THE UNVEILING OF A. J. DOWNING'S VICTORIAN PLAN
FOR
WASHINGTON, D. C., 1851

By
Heather Wanser *

This paper describes the examination and conservation of one of the treasures in the collections of the Library of Congress: a drawing by Andrew Jackson Downing entitled "Plan Showing Proposed Method of Laying Out the Public Grounds at Washington, February 1851." These "Public Grounds" in Downing's plan are today referred to as the Mall, the Nation's first formally landscaped public park.

For years, curators in the Library's Geography and Map Division had pleaded with the Conservation Office to treat the plan because it was in such poor condition that it could not be viewed. The original paper substrate was disintegrating into dust, broken in hundreds of pieces held together by two linings, and silked on the front. Furthermore, there was considerable loss of image that was evidence of major damage to the surface from its last restoration. The combined condition and value of the original plan made the prospects of treatment daunting.

I will review the problems and describe the experiments with enzymes and consolidants that led to a somewhat unusual treatment. But before I begin, I will present an historical perspective on this important artifact.

The area of the Mall and how it was to be used has been a controversial issue from the very beginning. It was conceived with the first plan of the city. The site for our nation's capital, located at the confluence of the Potomac River and the Eastern Branch, was chosen by George Washington and approved by Congress in 1790. A year later, Pierre L'Enfant, a French military engineer and architect, drew up a plan for the new city that was to become the seat of government in 1800. In his ambitious plan, he had a "Grand Avenue," the core around which he laid out the city. This "Grand Avenue,"or the Mall, was to be the model for all Federal Parks, with public walks, elaborate waterworks and a ceremonial avenue suitable for "spacious houses and gardens."

The grid design offered a series of visually uninterrupted vistas and dramatic vantage points, typical of the Neoclassical tradition, incorporating the beauty of the river front and the general topography to their best advantage.

* Senior Paper Conservator, Conservation Office, Library of Congress, Washington, D. C. 20540

Not surprisingly, the young government lacked funds to implement L'Enfant's grandiose scheme, which was intended to transform farm land and bucolic countryside into a sophisticated city. The Mall area remained basically undeveloped well into the 19th century. Settlements upstream caused silting along the river front that, in turn, led to the occasional flooding of the mall at high tide covering the area with mud and waste. This unhealthy condition further delayed development.

In 1846 the Smithsonian Institution was established, and soon a building to house the new institution was started on the Mall. James Renwick's Norman-style building stimulated a move to landscape the Mall in a manner consistent with the romantic character of the Smithsonian's building. President Millard Fillmore commissioned Andrew Jackson Downing to create a plan that would redeem the Mall from its physical neglect.

After publishing several books on gardening and architecture, Andrew Jackson Downing became the foremost landscape architect of the day. He was part of the romantic movement that believed that a "natural" environment, no matter how manipulated, was healthier for the mind and body than the restraints imposed by the classical order.

Downing's plan was a radical departure from the geometric, classical design of L'Enfant's. Instead of one "Grand Avenue," Downing envisioned four individual parks, with connecting curvilinear walks and drives defined with trees of various types. His objective was to form a national park that would serve as a model for the nation, as an influential example of the "natural style of landscape gardening" and as a "public museum of living trees and shrubs."

President Fillmore endorsed two thirds of Downing's plan in 1851, but Congress found it to be too expensive and released only enough funds to develop the area around the Smithsonian. A year later, Downing died in a steamboat accident; and despite the fact that the President had endorsed the remaining third of Downing's plan in 1853, Congress eventually cut off funds so that the plan was never entirely completed.

OLD RESTORATIONS

By the time the original plan was received in the Conservation Office, it had sustained extensive damage, including tears and paper losses, which in turn led to a series of earlier restorations. However well intended, these treatments were failing, thus making the plan unusable. The details of Downing's plan were so obscured that to really appreciate it, one had to refer to a tracing made in 1867 that is now in the collection at the National Archives.

The original plan is very large, measuring 45" H x 69.5"W, and is drawn on a single sheet of wove rag paper. It was cut into quarters, a common fate of large maps that presented a storage problem. The entire surface of the plan had been covered with a thick layer of glue varnish, a common 19th century practice intended to protect the surface of unglazed maps from exposure to dust when displayed on a wall. Rather than protecting the paper, the glue actually harmed it. Over time, the darkened glue layer cracked and cupped, pulling with it the shortened fibers of the embrittled paper.

In an attempt to arrest the flaking surface, two pieces of brown silk were adhered to the surface, giving the plan its dark brown color. Despite this effort, the flaking continued. Finally, the quadrants were lined with a machine made paper and united with muslin. A $^1/_8$ th inch allowance between quadrants allowed the plan to be folded for easier storage.

MEDIA

The media, consisting primarily of a black ink that dominates the design, was used to delineate the plan as well as the title and border. There are also two brown ink inscriptions by President Millard Fillmore. They demonstrate that this very plan was taken to the White House, where it was personally studied and annotated by the President.

The only visible colors are a blue watercolor that enhances the water areas and a green watercolor that defines the trees and shrubbery. The only other medium is a few penciled additions, also under the silk.

DAMAGE

The Geography and Map Division received the plan in 1933, and at that time its condition was noted in their Annual Report as "fragile and faded." The plan was only 80 years old at that time, and already it was severely degraded, which is most unusual for rag paper. The culprit was an alum rosin size (as identified with aluminon and Raspail respectively) which attacked the rag fibers and embrittled the paper. This, in addition to the paper's large size, proved to be a lethal combination. Large objects fall prey to clumsy handling and inadequate storage, causing tears and losses.

There was an overall horizontal and vertical pattern of tears that is consistent with brittle artifacts that are repeatedly rolled. Mishandling was also responsible for the wide blank bands that extend into the center area. This type of loss coincided with irregularly bunched silk. Such gross manipulation of the silk could only have occurred right after the facing was applied, during the previous restoration effort. Somehow the still damp surface was scraped, disturbing the silk and destroying the fragile surface. As a result, numerous words and design areas were nearly illegible. Additional abrasion was evident along the crest of raised creases.

Clusters of flyspecks, pinholes, and "splashed" cream colored spots were testimony to the plans unprotected wall display, which seriously compromised the preservation of the plan. However, the most serious conservation problem was the internal delamination of the primary paper support as evidenced by entire corners laterally splitting away from the backing. Surface loss of the paper and media was evident in small patches throughout the plan. Despite the presence of the silk, the flaking of the paper continued due to the inherent destruction of the alum rosin size and the glue varnish on the surface. Hundreds of paper fragments had pulled free from the paper support, tethered only by threads of silk.

PURPOSE OF TREATMENT

With all of these problems, the goal of the treatment was to chemically and physically stabilize the paper and to improve the appearance, to the degree possible given the severe degradation of the paper.

Standard immersion washing to remove the silk, the two backings, and the adhesive residues from both sides was simply too rigorous for such a deteriorated object. Paper "islands" floated in voids among the network of tears and fragmented areas---thousands of pieces would fall apart as soon as the backing was removed. Any brushing to remove adhesive residues risked disturbing the fragile paper surface and, hence, the image. This could be a real problem since some areas of design were already so badly abraded that even a minute loss of image could translate into a major loss of information.

The big question was, could the map even survive an aqueous treatment. The media was fairly inaccessible for solubility testing; however, the fact that it had already survived a rigorous treatment, without smearing, was encouraging. Of greater concern was whether the media would remain attached to the disintegrated paper support during treatment.

Before treatment, the condition of the plan was documented in a detailed written report and photographed with 4 x 5 Ektachromes and black and white negatives. Not surprisingly, the brown silk and darkened glue varnish effectively obscured the image, making the black and white photographs somewhat disappointing. So other photographic techniques were explored. Eventually, infrared luminescence photography was successful in producing a sharper image, that in some cases revealed image detail that was not previously apparent. So the entire design area was photographed using this technique.

TESTING BEGINS

Thorough testing with numerous products eventually produced a treatment strategy to remove the starch layers and glue varnish, without disturbing the surface. Detached fragments of the plan became candidates for testing. One such sample was immersed in l-methyl -2 pyrrolidinone, a solvent that dissolves starch. The idea behind its use was that without water the paper substrate would hold up better throughout treatment. However, the black ink was slightly smeared, so this approach was dismissed.

ENZYMES

The next approach was to investigate enzymes. After reviewing the literature and consulting two very patient enzymologists at Sigma Chemical Company, I tested and subsequently chose two enzymes: an alpha amylase to reduce starch and a protease to reduce protein, in this case the glue coating:

Alpha amylase (Sigma No. A-6380 Type 11-A) Bacterial, from Bacillus species, pH 6.9 20oC

Protease (Sigma No. P 5147 Type XIV) Bacterial (Pronase E) from Streptomuces griseus. The unit definition on the bottle was pH 7.45 and 37°C. However,the literature noted the enzyme was very stable in the pH range of 6-9 at an optimum temperature range of 40-60°C. This enzyme will be completely inactivated by heating it above 80°C for 15-20 minutes---a method not suitable in conservation practices.

The unit definition, printed on each bottle, is simply the performance of an enzyme when assayed; it is not necessarily the optimum conditions for its use as many conservators believe. For example, with the alpha amylase, pH 6.9 is the pH on the bottle, which differs from the optimum pH of 5.8, given by the Sigma enzymologists. Furthermore, with respect to temperature, this enzyme is heat resistant and is roughly twice as active at 37°C as the 20°C temperature used during assay. The Protease was assayed at pH 7.45 and 37°C, while the manufacturer's literature sited the optimum conditions as being pH 6-9 and 40-60°C.

Both of these particular enzymes are highly refined and relatively free of extraneous material that might harm the paper or media. Refined enzymes are effective at very low concentrations, and I found that a .005% alpha amylase solution and .0025% protease solution worked quite well. Such low percentages reduce the amount of enzyme that needs to be removed from the object afterwards. Due to the possible adverse effects that residual enzymes may have on paper, the complete removal of the enzymes is preferable to denaturing them with ethanol. Also, for these particular enzymes, the use of a .02M sodium phosphate buffer maintains a pH level that promotes the enzyme's activity throughout treatment.[1]

SEARCH FOR CONSOLIDANT

A number of agents were evaluated for their ability to consolidate the flaking paper support. Without a suitable consolidant, the treatment was not possible. After testing parchment size, dilutions of wheat starch paste, and Dow A4C and A4M methylcellulose for their ability to penetrate and adhere multiple layers of Japanese tissue and newsprint, only one worked, the A4M which is marketed for its adhesive properties.

In preparation for the aqueous treatment, the delaminated flakes needed to be anchored to the paper support with a material that would hold up during treatment. Cellulose acetate film was considered first, as it is insoluble in water but is soluble in acetone. First, the film's general stability was tested. Unmounted sheets of film, as well as sheets applied to Japanese tissue and newsprint by using acetone, were unaffected when artificially aged in humid ovens at 65% RH for 2 weeks at 90° C.

The cellulose acetate film was cut to the size of the detached area, placed under the fragment and fused with acetone. A record of the size and location of each site was made by shading in a comparable area on a tracing made of each quadrant. This record would be a crucial reference for removing the cellulose acetate film after washing.

It was essential to treat each map quadrant in one continuous operation: remove old repair adhesives with enzymes, wash, fill the cracks with toned pulp, consolidate the paper substrate, and apply a preliminary lining --- all without stopping during the process or disturbing the fragile surface. It was critical to have the quadrants fully supported during these operations. A trial run of the overall treatment was made with a sheet of newspaper in order to work out the details of the treatment and find any unforeseen problems.

To prepare for the enzyme treatment, a large stainless steel tray was placed and leveled in an oversize sink. An interior Mylar tray was made marginally larger than an aluminum framed fiberglass window screen that would support the artifact throughout the bathing processes. The tailored fit of the tray reduced the amount of expensive enzyme solution necessary to break down the adhesives. The limited amount of solution would also prevent water currents from disturbing the fractured paper surface. Three liters of solution barely covered the quadrant; however, it proved to be enough.

[1] .02 M sodium phosphate buffer: 17.3 g Na_2HPO_4 [sodium Phosphate Dibasic] + 12.2 g NaH_2PO_4 [Sodium Phosphate Monobasic] to 1 liter of water

TREATMENT BEGINS

The first step was to remove the cloth lining which was easily torn off in two inch wide strips while the map was dry.

Next, the quadrant was pre-soaked in two water baths in order to fully wet out the paper in preparation for the enzyme treatment. The adhesive swelled but did not release. The section was supported face up on the fiberglass screen, between Hollytex, throughout all of the bath operations.

Three liters of a .005% alpha amylase solution was prepared according to the following formula:

.15 g of alpha amylase + 2850 ml water + 150 ml of .02 M sodium phosphate buffer = 3 L .005 % solution

The solution was then heated to 38°C by running warm water under an elevated stainless steel sink. 150 ml of sodium phosphate buffer was used to counteract the acids from the artifact. This enzyme's optimum pH is 5.8.

The pre-soaked plan was removed from the water bath and placed in the alpha amylase solution. The Mylar tray was covered to contain the heat. After about 30 minutes, the enzyme bath was renewed, as the byproducts from the enzyme's activity can start to interfere with the enzyme's ability to work. The object was removed by *very* slowly lifting one side of the screen support and allowing the liquid to drain off the surface without disturbing the paper fragments that by this time were releasing.

After the second alpha amylase bath, a corner of the paper lining was lifted to determine if the starch adhesive was adaquately reduced to allow its removal. In two cases, the quadrant had to return to the amylase solution for an additional 20 minutes or so, to avoid skinning. The silk facing and paper backing were deliberately retained since they still offered a degree of support and protection.

The quadrant was set in a water bath in order to rinse away the enzyme residue, as the alpha amylase would tend to interfere with the performance of the protease. The water was slowly drained from the sink before moving the object.

Three liters of a .0025% protease solution were prepared according to the following formula:

.075 g of protease + 2700 ml water + 300 ml of .02 M sodium phosphate buffer = 3 L .0025 % solution

A sodium phosphate buffer (300 ml) was used to help maintain a pH range between 6-9. The quadrant was processed through two protease baths for approximately 30 minutes each.

The process of removing the remaining residual enzymes was initiated. First the quadrant was immersed in a dilute sodium phosphate buffer solution (100 ml buffer + 900 ml H_2O) for about 30 minutes. The enzymologists suggested that it was more effective to remove the enzymes than to "denature" them, and one enzymologist even suggested that the addition of the sodium phosphate would keep the enzymes soluble to ensure their removal.

The plan was rinsed in water to start the processes of removing the dissolved adhesives, residual enzymes, and buffer. The paper backing was carefully removed from the verso in strips while the artifact was face down on Hollytex and Mylar.

The residual adhesive was removed by placing a protective sheet of Hollytex over the verso, spraying with water to dilute the paste in situ, and absorbing it into blotters. This step was repeated until the water absorbed into the blotters looked clean.

Next, the object was washed on a vacuum table with deionized water that contained only a limited amount of magnesium bicarbonate because of the watercolors on the plan. The Hollytex supported section was placed on a blotter, face up, on the vacuum table and sprayed with water until the blotter became saturated. This step was repeated about eight times. At this point, the silk was finally removed from the face of the quadrant.

To realign tears and dislodged pieces, the plan was turned face down on thin Mylar and transferred to the light table. Tears and cracks were filled with rag fibers toned with acrylic pigments.

The map was returned to the vacuum table, face up, for the application of the consolidant. Hollytex was placed over the recto of the map, and a .5 % solution of A4M was brushed over the surface. The vacuum table was then turned on in order to pull the Methyl cellulose through the paper.

A clean sheet of Hollytex was placed over the face of the map, before it was placed face down on Mylar in preparation for the lining.

A very sheer sheet of machine made tissue, (Paper Nao RK-5) was brushed out with liberal amounts of water onto Mylar. The excess water was blotted off, and the fully expanded tissue was pasted out with thin wheat starch paste and applied to the verso of the plan. The section was dried between Hollytex and felts and left overnight to dry.

Tears were reinforced, on the verso, with very thin strips of Japanese tissue to discourage "tenting."

The cellulose acetate film, which had held the fragments beautifully throughout treatment, was removed with acetone. The paper flake was re-adhered with wheat starch paste. On a few occasions, the paper fragment was so fragile that it broke apart when pasted. I was forced to consider whether the removal of the cellulose acetate was in fact counter-productive, so not all of the mends were removed.

Inserts for the missing areas were cut from laminated sheets of Japanese tissue toned first with acrylic paints. Working from the verso, the lining tissue was removed from the area of the loss with a sharp scalpel. The plan was then placed face up on a light table to illuminated the loss. A Mylar barrier was placed over the plan's surface, and the outline of each insert was scored on the laminated insert tissue with a needle. The scored line was then painted with water and the insert was gently torn free, creating a feathered edge. The feathered edges of the fill were pasted out and placed in from the verso.

The quadrants will be reassembled and a second lining applied overall. Housing must provide a rigid support as the plan is still very brittle and can not be flexed.

SUMMARY

Downing's plan was successfully treated despite it's complex problems. These problems included fragmented and brittle paper, the removal of a silk facing, two linings and two adhesives. To summarize, the following treatment techniques were used:

- anchoring detached paper flakes of the plan to the substrate with cellulose acetate film

- supporting the quadrant throughout all operations by using a fiberglass screen, Mylar and Hollytex

- using limited liquid immersion

- using enzymes to remove the glue and starch layers from the delicate surface that could not be touched

- allowing the old backings and silk facing to contribute to the paper's support throughout a good portion of the treatment

- consolidating the flaking paper after washing with A4M methylcellulose

Downing's design flourished on the Mall through the rest of the century, as documented in numerous prints of the area from that period. In 1934, the Mall was changed again and today more closely resembles the open, "Grand Avenue" that L'Enfant had envisioned. However, Downing has not been forgotten. His contribution and fame is immortalized with a cenotaph dedicated in 1856 that still stands on the Mall near the Smithsonian "Castle." The beauty that he promoted, which dominated landscape design in the 19th century, is still evident today with the serpentine paths that wind through the cultivated grounds that surround the United States Capitol.

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