textit{roundel}. This approach is similar to the latter, however instead of being elongated into a cylinder, the glass sphere is spun rapidly to create a flat, circular plate.\textsuperscript{129} This method produced an extreme amount of wasted glass and thus not commonly used as an antique technique.

By the mid-nineteenth century, the Industrial Revolution had given way to the mass production of glass as well as various ways to manufacture it by machine. In 1847, James Hartley invented cathedral or rolled glass, later enhanced by the development of the double-rolled cathedral glass in 1870 by the Chance Brothers of Birmingham, England. Colored glass panes were produced by pressing the molten

\textsuperscript{128} Sloan, \textit{Conservation of Stained Glass in America}, 159.
\textsuperscript{129} Davison and Newton, \textit{Conservation of Glass}, 91.
glass between two rollers to create a flat sheet. Whether they are intentionally
textured, glass made by this method is often marked by impressions from the rollers
and generally referred to as cathedral glass. The colors in pot-metal cathedral glass
tend to be duller than those of antique glass and the finish significantly less shiny.\textsuperscript{130}

As mentioned before, colored glass was also achieved using “flashed” glass,
consisting of a thin layer of colored glass that is fused onto a clear or glass of a
different color. This type of glass can then be etched using hydrochloric acid to cut
away the thin colored layer to produce a two-toned effect. This allowed
glassmakers to create two colors in the same piece without using any lead lines.\textsuperscript{131}

While a popular technique, examination of the glass shows that Gibson did not
employ flashed glass in his design for the Woodlands.

The craft of stained glass differs from others arts in that it is divided into two
distinct operations; the design of the art and the actual mechanics of putting the
glass together. The true stained glassmaker is fluent in both phases of the
operation, however in actual practice, there is a well-defined division of labor
between the designer and craftsman-artisan. The stained glass craft took form
when the combined talents of the early medieval glazier and painter came together
to beautify religious buildings. In \textit{Stained Glass in America}, Lloyd writes, “The
arrangement of the material – lead and glass – is all important. They must be
arranged in such a way that the natural beauty is revealed and this comes about

\textsuperscript{130}Sloan, \textit{Conservation of Stained Glass in America}, 82.
through fixed, firm laws of design and color. The craftsmen of the twelfth and thirteenth centuries understood these rigid rules and applied them.”

This balance was abandoned in the fifteenth century, and the natural beauty of the glass lost in the heavy painting. By the 19th century, painting had secured a more dominant position and substituted the integrity of the glass for more naturalistic realism. It wasn’t until Viollet-le-Duc and others began to uncover the past and the windows based on the beauty of the true glass. Techniques returned to their origins although the glazier now shared his craft with the artist and glassmakers combined methods used by both the ancients and contemporary.

Whether or not colored paints were utilized, ancient and modern glass painting almost always consists of a colored glass painted with black enamel (matte paint). This paint is composed mostly of copper and iron oxide, a binding medium like gum arabic, and a flux. The trace line is then applied to the surface of the glass using a rigger brush and fired at 350 degrees Celsius. This technique is present throughout John Gibson’s windows, found on almost every panel including pot metal and clear glass pieces. The majority of Gibson’s painting is defined with black matte, illustrated in the poppies, central foliate flowers, and the winged hourglass.

Pigments for enamels were and still are made from earth or metal elements. The color itself is only revealed after firing as a result of the chemical change between the pigment and flux. Each pigment is unique in its properties, which in

---

turn will create different mixtures and behaviors within the paint. Also influential to the final result are the flux and the kiln conditions.\textsuperscript{135} This is most apparent with copper oxide that can create a black, blue, or green depending on the various ingredients and environmental factors.

![Image of a green pot metal arch with matte paint detailing.](image)

**Figure 30:** Green pot metal arch with matte paint detailing.

Glass paints are typically a form of iron oxide that appears brown, black, red, or grey-green when fired. Black is made from iron and copper oxides with a hint of cobalt. Equally common was the combination of manganese with smalt or jet. Brown was achieved with iron oxides, manganese oxide or a mixture of both. Both brown and black would occasionally receive an addition of scarlet ochre, red lead, or burnt umber for a redder hue. Red and grey-green were composed of iron and copper oxides. Like glass paints, enamels are composed of the same pigment

metallic oxides as colored pot metal glass as they are essentially just ground glass. These pigments – iron, copper, cobalt, gold, and silver – need to first be fused or precipitated. Next, a flux is made and the pigment melted and fused together. After this mixture cools, the vitreous material is pulverized and ground into a powder. The powder is then ready to be combined with a liquid and painted onto the glass.\footnote{Sloan, \textit{Conservation of Stained Glass in America}, 162.}

Gibson used black paints of varying composition. The poppy spandrels encompass a variety paint formulas, seen clearly in the x-ray fluorescence results. Graphs show that the pigment contained high levels of chromium, manganese, and iron. The high lead content indicates its use as a flux. The presence of silver is interesting, although it is more likely that it was picked up from the surrounding red color formed from silver stain and arsenic. The occurrence of iron oxide and manganese suggests that Gibson may have initially intended for these areas to be a dark brown, and not the dark grey color that they currently appear.

The introduction of a full range of colored vitreous paints(enamels) in the 16\textsuperscript{th} century changed the entire dynamic of stained glass fabrication. At first they were used sparingly in conjunction with pot metal. However by the 18\textsuperscript{th} century, glass painters utilized enamels to paint the entire surface of the glass, excluding colored glass and lead came all together. Vitreous paints block lights depending on their color and density, lacking the transparency of earlier windows. Nevertheless, enameled stained glass was the technique most often employed at this period.
When using the enamel technique, colored enamel paints were painted onto clear glass and fired. Lead came was not necessary to separate the different colored (pot metal) glass to compose a design. This method was most common in the 16th century and later by Louis Comfort Tiffany and John La Farge. In other instances, enamels could be painted on flashed pot metal glass in areas where a thin layer of colored glass was etched away.\footnote{137}

![Image](image_url)

**Figure 31: Hourglass motif at the window's base.**

Surviving examples and contemporary descriptions reveal the extent and intricacy of the enamel windows: In 1847, William J. Hannington of New York advertised: “Landscapes, figures, fruits, and flowers, painted and burnt into the glass in natural colors....”. In 1854, William Mowbray promoted the permanency of enameled stained glass: “Figures and landscapes of the most refined description can

\footnote{137} Farnsworth, "Stained Glass at the Capitol."
be, and are daily put upon glass in vitrified colors, and burnt entirely into the body of the glass, making them impervious to the action of any weather, situation or climate.\textsuperscript{138} The stability of the Gibson’s enamel paint is impressive especially in contrast to the seriously deteriorated enamel-painted portions of much nineteenth-century American stained glass. Working with enamels are challenging as they require several applications and varying firing temperatures in order to attain specific colors, and thus a composition using multiple colors requires planning and presents problems. The durability of the Woodlands’ windows paint is indicative of the Gibson’s expertise.\textsuperscript{139} Surprisingly, Gibson chose to use enamel paints for the yellow and red floret instead of the more obviously silver stain technique. The high levels of lead and arsenic indicate that it is a lead arsenate based enamel. The addition of iron leads one to believe that Gibson used Whitcock’s recipe for Dark Red that list white lead, sulphate of iron, and flux.\textsuperscript{140}

Another striking feature about the Woodlands windows are the small diamonds of red colored glass found at the corners of the quarried banding. This brilliant red hue was believed to be a product of flashed glass but upon further research and observation, it appears that this red accent was created with a distinctive technique involving the addition of gold to the batch. In Edward Armitage’s book \textit{Stained Glass: History Technology, and Practice} (1959), he writes:

\begin{flushleft}


\textsuperscript{139}Farnsworth, “Capitol Stained Glass,” 13.

\end{flushleft}
A classical example of the second type of colour, produced by colloidal suspension is gold ruby. First described by Neri, it is produced by adding a relatively small amount of gold or gold salt to the glass batch. When melted and cooled, the glass is colourless or, at most, a light straw colour. But when properly reheated, the colour strikes and an intense red develops – the red of ruby. The cost is high and only luxury products can be made from gold-ruby. The colour is so intense, however, that a thin gold ruby layer can be “flushed” as a casing over crystal glass with effective results. Copper ruby is made in much the same way.\footnote{E. Liddal Armitage, \textit{Stained Glass: History, Technology, and Practice}, (Newton: Charles T. Branford Company) 77.}

![Figure 32: Diamond ruby detail.](image)

John and his brother William are also documented using this method with an exceptional result at the 1849 Exhibition of Domestic Manufacturers sponsored by the Franklin Institute, Philadelphia. Judges awarded the brothers a second premium, for the composition and “beauty of enameled glass, and success in rose color” for their samples of stained glass.” A complex formula for the color was
published by Nathaniel Whittock that involved “a few drops of the gold,” and it demonstrated great skill for those who could accomplish such a vitreous ruby color.\footnote{142}

One of the earliest techniques of “painting” glass was the application of silver stain. First appearing in 1313 AD, silver stain allowed glaziers to enhance pot metal designs by inserting passages of yellow on clear glass or creating a green hue by adding it to blue.\footnote{143} Silver in its metallic form is not actually used, but rather the silver is precipitated through chemical reactions to form silver nitrate. A more uniform coating is enhanced with the addition of yellow ochre or red clay. Generally, silver stain is made from silver nitrate, chloride, carbonate, or phosphate. When fired, silver oxide fuses with the glass, staining it dark orange to pale yellow depending on the concentration. It is painted onto the exterior of the glass and unlike paint, can withstand weathering. Gibson’s glass exhibits silver stain in several panels, confirmed by XRF testing that exhibits the presence of silver and copper. It is clear that the red background on the top two panels was produced using layers of silver stain as evident by the tiny specks of red that are a result of firing. Nathaniel Whittock warns against this effect in his instructions, writing “…the orange stain with the pencil colour, care must be used to let the lines hide any spot or flaw that may appear in the stain.”\footnote{144} Emanuel Fromberg also writes in his book An Essay on the Art of Painting on Glass (1851) instructions on how to achieve a red hue from

\footnote{142} Farnsworth, “Stained and Embossed Glass in the U.S. Capitol,” 2009.
\footnote{144} Whittock, The Painters’ and Glaziers’ Guide, 246.
silver and copper. More obvious is its use as semi-circular arcs in the infill panels around the quarries. The hues of each arc vary in color, from a bright yellow to a golden orange. This could be intentional, however it is more likely inconsistencies in application and firing.

A fourth type of paint is a technique called cold paint, although this is much less common in American windows and does not occur in the Woodlands’ windows. Cold painting does not require firing and can be achieved using a variety of paints like housepainters’ oil paints or unfired glass paints. No matter the type of paint, each finish is composed of a pigment and a binder, which “holds the particles of the pigment together in a liquid medium that allows them to be spread on the material being painted.” Glass paints differ from other finishes in that in addition to being applied, they must also fuse to the substrate in the kiln to create a permanent coating. This makes it necessary to have two binders - allowing a smooth application and binding the pigments to the glass during firing.

The first binder and wetting agent allows for a liquid consistency and the capacity to adhere to the glass until firing. The powdered pigment and flux are suspended in this binder until later burn off in the presence of high temperatures. Binders come in various forms depending on the desired effect. Old recipes call for urine or wine as an adhesive, while today vinegar or water mixed with gum arabic are used for general painting. Also known to be used were turpentine and lavender,

---

146 Sloan, Conservation of Stained Glass in America, 160.
clove, or aniseed oils.\textsuperscript{147}

A flux is a necessary binder that fuses the paint to the glass. A flux by definition is a soft glass that melts at a low temperature, but can also composed of a variety of ingredients such as sand, red or yellow lead, borax, and occasionally pearlash, salt, or arsenic. Its vitreous nature allows the pigment to melt and fuse to the glass. It is the amount of flux that determines the type of paint applied – glass stainers colors or enamels. Of these, enamels require the highest amount of flux, in addition to a preliminary fusing flux (sintering) before its application. The process involves melting the pigment with the flux in a crucible and then pouring it out onto a slab to cool and vitrify. This soft glass product is crushed to produce the paint. These paints can be fired at a low temperature due to the flux, and thus desirable in enamel paints for its resistance to fading.\textsuperscript{148} Gibson used an unusually high amount of arsenic in his paint, especially in his mixes for red and yellow.

After the glass is painted and fired, the pieces are assembled and joined together using H-shaped lengths of metal known as cames. These thin strips were most commonly constructed from lead and later substituted for zinc, brass, or copper. In the Middle Ages, lead came was cast by hand by pouring molten lead into an H-shaped mold. After being cooled, these “bats” of lead were passed through a mill with an H-shaped opening that got successively smaller, elongating the metal to

\textsuperscript{147}Ibid., 161-162. See a M.A. Gessert, \textit{Rudimentary Treatise on the Art of Painting on Glass or Glass-Staining}, (London: Bradbury and Evans, 1857) for a full description of fluxes and their different properties.\textsuperscript{148} Ibid., 162.
the desired profile and size. Often mill marks were left from the gears on the heart of the lead. This method is still used today, although most modern came is manufactured by extrusion a method that uses hydraulic pressure and carried out in 150 degree Celsius environment.\textsuperscript{149}

While medieval lead typically had a larger profile, with thick hearts and flanges, American cames after 1850 had much thinner hearts and flanges that were very soft and easy to bend. Came could be designed in various styles, available in flat, rounded, or colonial profiles.\textsuperscript{150} John Gibson used a ¼ inch milled flat leaded came, evident by the distinct grooves along the interior.\textsuperscript{151} This feature may have also aided in adhering the glazing putty to the came to produce a watertight seal. The matrix is soldered together at the joints. The low modulus of elasticity made lead a perfect choice to accommodate the windows expansion. However once stretched, it cannot return to its original size causing the windows to sag. Much of the lead from the mid to late nineteenth century is in very poor condition in comparison to earlier leads that have still maintained a level of longevity. Testing conducted on two pieces of Gibson’s lead came, shows that the original alloy was almost entirely composed of lead with a small percentage of zinc. The second

\textsuperscript{149} Roy Newton, "When Repairing Stained Glass Windows, Why Must Some Leads Be Replaced After 100 Years or Less, Where As Other Leads Have Lasted 700 Years?" Draft for Content, 1981. Sent as email from Julie Sloan February 16, 2012.


sample however, revealed a much lower lead content and the addition of calcium, iron, and zinc. This demonstrates that at some point, a portion of the lead had been reglazed. The use of harder metals like zinc, brass, and copper came about later in the 19th century and produced a much stiffer came.\textsuperscript{152}

An alternative jointing material to lead is the use of copper foil. Copper foil is wrapped around each piece of glass prior to soldering and butted together in position by drawing molten solder over the seam. The advantage of this technique is its ability to be positioned in any angle prior to soldering, making it favorable for three-dimensional objects.\textsuperscript{153}

Finally, in order to waterproof

\textsuperscript{152} Sloan, \textit{Conservation of Stained Glass in America}, 123.
the window, glaziers applied a glazing putty made of linseed oil and whiting. When mixed with turpentine, the compound becomes a wet sludge that was scooped into the panel and forced under the flanges using brushes or the thumb. A thicker mixture is actually recommended for its controllability and easier clean up. It was extremely important that the glass panel be cleaned after glazing putty is applied as it will accelerate paint deterioration.\footnote{Sloan, \textit{Conservation of Stained Glass in America}, 148.}
Chapter 5: Deterioration Conditions

Like all architectural elements, stained glass is susceptible to many forms of deterioration, complicated by the numerous components required for its assembly. Maintenance is the most important and successful forms of preservation. Keeping the frame maintained, regular painting, and periodic replacement of the glazing compound prevent more serious problems in the future. Unfortunately, most maintenance is deferred, necessitating more invasive interventions. The price of these conservation campaigns are often more costly, extensive, and compromised in their solutions. Poorly executed or incorrect restoration efforts are unfortunately common and extremely harmful – such as the tendency to conduct major window repairs in situ.  

The stained glass at the Woodlands Cemetery exhibits a range of deterioration conditions across all elements of the construction. Conservation and treatment of stained glass first requires an assessment of their state in addition to the source of the problem. The following section is devoted to the documentation process and analysis of the Woodland’s observable conditions.

5.1 Documentation and Conditions Assessment:

Documentation of a window is the first measure taken in understanding its history, construction methods, and physical conditions. Historic research should contain existing information about the windows, frame, and the building.

construction. Investigations involve developing a history of the window from its fabrication to the present through photographs, building records, or archival documents. Professor of Art History Virginia Raguin characterizes these in the following outline:

A) *The Building*
1. Date construction from beginning to date completed
2. Types of building materials used and their relative quality and the construction techniques employed
3. Architect, designer and builder with any available information about them
4. Original drawings, elevations or plans of the structure
5. Major alterations or repairs to the building or interior furnishings. This may alter the way in which the windows were originally viewed

B) *The Stained Glass*
1. Artist/designer with information on other commissions in the area
2. Fabricating studio
3. Date fabricated and installed
4. Donor or person who commissioned the windows
5. The subject matter of the individual piece, how it may relate to the total ensemble. Make a record of all memorials or inscriptions, as these are difficult to reconstruct if damaged
6. Collated records of previous repairs to the windows or frames
7. Any catastrophes or nearby demolition that may have affected the windows

After the significance of the windows and their history has been assessed, the completion of a full conditions survey allows for future monitoring and serves as a record of invaluable information should any serious damage occur. The survey is also an essential first step in creating a set of specifications in the case that restoration is a possibly. Surveys begin with floor plans to provide a location and an identification with a logical numbering system so that individual parts of the

---

window can be surveyed. In accordance with the “Census of Stained Glass Windows in America,” forms for the Woodlands were created for each panel of glass within each window and included basic information like surveyor name, date, building name, location of window, name of the designer and when they were created, and description of the components in question (glass, paint, came, support bars, etc).\textsuperscript{157}

The glass is described based on type followed by the type of applied decoration – enamels, etching, stain, etc. Due to the over arching decay of the lead, came was characterized by whether or not they were present with a description of their profile and whether they showed any evidence of cracks. The windows exhibited multiple symptoms of deterioration:

Glass Cracking – fractures that span through the glass causing a break or sever within the piece of glass

Separation of Glass from the Came – site in which the glass has become detached from its coinciding lead came, often corresponding to cracking.

Missing Glass – Total loss of pieces or entire panels of glass, often the result of cracking.

Flaking – loss of adhesion between the coating and the glass substrate resulting in the detachment of small paint fragments.

Fading (photodegradation) – loss of tiny particles of paint causing the paint to lose color and brightness. This condition results in a faint appearance of the paint and eventual disappearance.

Lead Corrosion – process in which the lead is eaten away and altered through chemical reactions. Characterized by a white corrosive build up and/or detachment of the lead from the matrix.

Lead Cracking – weakened condition of lead caused by repeated stretching and thermal expansion, resulting in a fracture.

Missing Lead – total loss of metal came.

Soiling – accumulation of atmospheric deposits characterized by a dark buildup on the glass substrate.

Previous Repair (Lead) – preceding restoration campaigns, evident by the addition of lead flanges that were not part of the original design with the purpose of mending cracks within the glass (see cracking). Also refers to resoldering of the joints.

After being recorded on the survey form, these conditions were assigned colors and overlayed on scaled and rectified photography. These provide visuals to diagnose patterns and assist in comprehending deterioration mechanisms.\textsuperscript{158}

\textbf{5.2 Glass Deterioration}

Fortunately for most American stained glass, glass erosion is a rare occurrence due to changes in composition in the 19\textsuperscript{th} century. However, there have been significant studies into the deterioration of medieval glass, which often show signs of pitting on unpainted surfaces or covered with a hard opaque scale of corrosion. When glass reacts with water or any aqueous solution, a chemical change occurs at the glass surface involving two mechanisms: de-alkalization (leaching) and network dissolution. Other interdependent factors affecting the decomposition of glass can be separated into two different categories. The first are factors related to the glass itself, including the nature of the surface, composition of the bulk glass,

\textsuperscript{158} The glazing putty of the windows is so deteriorated that it will be necessary to clean off all of the older putty and replaced. For this reason, it was not included in the conditions survey, although still a critical aspect of historic stained glass.
inhomogeneities in the glass, and the firing process. Second, are those related to the atmospheric environment such as the amount of water and/or vapor present, the nature of the solution (i.e. pH, particular ions and their concentration, presence of agents and salts), the time of exposure for the attack, temperature. Window glass is particularly susceptible to pollution, condensation, humidity, and solarization.\textsuperscript{159}

The durability of stained glass is partially determined by the composition of glass – the ratio of silica, alkali (soda or potash), lime (calcium oxide), and additives like metallic oxides and opacifiers. Fused silica by itself produces a highly durable glass. However, due to its extremely high melting temperatures, modifiers are added as fluxes for construction purposes. The percentage of silica is a crucial factor in determining decomposition, typically representing 60\% of the total composition. Modifiers alter properties like viscosity, thermal expansion, and durability. They fall into two main categories: fluxes and stabilizers. Fluxes, a mix of sodium and potassium represent 15\% and reduce the viscosity. Stabilizers, usually lime or calcium and magnesium are alkaline earth oxides that make up 10\% of the batch and prevent crystallization when the batch cools, improves the chemical stability of the glass, and makes it less soluble in water.\textsuperscript{160} Therefore, the greater proportion of glass modifier, like calcium, to the alkali, the more stable the glass will be. Other minor components of glass like alumina, phosphorous, and iron are intermediates that aid in the forming and modifying of the glass. Their presence in glass stems from trace elements in the raw materials or from the surrounding environment and

\textsuperscript{160} Ibid., 177.
can increase its resistance to dissolution. It is the variation in the initial bulk batches of glass that allows for differential deterioration within one stained glass window.¹⁶¹

Water is the principal medium in which glass faces chemical deterioration, particularly when only a small amount of water is present like condensed moisture. In these conditions, the alkali ions in the glass (sodium and potassium) can diffuse out of the glass into the water, making it alkaline. If the alkalinity becomes high enough, the silica network can be attacked and the structure of the glass breaks down.¹⁶² Having a small amount of water present is actually the most dangerous to stained glass windows because the same amount of alkali coming from the glass will make the small amount of water more alkaline. Condensation can similarly create dangerously high alkalinity levels in which the alkali content increases with each drying cycle. However, if a significant amount of water is present, as it is during free-flowing rain, the alkali coming from the glass will be washed away preventing any deterioration from occurring.¹⁶³

Water plays an important role in the “replacement by protons of the diffusing alkali ions (leaching) and the subsequent hydration and dissolution of the silica network.”¹⁶⁴ Literary references to leached glass can refer to it in various forms such as alkali-deficient, silica-rich, or the gel layer. In damp or wet

¹⁶¹Ibid., 175–177.
¹⁶³Ibid, iv.
environments, negatively charged alkali and metal cations are extracted from the glass to form a sodium or potassium hydroxide solution. However, since neutrality of the glass must be maintained, hydronium ions (H₃O⁺) from the water exchange protons for the alkali ions leaching from the glass network. This process results in the gel-layer. Medieval glass made of potash glass has almost half the durability of later and consequently American soda glass because of the potassium ions, which are larger than those of sodium ions and thus take up a larger area in the glass.¹⁶⁵

Most American glass is quite stable due to the changes that occurred in glass composition during the 19th century. The durability greatly increased with the supplemented silica content and the use of soda lime instead of potash (potassium rich ash) as the alkali. However, glass properties and processing can cause issues, like minor discoloration or tiny fractures. Also debated is the harm that pollution can have on stained glass, specifically sulphur dioxide on medieval windows. This is highly debated and it is still undetermined whether SO₂ directly attacks the substrate of the glass.¹⁶⁶

As customary for American glass, the Woodlands windows do not exhibit any forms of glass deterioration. However, it is still susceptible to scratching, etching from abrasion or chemicals, and breakage. Alterations that can occur on the glass surface are dulling, iridescence and the formation of crusts. These deteriorated surfaces may also exhibit cracking, flaking, and the formation of pits. Since the Woodlands windows are set into doors, they have been particularly vulnerable to

¹⁶⁵Ibid., 175.
cracking or weakening from excessive force, vibration, and just day-to-day use. Cracking appears in several places on both windows, the most severe occurring on the clear panes between the central quarries and green border arch (A33, A21, B32, B23). Cracking also exists in the purple border panels as well as two small breaks at the top of panel A3. While no cracks are currently present in the double plated green border, it is clearly visible where a crack had previously occurred and repaired using a “Dutchman” technique (A20). While it is impossible to be certain, since the windows were part of functioning door, it is most likely that this damaged occurred during either the removal of the windows from the doors, or from poor storage conditions. Two larger cracks on Window B coincide with lead joints, leading one to presume that these weakened areas laid the foundation for glass breakage. Cracking can also be caused from improperly set nails or internal stresses from improper anneal.168

---

167See page 109 for the identification of all references glass.
5.3 Deterioration of Paint:

Much more prone to severe deterioration is the painted glass associated with pictorial scenes and figures beginning in the 16th century. Improperly fired paints or poor quality mixes, will cause the paints to flake off in particles. Manufacturing is a key factor with problems occurring in contamination of the components, poor production or improper mixing. Craftsmanship also plays a key role in the longevity of paint. Issues can come about from the use of wrong binders and artistic technique. If applied too thick, poorly mixed or retouched, the paint may not fuse properly to the glass and leave bubbles on the surface, known as frying. Failure is commonly caused from firing mistakes, including both temperature and duration,
such as baking the glass at too low a temperature or for too short a period.\textsuperscript{169} Of course weathering will result in the chemical and physical degradation of the pigments and fluxes in the paint depending on the location of the paint, protective glazing and atmospheric conditions of the specific site.

As assessed by conservator Julie Sloan, the deterioration of glass paint is a complex and essentially unresearched area of study. Paint can deteriorate in many forms, including flaking or cracking off the glass or fading. Fading does not occur with the pigments of the glass paints, but rather a change in the index of refraction of the fluxes causes such an appearance. Some paints will turn black from oxidization or take on the appearance of darkening from trapping sooty dirt in the grooves. Each of the factors of paint deterioration is difficult to analyze alone and often found working in combination as well as with the varying conditions of the situation specific to the window.\textsuperscript{170}

The conditions survey results show that the Gibsons’ paints were largely stable, with infrequent miniscule losses. The paint itself is not flaking or peeling, indicating that the loss is the cause of abrasion or scratches. Even so, they are hardly noticeable unless under intense scrutiny. More concerning, is the lost of paint concentrated near the came, seen clearly in panel B14. It appears that as the waterproofing putty is deteriorating and cracking off, it is taking with it small chips of the decorative enamel. In addition, there has been a significant amount of fading of the grey shading and floral detail on panel A33 as well as with the black paint on

\textsuperscript{169}\textit{Ibid.}

\textsuperscript{170}Sloan, \textit{Conservation of Stained Glass in America}, 166-168.
the surrounding purple lozenges (A36). These areas are considerably lighter than the other panels with the same pattern and appear streaked and uneven. This thin, streaked quality is most likely an application flaw from having used too much linseed oil or turpentine in the mixture.

Figure 35: Loss and fading of the matte paint.
5.4 Decay of the Supporting Structure:

The greatest and most common threat to American stained glass is often the deterioration of the skeletal structure. Stained glass framing consists of the came, waterproofing putty, support bars, and framing elements and are typically the site of the largest amount of restoration. The diversity of materials used in frame members facilitates a range of decay, including wood sashes and muntins that can decay, came, metal t-bars and saddle bars that corrode, and glazing putty that dry and harden. Insufficient framing leads to the sagging and cracking of the glass and lead came.

Lead came naturally produces a protective dark bluish-gray patina that allows it be resistant to most forms of corrosion. In the mid-19th century, improved smelting practices allowed manufacturers to extract valuable metal impurities from lead, thus producing 100% pure lead. 100% lead is very workable, however proves to be less durable than medieval lead that contains elements of tin, copper, silver, and antimony. The Corpus Vitrearum efforts in Europe found that medieval leads contain up to 3% silver, and 1% - 13% tin.\textsuperscript{171} The presence of silver or copper is critical to ensure the longevity of lead came. Both of these elements alter the physical structure of lead, enabling it to withstand the flex and strain placed on stained glass windows.\textsuperscript{172} Stiffer such as zinc, brass, and copper came into use in the late 1800's after the Chicago Metallic Corporation introduced them in 1893,
although never exceeded lead in their use. In the 1970s, “restoration lead (ASTM B29-84) was developed based on the metallurgic analyses of medieval camees, some of which have lasted for several centuries.\textsuperscript{173} Presently, lead came for restoration typically contains between 0.03\% to 0.06\% copper or silver as well as 0.5\% and 1.0\% tin and antimony and predicted to last for a century from ordinary aging.\textsuperscript{174}

Unfortunately, artisans continued to believe that pure lead had a greater longevity and therefore used throughout some of the most important years of American stained glass construction. Lead is also particularly prone to further deterioration when in contact with certain organic acids of alkalis. Alkalis like lime found in cement mortars or lye in cleaning products will produce a red corrosion produce to form. Organic acids (acetic, formic, nitric, tannic) will cause a white corrosive layer that is actively destruction as it eats into the lead. These can form when certain woods are exposed to water or in the curing process of many silicones. Like glass, water and humidity in close proximity will also attack lead.\textsuperscript{175}

The inherent strength of the assembly system is also related to the cross-section, profile and internal construction of the came. How camees are joined in a leaded panel is crucial to the performance of the window. Poor craftsmanship will weaken the assembly adding to premature failure. Skill level is reflected in the soldered joints and can give evidence to past repairs.\textsuperscript{176} It is also possible that the differences between milled and extruded camees give insight into the increased

\textsuperscript{173}Neal A. Vogel and Rolf Achilles, “Preservation Brief 33,” 7.
\textsuperscript{174}Sloan, Conservation of Stained Glass in America, 123.
\textsuperscript{175}Ibid., 119.
\textsuperscript{176}Vogel and Achilles, NPS Brief 33, 9.
deterioration in 19th century lead than some medieval came. Milled cames have a ridged heart, thus when force is applied to the glass, some movement between the glass and the lead can be accommodated by crushing the ridges.\textsuperscript{177}

Cracking is one of the most obvious signs of deteriorated came. This condition is known as metal fatigue, a result of stretching and thermal expansion. Repeated stretching over a century from changes in temperature and movement will make the meal become brittle and break down (crack). This is especially prevalent close to where the came was soldered to form the joints. More recently, concern has been raised from the damage caused by linseed oil putty on lead came. Linseed oil, which is the most common putty material, is also known to be corrosive. In addition, lead corrodes faster in the presence of fatty oils. Lead is also a drier of linseed by contributing oxygen in the drying process. These processes add to the corrosion of the heart of the lead when glazed with linseed oil putty.\textsuperscript{178}

\textsuperscript{177}Newton, “When Repairing Stained Glass Windows,” 7.
The Woodlands windows show severe lead corrosion ranging from small deposits of organic acids to complete decay of the came. The most acute display of corrosion exists on the exterior of the windows where it was in contact and set within the wooden frames. Some wood used for construction, especially English oak, liberate organic acids and can have extremely damaging effects on the lead. These areas display active deterioration where the lead is actively being eaten away in pockets and covered in white corrosion product.\textsuperscript{179} Some pieces in Window A are so corroded and stretched that they are easily snapped and bent and have detached from the window assembly. Other small deposits are present along the interior came. Cracking is also a prevalent issue with fractures occurring frequently in the interior quarries and near soldered joints. This is clearly seen in Window A where

the cames intersect at the small ruby panes, with cracks radiating out in several directions. This creates a highly unstable area, making the glass susceptible to breakage as well as separating from the came and becoming lost.

It has also become apparent from observation that the came was painted with a black coating during a past intervention. Although it appeared to be the lead itself, the darker, and more contemporary appearance of the interior lead came assembly is actually the result of being painted black. This is further confirmed from the streaks of black paint that are left on the edges of the glass owing to hasty, poor craftsmanship. This paint can be removed with simple water and cotton swabs.

Lead that has been stretched beyond its capacity is also prone to bowing or sagging. Like with cracking, lead expands and stretches with heat and with the addition of the weight of the glass, the lead does not have enough flexibility to pull back into the plane, thus causing the window to bow. If the lead is thin or if the lead pattern is composed of many small pieces, the likelihood of bowing is much greater. Since the windows have been removed from their original configuration, it is not possible to determine their state when functioning as part of the doors.

Finally, one of the most important components to the structural longevity of the window is the waterproofing compound. Glazing putty, cement, or waterproofing compound is an application that is rubbed on the window and pressed under the came flange to form a watertight bond between the leading and the glass. It is this compound that prevents wind and rain from penetrating the window and also gives the panels the rigidity needed to support themselves.
vertically. Therefore, glazing putty must be able to adhere to the glass and lead and hold up against water, heat, and cold.\textsuperscript{180} In addition, it must allow for a certain amount of expansion from the surrounding lead. A waterproofing compound was traditionally composed of linseed oil and whiting (calcium carbonate), plaster of Paris to extend the mixture, turpentine as a thinning agent, lead to help dry the oil, and a coloring component like lampblack or natural pigments.\textsuperscript{181} Recipes for waterproofing compound can be found in many stained glass manuals in various forms. One of the most harmful ingredients found in window putties is Portland cement. Made of calcium carbonate and aluminum silicates, this material found its way into putties over the past forty years for its similar properties to plaster of Paris. However, Portland cement continues to harden for a longer period of time and results in a hard, insoluble material. This is particularly dangerous because it does not allow for the movement of the window. The cement will not flex with the window, thus increasingly the likelihood of the glass breaking. It is also extremely difficult to remove from a glass panel.\textsuperscript{182}

The Chapel windows exhibit extreme deterioration of the glazing putty, cracking off in pieces at slight movement or contact. Thebrittleness of the putty is contributed to linseed oil, which is a siccative and thus hardens over time. As the putty hardens it loses its ability to maintain a seal and breaks away from the lead or frame. Its aging characteristics are not uniform and becomes can become brittle and

\textsuperscript{180}Sloan, \textit{Conservation of Stained Glass in America}, 144.
\textsuperscript{182}Sloan, \textit{Conservation of Stained Glass in America}, pp 144-149.
crack, while in other places become powdery and wash out of the cames. Gibson’s windows present all of these conditions - no longer adhering to the glass or lead, missing, and failing to prevent water from infiltrating the window – making it clear that it has been a significant amount of time since the windows have been re-puttied, if at all in some areas.¹⁸³

¹⁸³More contemporary ideas towards glazing can be found in the Science and Technology of Glazing Systems published by the American Society for Testing and Materials (July 1990).
Chapter 6: Methods of Conservation

The cleaning, repair, and conservation of a stained glass window are determined by the condition and quality of the glass. Poor restoration only results in increased or permanent long-term damage and repairs should only be executed after meticulous research and evaluation of the glass conditions. It is important to refer to appropriate intervention, national and international guidelines before any sort of undertaking. These ethics are best stated by the late Director of the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) in Rome, Italy, Bernard M. Feilden;

1. The condition of the building before any intervention and all methods and materials used during treatment must be fully documented.

2. Historic evidence must not be destroyed, falsified or removed.

3. Any intervention must be the minimum necessary.

4. Any intervention must be governed by unswerving respect for the aesthetic, historical and physical integrity of cultural property. Any proposed interventions should (a) be reversible, if technically possible, or (b) at least not prejudice a future intervention whenever this may become necessary; (c) not hinder the possibility of later access to all evidence incorporated in the object; (d) allow the maximum amount of existing material to be retained; (e) be harmonious in colour, tone, texture, form and scale, if additions are necessary, but should be less noticeable than original material, while at the same time being identifiable; (f) not be undertaken by conservators/restorers who are insufficiently trained or experienced, unless they obtain competent advice.\textsuperscript{184}

Of course, every conservation effort is determined after the completion of comprehensive research and documentation.

6.1 Cleaning:

Stained glass is highly valued for its ability to transform light into beautiful pieces of architectural art. Often just cleaning the glass has a drastic affect on the appearance and quality of the windows’ condition, restoring much of its original brilliance and offering an opportunity for close inspection. Dirt, soot, and grime build up on both sides of the panels from pollution, smoke, and oxidation. This is particularly prevalent in churches with carbon deposits from the burning of candles and incense. Clearly the main objective of cleaning the window is to remove the weathering products and accretions in order to restore the transparency of the glass and its color. The greatest concern when cleaning is to remove the products without negatively affecting or unintentionally altering the paint.\textsuperscript{185} The best type of cleaner is simply soft, de-ionized water, especially for significant glass and museum quality restorations. Tap water often contains calcium and magnesium, hydrogen carbonates, chlorides, and sulphates that can further deposition, and therefore not used for cleaning glass objects.\textsuperscript{186} In cases where water alone is inadequate, the application of non-ionic detergents may be required. Occasionally yellow layers of shellac, lacquer varnish, or thick grime can be removed with alcohol or solvents. Unpainted glass can also be treated with acetone, ethanol, or isopropyl alcohol in the case that gentler methods fail.

\textsuperscript{186}Davison and Newton, \textit{Conservation of Glass}, 65.
It is critical that cleaning only take place after the stability of the paint is confirmed. If the historic paint is failing, cleaning will cause it to flake and further damage the design of the artist. Acidic or abrasive cleaners should never be used, including household cleaners containing ammonia which will react with the glazing putty or metal cames. Before photographs could be taken at the Woodlands, basic cleaning was conducted to expose as much of the original detail as possible. The initial cleaning solution was deionized water with the addition a small addition of ethanol. However, after the stability of the paint became a concern, the solution was altered to just soft water. Dirt was removed panel by panel using cotton swabs, being careful to ensure that no paint was being damaged in the process.

6.2 Repair to Glass:

There are a variety of conservation methods, varying from minor repairs to epoxy gluing. Missing glass, especially windows that are still part of the building structure, require replacement and can be performed in place as a “stop-gap” measure. Referred to as a “drop in,” “stop-in,” or “open-lead” repair entails cutting the came flange around the broken piece of glass at the solder joints, folding it back to replace the old glass, and resoldering the joints. Even if the glass is damaged, it

---

188 For a more in depth discussion on cleaning techniques and their chemical effect on stained glass see “Scientific Examinations of Historical Stained Glass” by Manfred Torge, Wolfgang Muller, and Karen Adam. <http://www.struers.com/resources/elements/12/2436/38art6.pdf>
189 Vogel and Achilles, “The Preservation and Repair of Historic Stained Glass.”
is important that the original is retained. It is always better to use an imperfect original piece of glass than replace it whenever possible. Not only are reproductions difficult to match and costly to make, they compromise the integrity of the historical window. If replacement pieces are necessary to structural stability or function, the new pieces should strive to blend in with the design scheme, however never imitate and still be identifiable as a later alteration. New pieces should also be scribed under the came with the date to prevent confusion with the original glass for future interventions.

Cracking is a common problem that will continue to grow as the edges contact each other whenever the window is subject to vibration, thermal expansion, and forces from use or building movement. For a long time, cracks were repaired with a “Dutchman,” a technique that splices in a cover lead flange over the crack. This hides the crack, however creates a large visual intrusion, obscuring the original design and appearance. Post World War II developments offer more preferable techniques with the use of adhesives. There are numerous synthetic polymers tested including; epoxy edge gluing and silicones, cyanoacrylates, and acrylics. These methods differ in strength, reversibility, and visual effect and should be selected based on the individual case. The two most commonly used adhesives are epoxies and silicones. Epoxies are a “dual-component reactive adhesive system”\textsuperscript{190} meaning that a resin must be mixed with a hardener in specific proportions to activate a cure.\textsuperscript{191} This material can be grouped into number sub-classes and many

\textsuperscript{190}Sloan, \textit{Conservation of Stained Glass in America}, 101-103.
thousands of variations are available commercially.\textsuperscript{192} Due to epoxy sharing the same refractive index as glass, gluing creates a nearly invisible line and particularly useful for painted glass that intends for one continuous image. Epoxy can be tinted to match the glass and produces a very strong bond, however will yellow and deteriorate in sunlight and requires a seconding glazing to prevent UV degradation. Several disadvantages of epoxy include its prolonged period for curing, inflexible, and not waterproof. Of all techniques, epoxy is the least reversible and the most expensive.\textsuperscript{193} However, these characteristics make this adhesive suitable for most museum situations.

Silicones are polymer adhesives that have a lower strength, but desirable when a flexible joint is needed, such as a window that is under continuous stress. Silicone is easily reversible, clear, and resistant to temperature, humidity and UV light. Recently, RTV silicone adhesives have had wide success in the conservation of stained glass windows reinstalled in buildings and projected to last for more than twenty years. Unfortunately, its milky white color refracts light differently than the surrounding glass, and thus easily detectable.\textsuperscript{194}

\textsuperscript{194} Sloan, \textit{Conservation of Stained Glass in America}, 102.
### 6.3 Repairs to Paint:

Regardless of the state of the paint, original glass should never be repainted or refired. This can alter the color of the glass, burn away the original paint, cause crizzling of the glass or increase deterioration to the paint. Instead, missing painted decoration is applied to a piece of new clear glass and then plated over or behind the original panel. This creates the illusion of a cohesive design while still keeping the integrity of the historic glass intact. The plate can be attached to the window in several ways, either in its own came as a separate plate or by placing it against the original and leading them both as one piece. This technique is also used for missing glass pieces.

The deterioration of paint involves different kinds of physical and chemical processes vary from disaggregation of a fired surface layer and detachment from the glass substrate to lifting of flakes of applied paint. Consolidants have to fulfill a steep list of requirements and meet rigorous standards including,

- ability to adhere the paint or painted layer to the glass substrate
- improve cohesion of corroded layers on glass paint or stain
- cope with thermal and humidity conditions
- possess excellent light-aging
- resistant to chemical attack
- have minimal visual impact on the glass
- low viscosity that enables it to penetrate the areas of loose paint
- chemically neutral
- resistant to biodegradation; water, air pollution, and biological attack

---

195 For more information on crizzling see Robert H Brill, "The Use of Selica Gel for the Protection of Glass with Incipient Crizzling," Journal of Glass Studies, pp 100-102.
- reversible\textsuperscript{196}

The only material that relatively meets this requirement is epoxy, although as mentioned previously they do not do well in wet conditions. Expansion also proves to be an issue. Glass expands very little, however dark colors absorb more heat than light colors and thus dark paint will expand more contributing to flaking. The plastic nature of the adhesive makes it expand more than either glass of the paint and can actually accelerate the rate of deterioration. Finally reversibility is one of the hardest criterion to fulfill, because no matter the material, removal of the adhesive will also remove the paint. Paint consolidation is not reversible, and thus should not be undertaken unless it is crucial to the survival of the window.\textsuperscript{197}

Recent studies have been conducted on “Paraloids,” a thermoplastic acrylic resin available as solution grade or as a solid grade acrylic resin. Paraloids come in several types (B-44, B-66, B-67, and B-72). B-72 is a very stable resin made of a copolymer of ethyl methacrylate and methyl acrylate (70: 30). Its popularity also stems from its versatility, as it can be purchased in solution of in a solid pellet form. This allows restorers to vary the concentration of the solution so that the viscosity is appropriate for the application. B-72 is mixed with a solvent most commonly acetone, toluene, xylene, ethyl acetate, and diacetone alcohol. The correct choice of solvent and the solvent-solid ratio are important factors in obtaining a resin with


\textsuperscript{197} Sloan, \textit{Conservation of Stained Glass in America}, 181.
suitable workability and flow characteristics. The primary limitation of acrylic resins is their poor resistance to water and the problem of the permeability in plastics. There is a risk of water vapor penetrating the resin film and over time salts or pollutants can get trapped beneath and attack the glass substrate. B-72 was used during the 1991 restoration on Harvard University’s Memorial Hall. Its poor performance in the presence of water was avoided by using it only on the interior layers that were heavily plated to avoid contact with the atmospheric elements. Its application is much more appropriate in museum settings.

In 2003 there was a large focus on the potential application of the newly developed material silicon-zirconium alkoxides (SZA). SZA relied on sol-gel chemistry rather than mechanical adhesion to bind together the friable particles. Silicon and zirconium alkoxides react with moisture in the air to form an inorganic gel that has no impact on the optical properties of painted glass and preferable penetration properties. However, practical use found it to be sensitive to humidity and difficult to control due to its very low viscosity. SZA may have some potential to paint consolidation but still lacks the ease of handling and use of B-72. Study is still being conducted on its possibilities.

---

199 Ibid., 385.
201 Ibid., 387.
6.4 Conservation of Came and Support Bars:

Despite common practice, a conservation objective should be to retain as much of the original lead as structurally possible. Surviving lead from this period is extremely rare and the historic value of the original lead is often underestimated. A lead matrix is an integral part of the artistic design of a panel. Material deterioration by itself is not an acceptable reason to choose replacement over conservation and other avenues must be explored to determine if relleading is the necessary option. If the came does not need to be replaced, the problem of bowing or sagging can be solved by flattening the window and adding more support bars. This is only performed by laying the window horizontally, the putty removed, and laying weights down incrementally at the lead intersections.202

Unfortunately, often the metal has corroded to the point that it has to be replaced. Replacing the lead came does alter the historical integrity of the window. There is a valuable amount of information about the glaziers, artists, and materials that can be deterred from the original lead. However, when the window is not structurally sound and in danger of being lost all together, historical integrity must be compromised in order to protect the glass and artistic painting. In the case that reglazing is necessary to preserve the window, original lead should be comprehensively documented and if possible archived for future study. Most cracking in lead is due to the nature of the intergranular fatigue cracking from

excessive grain size. High purity lead falls victim to this mechanism and the solution is to add a small amount of copper. Copper refines the grain size and improves the fatigue resistance, also raising the recrystallisation temperature, allowing the fine-grained structure to remain stable at higher temperatures. Reglazing is no small task and should only be undertaken by a conservation specialist after documentation. First rubbing are made to serve as a map for the pieces once they are disassembled. Each piece should be laid on top of the rubbing in its correct location and labeled with corresponding numbers. The lead used should match the original in its dimension and profile.

In order to support the weight of the window, craftsmen have and still employ the use of reinforcement bars. These bars are necessary in giving the window the ability to stand vertical, and for this reason are often integrated into the design of the stain glass to minimize their interference. As discussed in the previous chapter, support bars come in a variety of forms depending on their style and shape. Deterioration of support bars is not always blatantly apparent. A thorough investigation of the full window and its support system must be conducted to determine what is the cause of the problem. Occasionally the bars will pull out of the sash or the sash will deteriorate around the seat of the bars. When the bars give out, deflection will occur from a decaying frame, water infiltration, or if the frame or sash is too small for the window. Tie wires will also play a roll in bowing if they have stretched or pulled out from the panel.  

\[203\] Newton, "Why Must Some Leads be Replaced," 1-6.  
\[204\] Sloan, Conservation of Stained Glass in America, 153-155.
6.4 Sealant Replacement:

One of the most important components to the structural longevity of the window is the waterproofing compound. Glazing putty, cement, or waterproofing compound is an application that is rubbed on the window and pressed under the came flange to form a watertight bond between the leading and the glass. It is this compound that prevents wind and rain from penetrating the window and also gives the panels the rigidity needed to support themselves vertically. Therefore, glazing putty must be able to adhere to the glass and lead and hold up against water, heat, and cold.\textsuperscript{205} In addition, it must allow for a certain amount of expansion from the surrounding lead.

The chapel windows exhibit extreme deterioration of the glazing putty, cracking off in pieces at the slightest touch. The brittleness of the putty is contributed to linseed oil, which is a siccative and thus hardens over time. As the putty hardens it loses its ability to maintain a seal and breaks away from the lead or frame. It’s aging characteristics are not uniform and becomes can become brittle and crack, while in other places become powdery and wash out of the came:\textsuperscript{206} Gibson’s windows present all of these conditions - no longer adhering to the glass or lead, missing, and failing to prevent water from infiltrating the window – making it clear that it has been a significant amount of time since the windows have been re-


\textsuperscript{206} Ibid., 5.
puttied, if at all.

Many modern putties are available commercially. These typically contain elastomers, a synthetic compound designed to keep the putty elastic and less likely to harden and deteriorate. However, one should take caution when choosing a sealant. Commercial glazing compounds that contain DAP 33 should not be used on leaded glass as they are not designed to adhere to metal. Others, such as metal-sash putties, will not properly stick to the lead due to its corrosion patina. The best option to mix the putty oneself, which can be easily done with materials found in hardware or craft stores.207

6.5 Protective Glazing

Since the end of World War II “isothermal glazing” (double-glazing with ventilated space) has been used to ensure the protection of conserved stained glass in situ. There are many benefits to protective glazing, including but not limited to; protection from physical impact, reducing maintenance, stabilization of glass, prevention condensation on the surface and thus minimizing the need for interventive conservation (CVMA 2004).208 In contrast, it also well-known that unsuitable or improperly ventilated protective glazing can cause extremely harmful conditions by increasing deterioration by condensation and thermal expansion, eliminating natural ventilation, and negatively affecting aesthetics (Vogel et all,

---

207 Sloan, Conservation of Stained Glass in America, 149.
208 Quoted by the Corpus Vitrearum Medii Aevi from Neal A Vogel, “Protective Glazing Study” for the National Preservation Coordinator (Chicago: Inspired Partnerships, Inc., 1996), 1-6.
5). When conserving windows that are still installed in the building, protective glazing is an important factor to consider as a means of preventing future deterioration. However, it is not suggested or necessary for windows in controlled museum settings.

6.6 Conservation in Practice – American Glass Case Studies:

One of the earlier endeavors into the conservation of American stained glass was undertaken by the Metropolitan Museum of Art in 2001. Designed by obscure artist Henry E. Sharp (1817 - 1897), the windows of double-lancet composition were installed in the historic St. Ann's Church in Brooklyn, NY. Typical for the period, the personification of biblical figure Faith and Hope and their attributes fill the lights, with rich damasked blue background and an elaborate ogee canopy. Sharpe used similar techniques to Gibson, employing pot metal glass, enamels, and stenciling. When the windows arrived at the museum, they were heavily compromised by a thick build-up of soot and dirt identified as gypsum and black particulate from candle smoke, dust, and grime. Extensive paint loss had occurred in the faces of Hope and Faith, resulting from being fired at too low of a temperature, water infiltration and previous improper cleaning. Breaks in the glass and missing pieces were prevalent throughout and the lead network was so weakened and brittle that it easily bent when folded or moved.

After documentation, cleaning was carried out using a 1:1 mixture of water and ethanol, followed by a second round adding 1% Orvus WA paste, an anionic

---

\(^{209}\)Ibid., Vogel, 5.
detergent. The gypsum crusts were so thick that this was largely ineffective, requiring the use of a saturated solution of ammonium bicarbonate and deionized water. Due to the fragile condition of the paint, delaminated areas were consolidated with a 3% solution of B-72 in acetone. The process involved placing the ammonium bicarbonate compresses on the affected area to soften the accretions and removing the buildup layer by layer with a cotton swab to get as close to the paint layer without risking damage. Dirt that was particularly stubborn was left in place. Broken glass was repaired using the adhesive HXTAL NYL-1 (spichlorohydrin epoxy resin with alkyl ether amine and imidizoles harder) and small losses filled with tinted ORASOL dyed HXTAL to match the color of the original glass. Replacement pieces were painted by copying mirroring images, although this can be considered a questionable practice by some conservators. One of the most important aspects of the window was the figures' faces, which had been largely lost and void of the original detail. This was resolved by painting a glass backplate and attaching it to the original, thus filling in the areas of loss while still leaving the original paint untouched. Finally, to preserve the lead matrix broken joints were patched with a copper mesh and lost or unsalvageable lead was replaced with lead of a matching profile.²¹⁰

As previously mentioned, James Ballantine was one of the pioneers of British Gothic Revival Stained Glass and the designer of the window in the Bigelow Chapel at Mount Auburn. During the 1980s, the window was removed for “restorations.” – a performance that actually accelerated the deterioration of the windows. The original 1/8” flat profile came was replaced with 5/16” round came, making the lancets wider than their initial size. In addition, two T-bars were inserted to support sections, adding ½” to the lancet’s height. This alteration in size made the lancets too large for the openings between the mullions and from the head to the silt, resulting in bulging lancets and significant amount of broken glass. In 2006, Julie Sloan was appointed the task of conducting corrective restoration.\(^{211}\) The team releaded the windows with 60/40 (lead tin) to match the width of the original 1845

came and removing the cross bars that had in fact not been after 1858. 800 pieces of glass were rejoined using copper foil or silicone adhesive. [RTV 118].

The only deteriorated paint had occurred in the pink sash around the body of the angel, where much of the enamel paint had been lost. The color was a unique rich rose hue that appeared lavender in areas of heavier brush strokes. Paint was consolidated using B-72 and the detail skillfully recreated on a separate piece of new clear glass and plated behind the original to restore the effect while still keeping it distinctive from Ballantine's work. The window was reinstalled in 2008 having been returned to its former glory.

---

Future Recommendations and Concluding Remarks:

The primary purpose of the research and fieldwork presented in this thesis is to offer information and documentation for future conservation work. This proposal is a set of recommendations for the Woodlands’ stained glass windows based on the investigations into its construction techniques and deterioration conditions. Each conservation project is unique and dependent on the particular window, its location, the client, and the desired outcome. As an artistic and architectural element, conservation philosophies differ from museum settings to windows restored in situ. The Woodlands’ Executive Director, Jessica Baumert has expressed interest in creating a display with the windows that would be part of the Woodlands’ historical interpretation, and not reinstalled in the south façade’s doors. The following suggestions are based on this objective as well as preservation theory as codified by the U.S. Secretary of the Interior’s Standards for Rehabilitation of Historic Structures and the AIC code of ethics and standards of practice.\textsuperscript{213}

Dismantling:

Before dismantling, a full set of rubbings is required for proper documentation. The rubbing of each panel should be on 100% rag acid free paper with a hard wax rubbing stone. Documentation of the process should include the date, person performing the rubbing, the window number, and dimensions. A

second set of rubbings should be made for storage of the glass and the reglazing of the windows. Panels should be photographs again for the conservation records.

**Cleaning:**

The windows should be dismantled and the glass correctly placed on the corresponding rubbing. Before any cleaning takes place, it is necessary that a professional confirm the stability of the paint. For panes that are secure, particulates should be cleaned from each side of the glass with a mild solution of a non-ionic surfactant (like ORVUS paste) and deionized water. Stubborn putty can be removed by carefully soaking it in a bath of warm deionized water and taken off manually using wooden picks. The need for stronger solvents will be based on the severity of the soiling and compatibility as to not harm the decoration.

**Mending Cracks:**

For the mending of cracks, epoxy edge-gluing (HXTAL NYL-1) should be implemented for an invisible line. Although not waterproof and inflexible, this should not be an issue as the windows will only be used in a protected, museum-like display. The edges set for mending need to be cleaned of all particles and degreased with acetone. Pieces should be aligned over a light table to ensure the matching of the painted decoration of the glass and taped together on the unpainted surface. Epoxy can then be applied using a wooden pick and working the epoxy from one end of the crack to the other. Drips should be removed with cotton swabs and when finished, allowed to cure for the recommended amount of time (24 – 48 hrs).
Replacement Glass:

While Window B is fortunate to be completely intact, Window A is missing two of the double-plated panels from its arched border, for a total of four missing pieces of glass. Two of these pieces, although detached from the assembly, were uncovered with the window and therefore assumed to be original. Depending on the Woodlands’ budget and needs, it is possible to replace the last two panes of glass with the additional pieces stored in the basement. However, purist philosophy suggests that the area should be left unfilled or replaced with new glass that doesn’t imitated but instead blends with the original program. Since the windows will be laid out in a display, they do not need these pieces for structural support and it is clear for the viewer to understand the original design of the creator even in their absence. For these reasons, the author recommends that this portion of the window be left empty to retain the highest level of integrity.

Paint:

The majority of the paint on the Gibson windows is in relatively good condition. However, before any decisions can be made for the restoration of paint, the stability of the remaining glass paint should be tested under a microscope by a professional restorer. Most of the lost paint is too small to compromise the appearance of the overall design and thus if not a threat to further deterioration should be left untouched. One area on Window A exhibits moderate fading of some of the black matte paint (A32). If it is determined that this area is unstable, consolidant Acryloid B-72 may be applied by brush or by spray and applied gently. This should only be conducted if critically necessary to prevent additional paint loss.
Lead:

Ideally, conservation effort should attempt to retain as much of the original lead as possible. However, it is clear from the current conditions that the lead came is in an active state of deterioration and should be re-leaded. New lead needs to match the original in profile and dimensions, including the heart. The new lead alloy should follow restoration standards and contain 0.5% - 1.0% tin, 0.5% - 1.0% antimony, and trace elements of 0.03% - 0.06% copper or silver. The chemical composition must be verified by a certified laboratory. Joints should be flat and consistent throughout the windows with the use of a specified flux, like a stearic acid thickened with glycerin, or oleic acid.

Waterproofing Compound:

Waterproofing compound will need to be applied to seal the panels. The mix must include whiting mixed with organic oil. One formula recommended by the American Glass Guild is 1 part linseed oil, 1 part turpentine, 2 parts 1012 glazing compound, and 1 part calcium carbonate. The mixture should be combined to the appropriate consistency and applied using the thumb or a brush under all flanges on the interior and exterior of the window. A trace of lampblack may be used, although hardening agents should never be added. Once the entire window is waterproofed, all excess linseed oil must be thoroughly cleaned from the panel. Window should be left to harden before any relocation occurs.
Concluding Remarks:

In an environment of neglect, vandalism, and demolition, the Woodlands Cemetery is extraordinarily fortunate to have retained its 19th century stained glass in relatively stable condition. While the focus of this thesis has been the research and documentation of the windows, it has only scratched the surface of preservation opportunities. Two original fanlights are still in need of analysis and recording, in addition to possible conservation. Each of the glass pieces found in the basement have been digitally archived and scanned, allowing for future projects and technological prospects. X-ray fluorescence has presented insight into painting and construction methods of the period, however a much more intensive analysis of the results and relevant comparisons can be conducted as an unprecedented study into American stained glass painting. With the information assembled and proposed throughout this study, it is hoped that work on the John Gibson’s windows will not only contribute to the Woodlands, but also to the field of stained glass in the United States.
Bibliography


“The Hamilton Mansion,” unidentified printed clipping, the Samuel Castner collection, vol. 25, no. 67, prints and photographs, the Philadelphia Free Library.


Newton, Roy. “When Repairing Stained Glass Windows, Why Must Some Leads Be Replaced After 100 Years or Less, Where As Other Leads Have Lasted 700 Years?” Draft for Content, 1981. Sent as email from Julie Sloan February 16, 2012.


Pugin, A.W.N. *Contrasts, or a Parallel between the Noble Edifices of the Middle Ages, and Corresponding Buildings of the Present Day* (London: 1836).


Smith, John Jay. Laurel Hill Cemetery, Memoranda kept by J. Smith, Jr., Drayton Smith Collection, private.


Warrington, William. *The History of Stained Glass: from the earliest period of the art to the present time / illustrated by coloured examples of entire windows in the various styles*. (London: 1848).


Appendix
A. Historic Photographs

Figure 38: Woodlands Cemetery Company receipt to John Gibson 1855. Archived at the Historical Society of Pennsylvania.

Figure 39: Detail of the northern entrance fan light from 1907 postcard. Archived at the Philadelphia Historic Commission.
Appendix B: Glossary of Conditions:

Glass Cracking – fractures that span through the glass causing a break or sever within the piece of glass
Separation of Glass from the Came – site in which the glass has become detached from its coinciding lead came, often corresponding to cracking.

Missing Glass – Total loss of pieces or entire panels of glass, often the result of cracking.
Flaking – loss of adhesion between the coating and the glass substrate resulting in the detachment of small paint fragments.

Fading (photodegradation) – loss of tiny particles of paint causing the paint to lose color and brightness. This condition results in a faint appearance of the paint and eventual disappearance.
Lead Corrosion – process in which the lead is eaten away and altered through chemical reactions. Characterized by a white corrosive build up and/or detachment of the lead from the matrix.

Lead Cracking – weakened condition of lead caused by repeated stretching and thermal expansion, resulting in a fracture.
Missing Lead – total loss of metal came.

Soiling – accumulation of atmospheric deposits characterized by a dark buildup on the glass substrate.
Previous Repair (Lead) – preceding restoration campaigns, evident by the addition of lead flanges that were not part of the original design with the purpose of mending cracks within the glass (see cracking). Also refers to resoldering of the joints.
# Appendix C: Survey Form

## CHAPEL STAINED GLASS WINDOWS SURVEY, SPRING 2012
Woodlands Cemetery, Philadelphia

<table>
<thead>
<tr>
<th>Date:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveyor:</td>
<td></td>
</tr>
<tr>
<td>Window:</td>
<td></td>
</tr>
<tr>
<td>I.D. number:</td>
<td></td>
</tr>
</tbody>
</table>

## CONSTRUCTION

<table>
<thead>
<tr>
<th>Artist: John Gibson</th>
<th>Other</th>
<th>Original</th>
<th>Replaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: 1855</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## PAINT:

<table>
<thead>
<tr>
<th>Type: Enamel Silver Stain Matte Other</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Color(s):</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

## GLASS:

<table>
<thead>
<tr>
<th>Type: Clear Pot-Metal Flashed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Color:</td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

## LEAD:

<table>
<thead>
<tr>
<th>Present:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair:</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

## CONDITIONS

| GLASS: Cracking Scracking Abrasion Missing Separated from Lead Previous Repair |
|---------------------------------|----------------------------------|-----------------|-------------------|
| Notes:                          |                                  |                 |                   |

153
CONDITIONS CONT'

PAINT: Flaking  Discoloration/Fading  Other:

Notes:

LEAD: Organic Acids (White Corrosion)  Alkalis (Red Corrosion)  Cracking  Missing

Previous Repair: Yes  No

Notes:

DRAWING AND NOTES:
Appendix D: XRF Fluorescent Testing Results

1. Results for yellow stain

2. Black Matte Paint
3. Red and Yellow Floret

![Graph showing spectral data for red and yellow florets.]

4. Comparison of Lead Results

![Graph showing spectral data for lead comparisons.]

156
A
A.G.N. Pugin ......................................................8
Alexander Jackson Davis.................................14
America...1, 3, 13, 14, 15, 21, 30, 32, 33, 36, 38,
46, 47, 52, 53, 54, 56, 79, 80, 81, 82, 84, 85,
86, 88, 93, 96, 97, 100, 107, 110, 111, 113,
115, 119, 120, 121, 123, 126, 128, 139, 140,
141, 142, 143, 144
Andrew Hamilton ...........................................23, 25
Andrew Jackson Downing..............................14, 16
architecture 1, 2, 3, 5, 7, 8, 9, 11, 14, 21, 28, 38,
45, 51, 70
C
came....2, 23, 52, 68, 85, 94, 95, 100, 101, 107,
110, 111, 112, 113, 114, 119, 122, 125, 127,
131, 136, 148, 151
Catholic........8, 11, 12, 33, 54, 55, 56, 90, 144
Census of Stained Glass Windows in America
.................................................................3, 100, 140
chapel...1, 33, 35, 39, 42, 43, 50, 51, 61, 62, 66,
74, 132
Charles Drayton .............................................26, 27
cleaning........78, 111, 117, 118, 119, 129, 134
conservation....2, 3, 4, 73, 75, 82, 95, 98, 117,
119, 121, 125, 126, 128, 129, 131, 133, 134,
136, 137, 140
Consolidant..................................................123
craftsman....................................................6, 11, 66, 85
D
decorative painting.................................20, 56, 58, 59
design....1, 2, 8, 9, 10, 11, 13, 15, 18, 34, 38, 39,
42, 47, 49, 50, 51, 65, 69, 79, 85, 89, 101,
119, 120, 122, 125, 126, 135, 152
deterioration...3, 4, 36, 73, 75, 80, 97, 98, 100,
101, 103, 104, 106, 107, 110, 111, 112, 113,
115, 122, 123, 125, 127, 128, 131, 133, 135,
136
Documentation........22, 24, 43, 98, 133, 139
E
Eli K Price ....................................................40
enamel .........................................................86, 89, 94, 107, 132
epoxy .........................................................119, 120, 123, 130, 134
Estate.........................................................23, 38, 141
F
fanlight......................................................63, 69, 71, 72
flaking .....................................................104, 107, 123
flashed glass .................................................85, 90
flux.................................79, 82, 86, 88, 90, 93, 94, 136
funeral......2, 42, 43, 45, 46, 47, 48, 49, 50, 51
funeral home.................................50, 51
G
glass ....1, 2, 4, 5, 6, 7, 10, 11, 14, 18, 20, 21, 26,
35, 36, 46, 51, 52, 53, 54, 55, 58, 59, 64, 66,
68, 69, 70, 71, 73, 74, 75, 79, 80, 81, 83, 84,
85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96,
98, 100, 101, 102, 103, 104, 106, 107, 110,
111, 112, 114, 116, 117, 118, 119, 121, 122,
123, 124, 125, 126, 127, 128, 129, 130, 131,
132, 134, 135, 137, 138, 140, 142, 147, 148,
149, 151, 152
glazing putty....95, 97, 101, 110, 115, 119, 127
Gothic Revival....2, 7, 10, 11, 13, 14, 17, 18, 36,
39, 45, 46, 131, 139, 140, 141, 144
J
Jacob Bigelow .............................................31
James Ballantine.................................11, 36, 131
Jean Farnsworth.................................iii, 12, 15, 55, 58, 144
John Gibson........See Gibson, John, See Gibson,
John, See Gibson, John, See Gibson, John,
See Gibson, John, See Gibson, John, See
Gibson, John, See Gibson, John, See
Gibson, John, See Gibson, John, See
Gibson, John, See Gibson, John, See
Gibson, John, See Gibson, John, See
Gibson, John, See Gibson, John
John Jay Smith ...........................................29, 37, 39
John Notman............................................15, 33, 39
L
Laurel Hill Cemetery.................................29, 37, 40, 143
lead....67, 68, 71, 79, 82, 85, 87, 88, 90, 94, 95,
96, 100, 101, 105, 106, 110, 111, 112, 113,
114, 115, 119, 120, 125, 127, 128, 129, 130,
131, 136, 148, 150, 152
Lyndhurst....15, 17, 18, 19, 55, 58, 81, 90, 140
M
manufacture .............................................3, 55, 80, 81, 83, 84
Metropolitan Museum of Art18, 129, 130, 138,
139
Mike Hardy............................................70, 71
Mount Auburn....31, 32, 33, 34, 35, 36, 37, 39,
42, 131, 132, 141
<table>
<thead>
<tr>
<th>N</th>
<th>Nathaniel Whittock</th>
<th>90, 92</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Pot-metal glass</td>
<td>82</td>
</tr>
<tr>
<td>R</td>
<td>preservation</td>
<td>4, 79, 98, 133, 137</td>
</tr>
<tr>
<td>restoration</td>
<td>4, 7, 70, 73, 75, 98, 99, 101, 110, 111, 117, 124, 131, 132, 135, 136, 152</td>
<td></td>
</tr>
<tr>
<td>Rural Cemetery</td>
<td>28, 29</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>saloon</td>
<td>51, 67, 68, 69, 70, 73</td>
</tr>
<tr>
<td></td>
<td>silver stain</td>
<td>53, 81, 88, 90, 92</td>
</tr>
<tr>
<td></td>
<td>St. James the Less</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>stained glass</td>
<td>1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 17, 18, 20, 35, 36, 39, 43, 44, 45, 51, 52, 54, 55, 57, 58, 62, 68, 69, 70, 71, 73, 79, 81, 85, 88, 89, 91, 98, 101, 102, 103, 104, 110, 111, 115, 117, 119, 121, 128, 129, 133, 137</td>
</tr>
<tr>
<td>survey</td>
<td>3, 4, 75, 99, 101, 107</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>The Cambridge Camden Society</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>the Cemetery of Pere Lachaise</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Theophilus</td>
<td>5</td>
</tr>
<tr>
<td>U</td>
<td>United States Capitol</td>
<td>55</td>
</tr>
<tr>
<td>V</td>
<td>Viollet-le-Duc</td>
<td>7, 86</td>
</tr>
<tr>
<td>W</td>
<td>William Gibson</td>
<td>19, 20</td>
</tr>
<tr>
<td></td>
<td>Woodlands Cemetery Company</td>
<td>1, 29, 40, 41, 51, 60, 62</td>
</tr>
<tr>
<td></td>
<td>Woodlands Mansion</td>
<td>2, 24, 141</td>
</tr>
</tbody>
</table>